**3GPP TSG-RAN WG2 Meeting #118-e R2-220xxxx**

**Electronic, 9th May – 20th May 2022**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.304** | **CR** | **0238** | **rev** | **1** | **Current version:** | **17.0.0** |  |
|  | | | | | | | | |
| *For* [***HELP***](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:*** | Miscellaneous CR on TS 38.304 for ePowSav | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | vivo | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_UE\_pow\_sav\_enh-Core | | | | |  | ***Date:*** | | | 2022-04-25 |
|  |  | | | |  | |  | | |  |
| ***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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | To capture some miscellaneous issues on TS 38.304 for ePowSav.  To be updated based on the progress on ePowSav in both RAN1 and RAN2. | | | | | | | | |
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| ***Summary of change:*** | | TO BE UPDATE | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | TO BE UPDATE | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 7.2, 7.3, 9 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

Start of change

## 7.2 Paging Early Indication

### 7.2.1 Paging Early Indication reception

The UE may use Paging Early Indication (PEI) in RRC\_IDLE and RRC\_INACTIVE states in order to reduce power consumption. If PEI configuration is provided in system information, the UE in RRC\_IDLE or RRC\_INACTIVE state supporting PEI (except for the UEs expecting multicast session activation notification) can monitor PEI using PEI parameters in system information according to the procedure described below.

If *lastUsedCellOnly* is configured in system information of a cell, the UE monitors PEI in the cell only if the UE most recently received *RRCRelease* without *noLastCellUpdate* in this cell. Otherwise (i.e. if *lastUsedCellOnly* is not configured in system information of a cell), the UE monitors PEI in the camped cell regardless of which cell the UE most recently entered RRC\_IDLE or RRC\_INACTIVE state.

The UE monitors one PEI occasion per DRX cycle. A PEI occasion (PEI-O) is a set of PDCCH monitoring occasions (MOs) and can consist of multiple time slots (e.g. subframes or OFDM symbols) where PEI can be sent (TS 38.213 [4]). In multi-beam operations, the UE assumes that the same PEI is repeated in all transmitted beams and thus the selection of the beam(s) for the reception of the PEI is up to UE implementation.

The time location of PEI-O for UE's PO is determined by a reference point and an offset from the reference point to the start of the first PDCCH monitoring occasion of this PEI-O:

- The reference point is the start of a reference frame determined by a frame-level offset from the start of the first PF of the PF(s) associated with the PEI-O, provided by *pei-FrameOffset* in SIB1;

- The offset is a symbol-level offset from the reference point to the start of the first PDCCH MO of PEI-O, provided by *firstPDCCH-MonitoringOccasionOfPEI-O* in SIB1.

If one PEI-O is associated with POs of two PFs, the two PFs are consecutive PFs calculated by the parameters *PF\_offset*, *T*, *Ns*, and *N*. The first PF of the PFs associated with the PEI-O is provided by (SFN for PF) - floor (*iPO*/*Ns*)\**T*/*N*, where SFN for PF is determined in clause 7.1, *iPO* = ((UE\_ID mod *N*) \* *Ns* + *i\_s*) mod *po-NumPerPEI*, and *po-NumPerPEI* is configured via SIB1, *T*, *Ns*, *N*, and *i\_s* are determined in clause 7.1.

The PDCCH monitoring occasions for PEI are determined as specified in TS 38.213 [4] according to *pei-SearchSpace*, *pei-FrameOffset*, *firstPDCCH-MonitoringOccasionOfPEI-O* and *nrofPDCCH-MonitoringOccasionPerSSB-InPO* ifconfigured as specified in TS 38.331 [3]. When *SearchSpaceId* = 0 is configured for *pei-SearchSpace*, the PDCCH monitoring occasions for PEI are same as for RMSI as defined in clause 13 in TS 38.213 [4]. UE determines first PDCCH MO for PEI-O based on *pei-FrameOffset*and *firstPDCCH-MonitoringOccasionOfPEI-O*, as for the case with *SearchSpaceId* > 0 configured.

When *SearchSpaceId* = 0 is configured for *pei-SearchSpace*, the UE monitors the PEI-O according to *searchSpaceZero*. When *SearchSpaceId* other than 0 is configured for *pei-SearchSpace,* the UE monitors the PEI-O according to the search space of the configured *SearchSpaceId*.

A PEI occasion 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]thPDCCH monitoring occasion for PEI in the PEI occasion corresponds to the Kth transmitted SSB, where x=0,1,…,X-1, K=1,2,…,S. The PDCCH monitoring occasions for PEI 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 PEI in the PEI-O. When the UE detects a PEI within its PEI-O, the UE is not required to monitor the subsequent monitoring occasion(s) associated with the same PEI-O.

If the UE detects PEI and the PEI indicates the subgroup the UE belongs to to monitor its associated PO, as specified in clause 10.4a in TS 38.213 [4], the UE monitors the associated PO as specified in clause 7.1. If the UE does not detect PEI on the monitored PEI occasion or the PEI does not indicate the subgroup the UE belongs to to monitor its associated PO, as specified in clause 10.4a in TS 38.213 [4], the UE is not required to monitor the associated PO as specified in clause 7.1.

If the UE is unable to monitor the PEI occasion (i.e. all valid PDCCH monitoring occasion for PEI) corresponding to its PO, e.g. during cell re-selection, the UE monitors the associated PO according to clause 7.1.

## 7.3 Subgrouping

### 7.3.0 General

If PEI and subgrouping are configured, UEs monitoring the same PO can be divided into one or more subgroups. With subgrouping, the UE monitors the associated PO if the corresponding bit for subgroup the UE belongs to is indicated as 1 by PEI corresponding to its PO, as specified in clause 10.4a in TS 38.213 [4]. UE's subgroup can be either assigned by CN as specified in clause 7.3.1 or formed based on UE\_ID as specified in clause 7.3.2:

- If *subgroupsNumForUEID* is absent in *subgroupConfig*, the subgroup ID based on CN assigned subgrouping as specified in clause 7.3.1 is used in the cell.

- If both *subgroupsNumPerPO* and *subgroupsNumForUEID* are configured, and *subgroupsNumForUEID* has the same value as *subgroupsNumPerPO*, the subgroup ID based on UE\_ID based subgrouping as specified in clause 7.3.2 is used in the cell.

- If both *subgroupsNumPerPO* and *subgroupsNumForUEID* are configured, and *subgroupsNumForUEID* < *subgroupsNumPerPO*, the subgroup ID based on CN assigned subgrouping as specified in clause 7.3.1, if available for the UE, is used in the cell; otherwise, the subgroup ID based on UE\_ID based subgrouping as specified in clause 7.3.2 is used in the cell.

The following parameters are used for the determination of subgroup ID:

- subgroupsNumPerPO: total number of subgroups for both CN assigned subgrouping (if any) and UE\_ID based subgrouping (if any) in a PO, which is broadcasted in system information;

- subgroupsNumForUEID: number of subgroups for UE\_ID based subgrouping in a PO, which is broadcasted in system information.

If a UE has no CN assigned subgroup ID or does not support CN assigned subgrouping, and there is no configuration for *subgroupsNumForUEID*, the UE monitors the associated PO according to clause 7.1.

### 7.3.1 CN assigned subgrouping

Paging with CN assigned subgrouping is used in the cell which supports CN assigned subgrouping, as described in clause 7.3.0. A UE supporting CN assigned subgrouping in RRC\_IDLE or RRC\_INACTIVE state can be assigned a subgroup ID (between 0 to 7) by AMF through NAS signalling. The UE belonging to the assigned subgroup ID monitors its associated PEI which indicates the paged subgroup(s) as specified in clause 7.2.

### 7.3.2 UE\_ID based subgrouping

Paging with UE\_ID based subgrouping is used in the cell which supports UE\_ID based subgrouping, as described in clause 7.3.0.

If the UE is not configured with a CN assigned subgroup ID, or if the UE configured with a CN assigned subgroup ID is in a cell supporting only UE\_ID based subgrouping, the subgroup ID of the UE is determined by below formula:

SubgroupID = (floor(UE\_ID/(N\*Ns)) mod subgroupsNumForUEID) + (subgroupsNumPerPO - subgroupsNumForUEID),

where:

N: number of total paging frames in T

Ns: number of paging occasions for a PF

UE\_ID: 5G-S-TMSI mod X, where X is 32768, if eDRX is applied; otherwise, X is 8192

subgroupsNumForUEID: number of subgroups for UE\_ID based subgrouping in a PO, which is broadcasted in system information

The UE belonging to the SubgroupID monitors its associated PEI which indicates the paged subgroup(s) as specified in clause 7.2.

Next change

# 9 Tracking Reference Signal

The UE in RRC\_IDLE and RRC\_INACTIVE states may use Tracking Reference Signal (TRS) whose configurations are provided in system information for its paging reception to save power. In a cell in which TRS are available for the UE in RRC\_IDLE and RRC\_INACTIVE states to use, the availability of the configured TRS is informed to the UEs in RRC\_IDLE and RRC\_INACTIVE states based on explicit L1 based availability indication defined in TS 38.213 [4].

End of change