3GPP TSG-RAN WG2 Meeting #119 electronic R2-220xxxx

Online, August 17 – August 26, 2022

Source: MediaTek Inc.

**Title: Summary of Subgrouping/PEI contributions (MediaTek)**

Agenda Item: 6.9

Document for: Discussion and decision

# Introduction

This document is to summarize the proposals made by the contributions submitted under the AI 6.9, as the following assignment:

[Pre119-e][004][ePowSav] Subgrouing/PEI Summary (MediaTek)

# Discussion

## UE\_ID based subgrouping

In addition to the issue how UE in RRC\_INACTIVE use *iPO* to decide PEI indication bit we discussed in RAN2#118-e [1], companies noticed a similar but not identical problem exists on how to calculate the subgroup ID for UE\_ID based subgrouping when the parameter T is configured as different in RRC\_IDLE and RRC\_INACTIVE.

There are four related contributions:

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| **Companies and Tdocs** | **Proposals / Corrections** |
| vivo R2-2207742 [5] | Clarify that DRX cycle of idle state is used for UE\_ID based subgroup ID calculation.  <TP 38.304>:  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 |
| OPPO R2-2207051 [10] | Clafify UE behavior that UE in RRC\_INACTIVE shall use the same SubgroupingID as for RRC\_IDLE state.  <TP 38.304>:  The UE belonging to the SubgroupID monitors its associated PEI which indicates the paged subgroup(s) as specified in clause 7.2.  In RRC\_INACTIVE state, the UE shall use the same SubgroupID as for RRC\_IDLE state. |
| Huawei, HiSilicon R2-2208226 [16] | Clarify for the UE\_ID subgroup ID determination that the UE in RRC\_INACTIVE state uses the same subgroup ID as that in RRC\_IDLE state.  <TP 38.304>:  The UE belonging to the SubgroupID monitors its associated PEI which indicates the paged subgroup(s) as specified in clause 7.2.  In RRC\_INACTIVE state, if the UE supports *inactiveStatePO-Determination* and the network broadcasts *ranPagingInIdlePO* with a value "true", the UE shall use the same SubgroupID as for RRC\_IDLE state. Otherwise, the UE determines the SubgroupID based on the parameters and formula above. |
| Xiaomi, ZTE, vivo, Ericsson, CATT R2-2208609 [18] | Clarify in TS 38.304 that In RRC-INACTIVE state, the UE uses the paging cycle in RRC-IDLE state to calculate the SubgroupID for PEI monitoring.  <TP 38.304>:  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 |

Contributions [5][18] propose to explicitly clarify the same T value is used for the subgroupID calculation in both RRC\_IDLE and RRC\_INACTIVE states.

**Option 1: To clarify the DRX cycle of RRC\_IDLE state is used for UE\_ID based subgroupID calculation in RRC\_INACTIVE state (contribution [18]).**

Meanwhile contributions [10][16] propose to simply specify that UE in RRC\_INACTIVE state shall use the same SubgroupingID as for RRC\_IDLE state, without re-calculation, except for contribution [16] mention about additional conditions (*inactiveStatePO-Determination* and *ranPagingInIdlePO*).

**Option 2: To specify that UE in RRC\_INACTIVE state shall use the same SubgroupingID as for RRC\_IDLE state.**

* **Alt1: UE in RRC\_INACTIVE state shall always use the same SubgroupingID as for RRC\_IDLE state. (contribution [10])**
* **Alt2: UE in RRC\_INACTIVE state shall use the same SubgroupingID as for RRC\_IDLE state if the UE supports *inactiveStatePO-Determination* and the network broadcasts *ranPagingInIdlePO* with a value "true", otherwise UE re-calculate subgroupID according to the formula. (contribution [16])**

Since contributions with diverse proposals and alternatives, rapporteur suggests discussing this part in AT-meeting online discussion so that companies could make consensus decision and know which approach to go.

**Proposal 1: [For online discussion] RAN2 to discuss whether new UE\_ID based subgroupID determination problem could be resolved by the option 1, or the option 2 with alternative 1 or 2.**

## PEI monitoring

PEI monitoring for RedCap

In RAN2#118-e, the aspects of paging and PEI monitoring for RedCap and TP were discussed in [2], most companies (7 out of 10) thought field description update could be continued in ePowSav WI and agreed considering the TP as baseline.

In this meeting, we have 2 field description revision proposals in following contributions:

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| **Companies and Tdocs** | **Proposals / Corrections** |
| Samsung R2-2207005 [9] | Clarified in description of *pei-Config* that this configuration is for PEI monitoring on *initialDownlinkBWP* (if *pei-ConfigBWB* is configured for *initialDownlinkBWP*) and/or for PEI monitoring on *initialDownlinkBWP-RedCap* (if *initialDownlinkBWP-RedCap* is configured and *pei-ConfigBWB* is configured for *initialDownlinkBWP-RedCap*).  <TP 38.331>:   |  | | --- | | ***pei-Config***  The PEI related configuration for PEI monitoring on *initialDownlinkBWP* (if *pei-ConfigBWB*is configured for *initialDownlinkBWP*)and/or for PEI monitoring on *initialDownlinkBWP-RedCap* (if *initialDownlinkBWP-RedCap* is configured and *pei-ConfigBWB* is configured*for**initialDownlinkBWP-RedCap*) | |
| ~~Xiaomi R2-2207206 [11]~~ | ~~Add the description in “~~*~~InitialBWP-Paging~~*~~” that if the RedCap specific initial DL BWP does NOT contain CD-SSB and the entire CORESET#0, then~~ *~~pei-ConfigBWP-r17~~* ~~can not be configured;~~  ~~<TP 38.331>:~~   |  |  | | --- | --- | | *~~InitialBWP-Paging~~* | ~~This field is optionally present, Need R, if this BWP is the~~ *~~initialDownlinkBWP~~* ~~or~~ *~~initialDownlinkBWP-RedCap~~* ~~which~~~~includes CD-SSB and the entire CORESET#0, and~~ *~~pei-Config~~* ~~is configured in~~ *~~DownlinkConfigCommonSIB~~*~~. Otherwise this field is absent.~~ | |
| vivo R2-2207744 [21] | (2nd change)  In RedCap, it was agreed that paging cannot be performed on RedCap specific initial BWP if the RedCap specific initial BWP doesn’t include CD-SSB and entire CORESET#0.  Similarly, for PEI, if the RedCap specific initial BWP doesn’t include CD-SSB and entire CORESET#0, PEI should not be configured on this RedCap specific initial BWP.  <TP 38.331>:   |  |  | | --- | --- | | *InitialBWP-Paging* | This field is optionally present, Need R, if this BWP is the *initialDownlinkBWP* or *initialDownlinkBWP-RedCap* with CD-SSB and entire CORESET#, and *pei-Config* is configured in *DownlinkConfigCommonSIB*. Otherwise this field is absent. | |

Rapporteur suggests discussing this part in AT-meeting offline discussion so that companies could check all detailed changes in contributions.

PEI reception during emergency session

Another UE behavior clarification for PEI reception during emergency service is proposed in below contribution:

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| **Companies and Tdocs** | **Proposals / Corrections** |
| MediaTek R2-2208334 [17] | Add precondition emergency service is not ongoing (same wording as 38.331) to clarify PEI reception.  <TP 38.304>: 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 and emergency service is not ongoing, 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.  Note 1: How the RRC layer in the UE is aware of an ongoing emergency service is up to UE implementation. |

Rapporteur suggests discussing this part in AT-meeting offline discussion so that companies could check all detailed changes in the contribution.

**Proposal 2: RAN2 to discuss PEI monitoring related proposals in [9][11] and [17] offline.**

## Other issues

### Stage 2 corrections

UE\_ID based subgrouping determination

To clarify UE subgroup determination, stage 2 figure is updated accordingly in the following contribution:

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| **Companies and Tdocs** | **Proposals / Corrections** |
| OPPO R2-2207070 [4] | In Figure 9.2.5-2, switch the order of “UE subgroup determination” and “The total number of subgroups for UE ID based subgrouping broadcasted in System Information”.  <TP 38.300>: |

Rapporteur suggests discussing this part in AT-meeting offline discussion so that companies could check all detailed changes in the contribution.

Mandatory behavior wording and last used cell agreement capturing

As per following contribution:

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| **Companies and Tdocs** | **Proposals / Corrections** |
| Nokia, Nokia Shanghai Bell R2-2208015 [6] | 1. Change the sentence to use “shall” to define a mandatory UE behaviour  2. Clarify the description for last used cell to the cell where the RRC release message is last received other than the connection is last released to align with stage 3.  <TP 38.300>:  - Total number of subgroups allowed in a cell is up to 8 and represents the sum of CN controlled and UE ID based subgrouping configured by the network;  - A UE configured with CN controlled subgroup ID shall apply CN controlled subgroup ID if the cell supports CN controlled subgrouping; otherwise, it derives UE ID based subgroup ID if the cell supports only UE ID based subgrouping.  PEI associated with subgroups has the following characteristics:  - If the PEI is supported by the UE, it shall at least support UE ID based subgrouping method;  - PEI monitoring can be limited via system information to the cell in which it last received RRC release message unless the network indicates that the UE shall not update its last used cell information;  - A PEI-capable UE shall store its last used cell information; |

Rapporteur suggests discussing this part in AT-meeting offline discussion so that companies could check all detailed changes in the contribution.

PEI related characteristics

Explicit stage 2 description to capture agreed PEI characteristics is proposed in the following contribution:

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| **Companies and Tdocs** | **Proposals / Corrections** |
| Huawei, HiSilicon R2-2208227 [7] | This clarification is added when describing PEI related characteristcs in section 9.2.5.  Additionally, some indentation is also corrected in the CR  <TP 38.300>:  PEI associated with subgroups has the following characteristics:  - If the PEI is supported by the UE, it shall at least support UE ID based subgrouping method;  - When PEI is configured, there is always at least one subgroup (UEID-based subgroup or CN-controlled subgroup) also configured by the network.  - PEI monitoring can be limited via system information to the cell in which its last connection was released unless the network indicates that the UE shall not update its last used cell information;  - A PEI-capable UE shall store its last used cell information;  - gNBs supporting the PEI monitoring to the last used cell function provide the UE's last used cell information to the AMF in the NG-AP UE Context Release Complete message for PEI capable UEs, as described in TS 38.413 [26];  - UE that expects MBS group notification shall ignore the PEI and shall monitor paging in its PO. |

Rapporteur suggests discussing this part in AT-meeting offline discussion so that companies could check all detailed changes in the contribution.

IDLE/INACTIVE TRS

TRS CSI-RS related contribution:

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| **Companies and Tdocs** | **Proposals / Corrections** |
| vivo R2-2207745 [12] | 1. Update the description for idle/inactive TRS, which is independent to the TRS in connected. 2. Additionally, some minor editorial corrections are also included in the CR.   <TP 38.300>:  UE power saving in RRC\_IDLE/RRC\_INACTIVE may be achieved by providing the configuration for TRS occasions. The TRS in TRS occasions may allow UEs in RRC\_IDLE/RRC\_INACTIVE to sleep longer before waking-up for its paging occasion. The TRS occasions configuration is provided in SIB17. The availability of TRS in the TRS occasions is indicated by L1 availability indication. These TRSs may also be used by the UEs configured with eDRX.  UE power saving may be achieved by UE relaxing measurements for RLM/BFD. When configured, UE determines whether it is in low mobility state and/or whether its serving cell radio link quality is better than a threshold. The configuration for low mobility and good serving cell quality criterion is provided through dedicated RRC signalling.  RLM and BFD relaxation may be enabled/disabled separately through RRC Configuration. Additionally, RLM relaxation may be enabled/disabled on per Cell Group basis while BFD relaxation may be enabled/disabled on per serving cell basis. |

Rapporteur suggests discussing this issue in AT-meeting offline discussion, so that companies could check the detailed change in the contribution.

**Proposal 3: RAN2 to discuss proposals for stage 2 specification in [4][6][7][12] offline.**

### General clarification for subgrouping

General UE subgrouping specification clarifications are proposed for subclause 7.3.0 of 38.304 in following contributions, especially for the wording “otherwise” in the paragraph.

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| **Companies and Tdocs** | **Proposals / Corrections** |
| ZTE R2-2208554 [8] | Split the paragraph that the case of *subgroupsNumPerPO* and *subgroupsNumForUEID* are configured, and *subgroupsNumPerPO* < *subgroupsNumForUEID* in order to indicate the CN assigned subgroup ID is prior over the UE ID based subgroup ID.  <TP 38.304>: 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. |
| Nokia, Nokia Shanghai Bell R2-2208017 [14] | Descriptions for *subgroupsNumForUEID* and *subgroupsNumForUEID* changed to be from UE point of view.  Other minor editorial changes.  <TP 38.304>:  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 the 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 derived 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 for the UEs assigned with corresponding CN assigned subgroup IDs.  - 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 for the UEs supporting PEI.  - 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 is used in the cell for the UEs with a CN assigned subgroup ID; the subgroup ID based on UE\_ID based subgrouping as specified in clause 7.3.2 is used in the cell for the UEs without a CN assigned subgroup ID. |
| CATT, Xiaomi R2-2207398 [20] | (2nd change)  *noLastCellUpdate* is applied to PEI-capable UEs only. The condition needs to be added in the field description, as it currently is for the field description of *lastUsedCellOnly*.  <TP 38.331>:   |  | | --- | | ***noLastCellUpdate***  Presence of the field indicates that the last used cell for PEI shall not be updated. When the field is absent, the PEI-capable UE shall update its last used cell with the current cell. | |

Rapporteur suggests discussing this part in AT-meeting offline discussion so that other companies could check all detailed changes in current contributions or a coordinated one.

### Capabilities

Rephrase field description to avoid possible misleading in 38.306 is proposed in the following contribution:

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| **Companies and Tdocs** | **Proposals / Corrections** |
| Nokia, Nokia Shanghai Bell R2-2208016 [13] | Change the description for ***pei-SubgroupingSupportBandList-r17*** to “Indicates whether the UE supports receiving paging early indication in DCI format 2\_7 as specified in TS38.304 [21] for a list of frequency band. The UE shall support UEID based subgrouping for a frequency band if it indicates supporting of paging early indication reception for the frequency band.”  <TP 38.306>:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | ***pei-SubgroupingSupportBandList-r17***  Indicates whether the UE supports receiving paging early indication in DCI format 2\_7 as specified in TS38.304 [21] for a list of frequency band. The UE shall support UEID based subgrouping for a frequency band if it indicates supporting of paging early indication reception for the frequency band. | UE | No | No | No | |

Rapporteur suggests discussing this part in AT-meeting offline discussion so that companies could check all detailed changes in the contribution.

**Proposal 4: RAN2 to discuss other proposals in [8][14][13] offline.**

# Conclusion

It is proposed to discuss and decide on the following proposals AT-meeting online discussion:

UE\_ID based subgrouping

**Proposal 1: [For online discussion] RAN2 to discuss whether new UE\_ID based subgroupID determination problem could be resolved by the option 1, or the option 2 with alternative 1 or 2.**

**Option 1: To clarify the DRX cycle of RRC\_IDLE state is used for UE\_ID based subgroupID calculation in RRC\_INACTIVE state (contribution [18]).**

**Option 2: To specify that UE in RRC\_INACTIVE state shall use the same SubgroupingID as for RRC\_IDLE state.**

* **Alt1: UE in RRC\_INACTIVE state shall always use the same SubgroupingID as for RRC\_IDLE state. (contribution [10])**
* **Alt2: UE in RRC\_INACTIVE state shall use the same SubgroupingID as for RRC\_IDLE state if the UE supports *inactiveStatePO-Determination* and the network broadcasts *ranPagingInIdlePO* with a value "true", otherwise UE re-calculate subgroupID according to the formula. (contribution [16])**

For AT-meeting offline discussion, it is proposed to treat contributions as following suggestions:

PEI monitoring

**Proposal 2: RAN2 to discuss PEI monitoring related proposals in [9][11] and [17] offline.**

Stage 2 correction

**Proposal 3: RAN2 to discuss proposals for stage 2 specification in [4][6][7][12] offline.**

Others

**Proposal 4: RAN2 to discuss other proposals in [8][14][13] offline.**

# Reference

1. R2-2206458 Report of [AT118-e][072][ePowSav] PEI and Subgrouping (Mediatek) MediaTek Inc.
2. R2-2206775 [DRAFT] Report of [Post118-e][072][ePowSav] PEI and Subgrouping (MediaTek) MediaTek Inc.

(RAN2#119-e Subgrouping/PEI related tdocs listed in the order of Agenda v2)

1. [R2-2206932](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_119-e/Docs/R2-2206932.zip) Reply LS on PEI and UE Subgrouping (R3-224004; contact: ZTE) RAN3
2. [R2-2207070](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_119-e/Docs/R2-2207070.zip) Stage-2 correction on UE-ID based subgrouping OPPO
3. R2-2207742 Miscellaneous CR on TS 38.304 for ePowSav vivo
4. R2-2208015 Stage 2 correction on power saving Nokia, Nokia Shanghai Bell
5. R2-2208227 Corrections for UE power saving enhancements In 38.300 Huawei, HiSilicon
6. R2-2208554 CR on 38.304 for PEI and pagingsubgrouping ZTE Corporation,Sanechips
7. R2-2207005 Clarification of PEI monitoring related parameters Samsung Electronics Co., Ltd
8. R2-2207051 Correction to UE ID based subgrouping OPPO
9. R2-2207206 38.331 Corrections on PDCCH-ConfigCommon for PEI Xiaomi Communications
10. R2-2207745 Correction on idle/inactive TRS for ePowSav vivo
11. R2-2208016 Clarification on PEI and subgrouping capability Nokia, Nokia Shanghai Bell
12. R2-2208017 Clarification on subgrouping descriptions Nokia, Nokia Shanghai Bell
13. R2-2208089 PDCCH monitoring adaptation and C-DRX (RIL V146) Ericsson
14. R2-2208226 Correction on the UE\_ID based subgrouping Huawei, HiSilicon
15. R2-2208334 Clarification on paging early indication with paging subgrouping during emergency call MediaTek Inc.
16. R2-2208609 38.304 Clarifications on SubgroupID for UE-ID based subgrouping Xiaomi, ZTE Corporation,Vivo, Ericsson, CATT
17. R2-2208090 PDCCH skipping in RAN1 and RAN2 specifications Ericsson
18. R2-2207398 Miscellaneous CR on TS 38.331 for ePowSav CATT, Xiaomi
19. R2-2207744 Correction on RLM/BFD relaxation and PEI configuration vivo