**3GPP TSG-RAN WG2 Meeting #121 R2-220xxxx**

**Athens, Greece, 27th February– 3rd March, 2023**

**Agenda Item: 6.8.2**

**Source: OPPO**

**Title: Summary of [AT121][109][RedCap] eDRX corrections (OPPO)**

**Document for: Discussion and Decision**

# Introduction

This document aims to collect companies’ views to following CRs submitted to RAN2#121 on eDRX corrections.

[R2-2300172](file:///C:\Data\3GPP\Extracts\R2-2300172-Correction%20on%20eDRX.docx) Correction on eDRX OPPO CR Rel-17 38.304 17.3.0 0317 - F NR\_redcap-Core

* Offline 109

[R2-2301330](file:///C:\Data\3GPP\Extracts\R2-2301330%20Correction%20on%20eDRX%20in%20TS%2038304.docx) Correction on eDRX Nokia, Nokia Shanghai Bell CR Rel-17 38.304 17.3.0 0323 - F NR\_redcap-Core

[R2-2300311](file:///C:\Data\3GPP\Extracts\38.304_CR0319(Rel-17)_R2-2300311_Correction%20on%2038.304%20for%20RedCap.docx) Correction on 38.304 for RedCap vivo, Guangdong Genius CR Rel-17 38.304 17.3.0 0319 - F NR\_redcap-Core, NR\_SmallData\_INACTIVE-Core

[R2-2301134](file:///C:\Data\3GPP\Extracts\R2-2301134%20Corrections%20for%20eDRX%20on%20IDLE%20eDRX%20cycle.doc) Corrections for eDRX on IDLE eDRX cycle Huawei, HiSilicon CR Rel-17 38.331 17.3.0 3869 - F NR\_redcap-Core

[R2-2301135](file:///C:\Data\3GPP\Extracts\R2-2301135%20Correction%20for%20hyperSFN%20on%20SI%20update.doc) Correction for hyperSFN on SI update Huawei, HiSilicon CR Rel-17 38.331 17.3.0 3870 - F NR\_redcap-Core

# 2. Contact information

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# Discussion

*UE ID for eDRX operation*

In current specification, when UE operates in eDRX, the UE\_ID used for PF/PO calculation and the UE\_ID used for SubgroupID calculation for UE ID based subgrouping are 5G-S-TMSI mod 4096 and 5G-S-TMSI mod 32768, respectively. While in other cases, the UE\_IDs are 5G-S-TMSI mod 1024 and 5G-S-TMSI mod 8192, respectively. The reason to extend the upper limit of UE\_ID for eDRX is to ensure all UEs distribute uniformly on all POs and all subgroups. Otherwise, for example, UEs configured with eDRX cycle equal to 1024 radio frames only monitor the first PO in one PF even if Ns > 1.

In R2-2300311 [1], it is stated that there is no doubt that when eDRX configured by upper layer and/or RRC is no longer than 1024 radio frames, the upper limit of UE\_ID should be extended. However, when UE operates in eDRX with eDRX cycle longer than 10.24s, the T used for paging monitor within PTW and/or outside PTW will not be longer than 256 radio frames, hence extending the UE\_ID is not necessary in this case. Therefore, it is proposed in [1] to restrict the scenario of extending upper limit of UE\_ID for the cases that UE operates in eDRX and the eDRX cycle configured by upper layer is not longer than 1024 radio frames or eDRX cycle configured by RRC is not longer than 1024 radio frames or both are not longer than 1024 radio frames.

The corresponding TP is as below.

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| 7.1 Discontinuous Reception for paging  ……  The following parameters are used for the calculation of PF and i\_s above:  ……  UE\_ID:  If the UE operates in eDRX and the eDRX cycle configured by RRC or upper layer is not longer than 1024 radio frames as specified in clause 7.4:  - 5G-S-TMSI mod 4096  else:  - 5G-S-TMSI mod 1024 |
| 7.3.2 UE\_ID based subgrouping  …...  SubgroupID = (floor(UE\_ID/(N\*Ns)) mod subgroupsNumForUEID) + (subgroupsNumPerPO - subgroupsNumForUEID),  where:  N: number of total paging frames in T, which is the DRX cycle of RRC\_IDLE state as specified in clause 7.1  Ns: number of paging occasions for a PF  UE\_ID: 5G-S-TMSI mod X, where X is 32768, if eDRX is applied and the eDRX cycle configured by RRC or upper layer is not longer than 1024 radio frames; otherwise, X is 8192  subgroupsNumForUEID: number of subgroups for UE\_ID based subgrouping in a PO, which is broadcasted in system information |

**Question 1: Do companies agree to the 1st change in R2-2300311 as above?**

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| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| OPPO | Disagree | When UE operates in eDRX with eDRX cycle longer than 10.24s, using 5G-S-TMSI mod 4096 and 5G-S-TMSI mod 1024 as UE ID would derive the same PF/PO, and using 5G-S-TMSI mod 32768 and 5G-S-TMSI mod 8192 would derive the same subgroupID for UE ID based subgroup. There is no need to introduce such restriction, we should keep the spec simple. |
| Nokia | Disagree | We agree with OPPO |
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*PTW\_start*

In current specification, regarding the PTW\_start, is described as follows:

**PTW\_start denotes the first radio frame of the PH that is part of the PTW and has SFN satisfying the following equation**:

As stated in R2-2300311 [1], it seems that the PTW\_start is the first radio frame of the PH according to the wording, while the actual intention is that the PTW\_start denotes the first radio frame of the PTW, and the first radio frame of the PTW, i.e. the PTW\_start belongs to the PH, i.e. is part of PH. Hence, it is proposed in R2-2300311 [1] to correct the wording to avoid misunderstanding.

The corresponding TP is as below.

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| PTW\_start denotes the first radio frame of the PTW that is part of the PH and has SFN satisfying the following equation:  SFN = 128 \* ieDRX\_CN, where  - ieDRX\_CN = floor(UE\_ID\_H /TeDRX\_CN) mod 8 |

Rapporteur: Note that the above wording is copying exactly the same from LTE spec (i.e. 36.304).

**Question 2: Do companies agree to the 2nd change in R2-2300311 as above?**

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| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| OPPO | Disagree | The description of PTW\_start in TS38.304 is exactly the same as that in TS36.304. We think there is no confusion and no need to correct the wording. |
| Nokia | Disagree | We agree with OPPO |
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*SI modification for eDRX*

As stated in R2-2301134 [2], UE determines when to use eDRX acquisition period by only comparing the IDLE eDRX cycle with modification period (rather than INACTIVE eDRX cycle). This should be clarified in the section 5.2.2.2.2 and 6.5 in TS 38.331.

In addition, according to the procedure for SI change in section 5.2.2.2.2 in TS 38.331, if the UE is configured with an RRC\_IDLE eDRX cycle longer than the modification period, the eDRX acquisition period is used; Otherwise, the modification period is used. However, the UE may not operate in eDRX even if it is configured with eDRX (due to that the camped cell does not support eDRX), in which case the UE should still use the modification period to avoid unnecessary long latency brought by the eDRX acquisition period. Therefore, it is proposed in R2-2301134 [2] to clarify in the SI change procedure and in the short message that if the UE uses an IDLE eDRX cycle longer than the modification period, the eDRX acquisition period is used; Otherwise, the modification period is used.

The corresponding TP is as below.

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| 5.2.2.2.2 SI change indication and PWS notification  A modification period is used, i.e. updated SI message (other than SI message for ETWS, CMAS, positioning assistance data, and some NTN-specific information as specified in the field descriptions ) is broadcasted in the modification period following the one where SI change indication is transmitted. The modification period boundaries are defined by SFN values for which SFN mod m = 0, where m is the number of radio frames comprising the modification period. The modification period is configured by system information. If H-SFN is provided in *SIB1*, and UE is configured with eDRX,modification period boundaries are defined by SFN values for which (H-SFN \* 1024 + SFN) mod *m* = 0.  For 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. The boundaries of the eDRX acquisition period are determined by H-SFN values for which H-SFN mod 1024 = 0.  The UE receives indications about SI modifications and/or PWS notifications using Short Message transmitted with P-RNTI over DCI (see clause 6.5). Repetitions of SI change indication may occur within preceding modification period or within preceding eDRX acquisition period. SI change indication is not applicable for SI messages containing posSIBs.  ……  If the UE receives a Short Message, the UE shall:  1> if the UE is ETWS capable or CMAS capable, the *etwsAndCmasIndication* bit of Short Message is set, and the UE is provided with *searchSpaceSIB1* and *searchSpaceOtherSystemInformation* on the active BWP or the initial BWP:  2> immediately re-acquire the *SIB1*;  2> if the UE is ETWS capable and *si-SchedulingInfo* includes scheduling information for *SIB6*:  3> acquire *SIB6*, as specified in clause 5.2.2.3.2,immediately;  2> if the UE is ETWS capable and *si-SchedulingInfo* includes scheduling information for *SIB7*:  3> acquire *SIB7*, as specified in clause 5.2.2.3.2,immediately;  2> if the UE is CMAS capable and *si-SchedulingInfo* includes scheduling information for *SIB8*:  3> acquire *SIB8*, as specified in clause 5.2.2.3.2,immediately;  NOTE: In case *SIB6*, *SIB7*, or *SIB8* overlap with a measurement gap it is left to UE implementation how to immediately acquire *SIB6*, *SIB7*, or *SIB8*.  1> if the UE does not use an IDLE eDRX cycle longer than the modification period and the *systemInfoModification* bit of Short Message is set:  2> apply the SI acquisition procedure as defined in clause 5.2.2.3 from the start of the next modification period;  1> if the UE uses an IDLE eDRX cycle longer than the modification period and the *systemInfoModification-eDRX* bit of Short Message is set:  2> apply the SI acquisition procedure as defined in clause 5.2.2.3 from the start of the next eDRX acquisition period boundary. |
| 6.5 Short Message  Short Messages can be transmitted on PDCCH using P-RNTI with or without associated *Paging* message using Short Message field in DCI format 1\_0 (see TS 38.212 [17], clause 7.3.1.2.1).  Table 6.5-1 defines Short Messages. Bit 1 is the most significant bit.  **Table 6.5-1: Short Messages**   |  |  | | --- | --- | | **Bit** | **Short Message** | | 1 | ***systemInfoModification***  If set to 1: indication of a BCCH modification other than SIB6, SIB7 and SIB8. | | 2 | ***etwsAndCmasIndication***  If set to 1: indication of an ETWS primary notification and/or an ETWS secondary notification and/or a CMAS notification. | | 3 | ***stopPagingMonitoring***  This bit can be used for only operation with shared spectrum channel access and if *nrofPDCCH-MonitoringOccasionPerSSB-InPO* is present.  If set to 1: indication that the UE may stop monitoring PDCCH occasion(s) for paging in this Paging Occasion as specified in TS 38.304 [20], clause 7.1. | | 4 | ***systemInfoModification-eDRX***  If set to 1: indication of a BCCH modification other than SIB6, SIB7 and SIB8. This indication applies only to UEs using IDLE eDRX cycle longer than the BCCH modification period. | | 5 – 8 | Not used in this release of the specification, and shall be ignored by UE if received. | |

**Question 3: Do companies agree to the 1st change in R2-2301134 as above?**

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| **Company** | **Agree/Disagree** | **Additional comments** |
| OPPO | Agree |  |
| Nokia | - | Wording can be improved if something is agreed |
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*Terminologies for the eDRX configured by CN*

As stated in R2-2301134 [2], in the current TS 38.331, there are different terminologies for the eDRX configured by CN. A uniform terminology should be used to avoid ambiguity (i.e. IDLE eDRX). Thereore, it is proposed to change the terminology “eDRX in IDLE mode” to “IDLE eDRX” in TS 38.331.

The corresponding TP is as below.

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| 6.2.2 Message definitions  – *RRCRelease*  …….   |  |  | | --- | --- | | **Conditional Presence** | **Explanation** | | *L2RemoteUE* | The field is mandatory present for L2 U2N Remote UE's RNAU; otherwise it is absent. | | *RANPaging* | This field is optionally present, Need R, if the UE is configured with IDLE eDRX, see TS 24.501 [23]; otherwise the field is not present. | | *Redirection2* | The field is optionally present, Need R, if *redirectedCarrierInfo* is included; otherwise the field is not present. | |

**Question 4: Do companies agree to the 2nd change in R2-2301134 as above?**

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| **Company** | **Agree/Disagree** | **Additional comments** |
| OPPO | Agree | Fine to align the terminology in TS 38.331. |
| Nokia | no strong view | current text seems fine |
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*commonControlResourceSet field descritpion*

This issue included in R2-2301134 [2] is not related to eDRX correction, but it seems no harm to check companies’ view.

As stated in R2-2301134 [2], RedCap introduced one sentence in commonControlResourceSet field descritpion in TS38.331, i.e. “*If the RedCap-specific initial downlink BWP does not contain the entire CORESET#0, the network configures the commonControlResourceSet in SIB1 for RedCap so that it is not contained in the bandwidth of CORESET#0.*” The original intention was to remove the restrcition of non-RedCap UE as in ”so that it is contained in the bandwidth of CORESET#0.” However, this new descirption causes the confusion that any part of commonControlResourceSet for RedCap cannot be contained in the bandwidth of CORESET#0 at all, even partially overlapped. Therefore, it should be clarified that the network configures the commonControlResourceSet in SIB1 for RedCap, which **does not have to be** contained in the bandwidth of CORESET#0. The commonControlResourceSet is allowed to be partially overlapped with the bandwidth of CORESET#0.

The corresponding TP is as below.

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| |  | | --- | | ***PDCCH-ConfigCommon field descriptions*** | | ***commonControlResourceSet***  An additional common control resource set which may be configured and used for any common or UE-specific search space. If the network configures this field, it uses a *ControlResourceSetId* other than 0 for this *ControlResourceSet*. The network configures the *commonControlResourceSet* in *SIB1* so that it is contained in the bandwidth of CORESET#0. If the RedCap-specific initial downlink BWP does not contain the entire CORESET#0, the network configures the *commonControlResourceSet* in *SIB1* for RedCap so that it is not necessarily contained in the bandwidth of CORESET#0. | |

**Question 5: Do companies agree to the 3rd change in R2-2301134 as above?**

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| **Company** | **Agree/Disagree** | **Additional comments** |
| OPPO | Disagree | it seems that the existing spec is clear. |
| Nokia | No strong view |  |
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*hyperSFN change*

As stated in R2-2301135 [3], for eDRX longer than 10.24s, the field *hyperSFN-r17* is introduced in SIB1 to indicate the current hyper SFN. The hyper SFN increments by one when the SFN wraps around, which can be subsequently maintained by the UE itself after it obtains the hyper SFN via SIB1, i.e. the UE does not rely on SIB1 modification with updated *hyperSFN-r17* to know the upcoming hyper SFN. Therefore, it is suggested in R2-2301135 [3] to clarify that changes to *hyperSFN-r17* may not lead to an SI change procedure in order to avoid frequent (every 10.24s) and unnecessary SI modification caused by updating the *hyperSFN-r17* field.

The corresponding TP is as below.

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| |  | | --- | | ***SIB1 field descriptions*** | | ***hyperSFN***  Indicates hyper SFN which increments by one when the SFN wraps around. This field is excluded when determining changes in system information, i.e. changes of hyper SFN should not result in system information change notifications. | |

Rapporteur: Note that in LTE we didn’t exclude *hyperSFN*.

**Question 6: Do companies agree to the change in R2-2301135?**

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| **Company** | **Agree/Disagree** | **Additional comments** |
| OPPO | Disagree | SI modification caused by the change of *hyperSFN* field is every 10.24s, which is much less frequent than that caused by *timeInfoUTC* in SIB9, *EphemerisInfo*, *epochTime*,  *ntn-UlSyncValidityDuration*, *ta-Common*, *ta-CommonDriftVariant* in NTN-Config. In addition, in LTE, the change of *hyperSFN* would lead to SI modification. We prefer to follow the same mechanism as LTE. |
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*Determination of T for eDRX operation*

In clause 7.1 of the current TS 38.304, the following text is captured to specify how to determine T for DRX/eDRX operation.

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| The following parameters are used for the calculation of PF and i\_s above:  T: DRX cycle of the UE.  If eDRX is not configured as defined in clause 7.4:  - T is determined by the shortest of the UE specific DRX value(s), if configured by RRC and/or upper layers or provided in PC5-RRC signalling in case of a L2 U2N Relay UE, and a default DRX value broadcast in system information. In RRC\_IDLE state, if UE specific DRX is not configured by upper layers, the default value is applied.  In RRC\_IDLE state, if eDRX is configured by upper layers, i.e., TeDRX, CN, according to clause 7.4:  - If TeDRX, CN is no longer than 1024 radio frames:  - T = TeDRX, CN;  - else:  - During CN configured PTW, T is determined by the shortest of UE specific DRX value, if configured by upper layers, and the default DRX value broadcast in system information.  In RRC\_INACTIVE state, if eDRX is configured by RRC, i.e., TeDRX, RAN , and/or upper layers, i.e., TeDRX, CN, as defined in clause 7.4:  - If both TeDRX, CN and TeDRX, RAN are no longer than 1024 radio frames, T = min{TeDRX, RAN, TeDRX, CN}.  - If TeDRX, CN is no longer than 1024 radio frames and no TeDRX, RAN is configured, T is determined by the shortest of UE specific DRX value configured by RRC and TeDRX, CN.  - If TeDRX, CN is longer than 1024 radio frames:  - If TeDRX, RAN is not configured:  - 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;  - else if TeDRX, RAN is no longer than 1024 radio frames:  - During CN configured PTW, T is determined by the shortest of the UE specific DRX value, if configured by upper layers and TeDRX, RAN, and a default DRX value broadcast in system information. Outside the CN configured PTW, T is determined by TeDRX, RAN. |

As stated in R2-2301330 [4], it is specified that the UE selects DRX cycle from different options (UE specific DRX value(s), default value, RAN configured, CN configured, DRX cycle, eDRX cycle) based on whether the UE is configured with eDRX. This is incorrect, because the UE can be configured with eDRX for RAN paging in INACTIVE and/or for CN paging in IDLE, but the UE is not necessarily operating in eDRX e.g. in case eDRX is not allowed for the specific RRC state where the UE is on the cell. This issue is also mentioned in R2-2300172 [5] that the case that TeDRX, RAN is configured but RAN eDRX is not allowed in the current cell is missing.

To clarify UE behaviour in such cases, the following corrections are given in [4] and [5], respectively.

* **Alt1:** Clarify that DRX cycle selection depends on whether the UE operates in eDRX according to clause 7.4 [4]

The corresponding TP is as below.

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| The following parameters are used for the calculation of PF and i\_s above:  T: DRX cycle of the UE.  If the UE does not operate in eDRX as defined in clause 7.4:  - T is determined by the shortest of the UE specific DRX value(s), if configured by RRC and/or upper layers or provided in PC5-RRC signalling in case of a L2 U2N Relay UE, and a default DRX value broadcast in system information. In RRC\_IDLE state, if UE specific DRX is not configured by upper layers, the default value is applied.  In RRC\_IDLE state, if the UE operates in eDRX and eDRX is configured by upper layers, i.e., TeDRX, CN, according to clause 7.4:  - If TeDRX, CN is no longer than 1024 radio frames:  - T = TeDRX, CN;  - else:  - During CN configured PTW, T is determined by the shortest of UE specific DRX value, if configured by upper layers, and the default DRX value broadcast in system information.  In RRC\_INACTIVE state, if the UE operates in eDRX and eDRX is configured by RRC, i.e., TeDRX, RAN , and/or upper layers, i.e., TeDRX, CN, as defined in clause 7.4:  - If both TeDRX, CN and TeDRX, RAN are no longer than 1024 radio frames, T = min{TeDRX, RAN, TeDRX, CN}.  - If TeDRX, CN is no longer than 1024 radio frames and no TeDRX, RAN is configured, T is determined by the shortest of UE specific DRX value configured by RRC and TeDRX, CN.  - If TeDRX, CN is longer than 1024 radio frames:  - If TeDRX, RAN is not configured:  - 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;  - else if TeDRX, RAN is no longer than 1024 radio frames:  - During CN configured PTW, T is determined by the shortest of the UE specific DRX value, if configured by upper layers and TeDRX, RAN, and a default DRX value broadcast in system information. Outside the CN configured PTW, T is determined by TeDRX, RAN. |

* **Alt2:** Adding text that “If TeDRX, CN is configured by upper layers but *eDRX-AllowedIdle* is not signalled in SIB1, the UE shall behave as if TeDRX, CN is not configured. If TeDRX, RAN is configured by RRC but *eDRX-AllowedInactive* is not signalled in SIB1, the UE shall behave as if TeDRX, RAN is not configured” [5]

The corresponding TP is as below.

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| In RRC\_INACTIVE state, if eDRX value configured by upper layers is longer than 1024 radio frames, during CN PTW, the UE shall use the same i\_s as for RRC\_IDLE state.  If TeDRX, CN is configured by upper layers but *eDRX-AllowedIdle* is not signalled in SIB1, the UE shall behave as if TeDRX, CN is not configured. If TeDRX, RAN is configured by RRC but *eDRX-AllowedInactive* is not signalled in SIB1, the UE shall behave as if TeDRX, RAN is not configured. |

**Question 7: Do companies think the issue raised by R2-2301330 and R2-2300172 is valid?**

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| **Company** | **Yes/No** | **Additional comments** |
| OPPO | Yes | UE behaviour in the following two cases should be clear:  Case 1：TeDRX, CN is configured but CN eDRX is not allowed in the current cell  Case 2：TeDRX, RAN is configured but RAN eDRX is not allowed in the current cell |
| Nokia | Yes |  |
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**Question 8: If the issue is confirmed, which of the following options is preferred?**

* **Option1: Clarify that DRX cycle selection depends on whether the UE operates in eDRX according to clause 7.4**
* **Option2: Adding text that “If TeDRX, CN is configured by upper layers but *eDRX-AllowedIdle* is not signalled in SIB1, the UE shall behave as if TeDRX, CN is not configured. If TeDRX, RAN is configured by RRC but *eDRX-AllowedInactive* is not signalled in SIB1, the UE shall behave as if TeDRX, RAN is not configured”**
* **Option3: Others**

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| **Company** | **Preferred Option** | **Additional comments** |
| OPPO | Option 2 | For option 1, the case that TeDRX, RAN is configured but RAN eDRX is not allowed in the current cell is still missing. |
| Nokia | Option 1 | Comments to OPPO: “the case that TeDRX, RAN is configured but RAN eDRX is not allowed” is covered here:  “In RRC\_INACTIVE state, if the UE operates in eDRX and eDRX is configured by RRC, i.e., TeDRX, RAN , and/or upper layers, i.e., TeDRX, CN, as defined in clause 7.4:”  In option 2 it is not clear what is meant by “the UE shall behave as if TeDRX, CN is not configured”.. “”  Option 1 only adds reference to existing text in clause 7.4 where it is defined when the UE operates in eDRX. |
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# 4. Summary and Proposals

This section summarizes the main proposals:

# 5. References

1. R2-2300311 Correction on 38.304 for RedCap vivo, Guangdong Genius CR Rel-17 38.304 17.3.0 0319 - F NR\_redcap-Core, NR\_SmallData\_INACTIVE-Core
2. R2-2301134 Corrections for eDRX on IDLE eDRX cycle Huawei, HiSilicon CR Rel-17 38.331 17.3.0 3869 - F NR\_redcap-Core
3. R2-2301135 Correction for hyperSFN on SI update Huawei, HiSilicon CR Rel-17 38.331 17.3.0 3870 - F NR\_redcap-Core
4. R2-2301330 Correction on eDRX Nokia, Nokia Shanghai Bell CR Rel-17 38.304 17.3.0 0323 - F NR\_redcap-Core
5. R2-2300172 Correction on eDRX OPPO CR Rel-17 38.304 17.3.0 0317 - F NR\_redcap-Core