3GPP TSG-RAN WG2 Meeting #117 electronic R2-220xxxx

Online, Feb. 21 – March 3, 2022

Agenda Item: 8.9.3.2.1

Source: MediaTek Inc.

**Title: Summary of 8.9.3.2.1 PEI and Paging Subgrouping**

Document for: Discussion and decision

# Introduction

This document is to summarize the proposals made by the contributions submitted under the AI 8.9.3.2.1, as the following assignment:

[Pre117-e][023][ePowSav] AI summary for 8.9.3.2.1 PEI and paging subgrouping (MediaTek)

# Discussion

## Open issues labelled as “company tdoc invited”

We first review companies’ comments on the open issues labelled as “company tdoc invited” after the post-meeting discussion [1].

**OI 1.4:** RAN2 has a preference to support PEI with both DRX and eDRX; FFS on potential issues (e.g., PEI and PTW).

Companies’ views are summarized as below.

UEID for UEID-based subgroups

* UEID = 5G-S-TMSI mod 32768 (1024\*4\*8): [2][4][5][11][19]
* No change: [9]

PEI monitoring with PTW

* No special handling (PEI is applicable to each PO within PTW): [2][5][8][17][18]
* Within the PTW, one PEI can be mapped to multiple consecutive POs associated with the same subgroups: [14]

Others

* Not to pursue PEI for e-DRX: [6]
* Dedicated eDRX subgrouping: [19] [22]

For UEID, rapporteur suggests that we follow many companies’ proposal to have UEID = 5G-S-TMSI mod 32768 (1024\*4\*8). For PEI monitoring with PTW, rapporteur suggest not introducing special handling, and PEI is applicable to each PO within PTW. Regarding dedicated eDRX subgrouping, rapporteur suggests that we do not introduce such special handling and leave it up to network implementation.

**Proposal 1: When PEI is applied with eDRX, the UEID for UEID-based subgrouping is determined by 5G-S-TMSI mod 32768.**

**Proposal 2: No special handling or configuration is introduced for PEI monitoring with PTW (i.e., PEI is applicable to each PO within PTW)**

**OI 1.5:** FFS on the detailed NAS signalling between AMF and UE for CN assigned subgrouping.

Companies’ views are summarized as below.

* It’s up to SA2/CT1: [3][5][7][8][10][12][17]

As mentioned in [12], SA2/CT1 already has corresponding signaling design.

**OI 1.6:** When AMF has assigned a UE with a Paging subgroup, some signaling should be supported between AMF and gNB(s) to inform gNB(s) about the related subgroup information for paging a UE in RRC\_IDLE/RRC\_INACTIVE. Exact information is FFS. The message(s) and associated design are up to RAN3.

Contributions [3][5] address this issue.

* AMF informs UE’s paging subgroup ID to gNB(s): [3][5][7][8][10][12][16]
* Send LS to RAN3: [7]

As suggested [5][12], RAN3 has agree to introduce "PEIPS Assistance Information" carrying a CN subgroup ID, and this OI can be closed.

**OI 1.7:** It is FFS when a UE in RRC\_INACTIVE has been assigned by CN a Paging subgroup, whether some signaling should be introduced between gNBs to inform each other about the UE’s subgroup for RAN paging.

Contributions [2][3] address this issue. Companies’ views are summarized below.

* Signaling between gNBs to inform each other about the UE’s subgroup for RAN paging (e.g., CN subgroup ID in Xn RAN Paging message): [2][3][5][7][8][10][12][16]
* LS to RAN3: [7]

According to [5][12], the *PEIPS assistance information* is included in the XnAP Paging message, which is used to inform each other about the UE’s subgroup for RAN paging. PEIPS assistance information contains CN Subgroup ID, and the OI can be close.

OI 1.5, 1.6 and 1.7 (i.e., Signalling between AMF and UE, between AMF and gNB, and between gNBs) are inter-WG issues. As some contributions mentioned, SA2 and RAN3 CRs already implements corresponding signaling.

**Proposal 3: (Discussion) RAN2 to check PEI-related signaling between AMF and UE, between AMF and gNB, and between gNBs, and decide if LS to SA2/CT1/RAN3 is still needed.**

**OI 1.8:** Handling in scenarios where certain gNB within a RNA does not support CN controlled subgrouping.

Contributions [2][3][5][6] address this issue. Companies’ views are summarized below.

* Not a valid configuration (or subgrouping/PEI is uniform over the UE’s paging area): [8][20]
* A gNB can indicate it does not support CN subgrouping (no additional handling, UEID-based subgrouping if supported): [2][3][5][12][17][19][21]
* NW implementation or leave it to RAN3: [6]
* The gNB informs the UE whether the UE can use CN controlled subgrouping for RAN paging reception within the RNA through an indication in *RRCRelease*: [13]

**Proposal 4: No additional handling for PEI and PO monitoring is introduced, even if certain gNB within a RNA does not support CN controlled subgrouping.**

**OI 1.9:** When K=1, the PEI configuration can be either (1) *subgroupConfig* is absent (i.e., PEI without subgrouping) or (2) *subgroupConfig* is present and *subgroupNumPerPO*=1. FFS if UE PHY processing for DCI format 2\_7 is the same.

Contributions [2][3][5] address this issue. Companies’ views are summarized below.

* Same processing as single subgroup: [2][3][7][8][9][12]
* New approach when *subgroupConfig* is absent (e.g. introducing 1 additional bit in PEI or based on the presence of PEI): [5]
* PEI and *subgroupConfig* shall be present together: [15]

**Proposal 5: UE PHY processing for DCI format 2\_7 is the same for PEI without subgrouping and PEI with one subgroup if UE monitors the PEI.**

## Other issues

### PEI monitoring when “K=1”

Contributions [8][9][11] provide more details about PEI monitoring when K=1. These contributions point out that “K=1” may mean different configurations. For example, as proposed in [11]:

* If PEI is configured and *subgroupConfig* is absent, all the UEs supporting PEI may monitor PEI.
* If *subgroupNumPerPO* = 1 and Nsg-UEID = 1, UEs supporting UE-ID based subgrouping may monitor PEI, while UEs not supporting UE-ID based subgrouping should monitor paging as legacy.
* If *subgroupNumPerPO* = 1 and Nsg-UEID is absent, UEs with a CN-assigned subgroup ID may monitor PEI, while UEs without a CN-assigned subgroup ID should monitor paging as legacy.

**Proposal 6: (Discussion) RAN2 to confirm the configurations and PEI/PO monitoring for different cases with “K=1”.**

### Configuration issues

Contribution [18] mentioned several issues about PEI configurations. Some of them are related to UE capability signalling and may be included in corresponding online or offline discussions, while others may be handled with short online discussions. The latter includes:

* PEI configuration is included in SIBx currently proposed for TRS resource configuration.
* CN informs RAN about the number of *subgroupsNumPerPO* to use for the CN-assigned subgrouping.
* Network can optionally configure a separate set of PO(s) dedicated to Rel-17 UEs with new paging capabilities.
* Network can configure dedicated POs for UEs supporting PEI and K0>0 via a second set of ns, and/or *nAndPagingFrameOffset* and/or *firstPDCCH-MonitoringOccasionOfPO* parameters.
* If configured by the NW, UE indicates whether PEI is currently useful for the UE.

Rapporteur suggests the following.

**Proposal 7: (Discussion) RAN2 discuss the following proposals about PEI configurations:**

* + **PEI configuration is included in SIBx currently proposed for TRS resource configuration.**
	+ **CN informs RAN about the number of *subgroupsNumPerPO* to use for the CN-assigned subgrouping.**
	+ **Network can optionally configure a separate set of PO(s) dedicated to Rel-17 UEs with new paging capabilities.**
	+ **Network can configure dedicated POs for UEs supporting PEI and K0>0 via a second set of ns, and/or *nAndPagingFrameOffset* and/or *firstPDCCH-MonitoringOccasionOfPO* parameters.**
	+ **If configured by the NW, UE indicates whether PEI is currently useful for the UE.**

# Conclusion

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

Easy agreements

**Proposal 1: When PEI is applied with eDRX, the UEID for UEID-based subgrouping is determined by 5G-S-TMSI mod 32768.**

**Proposal 2: No special handling is introduced for PEI monitoring with PTW (i.e., PEI is applicable to each PO within PTW)**

**Proposal 4: No additional handling for PEI and PO monitoring is introduced, even if certain gNB within a RNA does not support CN controlled subgrouping.**

**Proposal 5: UE PHY processing for DCI format 2\_7 is the same for PEI without subgrouping and PEI with one subgroup.**

For discussion

**Proposal 3: RAN2 to check PEI-related signaling between AMF and UE, between AMF and gNB, and between gNBs, and decide if LS to SA2/CT1/RAN3 is still needed.**

**Proposal 6: RAN2 to confirm the configurations and PEI/PO monitoring for different cases with “K=1”.**

**Proposal 7: RAN2 discuss the following proposals about PEI configurations:**

* + **PEI configuration is included in SIBx currently proposed for TRS resource configuration.**
	+ **CN informs RAN about the number of *subgroupsNumPerPO* to use for the CN-assigned subgrouping.**
	+ **Network can optionally configure a separate set of PO(s) dedicated to Rel-17 UEs with new paging capabilities.**
	+ **Network can configure dedicated POs for UEs supporting PEI and K0>0 via a second set of ns, and/or *nAndPagingFrameOffset* and/or *firstPDCCH-MonitoringOccasionOfPO* parameters.**
	+ **If configured by the NW, UE indicates whether PEI is currently useful for the UE.**

# Reference

1. R2-2201785 Summary of [Post116bis-e][080][ePowSav] Open Issues, MediaTek
2. R2-2202279 Open issues for PEI and paging subgrouping NEC Europe Ltd
3. R2-2202285 Open Issues for PEI and paging subgrouping Samsung Electronics Co., Ltd
4. R2-2202286 UE Identity for paging subgrouping with eDRX Samsung Electronics Co., Ltd
5. R2-2202310 Discussion on remaining open issues on PEI and subgrouping vivo
6. R2-2202353 Discussing on PEI and paging subgrouping Xiaomi Communications
7. R2-2202519 Open Issues in Enhanced NR UE Power Save PEI / Paging Subgrouping Apple
8. R2-2202771 Open Issues for PEI and Paging Subgrouping MediaTek Inc.
9. R2-2202881 PEI and subgrouping remaining issues Nokia, Nokia Shanghai Bell
10. R2-2202882 Impact of subgrouping on other WGs Nokia, Nokia Shanghai Bell
11. R2-2202993 Discussion on PEI and paging subgrouping OPPO
12. R2-2203036 R2-22xxxxx Remaining issues on PEI LG Electronics Inc
13. R2-2203229 Remaining issues on CN controlled subgrouping Huawei, HiSilicon
14. R2-2203231 PEI with eDRX Huawei, HiSilicon
15. R2-2203243 Considerations on PEI without Subgrouping Configuration ZTE Corporation,Sanechips
16. R2-2203244 Considerations on PEI and Subgrouping Information in Xn and NG interface ZTE Corporation,Sanechips
17. R2-2203245 Considerations on Open Issues of PEI and Subgrouping ZTE Corporation,Sanechips
18. R2-2203252 PEI and paging subgrouping Ericsson
19. R2-2203292 (OI 1.4) Considerations on support of PEI with eDRX Interdigital, Inc.
20. R2-2203305 Remaining issue on PEI mobility Intel Corporation
21. R2-2203474 Handling of gNB not supporting CN-assigned subgrouping Futurewei Technologies
22. R2-2203478 On supporting PEI with eDRX Futurewei Technologies