**3GPP TSG-RAN WG2 Meeting #121bis-e *R2-230xxxx***

**e-Meeting, 17th – 26th April, 2023**

**Agenda Item: 7.19.2**

**Source: OPPO**

**Title: Summary of [AT121bis-e][751][eRedCap] eDRX for RRC\_INACTIVE (OPPO)**

**Document for: Discussion and Decision**

# Introduction

This document is to kick off the following offline discussion and aims to discuss the issues that have been raised by contributions submitted to AI 7.19.2.

* [AT121bis-e][751] eDRX for RRC\_INACTIVE (OPPO)

Scope:

* + - Summarize and identify agreeable proposals for agenda item 7.19.2

      Intended outcome:

* + - Report with agreeable proposals in R2-2304361

Deadline:

* + - Deadline for comments: Wednesday 23:59 UTC
    - Rapporteur proposals: Thursday 10:00 UTC
    - Document deadline: 1h before session

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# Discussion

## 3.1 UE capability on Rel-18 eDRX

In RAN2#121 meeting, RAN2 has confirmed that the enhanced eDRX for RRC\_INACTIVE can be applied to all R18 UEs.

Relevant RAN2 proposals on UE capability on enhanced eDRX for RRC\_INACTIVE are listed below:

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| Tdoc No. | Relevant Proposals | Source |
| [3]R2-2302531 | Proposal 6: Introduce an optional UE capability with signaling for the Rel-18 enhanced eDRX for RRC\_INACTIVE.  Proposal 7: The UE capability for Rel-18 enhanced eDRX for RRC\_INACTIVE means UE supports all eDRX values from 2.56s (i.e. supporting Rel-18 enhanced eDRX has to support Rel-17 eDRX simultaneously). | OPPO |
| [4]R2-2302565 | Proposal 2: The enhanced INACTIVE eDRX can only be supported by UEs which support R17 eDRX. | CATT |
| [6]R2-2302703 | Proposal 7: The UE can indicate support for extended DRX in RRC\_INACTIVE longer than 10.24s only if it supports extended DRX in RRC\_IDLE in Rel-17. FFS it also support extended DRX in RRC\_INACTIVE with values of 256, 512 and 1024 radio frames. | Xiaomi Communications |
| [7]R2-2302735 | Proposal 1: A new optional capability with signaling and per UE is defined for Rel-18 UEs in RRC\_INACTIVE configured with eDRX > 10.24sec. A Rel-18 UE may indicate support for extended DRX in RRC\_INACTIVE > 10.24sec only if it supports extended DRX in RRC\_IDLE. | Intel Corporation |
| [9]R2-2302815 | Proposal 1: Introducing additional UE capability for Rel-18 UE supporting enhanced INACTIVE eDRX cycle.   * For UE supporting enhanced INACTIVE eDRX cycle feature, it is mandatory to support R17 INACTIVE eDRX cycle feature. * For UE supporting R17 INACTIVE eDRX cycle future, it may not support R18 INACTIVE eDRX cycle. | vivo, Guangdong Genius |
| [12]R2-2303304 | Proposal 7: The new capability for Rel-18 enhanced eDRX does not require the UE to support the existing capability for Rel-17 eDRX for RRC\_INACTIVE, i.e., the two capabilities are independent of each other. | MediaTek Inc. |
| [14]R2-2303322 | Proposal 2. Introduce a new UE capability to indicate whether UE supports INACTIVE eDRX > 10.24s.  Proposal 3. Discuss the presence condition of the new UE capability for INACTIVE eDRX > 10.24s   * Option 1. UE can support INACTIVE eDRX > 10.24s, without any restriction. * Option 2. UE can support INACTIVE eDRX > 10.24s, only if it supports IDLE eDRX. * Option 3. UE can support INACTIVE eDRX > 10.24s, only if it supports (IDLE eDRX and) INACTIVE eDRX ≤ 10.24s. | Samsung |
| [17]R2-2303468 | Proposal 4: Introduce optional capability with signaling for the R18 enhanced INACTIVE eDRX cycle, and UE supporting R18 enhanced INACTIVE eDRX has to support the R17 INACTIVE eDRX. | Huawei, HiSilicon |
| [19]R2-2303561 | Proposal 5: The Rel-18 UEs who support enhanced eDRX >10.24s in RRC inactive should support Rel-17 eDRX. | Qualcomm Incorporated |
| [20]R2-2304063 | Proposal 4: Support for Rel-17 eDRX in RRC\_INACTIVE is required to support Rel-18 eDRX in RRC\_INACTIVE. | Ericsson |

In Rel-17, two optional UE capabilities on RRC\_IDLE eDRX and RRC\_INACTIVE eDRX (≤10.24s), i.e., Rel-17 extended DRX in RRC\_IDLE and *extendedDRX-CycleInactive-r17* are defined in TS 38.306. In [3], [7], [9], [14] and [17], it is proposed to introduce an optional UE capability with signaling for Rel-18 enhanced eDRX in RRC\_INACTIVE. Regarding the presence condition of this new UE capability on Rel-18 RRC\_INACTIVE eDRX, the following options are brought by companies:

* Option 1: UE can support Rel-18 enhanced eDRX, only if it supports Rel-17 (RRC\_IDLE eDRX and) RRC\_INACTIVE eDRX. [1] [4] [9] [14] [17] [19] [20]
* Option 2: UE can support Rel-18 enhanced eDRX, only if it supports Rel-17 RRC\_IDLE eDRX. [6] [7] [14]
* Option 3: UE can support Rel-18 enhanced eDRX, without any restriction. [14]

For option 1, it is stated in [1] that Rel-18 RRC\_INACTIVE is an enhanced feature compared to Rel-17 RRC\_INACTIVE eDRX, which requires UE to implement more functions, e.g. RAN PTW. From UE perspective, it would not be difficult for a UE supporting Rel-18 eDRX to support Rel-17 eDRX. The similar reason is also mentioned in [9] and [19].

For option 2, the main point is to make Rel-18 enhanced eDRX independent from Rel-17 RRC\_INACTIVE eDRX [7]. In [7], it is stated that there is no motivation to have any dependency between Rel-17 INACTIVE eDRX ≤ 10.24 sec and Rel-18 INACTIVE eDRX > 10.24 sec. In [12], it is stated that having a dependency between two capabilities will force all UEs implementing Rel-18 enhanced eDRX for RRC\_INACTIVE to implement Rel-17 eDRX for RRC\_INACTIVE as well (i.e., with shorter eDRX cycles), and they think that the UEs should have the freedom to choose which eDRX version to implement.

For option 3, it means support of Rel-18 enhanced eDRX is completely independent from Rel-17 (RRC\_IDLE and RRC\_INACTIVE) eDRX. Note that in Rel-17, UE can indicate support for RRC\_INACTIVE eDRX only if it supports RRC\_IDLE eDRX. Rapporteur thinks for Rel-18 enhanced eDRX we should keep at least this principle.

Base on above, rapporteur would like to ask the following questions:

**Question 1: Do companies agree to introduce an optional UE capability with signaling for Rel-18 enhanced eDRX in RRC\_INACTIVE?**

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| **Company** | **Yes/No** | | **Additional comments** |
| OPPO | Yes | | A separate UE capability for Rel-18 enhanced eDRX in RRC\_INACTIVE is needed. |
| Xiaomi | Yes | |  |
| Vodafone | Yes | | A separate capability is needed |
| MediaTek | Yes | |  |
| Samsung | Yes | |  |
| Nokia | Yes | |  |
| Intel | Yes | |  |
| Huawei, HiSilicon | Yes | |  |
| NEC | Yes | |  |
| ZTE | Yes | | The capability reporting is necessary for RAN to decide whether enhanced eDRX in RRC\_INACTIVE can be configured. |
| Sharp | Yes | |  |
| CMCC | Yes | |  |
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**Question 2: Which is the preferred option regarding the presence condition of UE capability on Rel-18 RRC\_INACTIVE eDRX?**

* **Option 1: UE can support Rel-18 enhanced eDRX, only if it supports Rel-17 RRC\_IDLE eDRX and RRC\_INACTIVE eDRX.**
* **Option 2: UE can support Rel-18 enhanced eDRX, only if it supports Rel-17 RRC\_IDLE eDRX.**
* **Option 3: UE can support Rel-18 enhanced eDRX, without any restriction.**

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| **Company** | **Option** | | **Additional comments** |
| OPPO | Option 1 | | Rel-18 INACTIVE eDRX is an enhanced feature compared to Rel-17 INACTIVE eDRX, requiring UE to implement more functions, e.g. RAN PTW. From UE perspective, it would not be difficult for a UE supporting Rel-18 eDRX to support Rel-17 eDRX. |
| Xiaomi | Prefers option1 | | Rrestricting a UE supporting e-DRX in RRC\_INACTIVE longer than 10.24s to always implement the Rel-17 RAN INACTIVE eDRX support is reasonable since the later can be easily implemented by a UE supporting e-DRX in RRC\_INACTIVE longer than 10.24s |
| Vodafone | Option 1 | | It is more consistent from the deployment issue and also taking into account the “fallback” scenarios, it is easier to assume that UE supporting Rel-18 enhanced eDRX supports Rel-17 RRC\_IDLE eDRX and RRC\_INACTIVE eDRX. |
| MediaTek | Option 2 | | Because existing extendedDRX-CycleInactive-r17 already requires support of extended DRX in RRC\_IDLE, it is OK to have this requirement for Rel-18 enhanced eDRX as well.  However, Rel-18 enhanced eDRX should not require extendedDRX-CycleInactive-r17 (Rel-17 RRC\_INACTIVE eDRX). The UEs should be free to choose which INACTIVE eDRX feature to implement. |
| Samsung | Option 1 | | Same view with OPPO |
| Nokia | Option 1 | | Simplest option. |
| Intel | Option 2 | | From functional point of view, option 2 is required (as a UE in INACTIVE eDRX > 10.24sec needs to be reachable via RAN paging as well as CN paging). If majority of companies want to add the requirement that R18 eDRX UE shall also support R17 INACTIVE eDRX <= 10.24s, we could accept it (even though it is not technically necessary). Although, if companies’ views are split between option 1 and 2, at least RAN2 could conclude on the common part of requiring the support of R17 IDLE eDRX. |
| Huawei, HiSilicon | Option 1 | | We don’t see any use case that UE only support Rel-18 INACTIVE eDRX, either we don’t see any difficulty or additional complexity for a UE supporting Rel-18 INACTIVE eDRX to support Rel-17 INACTIVE eDRX. |
| NEC | Option 1 | | In RRC\_INACTIVE the UE monitors both RAN and CN paging, therefore it is reasonable to assume UE supporting Rel-18 enhanced eDRX also supports Rel-17 RRC\_IDLE eDRX and RRC\_INACTIVE eDRX. |
| ZTE | Option 2 | | We agree with MediaTek that, since extendedDRX-CycleInactive-r17 already requires support of extended DRX in RRC\_IDLE, it is OK to have this requirement for Rel-18 enhanced eDRX as well. Technically, without supporting extended DRX in RRC\_IDLE, the benefit of RRC\_INACTIVE eDRX may not be achieved as expectation.  For Rel-17 RRC\_INACTIVE eDRX vs Rel-18 RRC\_INACTIVE eDRX, we also have sympathy with MediaTek’s comments, e.g., there is no technical necessity for UE to support Rel-18 RRC\_INACTIVE eDRX only on top of Rel-17 RRC\_INACTIVE eDRX. The UE can choose to support only one. The main point is, if UE reports Rel-18 RRC\_INACTIVE eDRX capability but doesn’t report Rel-17 RRC\_INACTIVE eDRX capability, the NW would not assume UE can implicitly support Rel-17 RRC\_INACTIVE eDRX.  But yes, since we already agree two separately capabilities for Rel-17 RRC\_INACTIVE eDRX and Rel-18 RRC\_INACTIVE eDRX, it’s also possible (just possibility, not mandatory requirement) for UE to support both of these features and report both of these two capabilities. |
| Sharp | Option 1 | | More reasonable. |
| CMCC | Option 1 | | We think the Rel-18 eDRX is the enhance feature of Rel-17 eDRX, therefore the UE supporting the Rel-18 eDRX could support the Rel-17 eDRX in RRC\_IDLE and RRC\_INACTIVE. |
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## 3.2 gNB support of Rel-18 eDRX

In Rel-17, two parameters *eDRX-AllowedIdle* and *eDRX-AllowedInactive* are introduced in SIB1. The presence of *eDRX-AllowedIdle* indicates that extended DRX for CN paging is allowed in the cell for UEs in RRC\_IDLE or RRC\_INACTIVE, and the presence of *eDRX-AllowedInactive* indicates that extended DRX for RAN paging with values of 256, 512 and 1024 radio frames is allowed in the cell for UEs in RRC\_INACTIVE. *eDRX-AllowedInactive* can only be configured when *eDRX-AllowedIdle* is enabled.

In Rel-18, with the introduction of enhanced eDRX for RRC\_INACTIVE, RAN2 has agreed to introduce another 1 bit indication in SIB1 on whether allowing UEs in RRC\_INACTIVE to use the enhanced eDRX for RAN paging. An open question is whether a cell that supports Rel-18 INACTIVE eDRX must support Rel-17 (IDLE and/or INACTIVE) eDRX.

Relevant RAN2 proposals are listed below:

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| Tdoc No. | Relevant Proposals | Source |
| [6]R2-2302703 | Proposal 6: eDRX-AllowedInactive-R18 can only be configured when eDRX-AllowedIdle is enabled. | Xiaomi Communications |
| [9]R2-2302815 | Proposal 2: For a cell has indicated support for R18 INACTIVE eDRX cycle, it also supports R17 INACTIVE eDRX cycle. | vivo, Guangdong Genius |
| [14]R2-2303322 | Proposal 1: Discuss the presence condition of SIB1 indication for INACTIVE eDRX > 10.24s  - Option 1. A cell can allow INACTIVE eDRX > 10.24s, without any restriction  - Option 2. A cell can allow INACTIVE eDRX > 10.24s, only if it allows IDLE eDRX  - Option 3. A cell can allow INACTIVE eDRX > 10.24s, only if it allows (IDLE eDRX and) INACTIVE eDRX ≤ 10.24s | Samsung |

In summary, the following options regarding the presence condition of SIB1 indication for Rel-18 INACTIVE eDRX are brought by companies:

* Option 1: A cell can indicate support for Rel-18 INACTIVE eDRX, without any restriction. [14]
* Option 2: A cell can indicate support for Rel-18 INACTIVE eDRX, only if *eDRX-AllowedIdle* is configured. [6] [14]
* Option 3: A cell can indicate support for Rel-18 INACTIVE eDRX, only if *eDRX-AllowedIdle* and *eDRX-AllowedInactive* are configured. [9] [14]

For option 1, it means support of Rel-18 INACTIVE eDRX is completely independent from Rel-17 (IDLE and INACTIVE) eDRX.

For option 2, it is stated in [6] that currently, *eDRX-AllowedInactive* can only be configured when *eDRX-AllowedIdle* is enabled. Obviously, Rel-18 INACTIVE eDRX can only be configured when *eDRX-AllowedIdle* is enabled too.

For option 3, in [9], it is stated that it is natural for a gNB which supports Rel-18 INACTIVE eDRX to also support Rel-17 INACTIVE eDRX to accommodate UEs with different power saving requirement.

Based on above, rapporteur would like to ask the following question:

**Question 3: Which is the preferred option regarding the presence condition of SIB1 indication for Rel-18 INACTIVE eDRX?**

* Option 1. A cell can indicate support for Rel-18 INACTIVE eDRX, without any restriction.
* Option 2. A cell can indicate support for Rel-18 INACTIVE eDRX, only if *eDRX-AllowedIdle* is configured.
* Option 3. A cell can indicate support for Rel-18 INACTIVE eDRX, only if *eDRX-AllowedIdle* and *eDRX-AllowedInactive* are configured.

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| * **Company** | **Option** | | **Additional comments** |
| OPPO | Option 3 | | The same logic as that for UE capability.  Since Rel-18 INACTIVE eDRX is an enhanced feature compared to Rel-17 INACTIVE eDRX, which requires network to implement more functions, e.g. RAN PTW. From network perspective, it would not be difficult for a network supporting Rel-18 eDRX to support Rel-17 eDRX. |
| Xiaomi | Option2 | | *For R17, eDRX-AllowedInactive* can only be configured when *eDRX-AllowedIdle* is enabled. Obviously, Rel-18 INACTIVE eDRX can only be configured when *eDRX-AllowedIdle* is enabled too.  a Rel-18 gNB supports the extended DRX in RRC\_INACTIVE longer than 10.24s means that the MT buffering will be handled in CN rather than in gNB. Thus it is a valid case that a Rel-18 gNB supports the extended DRX in RRC\_INACTIVE longer than 10.24s but not support extended DRX in RRC\_INACTIVE with values of 256, 512 and 1024 radio frames if it do not want to buffer MT traffic. So we do not option3 is valid. |
| Vodafone | Option 3 | | We prefer option 3. It makes the design consistent and avoids interoperability problems. |
| MediaTek | Option 2 | | In Rel-17, eDRX-AllowedInactive requires eDRX-AllowedIdle. It is fine to make this association for Rel-18 INACTIVE eDRX as well. However, Rel-18 INACTIVE eDRX and eDRX-AllowedInactive should be independent. A cell should not have to enable Rel-17 INACTIVE eDRX in order to enable Rel-18 INACTIVE eDRX. |
| Samsung | Option 3 | |  |
| Nokia | Option 3 | | It would seem odd NW configuration to allow Rel-18 INACTIVE eDRX but not allow Rel-17 INACTIVE eDRX. Hence, it seems such option is not needed to be supported. |
| Intel | Option 2 | | This behaviour depends on RAN2 conclusion in previous question Q2. As it is explained before a UE in INACTIVE eDRX >10.24s shall be reachable via both RAN and CN paging. Said this, we can also accept option 1 and assume that network will provide the required configuration. |
| Huawei, HiSilicon | Option 3 | | We don’t see any use case that NW only configures Rel-18 INACTIVE eDRX. |
| NEC | Option 3 | | See comments for Question 2 |
| ZTE | Option 2 | | With the similar reason as mentioned in Q2, we also think it’s reasonable to require that, cell indicates support of Rel-18 INACTIVE eDRX only if *eDRX-AllowedIdle* is configured.  However, we see no any technical reason to require NW must indicate support of both Rel-17 INACTIVE eDRX and Rel-18 INACTIVE eDRX at the same time. For example, NW may only indicate Rel-18 INACTIVE eDRX if in this area most UEs have similar power saving requirement. Even we can agree in more cases, it’s possible for NW to indicate support of both of them (e.g., for accommodating UE with different capabilities), it’s just a possible implementation but should not be a mandatory requirement. |
| Sharp | Option 3 | |  |
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## 3.3 eDRX fallback operation

Relevant RAN2 proposals on fallback are listed below:

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| Tdoc No. | Relevant Proposals | Source |
| [1]R2-2302496 | Proposal 1: The R18 UE, if configured with enhanced INACTIVE eDRX (>10.24s), should check the R18 enhanced INACTIVE eDRX indicator at SIB1 ahead of the its check for R17 INACTIVE eDRX indicator within SIB1.  Proposal 2: The R18 UE, if configured with enhanced INACTIVE eDRX (>10.24s), should apply R18 enhanced INACTIVE eDRX during its Inactive state if both R18 enhanced INACTIVE eDRX indicator and R17 INACTIVE eDRX indicator is present within SIB1; or only R18 enhanced INACTIVE eDRX indicator is present within SIB1.  Proposal 3: The R18 UE, if configured with enhanced INACTIVE eDRX (>10.24s), should apply R17 INACTIVE eDRX cycle during its Inactive state, if only R17 INACTIVE eDRX indicator is present within SIB1.  Proposal 4: The R18 UE, if configured with enhanced INACTIVE eDRX (>10.24s), should apply normal DRX cycle during its Inactive state, if neither R18 enhanced INACTIVE eDRX indicator nor R17 INACTIVE eDRX indicator is present within SIB1. | NEC |
| [3]R2-2302531 | Proposal 5: An RRC\_INACTIVE UE configured with enhanced eDRX should fallback to use the default eDRX 10.24s if the Rel-18 enhanced eDRX is not allowed but the Rel-17 eDRX is allowed by the current cell. | OPPO |
| [4]R2-2302565 | Proposal 1: It should be left UE implementation without specification impacts for case of a UE which is configured with R18 eDRX but the gNB doesn’t indicate support for this. | CATT |
| [5]R2-2302642 | Proposal 3: Whether to configure shorter eDRX or use the default DRX is up to network implementation. | China Telecommunications |
| [6]R2-2302703 | Proposal 5: The UE only operates in eDRX for RAN paging longer than 10.24s in RRC\_INACTIVE state if the UE is configured for eDRX longer than 10.24s by RAN and eDRX-AllowedInactive-R18 is signalled in SIB1 (i.e., no fall back). | Xiaomi Communications |
| [7]R2-2302735 | Proposal 3: UE can be configured at the same time with Rel-17 INACTIVE eDRX ≤ 10.24 sec and Rel-18 INACTIVE eDRX > 10.24 sec. If so, UE always uses the longest configured eDRX configured and allowed by the network.  Proposal 3.1. For further clarification, Proposal 3 means:  Proposal 3.1.1. When UE is configured Rel-18 INACTIVE eDRX > 10.24 sec and cell allows its usage, UE uses it (i.e. UE does not use Rel-17 INACTIVE eDRX ≤ 10.24 sec even if it is configured and allowed in the cell) – scenarios (A) & (B).  Proposal 3.1.2. When UE is configured Rel-18 INACTIVE eDRX > 10.24 sec and cell does not allow its usage, UE uses use Rel-17 INACTIVE eDRX ≤ 10.24 sec if it was configured and is allowed by the network – scenario (C).  Proposal 3.2. To update what means “UE operates in eDRX” in TS 38.304 considering Rel-18 INACTIVE eDRX 10.24 sec agreed behaviour (e.g. as shown in above TP) | Intel Corporation |
| [8]R2-2302803 | Proposal 1: The UE shall stop using the “INACTIVE eDRX > 10.24s” for RAN paging in RRC\_INACTIVE if the “INACTIVE eDRX > 10.24s allowed” is not present in the system information.  Proposal 2: The UE configured with “INACTIVE eDRX > 10.24s” monitors paging according to DRX cycle in case the “INACTIVE eDRX > 10.24s allowed” is not present in the system information | Nokia, Nokia Shanghai Bell |
| [9]R2-2302815 | Proposal 3: UE fallbacks to use R17 INACTIVE eDRX cycle if it is configured with R18 enhanced eDRX cycle but the gNB only indicates to support R17 INACTIVE eDRX cycle.  Proposal 4: UE fallbacks to use legacy paging DRX cycle if it is configured with R18 enhanced eDRX but the gNB doesn’t indicate support R17 INACTIVE eDRX cycle nor R18 INACTIVE eDRX cycle.  Proposal 5: RAN2 to discuss the following alternatives to support UE fallback to use R17 INACTIVE eDRX:   * Alternative 1: gNB configures the R17 INACTIVE eDRX cycle for a UE when it configures the R18 enhanced INACTIVE eDRX for this UE. * Alternative 2: Capture in specification that UE configured with R18 enhanced INACTIVE eDRX uses default R17 INACTIVE eDRX cycle when it moves to a cell with only indication to support for R17 INACTIVE eDRX. | vivo, Guangdong Genius |
| [11]R2-2302824 | Proposal 5a: If long RAN eDRX is configured (e.g. *ran-ExtendedLongPagingCycle-r18*) to UE, the short RAN eDRX (e.g. *ran-ExtendedPagingCycle-r17*) shall not be configured to UE.  Proposal 5b: If long RAN eDRX is configured (e.g. *ran-ExtendedLongPagingCycle-r18*) to UE, and the long RAN eDRX is not allowed in the cell (e.g. *long-eDRX-AllowedInactive* is absent in the SIB), the *ran-PagingCycle* is used for RAN paging. | ZTE Corporation, Sanechips |
| [12]R2-2303304 | Proposal 8: If a UE is configured with Rel-18 eDRX and then moves to a cell that only supports Rel-17 eDRX:   * If the UE was previously configured for Rel-17 eDRX for RRC\_INACTIVE, it starts using Rel-17 eDRX * Otherwise, it stops using eDRX for RAN paging in RRC\_INACTIVE   Proposal 9: When a UE moves back to a cell that supports Rel-18 eDRX after falling back to Rel-17 eDRX operation or stopping eDRX operation for RRC\_INACTIVE, it resumes Rel-18 enhanced eDRX operation. | MediaTek Inc. |
| [14]R2-2303322 | Proposal 6. Discuss which options can be adopted, when UE is configured with INACTIVE eDRX > 10.24s, but the cell does not allow INACTIVE eDRX > 10.24:   * Option 1. UE monitors RAN paging with RAN paging cycle. * Option 2   + UE monitors RAN paging with INACTIVE eDRX cycle (< 10.24s), if it was configured.   + UE monitors RAN paging with RAN paging cycle, otherwise (i.e., if INACTIVE eDRX cycle (< 10.24s) was not configured). * Option 3   + UE monitors RAN paging with 10.24s, if the cell allows INACTIVE eDRX ≤ 10.24s   + UE monitors RAN paging with RAN paging cycle, otherwise (i.e., if the cell does not allow INACTIVE eDRX ≤ 10.24s as well) | Samsung |
| [16]R2-2303397 | Proposal 1: R18 UEs that are configured with longer than 10.24sec INACTIVE eDRX cycles, in INACTIVE mode follow the configured eDRX cycle even when the cell does not support this feature. | Apple |
| [17]R2-2303468 | Proposal 3: For INACTIVE eDRX, if the configured longer eDRX cycle (> 10.24s) is not supported in current cell, UE falls back to use a shorter eDRX cycle (<= 10.24s). FFS on how the fallback eDRX cycle value is provided. | Huawei, HiSilicon |
| [19]R2-2303561 | Proposal 4: The Rel-18 UE who supports enhanced eDRX (>10.24s) in RRC inactive can fallback to the Rel-17 eDRX default value specified in the spec if the enhanced eDRX (>10.24s) is not supported in the target cell and the Rel-17 eDRX is supported. | Qualcomm Incorporated |
| [20]R2-2304063 | Proposal 3: A UE in RRC\_INACTIVE configured with Rel-18 eDRX falls back to Rel-17 eDRX configuration in RRC\_INACTIVE, if configured and the serving cell does not support Rel-18 eDRX but it supports Rel-17 eDRX.  Proposal 5: UEs are allowed to use Rel-18 eDRX in RRC\_INACTIVE, if configured and indicated, regardless of whether it is allowed to use Rel-17 eDRX in RRC\_INACTIVE in the serving cell. | Ericsson |

Considering gNB capability on INACTIVE eDRX, there may be the following cases:

|  |  |  |
| --- | --- | --- |
| Cases | Rel-17 INACTIVE eDRX | Rel-18 INACTIVE eDRX |
| Case 1 | Allowed | Allowed |
| Case 2 | Not allowed | Allowed |
| Case 3 | Allowed | Not allowed |
| Case 4 | Not allowed | Not allowed |

For a RRC\_INACTIVE UE configured with Rel-18 INACITVE eDRX, RAN2 need to discuss UE behaviour in the above cases.

For case 1 and case 2 (whether case 2 is valid may depend on the outcome of Question 3), it is proposed in [1], [7], and [20] that UEs configured with Rel-18 enhanced INACTIVE eDRX should apply R18 enhanced INACTIVE eDRX in these two cases, i.e., UEs apply Rel-18 enhanced INACTIVE eDRX, if it is configured and allowed, regardless of whether Rel-17 INACTIVE eDRX is allowed in the serving cell.

For case 3, an open issue is whether/how to support fallback to Rel-17 INACTIVE eDRX, which will be discussed later.

For case 4, it is proposed in [1] and [9] that UEs configured with Rel-18 enhanced INACTIVE eDRX should apply normal DRX in this case.

Rapporteur thinks that the above proposals regarding UE behaviour in case 1, case 2 and case 4 are less controversial, and these seem to be the common understanding, but it would be good to check companies’ views.

**Question 4: Do companies agree that UEs configured with Rel-18 enhanced INACTIVE eDRX should apply Rel-18 enhanced INACTIVE eDRX if Rel-18 enhanced INACTIVE eDRX is allowed in the serving cell, regardless of whether Rel-17 INACTIVE eDRX is allowed in the serving cell?**

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| --- | --- | --- | --- |
| **Company** | **Yes/No** | | **Additional comments** |
| OPPO | Yes | |  |
| Xiaomi | Yes | | Rel-18 UE do not need to read R17 indications. |
| Vodafone | Yes | | We agree with the statement. |
| MediaTek | Yes | |  |
| Samsung | Yes | |  |
| Nokia | Yes | | However, the “regardless of” statement is relevant to the previous question as well, ie., whether a case that Rel-17 INACTIVE eDRX would not be always allowed in the cell in this case is a viable option. |
| Intel | Yes | |  |
| Huawei, HiSilicon | Yes | | Rel-18 enhanced INACTIVE eDRX is better for UE power saving. |
| NEC | Yes | |  |
| ZTE | Yes | | It’s a reasonable process for more gain of UE power saving. |
| Sharp | Yes | |  |
| CMCC | Yes | |  |
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**Question 5: Do companies agree that UEs configured with Rel-18 enhanced INACTIVE eDRX should apply INACTIVE DRX if both Rel-18 enhanced INACTIVE eDRX and Rel-17 INACTIVE eDRX are not allowed in the serving cell?**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Yes/No** | | **Additional comments** |
| OPPO | Yes | |  |
| Xiaomi | Yes | |  |
| Vodafone | Kind of yes | | Probably we could clarify it means pre-release 17 Inactive DRX |
| MediaTek | Yes | | I.e., the UE stops eDRX operation in INACTIVE. |
| Samsung | Yes if | | Agree if “Inactive DRX” in Q5 means UE uses legacy RAN paging cycle (configured via RRCRelease) to monitor RAN paging. |
| Nokia | Yes | | No eDRX applied. |
| Intel | Yes (with clarification) | | We assume that “INACTIVE DRX” refers to legacy DRX used by a UE in INACTIVE as if it was not configured by eDRX (which is aligned to Rel-17 operation defined when the cell did not allow the usage of R17 eDRX). |
| Huawei, HiSilicon | Yes | |  |
| NEC | Yes | |  |
| ZTE | Yes | | It’s the only choice. |
| Sharp | Yes | |  |
| CMCC | Yes | |  |
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For case 3, we should firstly discuss for a RRC\_INACTIVE UE configured with Rel-18 INACTIVE eDRX, whether to support fallback to Rel-17 INACTIVE eDRX. In [1], [3], [7], [9], [12], [17], [19], and [20], it is stated that UE should fall back to use R17 INACTIVE eDRX, which would be more beneficial for UE power saving compared to falling back to use normal DRX. On the contrary, in [6], [8], and [11], companies hold the different views and propose to fall back to use normal DRX in case 3. In [11], company thinks that different type of gNBs in a RAN area is a corner case. In [4], they think in case 3, UE can even continue to use Rel-18 INACTIVE eDRX, or falls back to use Rel-17 INACTIVE eDRX or even DRX by UE implementation.

**Question 6: Do companies agree that UEs configured with Rel-18 enhanced INACTIVE eDRX should fall back to use Rel-17 INACTIVE eDRX if the Rel-18 enhanced INACTIVE eDRX is not allowed but the Rel-17 INACTIVE eDRX is allowed by the current cell?**

* **Option 1: Agree**
* **Option 2: Disagree, UE should use INACTIVE DRX instead**
* **Option 3: It is up to UE implementation to decide whether to use Rel-18 enhanced INACTIVE eDRX or falls back to use Rel-17 INACTIVE eDRX or normal DRX.**

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| **Company** | **Option** | | **Additional comments** |
| OPPO | Option 1 | | Falling back to Rel-17 INACTIVE eDRX would be more beneficial for UE power saving compared to using INACTIVE DRX. |
| Xiaomi | Option2 | | Falling back requires a Rel-18 UE to read a Rel-17 indication.  And, we need to discuss which eDRX will the UE use when falling back. Is a default eDRX cycle or the NW has to configure a default eDRX cycle for UE to fall back?  It is rather complex… |
| Vodafone | Option 1 | | Under the assumption that this question is for case 3 only: In my understanding the behaviour should be for the fallback the following: 1. If UE is configured with Rel-18 enhanced INACTIVE eDRX, it should fall back to Rel 17 INACTIVE eDRX. If Rel 17 INACTIVE eDRX is not supported, the UE should fall back to Pre-release INACTIVE DRX |
| MediaTek | Option 1 | | If Rel-17 INACTIVE eDRX is configured. See Q7. |
| Samsung | Option 1 (Option 1-2 in Q7) | | Firstly, we do not support Option 3, since paging monitoring cycle should be under control of NW. Next, there is trade-off between Option 1 and 2. Option 1 (i.e., Falling back to Rel-17 INACTIVE eDRX) is useful for UE power saving with the cost of delayed RAN paging. On the other hand, Option 2 ((i.e., Falling back to Rel-15 INACTIVE DRX) is useful in that RAN can page UE quickly, while UE consumes more power for paging. Therefore, it would be beneficial if Option 1 or 2 is configurable by NW based on its preference. Furthermore, this can be implemented via existing (or agreed already) parameters (i.e., Rel-17 INACTIVE eDRX cycle and Rel-18 INACTIVE eDRX cycle). That is Option 1-2 in Q7. |
| Nokia | Option 2 | | Option 1 would require configuring UE with both eDRX cycles (ie., Rel-17 and Rel-18 cycles) when suspending the UE. This seems unnecessary optimization as NW would generally configure either of the eDRX cycles. |
| Intel | Option 1 | | We are not sure whether option 3 can work as this would add more complexity to network side when paging the UE on those cells. |
| Huawei, HiSilicon | Option 1 | | Fallback to Rel-17 INACTIVE eDRX is beneficial for UE power saving, considering that UE configured with Rel-18 enhanced INACTIVE eDRX is sensitive to power consumption. |
| NEC | Option 1 | |  |
| ZTE | Option 2 | | Option 3 is certainly infeasible as UE and gNB should have consistent understanding on DRX/eDRX scheme.  For the case that UE supports Rel-18 INACTIVE eDRX but not support Rel-17 INACTIVE eDRX, it’s obviously UE should fall back to use INACTIVE DRX.  For the case that UE supports both Rel-18 INACTIVE eDRX and Rel-17 INACTIVE eDRX, as Rel-17 INACTIVE eDRX is also optionally supported in a cell, for a cell where the Rel-18 enhanced INACTIVE eDRX is not allowed, UE cannot straightforward to apply the Rel-17 INACTIVE eDRX (the question just simplified the real issue by giving the ideal assumption that Rel-17 INACTIVE eDRX is allowed). Anyway, in a cell where the Rel-18 enhanced INACTIVE eDRX is not allowed, UE needs to firstly check whether the Rel-17 INACTIVE eDRX is allowed by the current cell. If not, UE needs to further go for INACTIVE DRX. This would cause more branches in TS 38.304 for RAN paging cycle determination, which further result complexity in specification and UE/NW implementation. Moreover, as indicated by Nokia, another possible pre-condition is that it requires configuring UE with both eDRX cycles (i.e., Rel-17 and Rel-18 cycles) when suspending the UE.  Considering the gNBs in one RAN paging area are usually upgraded simultaneously, the case that there are different type of gNBs in this area is a corner case. It's not worth introducing these complex processes for this corner case. |
| Sharp | Option 1 | | That could save more UE’s power. |
| CMCC | Option 1 | |  |
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For case 3, if it is agreed to support fallback to Rel-17 INACTIVE eDRX for UEs configured with Rel-18 enhanced INACTIVE eDRX, then the next open issue is how to fall back to Rel-17 INACTIVE eDRX.

In summary, the following options are brought by companies:

* Option 1: gNB configures both Rel-17 INACTIVE eDRX and Rel-18 enhanced INACTIVE eDRX, and UE falls back to use Rel-17 INACTIVE eDRX.[1] [7] [9] [12] [14] [20]
  + Option 1-1: Rel-17 INACTIVE eDRX is always configured if Rel-18 enhanced INACTIVE eDRX is configured [9]
  + Option 1-2: Rel-17 INACTIVE eDRX is optionally configured if Rel-18 enhanced INACTIVE eDRX is configured, and if Rel-17 INACTIVE eDRX is not configured, UE falls back to use normal DRX [12] [14]
* Option 2: UE falls back to use Rel-17 INACTIVE eDRX with a default eDRX cycle of 10.24s. [3] [9] [14] [19]

For option 1, Rel-17 INACTIVE eDRX should be configured together with Rel-18 INACTIVE eDRX. In this way, UE could fall back to use Rel-17 INACTIVE eDRX based on NW’s configuration.

For option 2, as stated in [3], we should aim at maximizing UE’s power saving, thus the most reasonable option would be to fallback to upper limit of Rel-17 INACTIVE eDRX cycle, i.e., 10.24s. it is also mentioned in [3] that this can save one IE (i.e. the shorter Rel-17 INACTIVE eDRX cycle) in the RRC configuration.

Based on above, rapporteur would like to ask the following question:

**Question 7: Which is the preferred option regarding how to fall back to Rel-17 INACTIVE eDRX for UEs configured with Rel-18 enhanced INACTIVE eDRX in case 3?**

* **Option 1: gNB configures both Rel-17 INACTIVE eDRX and Rel-18 INACTIVE eDRX, and UE falls back to use Rel-17 INACTIVE eDRX.**
  + **Option 1-1: Rel-17 INACTIVE eDRX is always configured if Rel-18 enhanced INACTIVE eDRX is configured**
  + **Option 1-2: Rel-17 INACTIVE eDRX is optional configured if Rel-18 enhanced INACTIVE eDRX is configured, and if Rel-17 INACTIVE eDRX is not configured, UE falls back to use normal DRX**
* **Option 2: UE falls back to use Rel-17 INACTIVE eDRX with a default eDRX cycle of 10.24s.**

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| **Company** | **Option** | | **Additional comments** |
| OPPO | Option 2 | | For UE configured with Rel-18 INACTIVE eDRX, we should aim at maximizing UE’s power saving, the most reasonable option would be to fallback to upper limit of Rel-17 INACTIVE eDRX cycle, i.e., 10.24s. Moreover, this can save one IE (i.e. the shorter Rel-17 INACTIVE eDRX cycle) in the RRC configuration compared to Option 1. |
| Xiaomi | - | | It if not preferred that gNB will configure Rel-17 INACTIVE eDRX less than 10.24s and Rel-18 INACTIVE eDRX longer than 10.24s at the same time.  So option1 is not preferred and should be excluded. |
| Vodafone | Option 1 | | For case 3, I think the UE should follow the current Rel 17 configuration |
| MediaTek | Option 1-2 | |  |
| Samsung | Option 1-2 or Option 2 | | We support Option 1-2 (Please see our response in Q6). Besides, we can also accept Option 2, since we understand the benefits of Option 2. |
| Nokia | None. | |  |
| Intel | Option 1-2 | | We do not see the need to mandate network behaviour when configuring R18 INACTIVE eDRX or to define a new default eDRX cycle if the cell does not allow/support this new feature. |
| Huawei, HiSilicon | Option 1-2 or Option 2 | | Option 1-2 gives more NW flexibility for configuration. |
| NEC | Option 1 | |  |
| ZTE | Option 1-2 | | Considering the complexity in UE and impacts on TS 38.304, if fallback to Rel-17 INACTIVE eDRX is supported, the legacy Rel-17 INACTIVE eDRX mechanism can be used. |
| Sharp | Option 1-2 | |  |
| CMCC | Option 1 | |  |
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## 3.4 RAN eDRX configuration

**Rel-18 RAN eDRX cycle configuration**

In RAN2#121 meeting, the following agreements regarding Rel-18 RAN eDRX cycle configuration were made.

|  |
| --- |
| Long eDRX cycle (>10.24 s) value range of enhanced INACTIVE eDRX is same as IDLE eDRX from 20.48s to 10485.76s, i.e. hf2, hf4, hf8, hf16, hf32, hf64, hf128, hf256, hf512, hf1024.  Add the configuration of eDRX cycle (>10.24 s) and PTW length for enhanced INACTIVE eDRX in the RRCRelease message |

Relevant RAN2 proposals on Rel-18 RAN eDRX cycle configuration are listed below:

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| --- | --- | --- |
| Tdoc No. | Relevant Proposals | Source |
| [3]R2-2302531 | Proposal 1: The eDRX cycle configured by RAN should be no longer than the eDRX cycle configured by CN. | OPPO |
| [4]R2-2302565 | Proposal 3：Introduce an additional new IE for INACTIVE eDRX to include the eDRX cycle values larger than or equal to 10.24s. | CATT |
| [7]R2-2302735 | Proposal 2: For Rel-18 UEs in RRC\_INACTIVE configured with eDRX > 10.24sec, Rel-17 eDRX agreements of the invalid cases are also applicable for Rel-18 INACTIVE eDRX > 10.24 sec, i.e.:  Proposal 2.1. “RAN2 considers the configuration as an invalid case, where INACTIVE eDRX cycle is configured but IDLE eDRX cycle is not configured”.  Proposal 2.2. “RAN2 considers the configuration as invalid case when INACTIVE eDRX cycle is longer than IDLE eDRX cycle”. | Intel Corporation |
| [10]R2-2302816 | Proposal 3: RAN2 confirms the R17 agreements made at RAN2#115 for enhanced INACTIVE eDRX:   * RAN2 considers the configuration as an invalid case, where INACTIVE eDRX cycle is configured but IDLE eDRX cycle is not configured. * RAN2 considers the configuration as invalid case, where INACTIVE eDRX cycle is longer than IDLE eDRX cycle. FFS whether to capture this restriction in RAN2 spec. | vivo, Guangdong Genius |
| [11]R2-2302824 | Proposal 1: The configuration restrictions and corresponding configuration scenarios for Rel-17 RedCap UE can be reused for Rel-18 eRedCap UE.  Proposal 2: A new configuration scenario where IDLE eDRX cycle is larger than 10.24s and INACTIVE eDRX cycle is also larger than 10.24s but shorter or equal to IDLE eDRX cycle can be considered for Rel-18 eRedCap UE. | ZTE Corporation, Sanechips |
| [13]R2-2303321 | Proposal 1: Discuss whether the each of following configuration is valid or not.   1. UE is configured with INACTIVE eDRX > 10.24s and IDLE eDRX > 10.24s, where INACTIVE eDRX ≤ IDLE eDRX 2. UE is configured with INACTIVE eDRX > 10.24s and IDLE eDRX > 10.24s, where INACTIVE eDRX > IDLE eDRX 3. UE is configured with INACTIVE eDRX > 10.24s and IDLE eDRX ≤ 10.24s 4. UE is configured with INACTIVE eDRX > 10.24s, but not configured with IDLE eDRX. | Samsung |
| [15]R2-2303396 | Proposal 1: When RAN configured eDRX, TeDRX\_RAN should be a lower or equal value as TeDRX\_CN | Apple |

In Rel-17, a parameter ran-ExtendedPagingCycle-r17 is defined in SuspendConfig IE.

SuspendConfig ::= SEQUENCE {

……

ran-ExtendedPagingCycle-r17 ExtendedPagingCycle-r17 OPTIONAL -- Cond RANPaging

……

}

ExtendedPagingCycle-r17 ::= ENUMERATED {rf256, rf512, rf1024, spare1}

As observed in [4], only one spare value is left in ExtendedPagingCycle-r17, so it is suggested to introduce an additional new IE for INACTIVE eDRX to include the eDRX cycle values larger than or equal to 10.24s. Rapporteur thinks it would be reasonable to define a new IE, but maybe no need to include the value of 10.24s in this new IE, since this value has been included in ExtendedPagingCycle-r17.

Base on above, rapporteur would like to ask the following questions:

**Question 8: Do companies agree to introduce a new IE for INACTIVE eDRX to include the eDRX cycle values larger than 10.24s?**

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| --- | --- | --- | --- |
| **Company** | **Yes/No** | | **Additional comments** |
| OPPO | Yes | |  |
| Xiaomi | YEs | |  |
| MediaTek | Yes | |  |
| Samsung | Yes | |  |
| Nokia | Yes | |  |
| Intel | Yes | |  |
| Huawei, HiSilicon | Yes | |  |
| NEC | Yes | | Agree with rapporteur view. |
| ZTE | Yes | | A new IE including eDRX cycle values larger than 10.24s and PTW length configuration should be introduced.  Moreover, according to our answer to Q6, we suggest not to support fallback to Rel-17 RRC\_INACTIVE eDRX when the Rel-18 RRC\_INACTIVE eDRX is not allowed in a cell. Therefore, if Rel-18 RRC\_INACTIVE eDRX is configured to UE, the Rel-17 RRC\_INACTIVE eDRX doesn’t need to be configured, which can have less impacts on TS 38.304. |
| Sharp | Yes | |  |
| CMCC | Yes | |  |
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In Rel-17, RAN2 defines as invalid scenarios when Rel-17 INACTIVE eDRX cycle is configured and Rel-17 IDLE eDRX cycle is not configured or is configured with a smaller value than for Rel-17 INACTIVE eDRX cycle. (corresponding RAN2#115e agreement copied below).

*RAN2 considers the configuration as an invalid case, where INACTIVE eDRX cycle is configured but IDLE eDRX cycle is not configured.*

*RAN2 considers the configuration as invalid case, where INACTIVE eDRX cycle is longer than IDLE eDRX cycle.*

In [3], [7], [10], [11], [13] and [15], it is proposed that Rel-17 eDRX agreements of the invalid cases are also applicable for Rel-18 INACTIVE eDRX > 10.24s.

**Question 9: Do companies agree that the following cases are invalid?**

* Case 1: UE is configured with a Rel-18 enhanced INACTIVE eDRX cycle but not configured with the IDLE eDRX cycle.
* Case 2: UE is configured with a Rel-18 enhanced INACTIVE eDRX cycle longer than the IDLE eDRX cycle.

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| **Company** | **Yes/No** | | **Additional comments** |
| OPPO | Yes | | Fine to follow Rel-17 principle. |
| Xiaomi | Yes | |  |
| MediaTek | Yes | |  |
| Samsung |  | | No strong view |
| Nokia | Yes | |  |
| Intel | Yes | | R17 eDRX invalid cases are equally applicable in R18 eDRX |
| Huawei, HiSilicon | Yes | |  |
| NEC | Yes | |  |
| ZTE | Yes | | See our comments for Q2 and Q3. Moreover, the INACTIVE eDRX cycle should be less than or equal to the IDLE eDRX cycle. |
| Sharp | Yes | |  |
| CMCC | Yes | |  |
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**RAN PTW configuration**

Relevant RAN2 proposals are listed below:

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| Tdoc No. | Relevant Proposals | Source |
| [3]R2-2302531 | Proposal 2: The PTW length configured by RAN should be no longer than the PTW length configured by CN. | OPPO |
| [6]R2-2302703 | Proposal 1: UE in RRC\_INACTIVE should be configured with a shorter inactive mode PTW length than the idle mode PTW length.  Proposal 2: If RAN does not assign a new PTW length, UE will assume the idle mode PTW length will be reused for inactive mode e-DRX. | Xiaomi Communications |
| [10]R2-2302816 | Proposal 4: The RAN PTW length should be no longer than the CN PTW length. | vivo, Guangdong Genius |
| [12]R2-2303304 | Proposal 4: PTW length for RAN is longer than or equal to PTW length for CN. | MediaTek Inc. |

In RAN2#121 meeting, we have reached the agreement that RAN is responsible for the eDRX configuration for RRC INACTIVE, and for both DRX cycle and PTW length, the configuration for RRC\_INACTIVE and for RRC IDLE may be different. An open issue is whether to define any restriction for PTW length configured by RAN.

In summary, the following options are brought by companies:

* Option 1: The RAN configured PTW length should be no longer than the CN configured PTW length. [3] [6] [10]
* Option 2: The RAN configured PTW length should be no shorter than the CN configured PTW length. [12]

For option 1, as stated in [3], if a UE in RRC INACTIVE is configured with a shorter RAN eDRX cycle compared to CN eDRX cycle, which means the paging latency can be reduced to some extent, it seems reasonable to desire a shorter RAN PTW than CN PTW. This would be beneficial for UE power consumption since UE does not need to monitor for RAN paging in a PTW as long as for CN paging.

For option 2, as stated in [12], it thinks that there is no strong motivation to have a RAN PTW length that is smaller than the CN PTW length. The motivation for going into RRC\_INACTIVE state is to improve the reachability of the UE by reducing the latency for paging compared to RRC\_IDLE state. Therefore, the PTW length for RAN should always be longer than or equal to the PTW length for CN.

Base on above, rapporteur would like to ask the following questions:

**Question 10: Do companies agree to define any restriction for RAN configured PTW length?**

* **Option 1: Yes, the RAN configured PTW length should be no longer than the CN configured PTW length.**
* **Option 2: Yes, the RAN configured PTW length should be no shorter than the CN configured PTW length.**
* **Option 3: No**

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| **Company** | **Option** | | **Additional comments** |
| OPPO | Option 1 | | A shorter eDRX cycle should correspond to a shorter PTW length, which would be beneficial for UE power consumption. |
| Xiaomi | Option 1 | |  |
| MediaTek | Option 2 | |  |
| Samsung | Option 3 | | We do not see the benefit of any restriction. For UE power saving, RAN already can set longer INACTIVE eDRX cycle.  Besides, the aim to use PTW is to address synchronization failure issue of paging Tx/Rx timing between UE and NW due to long eDRX cycle. NW (CN or RAN) should have sufficient flexibility to handle this issue. Therefore, we do not support any restriction. |
| Nokia | Option 3 | | Seems NW would configure these reasonably. |
| Intel | Option 3 | | We do not see strict need to mandate network configuration of RAN PTW. From UE’s power saving PoV, it is always preferable if it is as short as possible, but this is already known by the network and applicable to any UE operating on eDRX. |
| Huawei, HiSilicon | Option 1 or Option 3 | | Generally, the RAN DRX cycle is shorter or equal to the IDLE DRX cycle, so the RAN POs are denser. Shorter RAN PTW can provide same number of paging reception opportunities, so RAN PTW should be no longer than CN PTW.  Option 1 can be the basic assumption for designing the mechanism for paging monitoring in INACTIVE, but not sure if there is any spec impact. |
| NEC | - | | No strong view, follow majority. |
| ZTE | Option 3 | | Since the RAN eDRX cycle may be shorter than the CN eDRX cycle, There may be more occurrences of RAN PTW than the CN PTW, refer to the following figure:  CN PTW is longer  Thus, the UE should consider the case of “during RAN PTW but outside the CN PTW”. The restriction of “the RAN configured PTW length should be no longer than the CN configured PTW length” is not necessary (e.g. without any gains).  Moreover, the CN PTW length is determined mainly by the: time alignment between CN and gNB (e.g. per SA2 specification, when eDRX is used, “*the H-SFN of all NG-RAN nodes and AMFs should be loosely synchronized, with accuracy of 1 to 2 seconds”*), possible Paging retransmission etc. Meanwhile, the RAN PTW length is determined mainly by the: possible Paging retransmission etc. Thus, the shorter the PTW length is, the more the UE power will be saved,  There is no reason for the restriction of “the RAN configured PTW length should be no shorter than the CN configured PTW length”. Especially for the following figure case, if apply the restriction of “the RAN configured PTW length should be no shorter than the CN configured PTW length”, the UE is unnecessary required to monitor longer time period and UE power consumption will be increased.  CN PTW includes RAN eDRX |
| Sharp | Option 3 | |  |
| CMCC | Option 3 | |  |
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Another question is that when gNB provides Rel-18 INACTIVE eDRX configuration to a UE in RRCRelease message, whether PTW length is mandatory or not. It is proposed in [6] to reuse the CN configured PTW length as RAN PTW length if gNB does not provide a separate PTW length in the RRCRelease message.

Base on this, rapporteur would like to ask the following question:

**Question 11: Which is the preferred option regarding RAN PTW length?**

* **Option 1: RAN PTW length is mandatorily present within Rel-18 INACTIVE eDRX’s configuration.**
* **Option 2: RAN PTW length is optionally present within Rel-18 INACTIVE eDRX’s configuration. If RAN PTW length is absent in Rel-18 INACTIVE eDRX’s configuration, UE considers RAN PTW length is equal to the CN PTW length.**

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| **Company** | **Option** | | **Additional comments** |
| OPPO | Option 2 | | With option 2, RRC signalling overhead could be saved to some extent compared to option 1 if RAN wants to configure a RAN PTW with the same length as that for CN PTW. |
| Xiaomi | - | | There is also another option3:   * **Option 3: RAN PTW length is optionally present within Rel-18 INACTIVE eDRX’s configuration. If RAN PTW length is absent in Rel-18 INACTIVE eDRX’s configuration, UE considers RAN eDRX’s configuration is not valid as not configured.**   We do not have a strong view among those. |
| MediaTek | Option 1 | | It is simpler to always indicate RAN PTW in the relevant IE. |
| Samsung | Option 1 | | RAN PTW and CN PTW are totally independent configuration. So, considering various configurable values of PTW length, RAN will configure different RAN PTW length with CN PTW in most case. Making IE as optional filed also requires another bit in ASN.1 code, which should be avoided in this kind of case. |
| Nokia | Option 1 | |  |
| Intel | Option 2 | |  |
| Huawei, HiSilicon | Option 1 | | Explicit configuration is clearer. |
| NEC | Option 1 | | Option 2 sounds an optimization. No need to do that. |
| ZTE | Option 2 | | RAN2 has agreed RAN PTW and CN PTW can be independently configured. We assume no matter Option 1 or Option 2, there should be an IE for RAN PTW length within Rel-18 INACTIVE eDRX’s configuration.  But it’s still possible that RAN PTW length can be equal to the CN PTW length. So it’s better to allow the RAN PTW length can be optionally present. The signaling overhead can be reduced in this case (e.g. RAN PTW length not configured in this case). |
| Sharp | Option 1 | |  |
| CMCC | Option 1 | |  |
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## 3.5 PTW location and paging monitoring

**PH calculation**

In RAN2#121 meeting, it has been agreed that the formula of PH/PTW for IDLE eDRX can be reused for enhanced INACTIVE eDRX for eDRX cycles longer than 10.24s.

According to the current spec, The PH for CN paging is the H-SFN satisfying the following equations:

H-SFN mod TeDRX\_CN= (UE\_ID\_H mod TeDRX\_CN), where

- UE\_ID\_H: 13 most significant bits of the Hashed ID.

- TeDRX\_CN: UE-specific eDRX cycle in Hyper-frames, (TeDRX\_CN = 2, …, 1024 Hyper-frames) configured by upper layers.

It can be observed that PH only depends on the UE\_ID\_H and TeDRX values used in the formula.

Relevant RAN2 proposals on RAN PH calculation are listed below:

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| Tdoc No. | Relevant Proposals | Source |
| [7]R2-2302735 | Proposal 5： For Rel-18 INACTIVE eDRX > 10.24 sec, PH and PWT\_start are determined using TeDRX\_CN. If this is not acceptable, to consider PH is determined using TeDRX\_CN and PWT\_start using TeDRX\_RAN | Intel Corporation |
| [10]R2-2302816 | Proposal 1: Using the same UE\_ID\_H as IDLE eDRX when calculating the PH for RAN paging when INACTIVE eDRX is longer than 10.24s. | vivo, Guangdong Genius |
| [12]R2-2303304 | Proposal 2: The UE\_ID\_H used in the CN eDRX formulas in Rel-17 is reused in the RAN eDRX formulas in Rel-18.  Proposal 3: The PH for RAN is the H-SFN satisfying the following equation:  H-SFN mod TeDRX\_RAN= (UE\_ID\_H mod TeDRX\_RAN) | MediaTek Inc. |

In both [10] and [12], it is proposed to use the same UE\_ID\_H as IDLE eDRX when calculating the PH for RAN paging when INACTIVE eDRX is longer than 10.24s.

**Question 12: Do companies agree to use the same UE\_ID\_H as IDLE eDRX when calculating the PH for RAN paging when INACTIVE eDRX is longer than 10.24s?**

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| **Company** | **Yes/No** | | **Additional comments** |
| OPPO | Yes | |  |
| Xiaomi | Yes | |  |
| MediaTek | Yes | |  |
| Samsung | Yes | |  |
| Nokia | Yes | |  |
| Intel | Yes | |  |
| Huawei, HiSilicon | Yes | |  |
| NEC | Yes | |  |
| ZTE | Yes | | The chances to align CN PH and RAN PH is maximized if same UE\_ID\_H is used. |
| Sharp | Yes | |  |
| CMCC | Yes | |  |
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Regarding which eDRX cycle is used to calculate the PH for RAN paging, it seems straight forward and reasonable to replace TeDRX\_CN with TeDRX\_RAN in the PH formula, as proposed in [12]. On the contrary, it is proposed to use TeDRX\_CN to calculate the PH for RAN paging. In rapporteur’s understanding, the PH distribution in time domain for RAN paging should be related to RAN eDRX cycle, otherwise, it would not make sense to configure a separate RAN eDRX cycle in addition to CN eDRX cycle. However, it would be good to check companies’ views.

**Question 13: Do companies agree to use TeDRX\_RAN instead of TeDRX\_CN to calculate the PH for RAN paging when TeDRX\_RAN is longer than 10.24s?**

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| **Company** | **Yes/No** | | **Additional comments** |
| OPPO | Yes | |  |
| Xiaomi | Yes | |  |
| MediaTek | Yes | |  |
| Samsung | Yes | |  |
| Nokia | Yes | |  |
| Intel | Yes | |  |
| Huawei, HiSilicon | Yes | |  |
| NEC | Yes | |  |
| ZTE | Yes | |  |
| Sharp | Yes | |  |
| CMCC | Yes | |  |
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**PTW location in overlapping PH**

In RAN2#121 meeting, RAN2 has confirm the following agreement made in Rel-17.

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| * When RAN and CN paging coincide in the same PH, the actually used PTW starting location is the same for RAN and CN paging. FFS how to calculate the PTW starting location so that it is the same for RAN and CN PTW. |

Relevant RAN2 proposals on PTW calculation in overlapping PH are listed below:

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| Tdoc No. | Relevant Proposals | Source |
| [2]R2-2302497 | Proposal 1: When the PH overlaps between the CN paging PTW window and RAN paging PTW window, select one of the following options to calculate the PTW starting location  Option-1: The CN PTW overrides the RAN PTW when the PH overlaps between these two PTW windows.  Option-2: The first PTW within that PH overrides the second PTW when the PH overlaps between these two PTW windows. | NEC |
| [3]R2-2302531 | Proposal 3: For all kinds of PH (including RAN eDRX’s PH and common PH), use CN eDRX cycle to derive the PTW starting point based on the legacy calculation formula in Rel-17. | OPPO |
| [5]R2-2302642 | Proposal 1: When paging coincides in the same PH, use the CN PTW in overlapped PH. | China Telecommunications |
| [6]R2-2302703 | Proposal 3: A common PTW start is provided for idle mode e-DRX as well as for inactive mode e-DRX, i.e., PTW start is given by AMF and is calculated by idle mode e-DRX cycle. | Xiaomi Communications |
| [7]R2-2302735 | Proposal 5： For Rel-18 INACTIVE eDRX > 10.24 sec, PH and PWT\_start are determined using TeDRX\_CN. If this is not acceptable, to consider PH is determined using TeDRX\_CN and PWT\_start using TeDRX\_RAN | Intel Corporation |
| [10]R2-2302816 | Proposal 2: For all RAN paging PH, using IDLE eDRX cycle to calculate the PTW\_start and RAN PTW\_length to calculate the PTW\_end when INACTIVE eDRX is longer than 10.24s. | vivo, Guangdong Genius |
| [11]R2-2302824 | Proposal 3: The formula and parameters for CN PTW start calculation is used for RAN PTW start calculation. | ZTE Corporation, Sanechips |
| [12]R2-2303304 | Proposal 1: TeDRX,CN is used in the PTW\_start formula for RAN paging, i.e., adopt the following formula:  ieDRX\_RAN = floor(UE\_ID\_H /TeDRX\_CN) mod 8 | MediaTek Inc. |
| [14]R2-2303322 | Proposal 5. Discuss how to determine starting SFN of RAN configured PTW:   * Option 1. TeDRX\_CN is used:   + SFN = 128 \* ieDRX\_RAN, where ieDRX\_RAN = floor(UE\_ID\_H /TeDRX\_CN) mod 8) * Option 2. TeDRX\_CN is used in overlapping PH, and TeDRX\_RAN is used in non-overlapping PH:   + In overlapping PH, SFN = 128 \* ieDRX\_RAN, where ieDRX\_RAN = floor(UE\_ID\_H /TeDRX\_CN) mod 8   + In non-overlapping PH, SFN = 128 \* ieDRX\_RAN, where ieDRX\_RAN = floor(UE\_ID\_H /TeDRX\_RAN) mod 8 | Samsung |
| [15]R2-2303396 | Proposal 4: The formulae for PTW\_start and PTW\_end as as below  PTW\_start denotes the first radio frame of the PH that is part of the PTW and has SFN satisfying the following equation:  For the case where RAN eDRX PH and CN eDRX PH are the same  SFN = 128 \* ieDRX\_RAN, where  -    ieDRX\_RAN = floor(UE\_ID\_H /TeDRX\_CN) mod 8  else  SFN = 128 \* ieDRX\_RAN, where  -    ieDRX\_RAN = floor(UE\_ID\_H /TeDRX\_RAN) mod 8  PTW\_end is the last radio frame of the PTW and has SFN satisfying the following equation:  SFN = (PTW\_start + L\*100 - 1) mod 1024, where  in the case where PH has both RAN and CN PTW\_start,  L = max { Paging Time Window (PTW) length (in seconds) configured by upper layers,  Paging Time Window (PTW) length (in seconds) configured by RAN }  else  L = Paging Time Window (PTW) length (in seconds) configured by upper layers | Apple |
| [17]R2-2303468 | Proposal 1: RAN2 to discuss following options to achieve the same PTW starting location, in case paging coincides in the same PH:   * Alt. 1: use both RAN PTW and CN PTW in overlapped PH (i.e. the PTW\_start for RAN paging is re-defined as the PTW\_start for CN paging); * Alt.2: only use the CN PTW in overlapped PH (i.e. both the PTW\_start and PTW\_end for RAN paging are same as CN paging). | Huawei, HiSilicon |
| [18]R2-2303542 | Proposal 1: when RAN and CN paging coincide in the same PH, the PTW starting locations for INACTIVE eDRX cycles longer than 10.24s could be determined by CN eDRX cycle. When RAN and CN paging is not located in same PH, the PTW starting locations for INACTIVE eDRX cycles longer than 10.24s could be determined by the formula using RAN eDRX cycle. | CMCC |
| [19]R2-2303561 | Proposal 2: When RAN and CN paging coincides in the same PH and PTWs configured by RAN/CN overlapping each other, UE monitors both RAN and CN paging in the PTW configured by RAN when UE is in RRC inactive with eDRX > 10.24s.  Proposal 3: The eDRX cycle and PTW length configured by RAN is provided to CN for eDRX > 10.24s in RRC inactive. | Qualcomm Incorporated |

Regarding how to calculate the PTW starting location in the overlapping PH, the following options are brought by companies:

* Option 1: PTW starting location is determined based on CN eDRX cycle. [2] [3] [5] [6] [10] [11] [12] [14] [15] [18]
* Option 2: PTW starting location is determined based on RAN eDRX cycle. [19]
* Option 3: PTW starting location is determined based on the first PTW among the two PTWs calculated using CN eDRX cycle and RAN eDRX cycle, respectively [2]

For option 1, as stated in [3], for a UE in RRC INACITVE, in case of RRC state mismatch happens and network considers the UE as in RRC IDLE state, network would derive the PTW starting point based on the CN eDRX cycle. In this case, if the UE derives the PTW starting point using RAN eDRX cycle, there will be misunderstanding for PTW location between UE and network, which would lead to CN paging failure. To avoid this issue, we should not change anything that is related to CN eDRX, i.e. the PTW starting point for CN eDRX PTW in a common PH should be determined in the same way as that in RRC\_IDLE.

For option 2, in [19], it is stated that this option is aligned with the PTW design principle for different RRC states, i.e., UE in RRC inactive state should only follow the paging window configuration by RAN. However, this option requires that the eDRX cycle and PTW length configured by RAN should be informed to CN so that CN can know when to initiate CN paging to gNB..

For option 3, it means the first PTW within the PH overrides the second PTW when the PH overlaps between these two PTW windows.

Base on above, rapporteur would like to ask the following question:

**Question 14: Which is the preferred option regarding how to calculate the PTW starting location in the overlapping PH?**

* **Option 1: PTW starting location is determined based on CN eDRX cycle.**
* **Option 2: PTW starting location is determined based on RAN eDRX cycle.**
* **Option 3: PTW starting location is determined based on the first PTW among the two PTWs calculated using CN eDRX cycle and RAN eDRX cycle, respectively.**

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| **Company** | **Option** | | **Additional comments** |
| OPPO | Option 1 | | As UE also needs to monitor CN paging during the PTW to avoid RRC state mismatch, there should be a common understanding for PTW location between UE and CN. So we should not change anything that is related to CN eDRX, i.e. the PTW starting point for CN eDRX PTW in an overlapping PH should be determined in the same way as that in RRC\_IDLE. |
| Xiaomi | Option 1 | | A common PTW start is simpler. |
| MediaTek | Option 1 | |  |
| Samsung | Option 1 | |  |
| Nokia | Option 1 | |  |
| Intel | Option 1 | | We prefer option 1 to minimize UE’s power consumption and complexity. Otherwise, in our understanding, UE would need to wake up to monitor both RAN PTW and CN PTW in the overlapping PH (which does not seem to be covered by current options). |
| Huawei, HiSilicon | Option 1 | | The UE in INACTIVE should monitor both CN paging and RAN paging, to avoid missing CN paging, the PTW starting location should be aligned with starting location of CN PTW.  Using RAN PTW requires CN to use RAN PTW to override CN PTW, which introduces a big impact on the CN (has additional impact on SA2). Currently, CN takes the local policy into account for assigning PTW length, using CN PTW may deviate the local policy. |
| NEC | Option 1 or Option 3 | |  |
| ZTE | Option 1 | | In order that UE monitors POs as less as possible, RAN2 has agreed that “When RAN and CN paging coincide in the same PH, the actually used PTW starting location is the same for RAN and CN paging.”  To align the PTW starting location for RAN and CN paging, Option 2 is not feasible.  And considering that gNB may send a CN paging to a UE in RRC\_INACTIVE state, in which case gNB cannot know the RAN eDRX parameters, only the CN PTW can be used. If the UE in RRC\_INACTIVE state use the RAN PTW starting location for CN paging monitoring, the CN paging may be missed. Thus, the Option 3 is also not feasible.  Thus, Option 1 is the only feasible way to align the PTW starting location for RAN and CN paging. |
| Sharp | Option 1 | |  |
| CMCC | Option 1 | | Since the RRC\_INACTIVE UE should be reached by both RAN paging and CN paging due to the state mismatch issue between network and UE and the CN paging is negotiated by RAN and CN. Then when RAN and CN paging coincide in the same PH, the PTW starting locations for INACTIVE eDRX cycles longer than 10.24s could be determined by CN eDRX cycle. |
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Another issue is how to determine PTW length in the overlapping PH. The following options are brought by companies:

* Option 1: use a common PTW for CN paging and RAN paging
  + Option 1-1: use CN PTW length to derive the PTW ending location. [2] [5] [17]
  + Option 1-2: use the PTW length of the first PTW within the PH between the two PTWs (which are calculated using CN eDRX cycle and RAN eDRX cycle, respectively) to derive the PTW ending location. [2]
* Option 2: use separate PTWs for CN paging and RAN paging. [10] [17]

For Option 1, UE monitors both CN paging and RAN paging within the PTW. For option 1-1, as stated in [17], since the UE in RRC\_INACTIVE is required to monitor CN paging to avoid state mismatch, UE should always follow the CN configured PTW in overlapped PH for monitoring paging for both CN paging and RAN paging. In [2], it thinks option 1-2 may provide more flexibility compared to option 1-1.

For option 2, the PTW ending location for CN PTW and RAN PTW are derived based on CN PTW length and RAN PTW length, respectively.

Base on above, rapporteur would like to ask the following question:

**Question 15: Which is the preferred option regarding how to determine PTW length in overlapping PH?**

* **Option 1: use a common PTW for CN paging and RAN paging**
  + **Option 1-1: use CN PTW length to derive the PTW ending location.**
  + **Option 1-2: use the PTW length of the first PTW within the PH between the two PTWs (which are calculated using CN eDRX cycle and RAN eDRX cycle, respectively) to derive the PTW ending location.**
* **Option 2: use separate PTWs for CN paging and RAN paging.**

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| **Company** | **Option** | | **Additional comments** |
| OPPO | Option 2 | |  |
| Xiaomi | Option1 | | For the overlapping PH, using a common PTW for CN paging and RAN paging is simpler. |
| MediaTek | Option 2 | | RAN and CN PTW lengths can be different, with the condition that RAN PTW length >= CN PTW length. |
| Samsung | Option 2 | | CN PTW and RAN PTW are independent. No need to align PTW ending location with Option 1-1. |
| Nokia | Option 2 | |  |
| Intel | See comment | | Suggest discussing this point after RAN2 has made agreements on previous questions.  In our understanding, RAN PTW and CN PTW could start in same PH/PTW\_Start but the length can be differently configured. Therefore, UE behaviour would be specified for the following cases: 1) inside RAN PTW overlapped with CN PTW, 2) inside only CN PTW, 3) inside only RAN PTW and 4) outside both PTWs. From the text explained above, it was not clear to use whether this operation maps to any of the options here explained. |
| Huawei, HiSilicon | Option 1-1 or Option 2 | | We assume that RAN PTW should be no longer than CN PTW (related to Q10), so using CN PTW (Option 1-1) can ensure that no paging will be missed. Option 2 also works since both CN PTW and RAN PTW are considered. |
| NEC | Option 1 | |  |
| ZTE | Option 2 | | Since RAN2 has agreed that “the RAN PTW length can be different from the CN PTW length”, to use separate PTW length for CN paging and RAN paging is a reasonable way. |
| Sharp | Option 2 | |  |
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**PTW location in non-overlapping PH**

Relevant RAN2 proposals are listed below:

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| Tdoc No. | Relevant Proposals | Source |
| [3]R2-2302531 | Proposal 3: For all kinds of PH (including RAN eDRX’s PH and common PH), use CN eDRX cycle to derive the PTW starting point based on the legacy calculation formula in Rel-17. | OPPO |
| [6]R2-2302703 | Proposal 3: A common PTW start is provided for idle mode e-DRX as well as for inactive mode e-DRX, i.e., PTW start is given by AMF and is calculated by idle mode e-DRX cycle. | Xiaomi Communications |
| [10]R2-2302816 | Proposal 2: For all RAN paging PH, using IDLE eDRX cycle to calculate the PTW\_start and RAN PTW\_length to calculate the PTW\_end when INACTIVE eDRX is longer than 10.24s. | vivo, Guangdong Genius |
| [12]R2-2303304 | Proposal 1: TeDRX,CN is used in the PTW\_start formula for RAN paging, i.e., adopt the following formula:  ieDRX\_RAN = floor(UE\_ID\_H /TeDRX\_CN) mod 8 | MediaTek Inc. |
| [14]R2-2303322 | Proposal 5. Discuss how to determine starting SFN of RAN configured PTW:   * Option 1. TeDRX\_CN is used:   + SFN = 128 \* ieDRX\_RAN, where ieDRX\_RAN = floor(UE\_ID\_H /TeDRX\_CN) mod 8) * Option 2. TeDRX\_CN is used in overlapping PH, and TeDRX\_RAN is used in non-overlapping PH:   + In overlapping PH, SFN = 128 \* ieDRX\_RAN, where ieDRX\_RAN = floor(UE\_ID\_H /TeDRX\_CN) mod 8   + In non-overlapping PH, SFN = 128 \* ieDRX\_RAN, where ieDRX\_RAN = floor(UE\_ID\_H /TeDRX\_RAN) mod 8 | Samsung |
| [15]R2-2303396 | Proposal 4: The formulae for PTW\_start and PTW\_end as as below  PTW\_start denotes the first radio frame of the PH that is part of the PTW and has SFN satisfying the following equation:  For the case where RAN eDRX PH and CN eDRX PH are the same  SFN = 128 \* ieDRX\_RAN, where  -    ieDRX\_RAN = floor(UE\_ID\_H /TeDRX\_CN) mod 8  else  SFN = 128 \* ieDRX\_RAN, where  -    ieDRX\_RAN = floor(UE\_ID\_H /TeDRX\_RAN) mod 8  PTW\_end is the last radio frame of the PTW and has SFN satisfying the following equation:  SFN = (PTW\_start + L\*100 - 1) mod 1024, where  in the case where PH has both RAN and CN PTW\_start,  L = max { Paging Time Window (PTW) length (in seconds) configured by upper layers,  Paging Time Window (PTW) length (in seconds) configured by RAN }  else  L = Paging Time Window (PTW) length (in seconds) configured by upper layers | Apple |
| [18]R2-2303542 | Proposal 1: when RAN and CN paging coincide in the same PH, the PTW starting locations for INACTIVE eDRX cycles longer than 10.24s could be determined by CN eDRX cycle. When RAN and CN paging is not located in same PH, the PTW starting locations for INACTIVE eDRX cycles longer than 10.24s could be determined by the formula using RAN eDRX cycle. | CMCC |
| [19]R2-2303561 | Proposal 1: For non-overlapped PHs for RAN and CN paging, UE follows the PTW configured for RRC inactive when UE is in RRC inactive with eDRX > 10.24s. | Qualcomm Incorporated |

Regarding how to determine PTW starting location for RAN PTW in the non-overlapping PH, the following options are brought by companies.

* Option 1: PTW starting location for RAN PTW is determined based on CN eDRX cycle. [3] [6] [10] [12] [14]
* Option 2: PTW starting location for RAN PTW is determined based on RAN eDRX cycle. [14] [15] [18]

For option 1, as stated in [3], this option can ensure that UE’s RAN PTWs (including in those overlapping PHs and non-overlapping PHs) to be uniformly distributed in time domain. Besides, it provides a unified calculation formula of PTW starting point for all kinds of PH, which has less specification impact.

For option 2, no explicit reasons are given before their proposals in [14] [15] [18].

Base on above, rapporteur would like to ask the following question:

**Question 16: Which is the preferred option regarding how to determine PTW starting location for RAN PTW in the non-overlapping PH?**

* **Option 1: PTW starting location for RAN PTW in the non-overlapping PH is determined based on CN eDRX cycle.**
* **Option 2: PTW starting location for RAN PTW in the non-overlapping PH is determined based on RAN eDRX cycle.**

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| **Company** | **Option** | | **Additional comments** |
| OPPO | Option 1 | | Option 1 could ensure that UE’s RAN PTWs (including in those overlapping PHs and non-overlapping PHs) to be uniformly distributed in time domain. In addition, we prefer a unified calculation formula of PTW starting point for all kinds of PH. |
| Xiaomi | Option1 | |  |
| MediaTek | Option 1 | | It is simpler to use the same eDRX cycle (CN) for both overlapping and non-overlapping PH cases. |
| Samsung | Either | |  |
| Nokia | Option 1 | |  |
| Intel | Option 2 | | In our understanding, non-overlapping PH would not be visible/known for CN paging. |
| Huawei, HiSilicon | Option 2 | | Anyway we need to capture PH for CN and PH for RAN separately, having different PTW starting location for overlapping PH and RAN only PH may not introduce additional complexity from spec perspective. |
| NEC | Option 1 | | Align with overlapping case. |
| ZTE | Option 1 | | Since PTW starting location does not impact the UE power saving, for simplicity, we prefer only one PTW starting location determination mechanism for RAN PTW, wherever in overlapping PH or in non-overlapping PH. |
| Sharp | Option 1 | |  |
| CMCC | Option 2 | |  |
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**Determination of T**

Relevant RAN2 proposals are listed below:

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| Tdoc No. | Relevant Proposals | Source |
| [3]R2-2302531 | Proposal 4: For a UE in RRC INACTIVE, if RAN eDRX cycle is above 10.24s, the UE monitors PO with T during PTW, where T is determined as follows:   * For RAN eDRX's PTW, T is RAN paging cycle. * For CN eDRX's PTW, T is determined by the shorter of CN configured DRX cycle and the default DRX value broadcasted in SIB. * For overlapping PTW, T is determined by the shortest of CN configured DRX cycle, RAN paging cycle, and the default DRX value broadcasted in SIB. | OPPO |
| [5]R2-2302642 | Proposal 2: During the PTW: T=min{UE specific DRX value if configured by upper layers, UE specific DRX value if configured by RRC, default DRX value broadcast in system information}. | China Telecommunications |
| [6]R2-2302703 | Proposal 4: For UE in RRC\_INACTIVE, if both idle mode eDRX cycle and inactive mode eDRX cycle are above 10.24s:   * For none overlapped RAN PTW (PTW2), T is RAN paging cycle; * For overlapped PTW (PTW1), T is determined by the shortest of CN configured DRX value, default DRX cycle and RAN paging cycle. | Xiaomi Communications |
| [7]R2-2302735 | Proposal 4: If TeDRX, CN > 10.24 s and TeDRX, RAN > 10.24 s, UE paging monitoring behaviour is as follow:  Proposal 4.1. During CN configured PTW, T is determined by T is determined by the shortest of the UE specific DRX value (s), if configured by RRC and/or upper layers, and a default DRX value broadcast in system information. [Note this behaviour applies independent of RAN configured PTW i.e. inside or outside RAN configured PTW]  Proposal 4.2. During RAN configured PTW while outside the CN configured PTW, T is determined by UE specific DRX value configured by RRC.  Proposal 4.3. Outside RAN configured PTW and CN configured PTW, UE is not required to monitor paging. | Intel Corporation |
| [10]R2-2302816 | Proposal 5: If both IDLE eDRX cycle and INACTIVE eDRX cycle are both longer than 10.24s:   * In only CN PTW, T is determined by the shortest of UE specific DRX cycle, if configured by upper layer and default paging cycle. * In only RAN PTW configured, T is determined by RAN paging cycle. * In overlapping PTW, T is determined by the shortest of RAN paging cycle, UE specific DRX cycle if configured by upper layer and default paging cycle. * Outside the PTW, UE does not monitor Paging. | vivo, Guangdong Genius |
| [11]R2-2302824 | Proposal 4a: The following UE behaviors need to be specified:   * UE should monitor CN paging and RAN paging during both the CN PTW and RAN PTW (e.g. during the overlapping PTW part). * UE should only monitor RAN paging during the RAN PTW but outside the CN PTW. * UE should only monitor CN paging during the CN PTW but outside the RAN PTW.   Proposal 4b: T is determined as following:   * During both CN PTW and RAN PTW (e.g. during the overlapping PTW part), T is determined by the shortest of RAN paging cycle, UE specific DRX cycle, if configured by upper layers, and the default DRX cycle broadcast in system information. * During CN PTW but outside RAN PTW (e.g. in the PHs with only CN paging), T is determined by the shortest of the UE specific DRX cycle, if configured by upper layers, and the default DRX cycle broadcast in system information. * Outside CN PTW but during RAN PTW (e.g. in the PHs with only RAN paging), T is determined by RAN paging cycle. | ZTE Corporation, Sanechips |
| [12]R2-2303304 | Proposal 5: During PTWRAN only, T=TRAN (UE specific DRX value configured by RRC).  Proposal 6: When PTWCN and PTWRAN are overlapping, RAN2 to select between two options:   * Option 1: T = min (TCN, TRAN, defaultPagingCycle) * Option 2: T = TRAN | MediaTek Inc. |
| [14]R2-2303322 | Proposal 4. When UE is configured with IDLE eDRX > 10.24s and INACTIVE eDRX > 10.24s, and the cell allows INACTIVE eDRX (>10.24s) and IDLE eDRX via SIB1, the paging monitoring cycle (T) UE in RRC\_INACTIVE uses can be summarized as:  1) During CN PTW and during RAN PTW, T = min (default DRX cycle, UE specific DRX cycle, RAN paging cycle)  2) During CN PTW and outside RAN PTW, T = min (default DRX cycle, UE specific DRX cycle)  3) Outside CN PTW and during RAN PTW, T = RAN paging cycle  4) Outside CN PTW and outside RAN PTW, No paging monitoring | Samsung |
| [15]R2-2303396 | Proposal 2: T is valid only within the paging window, outside the PTW, the UE does not monitor for any paging.  Proposal 3: RAN2 to confirm that UE only monitors RAN PO in the PTW when configured with RAN PTW/PH in INACTIVE. CN paging should align with RAN PO in this case. | Apple |
| [17]R2-2303468 | Proposal 2a: For the UE in RRC\_INACTIVE configured with both IDLE and IANCTIVE eDRX cycle longer than 10.24s, it should monitor both CN and RAN paging in the PTW(s) of the overlapped PH.  Proposal 2b: RAN2 to discuss following options on the T calculation in the overlapped PH:   * Option 1 (if Alt. 1 in Proposal 1 is adopted):  During the overlapped PTW part: T=min{UE specific DRX value if configured by upper layers, UE specific DRX value if configured by RRC, default DRX value broadcast in system information}. During the non-overlapped PTW part: if the RAN PTW is longer, T=min{UE specific DRX value if configured by RRC, default DRX value broadcast in system information}; If the CN PTW is longer, T=min{UE specific DRX value if configured by upper layer, default DRX value broadcast in system information}. * Option 2 (if Alt. 2 in Proposal 1 is adopted):   During the PTW: T=min{UE specific DRX value if configured by upper layers, UE specific DRX value if configured by RRC, default DRX value broadcast in system information}. | Huawei, HiSilicon |
| [18]R2-2303542 | Proposal 2: For combination of IDLE eDRX cycle >10.24s and INACTIVE eDRX cycle>10.24s, UE should monitor the paging with longer PTW of IDLE and INACTIVE eDRX. During this PTW, T is determined by the shortest of the UE specific DRX value (s), if configured by RRC and/or upper layers, RAN DRX cycle value and a default DRX value broadcast in system information. | CMCC |
| [20]R2-2304063 | Proposal 1: When PHs for CN and RAN paging overlap and PTW is configured for both CN and RAN paging, UE monitors for both CN and RAN paging during PTW where there is overlap.  Proposal 2: When PHs for CN and RAN paging overlap and PTW is configured for both CN and RAN paging, T is determined as follows:   * During CN and RAN configured PTW, for the overlapped part::   + T = min (UE specific DRX value if configured by upper layers, UE specific DRX value if configured by upper layers RRC, and a default DRX value broadcast in system information) * During CN and RAN configured PTW if partially overlapped where CN PTW is longer than RAN PTW, for the non-overlapped part :   + T = min (UE specific DRX value if configured by upper layers, and a default DRX value broadcast in system information) * During CN and RAN configured PTW if partially overlapped where RAN PTW is longer than CN PTW, for the non-overlapped part:   + T = min (UE specific DRX value if configured by RRC, and a default DRX value broadcast in system information) | Ericsson |

For a Rel-18 UE in RRC\_INACTIVE, if both CN configured eDRX cycle and RAN configured eDRX cycle are longer than 10.24, there may be three kinds of PTW:

* RAN PTW only, i.e., within RAN PTW and outside CN PTW
* CN PTW only, i.e., within CN PTW and outside RAN PTW
* Overlapping PTW, i.e. within both CN PTW and RAN PTW

RAN2 needs to discuss how to determine T in different kinds of PTW.

For RAN PTW only, the following options on T determination are brought by companies:

* Option 1: T = RAN configured DRX cycle [3] [6] [7] [10] [11] [12] [14]
* Option 2: T = min {RAN configured DRX cycle, default paging cycle broadcast in system information} [17] [20]

For CN PTW only, the following options on T determination are brought by companies:

* Option 1: T = min {CN configured DRX cycle, default paging cycle broadcast in system information} [3] [10] [11] [14] [17] [20]
* Option 2: T = min {CN configured DRX cycle, RAN configured DRX cycle, default paging cycle broadcast in system information} [7]

For overlapping PTW, the following options on T determination are brought by companies:

* Option 1: T = min {CN configured DRX cycle, RAN configured DRX cycle, default paging cycle broadcast in system information} [3] [5] [6] [7] [10] [11] [12] [14] [17] [18] [20]
* Option 2: T = RAN configured DRX cycle [12]

Base on above, rapporteur would like to ask the following questions:

**Question 17: Which is the preferred option regarding how to determine T within RAN PTW and outside CN PTW?**

* **Option 1: T = RAN configured DRX cycle**
* **Option 2: T = min {RAN configured DRX cycle, default paging cycle broadcast in system information}**

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| **Company** | **Option** | | **Additional comments** |
| OPPO | Option 1 | | In this case, UE only needs to monitor RAN paging. |
| Xiaomi | Option1 | | Since the idle mode e-DRX cycle is an integer multiple of inactive mode e-DRX cycle, there exists RAN paging only PTW. |
| MediaTek | Option 1 | | Aligns with the Rel-17 case for outside the CN PTW. In Rel-17, if CN PTW is configured, T=T\_RAN when outside the CN PTW. |
| Samsung | Option 1 | |  |
| Nokia | Option 1 | |  |
| Intel | Option 1 | |  |
| Huawei, HiSilicon | Option 2 | | For normal DRX, default DRX value broadcast in SI is considered for determining T, we think the same principle can be applied here. For CN paging monitoring, the CN DRX cycle may be configured as TA specific, cell specific default DRX value is taken into account. For RAN paging monitoring, RAN DRX cycle may be configured as RAN area specific, so cell specific default DRX value should also be considered. |
| NEC | Option 1 | |  |
| ZTE | Option1 | | Within RAN PTW and outside CN PTW, UE should only monitor RAN paging. As legacy, RAN configured DRX cycle should be used when UE only monitors RAN paging.  We see no clear justification for together with using cell specific default DRX value. Is the main problematic case RAN DRX cycle longer than cell specific default DRX value or RAN DRX cycle short than cell specific default DRX value? |
| Sharp | Option 1 | |  |
| CMCC | Option 1 | |  |
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**Question 18: Which is the preferred option regarding how to determine T within CN PTW and outside RAN PTW?**

* **Option 1: T = min {CN configured DRX cycle, default paging cycle broadcast in system information}**
* **Option 2: T = min {CN configured DRX cycle, RAN configured DRX cycle, default paging cycle broadcast in system information}**

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| **Company** | **Option** | | **Additional comments** |
| OPPO | Option 1 | | We should follow UE behaviour in Rel-17. |
| Xiaomi | - | | Since the idle mode e-DRX cycle is necessarily an integer multiple of inactive mode e-DRX cycle, a PTW start of CN paging is overlapping with a PTW start of RAN paging.  We need to discuss whether we applies a common PTW to receive both RAN paging and CN paging or we differentiate overlapped PTW part and none-overlapped PTW part for RAN paging+ CN paging and CN paging.  If common PTW applies, then Q18 does not exist. |
| MediaTek | None | | In our view, this case should not be possible, because PTW length of RAN should be >= PTW length for CN, and also when in the same PH, PTW start for CN and RAN should be the same. |
| Samsung | Option 1 | |  |
| Nokia | Option 1 | |  |
| Intel | Option 2 (with change) | | Option 2 is based on Intel’s TDoc, however our proposal had an “and/or” that is not reflected properly. Our proposal was:  “Proposal 4.1 During CN configured PTW, T is determined by T is determined by the shortest of the UE specific DRX value (s), if configured by RRC and/or upper layers, and a default DRX value broadcast in system information.”  In our understanding, this might be sufficient similarly as it was captured in R17 eDRX related operation *“During CN configured PTW, T is determined by the shortest of the UE specific DRX value (s), if configured by RRC and/or upper layers, and a default DRX value broadcast in system information. Outside the CN configured PTW, T is determined by the UE specific DRX value configured by RRC;”*  This way, the proposed UE behaviour would be applicable independently on whether the UE is or not inside of the RAN PTW. |
| Huawei, HiSilicon | Option 1 | |  |
| NEC | - | | No strong view, follow majority |
| ZTE | Option 1 | | Within CN PTW and outside RAN PTW, UE should only monitor CN paging. Thus, the legacy CN paging T (e.g. T = min {CN configured DRX cycle, default paging cycle broadcast in system information}) is used. |
| Sharp | Option 1 | |  |
| CMCC | Option 1 | |  |
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**Question 19: Which is the preferred option regarding how to determining T** **within both CN PTW and RAN PTW?**

* **Option 1: T = min {CN configured DRX cycle, RAN configured DRX cycle, default paging cycle broadcast in system information}**
* **Option 2: T = RAN configured DRX cycle**

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| **Company** | **Option** | | **Additional comments** |
| OPPO | Option 1 | | In this case, UE should monitor both RAN paging and CN paging. |
| Xiaomi | Option1 | |  |
| MediaTek | Option 2 | | In our view, Option 2 simplifies the eDRX operation without much negative impact on the UE reachability. |
| Samsung | Option 1 | |  |
| Nokia | Option 1 | |  |
| Intel | Option 1 (with change) | | As we explained in previous comment, we could add “and/or” and both cases could be covered at the same time.  “Proposal 4.1 During CN configured PTW, T is determined by T is determined by the shortest of the UE specific DRX value (s), if configured by RRC and/or upper layers, and a default DRX value broadcast in system information. [Note this behaviour applies independent of RAN configured PTW i.e. inside or outside RAN configured PTW]” |
| Huawei, HiSilicon | Option 1 | |  |
| NEC | - | | No strong view, follow majority |
| ZTE | Option 1 | | Within both CN PTW and RAN PTW, UE should monitor CN paging and RAN paging simultaneously. Thus the min {RAN paging T, CN Paging T} should be used. |
| Sharp | Option 1 | |  |
| CMCC | Option 1 | |  |
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## 3.6 SI modification mechanism for eDRX

In Rel-17, a new indication *systemInfoModification-eDRX* is defined in the Short Message to indicate of a BCCH modification other than SIB6, SIB7 and SIB8, and this indication applies only to UEs using eDRX cycle longer than the BCCH. More specifically, the CN eDRX cycle, if configured, is used to compare with the modification period.

Relevant RAN2 proposals are listed below:

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| Tdoc No. | Relevant Proposals | Source |
| [6]R2-2302703 | Proposal 8: RAN2 confirms that for UE in RRC\_INACTIVE, the idle mode extended DRX cycle, if configured, is used to compare with the modification period (e-DRX in RRC\_INACTIVE longer than 10.24s does not impact the current Spec). | Xiaomi Communications |
| [7]R2-2302735 | Proposal 6: Legacy *systemInfoModification-eDRX* indication in Short message and eDRX modification period/boundaries are also applicable for Rel-18 UEs in RRC\_INACTIVE configured with eDRX > 10.24sec. | Intel Corporation |

It is proposed in [7] that legacy *systemInfoModification-eDRX* indication in Short message and eDRX modification boundaries are also applicable for Rel-18 UEs in RRC\_INACTIVE configured with eDRX > 10.24sec. And it is proposed in [6] that for Rel-18 UEs conifgued with enhanced INACIVE eDRX, the CN eDRX cycle is used to compare with the modification period, i.e., INACTIVE eDRX longer than 10.24s does not impact the current spec.

**Question 20: Do companies agree that legacy systemInfoModification-eDRX indication in Short message and eDRX modification boundaries are also applicable for Rel-18 UEs configured with INACTIVE eDRX > 10.24sec, and in this case, the CN eDRX cycle is used to compare with the modification period?**

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| **Company** | **Yes/No** | | **Additional comments** |
| OPPO | Yes | | Fine to follow legacy SI modification mechanism for eDRX |
| Xiaomi | Yes | |  |
| MediaTek | Yes | |  |
| Samsung | Yes | |  |
| Nokia | Yes | |  |
| Intel | Yes | |  |
| Huawei, HiSilicon | Yes | |  |
| NEC | Yes | |  |
| ZTE | Yes | | The legacy *systemInfoModification-eDRX* indication in Short message and eDRX modification boundaries mechanism can be used, e.g.  F*or UEs in RRC\_IDLE or RRC\_INACTIVE configured to use an IDLE eDRX cycle longer than the modification period, an eDRX acquisition period is defined.* |
| Sharp | Yes | |  |
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## 3.7 SDT and eDRX

In RAN2#121 meeting, RAN2 intends to allow configuring eDRX > 10.24s in RRC inactive state together with MO-SDT and/or MT-SDT, and an LS has been sent to RAN3/SA2/CT1.

Relevant RAN2 proposals are listed below:

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| Tdoc No. | Relevant Proposals | Source |
| [17]R2-2303468 | Observation 2: For now, no RAN2 specification impacts exist when INACTIVE eDRX (beyond 10.24s) is configured together with MO/MT SDT. | Huawei, HiSilicon |
| [19]R2-2303561 | Proposal 6: If eDRX > 10.24s is configured in RRC inactive, UE should be allowed to trigger MO-SDT and can be transition to RRC connected state to handle the subsequent data if any. | Qualcomm Incorporated |

Rapporteur understands the above observation and proposal given [17] and [19] respectively both align with RAN2’s intention, and seems no critical issue is raised. So no question is given here.

# 4. Summary and Proposals

This section summarizes the main proposals:

# 5. References

1. R2-2302496 Fallback behaviour for eRedcap UE NEC discussion NR\_redcap\_enh-Core
2. R2-2302497 Paging monitoring for Inactive UE in enhanced eDRX NEC discussion NR\_redcap\_enh-Core
3. R2-2302531 Discussion on enhanced eDRX in RRC\_INACTIVE OPPO discussion Rel-18 NR\_redcap\_enh-Core
4. R2-2302565 Discussion on enhanced eDRX in RRC\_INACTIVE CATT discussion Rel-18 NR\_redcap\_enh-Core
5. R2-2302642 Discussion on enhanced eDRX in RRC\_INACTIVE China Telecommunications discussion Rel-18 NR\_redcap\_enh-Core
6. R2-2302703 Discussion on e-DRX for eRedcap Devices Xiaomi Communications discussion
7. R2-2302735 RAN2 impacts to support eDRX in RRC\_INACTIVE above 10.24 sec Intel Corporation discussion Rel-18 NR\_redcap\_enh-Core
8. R2-2302803 On eDRX for enhanced RedCap Nokia, Nokia Shanghai Bell discussion Rel-18 NR\_redcap\_enh-Core
9. R2-2302815 Discussion on UE fallback behaviour for INACTIVE eDRX vivo, Guangdong Genius discussion Rel-18 NR\_redcap\_enh-Core
10. R2-2302816 Enhanced eDRX cycle in RRC\_INACTIVE for eRedCap UEs vivo, Guangdong Genius discussion Rel-18 NR\_redcap\_enh-Core
11. R2-2302824 Further discussion on longer eDRX in RRC\_INACTIVE ZTE Corporation, Sanechips discussion Rel-18 NR\_redcap\_enh-Core
12. R2-2303304 Enhanced eDRX in RRC\_INACTIVE MediaTek Inc. discussion Rel-18 NR\_redcap\_enh-Core
13. R2-2303321 Discussion on available eDRX configurations Samsung discussion Rel-18
14. R2-2303322 Discussion on enhanced eDRX in RRC\_INACTIVE Samsung discussion Rel-18
15. R2-2303396 RedCap PTW/PH operation for >10.24sec INACTIVE eDRX Apple discussion Rel-18 NR\_redcap\_enh-Core
16. R2-2303397 RedCap UE behavior in cells not supporting R18 eDRX Apple discussion Rel-18 NR\_redcap\_enh-Core
17. R2-2303468 Discussion on enhanced eDRX in RRC\_INACTIVE Huawei, HiSilicon discussion Rel-18 NR\_redcap\_enh-Core
18. R2-2303542 Discussion on eDRX in RRC\_INACTIVE CMCC discussion Rel-18 NR\_redcap\_enh-Core
19. R2-2303561 Discussion on enhanced eDRX in RRC inactive Qualcomm Incorporated discussion NR\_redcap\_enh-Core
20. R2-2304063 Extending eDRX cycles in RRC\_INACTIVE Ericsson discussion Rel-18 NR\_redcap\_enh-Core