**3GPP TSG-RAN2 Meeting #121 *R2-2301330***

**Athens, Greece, 27 February – 03 March 2023**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.304** | **CR** | **0323** | **rev** | **-** | **Current version:** | **17.3.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | Correction on eDRX | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Nokia, Nokia Shanghai Bell | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_redcap-Core | | | | |  | ***Date:*** | | | 2023-02-16 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | F |  | | | | | ***Release:*** | | | Rel-17 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
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| ***Reason for change:*** | | 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 results erroneous selection of the DRX cycle. | | | | | | | | |
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| ***Summary of change:*** | | Clarified that DRX cycle selection depends on whether the UE operates in eDRX according to clause 7.4*.* | | | | | | | | |
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| ***Consequences if not approved:*** | | Incorrect DRX cycle may be selected.  **Impact analysis**  Impacted functionality: eDRX.  Inter-operability:   1. If the network is implemented according to the CR and the UE is not, the UE and the NW may select different DRX cycle. 2. If the UE is implemented according to the CR and the network is not, the UE and the NW may select different DRX cycle. | | | | | | | | |
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| ***Clauses affected:*** | | 7.1 | | | | | | | | |
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|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | |  | | --- | | TS/TR ... CR ... | | TS/TR ... CR ... | | TS/TR ... CR ... | | | |
| ***affected:*** | |  | **X** | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

*First Modified Subclause*

7.1 Discontinuous Reception for paging

The UE may use Discontinuous Reception (DRX) in RRC\_IDLE and RRC\_INACTIVE state in order to reduce power consumption. The UE monitors one paging occasion (PO) per DRX cycle. A PO is a set of PDCCH monitoring occasions and can consist of multiple time slots (e.g. subframe or OFDM symbol) where paging DCI can be sent (TS 38.213 [4]). One Paging Frame (PF) is one Radio Frame and may contain one or multiple PO(s) or starting point of a PO. A L2 U2N Relay UE monitors the paging occasions of its PC5-RRC connected L2 U2N Remote UEs. In this case, the DRX cycle and UE ID mentioned in this clause refer to those of the L2 U2N Remote UE.

In multi-beam operations, the UE assumes that the same paging message and the same Short Message are repeated in all transmitted beams and thus the selection of the beam(s) for the reception of the paging message and Short Message is up to UE implementation. The paging message is same for both RAN initiated paging and CN initiated paging.

The UE initiates RRC Connection Resume procedure upon receiving RAN initiated paging. If the UE receives a CN initiated paging in RRC\_INACTIVE state, the UE moves to RRC\_IDLE and informs NAS. However, if a L2 U2N Relay UE in RRC\_INACTIVE state receives a CN initiated paging for a L2 U2N Remote UE, the L2 U2N Relay UE does not move to RRC\_IDLE state.

NOTE 0a: The L2 U2N Remote UE does not need to monitor the PO in order to receive the paging message.

NOTE 0b: While the SDT procedure is ongoing in RRC\_INACTIVE state, the UE monitors the PO in order to receive only the Short Message as specified in TS 38.331 [3].

The PF and PO for paging are determined by the following formulae:

SFN for the PF is determined by:

(SFN + PF\_offset) mod T = (T div N)\*(UE\_ID mod N)

Index (i\_s), indicating the index of the PO is determined by:

i\_s = floor (UE\_ID/N) mod Ns

The PDCCH monitoring occasions for paging are determined according to *pagingSearchSpace* as specified in TS 38.213 [4] and *firstPDCCH-MonitoringOccasionOfPO* and *nrofPDCCH-MonitoringOccasionPerSSB-InPO* ifconfigured as specified in TS 38.331 [3]. When *SearchSpaceId* = 0 is configured for *pagingSearchSpace*, the PDCCH monitoring occasions for paging are same as for RMSI as defined in clause 13 in TS 38.213 [4].

When *SearchSpaceId* = 0 is configured for *pagingSearchSpace*, Ns is either 1 or 2. For Ns = 1, there is only one PO which starts from the first PDCCH monitoring occasion for paging in the PF. For Ns = 2, PO is either in the first half frame (i\_s = 0) or the second half frame (i\_s = 1) of the PF.

When *SearchSpaceId* other than 0 is configured for *pagingSearchSpace,* the UE monitors the (i\_s + 1)th PO. A PO is a set of 'S\*X ' consecutive PDCCH monitoring occasions where 'S' is the number of actual transmitted SSBs determined according to *ssb-PositionsInBurst* in *SIB1* and X is the *nrofPDCCH-MonitoringOccasionPerSSB-InPO* if configured or is equal to 1 otherwise. The [x\*S+K]th PDCCH monitoring occasion for paging in the PO corresponds to the Kth transmitted SSB, where x=0,1,…,X-1, K=1,2,…,S. The PDCCH monitoring occasions for paging which do not overlap with UL symbols (determined according to *tdd-UL-DL-ConfigurationCommon*) are sequentially numbered from zero starting from the first PDCCH monitoring occasion for paging in the PF. When *firstPDCCH-MonitoringOccasionOfPO* is present, the starting PDCCH monitoring occasion number of (i\_s + 1)th PO is the (i\_s + 1)th value of the *firstPDCCH-MonitoringOccasionOfPO* parameter; otherwise, it is equal to i\_s \* S\*X. If X > 1, when the UE detects a PDCCH transmission addressed to P-RNTI within its PO, the UE is not required to monitor the subsequent PDCCH monitoring occasions for this PO.

NOTE 1: A PO associated with a PF may start in the PF or after the PF.

NOTE 2: The PDCCH monitoring occasions for a PO can span multiple radio frames. When *SearchSpaceId* other than 0 is configured for *paging-SearchSpace* the PDCCH monitoring occasions for a PO can span multiple periods of the paging search space.

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.

N: number of total paging frames in T

Ns: number of paging occasions for a PF

PF\_offset: offset used for PF determination

UE\_ID:

If the UE operates in eDRX as specified in clause 7.4:

- 5G-S-TMSI mod 4096

else:

- 5G-S-TMSI mod 1024

Parameters *Ns*, *nAndPagingFrameOffset*, *nrofPDCCH-MonitoringOccasionPerSSB-InPO*, and the length of default DRX Cycle are signaled in *SIB1*. The values of N and PF\_offset are derived from the parameter *nAndPagingFrameOffset* as defined in TS 38.331 [3]. The parameter *firstPDCCH-MonitoringOccasionOfPO* is signalled in *SIB1* for paging in the BWP configured by *initialDownlinkBWP*.For paging in a DL BWP other than the BWP configured by *initialDownlinkBWP*, the parameter *first-PDCCH-MonitoringOccasionOfPO* is signaled in the corresponding BWP configuration.

If the UE has no 5G-S-TMSI, for instance when the UE has not yet registered onto the network, the UE shall use as default identity UE\_ID = 0 in the PF and i\_s formulas above.

5G-S-TMSI is a 48 bit long bit string as defined in TS 23.501 [10]. 5G-S-TMSI shall in the formulae above be interpreted as a binary number where the left most bit represents the most significant bit.

In RRC\_INACTIVE state, if the UE supports *inactiveStatePO-Determination* and the network broadcasts *ranPagingInIdlePO* with value "true", the UE shall use the same i\_s as for RRC\_IDLE state. Otherwise, the UE determines the i\_s based on the parameters and formula above.

In RRC\_INACTIVE state, if eDRX value configured by upper layers is no longer than 1024 radio frames, the UE shall use the same i\_s as for RRC\_IDLE state.

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.

*Last Modified Subclause*