3GPP TSG-RAN WG2 #109bise R2- 200XXXX

**Online meeting, 20th - 30th April 2020**

Agenda Item: 7.2.2.

Source: Ericsson (Rapporteur)

Title: Report - Email discussion [AT109bis-e][310][NBIOT eMTC] WUS open issues

Document for: Discussion, Decision

# 1 Introduction

RAN2 has made the following agreement in RAN2#109bis-e regarding UE group wake up signal (WUS):

“The following codepoints are used to indicate a paging probability threshold value: {p20,p30,p40,p50,p60,p70,p80,p90}”

The discussion is ongoing and in order to finalize the remaining open issues for UE group WUS, it was agreed to continue the discussion with the following offline discussion:

* [AT109bis-e][310][NBIOT/eMTC] WUS open issues (Ericsson)

 Scope: Remaining open issues on WUS

 Intended outcome: Finalise the open issues, report in R2-2004045

 Deadline: 22-04-2020, 16:00 UTC

In this document, companies are invited to provide their views regarding the remaining open issues on UE groups WUS based on the agreements made so far.

# 2 Discussion

## 2.1 Configuration of paging probability thresholds

A UE that supports Rel-16 group WUS is configured by MME with a paging probability class via NAS layer, e.g. during attach or TA update. It is up to the CN how to determine the paging probability class as it can be based on e.g., information provided by the UE, subscription information, data collected by the CN etc. In CT1 it was agreed to introduce the following values for such configuration: ““p00, p05, p10, p15, p20, p25, p30, p35, p40, p45, p50, p55, p60, p65, p70, p75, p80, p85, p90, p95, p100”.

When the network needs to reach the UE, MME sends a paging request to the eNB including the configured paging probability class so that the eNB knows which WUS group the UE is supposed to monitor prior to its paging occasion. RAN3 has been discussing what value range and resolution are sufficient to be provided from the MME to the eNB along with the paging request. There are 2 options under discussion:

- Option 1 [5-6]: introduce a WUS Assistance Information IE in S1AP PAGING Message which contains the following codepoints “p00, p05, p10, p15, p20, p25, p30, p35, p40, p45, p50, p55, p60, p65, p70, p75, p80, p85, p90, p95, p100”. (same as CT1)

- Option 2 [7-8]: similar to option 1 but with a different set of codepoints such as “p10, p20, p30, p40, p50, p60, p80, p100”. The exact value range is FFS.

RAN2 has agreed to have a configuration where maximum number of probability thresholds is 3 giving 4 groups in a working assumption. Those thresholds are provided in *probabilityThresholdList*, as part of broadcast signalling in the serving cell, so that it would be possible for the UE to know which WUS group set and thus the WUS group, based on the formula agreed in RAN2#109e, it should use when monitoring for WUS.

In the paging request message from the MME, the eNB receives the configured paging probability class for the UE and pages the UE with WUS using the corresponding WUS group set and thus the WUS group by mapping it according to the probability thresholds eNB broadcasts in the serving cell.

Considering that RAN2 assumes maximum number of probability thresholds is 3 giving 4 groups, the codepoints, i.e., {p20,p30,p40,p50,p60,p70,p80,p90}, agreed during the online session on Monday, April 20th, to indicate a paging probability threshold value is associated with the configuration provided by MME via NAS layer and the information provided from the MME to the eNB along with the paging request via S1AP. Therefore, those codepoins are a recommendation to CN working groups and RAN3 from RAN2.

**Discussion point 1: Do you confirm the understanding provided above? If no, please elaborate on why and provide your interpretation.**

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| Company | Yes / No | Comments |
| Ericsson | Yes |  |
| Lenovo | Yes |  |
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## 2.2 Support for 4 WUS group sets

**Discussion point 2: Do you think there is a need to** **support 4 WUS group sets considering that 1 WUS group set is assigned for UEs with no paging probability class? If no, please elaborate on why.**

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| Company | Yes / No | Comments |
| Ericsson | No | We think the agreed number of WUS group sets would be enough considering that Rel-16 group WUS is introduced mainly to reduce the impact on UEs with low paging probability due to false wake ups. |
| Lenovo | Yes or FFS. | In last RAN2#109e, there is a WA: Maximum number probability thresholds is 3 giving 4 group. Thus, we think the agreed number of WUS group sets for service-based grouping is 4. The WUS group set with highest paging probability class has been agreed to be applied by the UE without paging probability if no other UE-ID based group set is configured based on current agreement. This is our understanding to the WUS progress. If there is any issue on this point, we can further discuss it. |
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## 2.3 Assistance information for paging probability classes

**Discussion point 3: Do you think it would be beneficial for the eNB if the MME provides assistance information regarding a particular paging probability class.? Please elaborate on why.**

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| Company | Yes / No | Comments |
| Ericsson | Yes | MME can provide a relative measure to the eNB so that the eNB can configure the number of WUS groups in a particular WUS group set accordingly. This does not have to be an exact number, a relative measure will do, e.g., let’s assume MME uses the following codepoints to inform the eNB about the configured class as part of the paging request:{p20,p30,p40,p50,p60,p70,p80,p90}. If MME indicates to the eNB that the number of UEs configured with a particular codepoint is represented with x units, which is a normalized absolute value so no actual value is needed, eNB can configure the number of WUS groups in a particular WUS group more realistically. Note that this does not need to be done with every paging request, once will be enough unless there has been in update in the CN. For example, for p40 let’s assume 1 unit is indicated whereas for p20 2 units are indicated. This would mean that there are roughly twice the number of UEs configured with a paging probability up to %20 compared to ones with a probability between %30 - %40. The eNB may use that information as a reference to configure twice the number of WUS groups in the corresponding WUS group sets.  |
| Lenovo | Yes | We are positive to above point that MME could give some UE information, such as the number of UEs to the specific codepoint to help eNB configure the reasonable WUS resource to each WUS group set. Otherwise, eNB may not know how much the WUS resource could be allocated to the WUS group set in which a large number of UEs or a small number of UEs is applied, that will increase the wrong paging alarm of UE. |
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## 2.4 Mechanism to minimize false wake-up

In SA2 WG a mechanism has been proposed in Rel-15 to reduce the impact on UE power consumption due to false wake-up signalling caused by paging “mobile” UEs. In RAN2#109e, it was discussed whether a mechanism is needed for Rel-16 and companies stated their preference regarding whether there is a need and if yes how the mechanism should work [4].

Based on the feedback provided to the email discussion prior to the meeting; 4 + 1 companies think that the mechanism proposed in SA2 for Release 15 to reduce false wake-up be should be used in Rel-16. The support from one company, i.e., representing + 1 above, depends on whether their interpretation on how the mechanism is supposed work is correct. The rapporteur assumes that this is the case and counted their support. 2 companies think that it would be better to utilize the Rel-16 WUS mechanism to address the issue for various reasons.

The following proposal was made by the rapporteur: “The mechanism proposed in SA2 for Release 15 to reduce false wake-up is used in Rel-16.”

**Discussion point 4: Considering the outcome of the email discussion above, please comment only if you think the proposal above is not agreeable and elaborate on why.**

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## 2.5 Support of Rel-16 WUS vs. Rel-15 WUS

**Discussion point 5: Do you think RAN2 should confirm the following working assumption: “Support of Release 16 WUS is independent to support of Release 15 WUS”? Please elaborate on why.**

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| Company | Yes / No | Comments |
| Lenovo | Yes | In last RAN2#109e meeting, some other company said maybe they would apply only the R16 network and UE, it is the reason leading to this work assumption. We think it is reasonable. |
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# 3 Summary

TBD

# 4 Conclusion

Based on the discussion and summary, the following proposals are made:

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# 4 References

1. [RP-192875](http://3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_86/Docs/RP-192875.zip), “Additional MTC enhancements for LTE”, Ericsson, RAN#86, Sitges, Spain, 9th – 12th December 2019.
2. [RP-193224](http://3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_86/Docs/RP-193224.zip), “Additional enhancements for NB-IoT”, Futurewei, RAN#86, Sitges, Spain, 9th – 12th December 2019.
3. [R2-2001886](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_109e/Docs/R2-2001886.zip), “RAN2 agreements for Rel-16 additional enhancements for NB-IoT and MTC”, Blackberry, Rel-16, LTE\_eMTC5-Core, NB\_IOTenh3-Core
4. [R2-2001789](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_109e/Docs/R2-2001789.zip), “Report of WUS: Progress the FFS from Email Discussion 108#94 and Summary”, Qualcomm, Rel-16, LTE\_eMTC5-Core, NB\_IOTenh3-Core.
5. R3-201676, Consideration on UE group wake up signal (WUS), Huawei, Vodafone
6. R3-201677 Support of WUS grouping, S1AP CR#1762, Huawei, Vodafone
7. R3-202190, Introduction of WUS grouping, Ericsson, ZTE
8. R3-202191, Introduction of WUS grouping, S1AP CR#1772, Ericsson, ZTE