**3GPP TSG-RAN WG2 Meeting #116 electronic R2-21xxxx**

**Online, 1 - 12 November 2021, 2021**

**Agenda Item: 8.9.3**

**Source: Xiaomi Communications (email discussion rapporteur)**

**Title: Summary of [AT116-e][045][ePowSav] Paging Subgrouping (Xiaomi)**

**Document for: Discussion and Decision**

# Introduction

This contribution provides a summary of the following email discussion:

* [AT116-e][045][ePowSav] Paging Subgrouping (Xiaomi)

 Scope: a) based on [R2-2109647](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2109647.zip), taking into account agreements above, for remaining proposals, collect one round of comments, attempt agreement offline,

 b) determine what configuration info need to broadcasted by gNB.

 Intended outcome: Report

 Deadline: Wed W2

Deadline for companies’ inputs:

For initial comments collection, before Nov 8th, 0900 UTC, Monday

For proposal checking and companies can further comment by Nov 9th,, 0900 UTC

# Contact information

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# Discussion

## 3.1 General

In the current RAN2 #116e meeting, the following agreements were made [1].

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| => Assume that one subgroup indication refer to either CN assigned subgroups or UE-ID based subgroup (no overlapping)=> Both UE ID based and CN based subgrouping can be supported simultaneously in a cell, it is allowed to just support one of them. => FFS if the total number of CN-assigned subgroups is OAM configured. Max would be 8 as this is what RAN support.  |

Following agreements were made in the previous RAN1 #106-bis meetings:

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| **From RAN1 #106-bis-e:**AgreementFor NR Rel-17, paging indications to UE subgroups are carried only in PEI.Agreement For PEI, a new DCI format is supported to include at least paging indications to UE group(s)/subgroups of the associated PO(s)* One bit in the DCI payload indicating one UE subgroup of a PO or one UE group/PO
* The maximum number of total bits for paging indication field in PEI DCI format is x
	+ One PEI can be configured to indicate up to 4 PO(s) in a PF
		- FFS whether to supporting map PEI to 3 POs in a PF
	+ FFS: 1 PEI for POs across multiple PFs
	+ FFS: value of x
 |

And on the draft RRC parameters list for R17 power saving in RAN1 [5], a new parameter, subgroupsNumPerPO, was introduced to indicate the “*Number of subgroups supported per PO in the cell, for UE to read the subgroup indication from physical layer signaling*”:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **WI code** | **Sub-feature group** | **RAN1 specification** | **Section** | **RAN2 Parent IE** | **RAN2 ASN.1 name** | **Parameter name in the spec** | **New or existing?** | **Parameter name in the text** | **Description** | **Value range** | **Default value aspect** | **Per (UE, cell, TRP, …)** | **UE-specific or Cell-specific** | **Specification** | **Comment** |
| **8.7.1.1 Paging Enh.** |
|  | Paging enhancement | 38.213 |   |  |   | subgroupsNumPerPO | new |   | Number of subgroups per Paging Occasion (PO) for UE to read subgroups indication from physical-layer singling | TBD with maximum of 8  |   | per cell | cell-specifc |   | Agreement:For UE subgroups indication in physical layer, maximum of 8 subgroups per PO is supported. |

And we also received the LS from SA2 with the following were captured in the cover sheet [3] (may be somewhat outdated, co-sourced by QC, MTK, Apple, Ericsson, HW):

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| --- |
| Given the above, the following impacts to SA2 specification TS 23.501 are identified:1. UE may provide “UE paging probability” to aid AMF in decision for paging subgrouping.
2. AMF may assign a paging subgroup ID. If assigned it provides to RAN in N2 paging request.
3. Even if AMF does not assign, RAN needs to know UE supports paging subgrouping. Proposal: UE provides NR paging subgrouping information in registration request. AMF indicates NR paging subgrouping support to UE in Registration Accept and to NG-RAN in N2 paging request.
4. It is assumed that a UE that supports NR paging subgrouping support both 5GC assigned NR paging subgroup and NR paging subgroup by randomization, this simplifies the negotiation.
 |

## 3.2 RAN capability

This is mainly focusing on RAN capability for CN-assigned subgrouping and/or UE-ID based subgrouping. Since RAN1 decided the total number of L1 subgroups per PO (*subgroupsNumPerPO*), and we need to know how to split those L1 subgroups into the 2 methods.

### 3.2.1 Co-exist of CN-assigned subgrouping and UE-ID subgrouping

The network can broadcast its support for both CN assigned subgrouping and UE-ID based subgrouping. Since we have agreed the hard split between the 2 methods, we have to split the L1 subgroups for each separately. An example is there are two separate sets of subgroups at the same time, e.g., X (>=0) number of L1 subgroups for CN based subgroups and the rest are for UE-ID based subgrouping as show in the figure. Note X is less than *subgroupsNumPerPO.*



Figure 1: an example of Co-exist case

Q1: Do Companies agree that RAN indicates a parameter Nsg-CN to indicate how many L1 subgroups are used for CN-assigned subgrouping?

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| --- | --- | --- |
| Company  | Yes/No | Comments |
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For the co-exist case, we are not sure the total number of CN assigned subgroups the CN can assign and whether it can be bigger than the Nsg-CN L1 subgroups the RAN can support (More RAN1’s input is needed for the DCI size design). But before that we can consider to resolve the “FFS if the total number of CN-assigned subgroups is OAM configured” in this meeting first. And we will further consider if some N to 1 mapping from CN assigned subgroups to Nsg-CN L1 subgroups or remapping solutions will be needed in the next meeting.

* Option 1: The total number of CN-assigned subgroups is fixed and specified
* Option 2: No need to specify, e.g., by OAM
* Option 3: The total number of CN-assigned subgroups is decided by CN and informed to RAN (I still list it here)

Q2: Which option do companies prefer described above for the total number of CN-assigned subgroups?

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| --- | --- | --- |
| Company  | Option1/2/3 | Comments |
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### 3.2.2 CN-assigned subgrouping only

The second question is how gNB informs the UE that it supports CN-assigned subgrouping only. A candidate solution would be network to configure the total Lay1 subgroups for CN based subgroups or 0 Lay1 subgroup for UE-ID based grouping.

Q3: Do Companies agree that RAN indicates a parameter Nsg-CN with a value equal to *subgroupsNumPerPO*  indicate all the L1 subgroups are used for CN-assigned subgrouping ? (or some other options, you can add)

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| --- | --- | --- |
| Company  | Yes/No | Comments |
|  |  |  |

### 3.2.3 UE-ID based subgrouping only

It is also possible for RAN to not spare any L1 subgroup used for CN assigned subgrouping which means all the RAN configured L1 subgroups per PO will be used by UE-ID assigned subgrouping by default.

A candidate solution would be network to configure Nsg-CN to 0 or the absence of Nsg-CN can indicate implicitly that the total Lay1 subgroups are for UE-ID based grouping.

* Option 1: Explicitly, by configuring Nsg-CN =0
* Option 2: Implicitly way, by absence of Nsg-CN

Q4: Which option do companies prefer described above for RAN indicating only support UE-ID based subgrouping?

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| Company  | Option1/2 | Comments |
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### 3.2.4 Not support any of them

Q5: Do companies agree that RAN indicates not support any of them by not giving the supported L1 subgroups for subgrouping (e.g., no PEI subgrouping configuration)?

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| Company  | Yes/No | Comments |
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## 3.3 issues related to other WG

This session relates to issues related to other WG.

We only capture the results of UE capability. UE assistance information is currently discussed in a separate email (CMCC) and the proponent company will treat RAN paging in another email (Ericsson, 046).

Note other issues discussed in [4] (e.g., negotiations between CN and gNBs) are currently dropped here since people show not much interest.

### 3.3.1 UE capability

Q6 is about the UE capability.

20 companies provide inputs for this question in [3].

* 12/19 companies support (option 1) that introduce common UE capability for UE-ID based subgrouping and network-assigned subgrouping in CN and RAN. With key argument is that option 1 is a simple scheme and from UE perspective there is no too much difference.
* 8/19 companies support option 2:
	+ 5 companies support (option 2a) that RAN only needs to care about UE’s capability of supporting the UE ID based subgrouping while UE’s capability of supporting the CN-assigned subgrouping is handled in NAS.
	+ 3 companies support (option 2b) that both capabilities are reported to CN by NAS signalling and CN forwards both to RAN in paging message. Futurewei brings a point that we need to transfer UE’s AS capability when escalating CN-initiated paging to support 2b.

**Proposal: No consensus on whether subgrouping capability is common or separate.**

* Option 1: introduce common UE capability (i.e., only one UE capability reported to RAN or CN by NAS);
* Option 2: introduce separate UE capabilities;
* Option 2a: UE’s capability of supporting the UE ID based subgrouping is reported to RAN by AS UE capability signalling while UE’s capability of supporting the CN-assigned subgrouping is reported to CN by NAS signalling).
* Option2b: both capabilities are reported to CN by NAS signalling and CN forwards both to RAN in paging message

And a question is asked to people: can companies accept what is captured in [3]? If not, we will further discuss in RAN2.

Q6: Can companies accept what is captured in [3]? If not, we will further discuss in RAN2.

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| Company  | Yes/No | Comments |
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### 3.3.2 LS to CT1/SA2

Rapporteur thinks at least the progress or decisions on the following topics made by RAN2 should be informed to CT1/SA2.

* The total number of CN-assigned subgroups CN can assign in Q2;
* UE capability in Q6.

Q7: Can companies agree that a LS should be sent to CT1/SA2 to capture the progress of RAN2?

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| --- | --- | --- |
| Company  | Yes/No | Comments |
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## 3.4 Other

Q8: Any other relevant issue to discuss (Only limits to paging subgrouping)?

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| --- | --- |
| Company | Issue description  |
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Summary:

# Conclusions

Based on companies’ inputs to this email discussion, the following proposals are listed for agreement:

# References

1. RAN2 #116-e Meeting minutes
2. R2-2108917, LS on UE Power Saving, MTK
3. [R2-2111234](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2111234.zip) LS Reply on UE Power Saving (S2-2107856)
4. [R2-2109647](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2109647.zip) Summary of [Post115-e][089][ePowSav] Paging Subgrouping, xiaomi
5. [R2-2111246](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2111246.zip) LS on Re-17 LTE and NR higher-layers parameter list (R1-2110575; contact: Ericsson)