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

Online, May 9-20, 2022

Agenda Item: 6.9.3.1

Source: MediaTek Inc.

**Title: [DRAFT] Report of [Post118-e][072][ePowSav] PEI and Subgrouping (MediaTek)**

Document for: Discussion and decision

# Introduction

The document summarizes the following offline discussion:

* [Post118-e][072][ePowSav] PEI and Subgrouping (Mediatek)

 Scope: Address Last Cell issues determine TS changes, determine TS changes needed to support PEI + RedCap.

 Intended outcome: Report with TP.

 Deadline: Extra Short.

Contact information

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| **Company** | **Contact <email>** |
| **MediaTek** | Li-Chuan TSENG <li-chuan.tseng@mediatek.com> |
| **Vivo** | Chenli <Chenli5g@vivo.com> |
| **ZTE** | Fei Dong <dong.fei@zte.com.cn> |

# Discussion

## PEI monitoring in last used cell

In RAN3 reply-LS [1], it is confirmed that the mismatched understanding about the ‘last used cell’ between UE and NW also exists in NR.

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| **Question 1: Whether the mismatched understanding about the ‘last used cell’ between UE and NW still exists in NR, if so, whether the LTE method (i.e. to introduce ‘no last cell update’ indication in *RRCRelease* Message) can be reused?****RAN3's answer:** RAN3 thinks that the mismatched understanding about the ‘last used cell’ between UE and NW also exists in NR. From RAN3 perspective, the mentioned LTE method can be reused for NR, however, the final decision is up to RAN2. |

Rapporteur suggests that we take an approach similar to that in LTE, i.e., introduce *noLastCellUpdate* in RRCRelease for NR. Then if *lastUsedCellOnly* is configured in SIB1, UE monitors PEI in the cell only if it receives latest *RRCRelease* message without *noLastCellUpdate* from this cell. We have the following draft proposal.

**Proposal 1: Introduce *noLastCellUpdate* indication in *RRCRelease* to handle mismatched understanding about ‘last used cell’ between UE and NW in NR. (TS 38.331 changes needed)**

**Proposal 2: If *lastUsedCellOnly* is configured in system information of a cell, the UE monitors PEI in the cell only if the latest received *RRCRelease* without *noLastCellUpdate* is from that cell. (TS 38.304 changes needed)**

**Q1: Do you support Proposal 1?**

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| **Company** | **Yes/No** | **Comments, TS changes** |
| **MediaTek** | Yes |  |
| **Samsung** | Yes |  |
| **vivo** | Yes |  |
| **ZTE** | Yes |  |

**Q2: Do you support Proposal 2?**

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| **Company** | **Yes/No** | **Comments, TS changes** |
| **MediaTek** | Yes |  |
| **Samsung** | Yes |  |
| **vivo** | Yes | The TP on TS 38.304 is provided below in Section 4, which will be merged into 304 CR for ePowSav. Let’s discuss the details in offline#089.In addition to the case mentioned by proposal 2, do we need to discuss the case that “If *lastUsedCellOnly* is configured in system information of a cell, and if the latest *RRCRelease* with *noLastCellUpdate* is received from that cell”? or we could assume that “SDT without relocation on the lastUsedCell cell, i.e. the same cell” could be avoided by the network implementation?[Rapp] Thanks for the TP. We may not need to discuss this case. For SDT without relocation, assume the serving cell is A but UE is released in receiving cell B after SDT, and both cells are configured with *lastUsedCellOnly* PEI.* If the gNB tells CN the last used cell = A, UE does not monitor PEI in B, but it may monitor PEI when reselecting to A
* If a “smart” gNB tells CN the last used cell = B (even if the *RRCRelease* message is generated by A), UE can monitor PEI in B
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| **ZTE** | Yes |  |

## UE Subgrouping capability in RNA

Regarding the potential problematic scenario that anchor gNB does not support CN-assigned subgrouping while other gNBs in the same RNA does, RAN3 LS confirmed that this can be avoided by implementation, e.g., CN-assigned subgrouping support is uniform in a certain area.

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| **Question 2: Whether this problematic scenario can be avoided or needs to be resolved through signaling? (In this scenario, assuming that the anchor gNB does not support CN assigned subgrouping).****RAN3's answer:** From RAN3 perspective, the problematic scenario can be avoided by implementation, e.g., CN-assigned subgrouping support is uniform in a certain area e.g., RNA or TAs. RAN3 has no solution other than to assume deployment coordination. |

Rapporteur thinks that then RAN2 can assume proper network implementation for subgrouping support in an RNA. We have the following draft Proposal.

**Proposal 3: RAN2 assumes that deployment coordination for paging subgrouping capability of gNBs within an RNA can be handled by implementation, e.g., CN-assigned subgrouping support is uniform in a certain area (TA/RNA). (No specification impact)**

**Q3: Do you support Proposal 3?**

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| **Company** | **Yes/No** | **Comments, TS changes** |
| **MediaTek** | Yes |  |
| **Samsung** | Yes |  |
| **vivo** | Yes |  |
| **ZTE** | Yes |  |

## Paging & PEI monitoring for RedCap

In Release 17, redcap specific initial DL BWP can be configured. RedCap WI made the following agreements regarding *pagingSearchSpace* and the associated physical time/frequency domain resources.

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| 2. RedCap UE in idle/inactive mode monitors paging in the RedCap-specific initial DL BWP if RedCap-specific initial DL BWP contains CD-SSB and the RedCap-specific initial DL BWP is configured with search space for paging (i.e. pagingSearchSpace).3. If paging and OSI search space are configured in the RedCap-specific initial DL BWP which contains CD-SSB, it is up to NW configuration whether the associated physical time/frequency domain resources can be the same as or different from the ones in the legacy initial DL BWP (FFS whether we need to update the field description) |

Although RedCap WI conclusion does not mention PEI, rapporteur’s understanding is that PEI monitoring should follow paging monitoring. Therefore, *pei-SearchSpace-r17* and *firstPDCCH-MonitoringOccasionOfPEI-O-r17* needs to be configured separately for *initialDownlinkBWP-RedCap-r17* and *initialDownlinkBWP*. This implies some ASN.1 re-structing, i.e., moving pei-SearchSpace-r17, *firstPDCCH-MonitoringOccasionOfPEI-O-r17* to *PDCCH-ConfigCommon* of *initialDownlinkBWP-RedCap-r17* and *initialDownlinkBWP*. Moreover, the field descriptions may need to be updated to describe RedCap-related UE behaviour. However, rapporteur suggests that this be discussion in RedCap session. We have the following proposals:

**Proposal 4: Move *pei-SearchSpace-r17*, *firstPDCCH-MonitoringOccasionOfPEI-O-r17* to *PDCCH-ConfigCommon* of *initialDownlinkBWP-RedCap-r17* and *initialDownlinkBWP*. (TS 38.331 changes needed)**

**Proposal 5: Field description updates about PEI monitoring for RedCap UEs can be discussed in RedCap session.**

**Q4: Do you support Proposal 4?**

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| **Company** | **Yes/No** | **Comments** |
| **MediaTek** | Yes |  |
| **Samsung** | Yes | -- ASN1START-- TAG-PDCCH-CONFIGCOMMON-STARTPDCCH-ConfigCommon ::= SEQUENCE { controlResourceSetZero ControlResourceSetZero OPTIONAL, -- Cond InitialBWP-Only commonControlResourceSet ControlResourceSet OPTIONAL, -- Need R searchSpaceZero SearchSpaceZero OPTIONAL, -- Cond InitialBWP-Only commonSearchSpaceList SEQUENCE (SIZE(1..4)) OF SearchSpace OPTIONAL, -- Need R searchSpaceSIB1 SearchSpaceId OPTIONAL, -- Need S searchSpaceOtherSystemInformation SearchSpaceId OPTIONAL, -- Need S pagingSearchSpace SearchSpaceId OPTIONAL, -- Need S ra-SearchSpace SearchSpaceId OPTIONAL, -- Need S ..., [[ firstPDCCH-MonitoringOccasionOfPO CHOICE { sCS15KHZoneT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..139), sCS30KHZoneT-SCS15KHZhalfT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..279), sCS60KHZoneT-SCS30KHZhalfT-SCS15KHZquarterT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..559), sCS120KHZoneT-SCS60KHZhalfT-SCS30KHZquarterT-SCS15KHZoneEighthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..1119), sCS120KHZhalfT-SCS60KHZquarterT-SCS30KHZoneEighthT-SCS15KHZoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..2239), sCS120KHZquarterT-SCS60KHZoneEighthT-SCS30KHZoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..4479), sCS120KHZoneEighthT-SCS60KHZoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..8959), sCS120KHZoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..17919) } OPTIONAL -- Cond OtherBWP ]], [[ commonSearchSpaceListExt-r16 SEQUENCE (SIZE(1..4)) OF SearchSpaceExt-r16 OPTIONAL -- Need R ]], [[ sdt-SearchSpace-r17 SearchSpace OPTIONAL, -- Need R searchSpaceMCCH-r17 SearchSpaceId OPTIONAL, -- Need R searchSpaceMTCH-r17 SearchSpaceId OPTIONAL, -- Need S pei-SearchSpace-r17 SearchSpaceIdOPTIONAL, -- Cond InitialBWP-PagingfirstPDCCH-MonitoringOccasionOfPEI-O-r17 CHOICE { sCS15KHZoneT-r17 SEQUENCE (SIZE (1..maxPEI-perPF-r17)) OF INTEGER (0..139), sCS30KHZoneT-SCS15KHZhalfT-r17 SEQUENCE (SIZE (1..maxPEI-perPF-r17)) OF INTEGER (0..279), sCS60KHZoneT-SCS30KHZhalfT-SCS15KHZquarterT-r17 SEQUENCE (SIZE (1..maxPEI-perPF-r17)) OF INTEGER (0..559), sCS120KHZoneT-SCS60KHZhalfT-SCS30KHZquarterT-SCS15KHZoneEighthT-r17 SEQUENCE (SIZE (1..maxPEI-perPF-r17)) OF INTEGER (0..1119), sCS120KHZhalfT-SCS60KHZquarterT-SCS30KHZoneEighthT-SCS15KHZoneSixteenthT-r17 SEQUENCE (SIZE (1..maxPEI-perPF-r17)) OF INTEGER (0..2239), sCS120KHZquarterT-SCS60KHZoneEighthT-SCS30KHZoneSixteenthT-r17 SEQUENCE (SIZE (1..maxPEI-perPF-r17)) OF INTEGER (0..4479), sCS120KHZoneEighthT-SCS60KHZoneSixteenthT-r17 SEQUENCE (SIZE (1..maxPEI-perPF-r17)) OF INTEGER (0..8959), sCS120KHZoneSixteenthT-r17 SEQUENCE (SIZE (1..maxPEI-perPF-r17)) OF INTEGER (0..17919) }OPTIONAL, -- Cond InitialBWP-Paging commonSearchSpaceListExt2-r17 SEQUENCE (SIZE(1..4)) OF SearchSpaceExt2-r17 OPTIONAL -- Need R ]]}-- TAG-PDCCH-CONFIGCOMMON-STOP-- ASN1STOP

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| Conditional Presence | Explanation |
| *InitialBWP-Only* | If *SIB1* is broadcast the field is mandatory present in the *PDCCH-ConfigCommon* of the initial BWP (BWP#0) in *ServingCellConfigCommon*; it is absent in other BWPs and when sent in system information. If SIB1 is not broadcast and there is an SSB associated to the cell, the field is optionally present, Need M, in the *PDCCH-ConfigCommon* of the initial BWP (BWP#0) in *ServingCellConfigCommon* (still with the same setting for all UEs). In other cases, the field is absent. |
| *OtherBWP* | This field is optionally present, Need R, if this BWP is not the initial DL BWP and *pagingSearchSpace* is configured in this BWP. Otherwise this field is absent. |
| *InitialBWP-Paging* | This field is mandatory present, if this BWP is the *initialDownlinkBWP* or *initialDownlinkBWP-RedCap*, and *pagingSearchSpace* is configured in this BWP and *pei-Config* is configured in *DownlinkConfigCommonSIB*. Otherwise this field is absent. |

PEI-Config-r17 ::= SEQUENCE { po-NumPerPEI-r17 ENUMERATED {po1, po2, po4, po8}, payloadSizeDCI-2-7-r17 INTEGER (1..maxDCI-2-7-Size-r17), pei-FrameOffset-r17 INTEGER (0..16),  subgroupConfig-r17 SubgroupConfig-r17, lastUsedCellOnly-r17 ENUMERATED {true} OPTIONAL, -- Need R ...} |
| **vivo** | Yes | Assuming some comments on the TP provided by Samsung could be discussed in RRC CR for ePowSav. |
| **ZTE** | Yes | It can be discussed in RRC CR for ePowerSaving |

**Q5: Do you support Proposal 5?**

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| **Company** | **Yes/No** | **Comments** |
| **MediaTek** | Yes |  |
| **Samsung** | No | Do not see any need to toss this over to redcap session. In our view, we can discuss it as part of UE PS RRC CR discussion, if any change is needed. In our view the changes are very simple and indicated below:**pei-SearchSpace**ID of dedicated search space for PEI. If the field is absent, the UE does not receive PEI in this BWP. It can be configured to one of up to 4 common SS sets configured by *commonSearchSpaceList* with *SearchSpaceId* > 0. The CCE aggregation levels and maximum number of PDCCH candidates per CCE aggregation level follows Table 10.1-1 of TS38.213 [13]. SearchSpaceId = 0 can be configured for the case of SS/PBCH block and CORESET multiplexing pattern 2 or 3.***firstPDCCH-MonitoringOccasionOfPEI-O***Offset, in number of symbols, from the start of the reference frame for PEI-O to the start of the first PDCCH monitoring occasion of PEI-O on this BWP, see TS 38.213 [13], clause 10.4A. For the case *po-NumPerPEI* is smaller than Ns, UE applies the (floor(i\_s/poNumPerPEI)+1)-th value out of (N\_s/po-NumPerPEI) configured values in *firstPDCCH-MonitoringOccasionOfPEI-O* for the symbol-level offset. When *po-NumPerPEI* is one or mutliple of Ns, UE applies the first configured value in *firstPDCCH-MonitoringOccasionOfPEI-O* for the symbol-level offset.[Rapp] We are fine to make chnages here if companies and TS rapporteur can agree to some TP. |
| **vivo** | See comments | Fine to discuss either in ePowSav RRC CR or in RedCap session.  |
| **ZTE** | Yes | Share the same view with vivo, can discuss in RRC CR of either ePowSav or RedCap |

## Other issues

**Q6: Do you see any other issues for PEI and subgrouping to be discussed?**

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| **Company** | **Comments** |
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# Conclusion

It is proposed to discuss and decide on the following proposals:

# Text Proposals

(To be provided by TS rapporteurs)

For last used cell

-----------------------------------------------------------TP on TS 38.304 start----------------------------------------------------------------

If *lastUsedCellOnly* is configured in system information of a cell, the UE monitors PEI only in the cell if the UE most recentlyreceived *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.

-----------------------------------------------------------TP on TS 38.304 end----------------------------------------------------------------

For RedCap

# Reference

1. R3-224004, Reply LS on PEI and UE Subgrouping, RAN3
2. RAN2#118-e Report from Break-out session on R17 NTN, REDCAP and CE, Vice Chair