3GPP TSG-RAN WG2 #111-e draft\_R2-200xxxx

Online, 17 – 28 August 2020

Agenda Item: 9.1.3

Source: Ericsson

Title: [AT111-e][309][NBIOT/eMTC R17] Carrier selection (Ericsson)

Document for: Discussion, Decision

# 1 Introduction

This document is to kick off the following email discussion:

* [AT111-e][309][NBIOT/eMTC R17] Carrier selection (Ericsson)

Status:

Scope: To clarify the scope of this objective in terms of what could be enhanced.

Intended outcome: Report in R2-2008311

Deadline: Wednesday 26 1100 UTC.

# 2 Submitted Documents

R2-2006832 NB-IoT carrier selection and configuration based on coverage level Ericsson discussion Rel-17

R2-2006835 Enhancements on multi carrier configuration and selection ZTE Corporation, Sanechips discussion Rel-17 NB\_IOTenh4\_LTE\_eMTC6-Core

R2-2007343 Use cases and scenarios of carrier specific configuration Huawei, HiSilicon discussion Rel-17 NB\_IOTenh4\_LTE\_eMTC6-Core

R2-2007354 Analysis on carrier selection options Nokia, Nokia Shanghai Bell discussion Rel-17

R2-2007570 Support for NB-IoT carrier selection based on the coverage level Qualcomm Incorporated discussion Rel-17 NB\_IOTenh4\_LTE\_eMTC6-Core

R2-2007957 Carrier selection enhancement Shanghai Chen Si Electronics discussion Rel-17 NB\_IOTenh4\_LTE\_eMTC6-Core

# 3 Discussion

## 3.1 Scope of WID

Based upon submitted documents, the enhancements desired can be categorized in below three different areas

* Paging carrier selection Improvements
* UL NPRACH Carrier Selection Improvements
* Service base carrier selection Improvements

Companies are requested to provide their comments and percentage allocation; so it may help to prioritize or downselect. Where would companies like to focus and prioritize?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Company | Paging | NPRACH | Service Based | Any Other |
| Ericsson | Yes. 70% We are fine to enhance Paging carrier selection. However, the solution should be reasonable and implementable; i.e not big impact on the NW and UE power consumption. | Yes. 30% We are fine to discuss any enhancements that companies think could be desired. | No. We think Paging and NPRACH carrier selection should be sufficient and may address service-based selection. |  |
| Huawei, HiSilicon | Yes.  According to the submitted documents, it is clear that it is beneficial to have carrier specific paging configuration and assign UEs on specific carriers based on latency requirement, coverage, etc. | TBD.  We are open to discuss possible use case and scenario. But we do not see clear benefit to do further optimization for NPRACH as it is already possible to have very flexible NPRACH configuration among carriers. | -  We think “service” is a high level concept which is very difficult to use in RAN side.  Thus, we should focus on service requirement (latency requirement, coverage, etc.) instead of service concept.  Service requirement can be covered by the first two columns. |  |
| ZTE | Yes, we agree that paging improvements are the main objective that needs to be done.  What need to be studied for this objective can be found in our comments for next question. | No strong view. As in our view, NPRACH carriers and resources can already be configured for different CELs, which seems enough. If some further improvement points can be proposed, we are fine to discuss them. | We can see benefit and feasibility of service based carrier selection scheme for some known service types, e.g., mobility/stationary, paging probability, enhanced coverage restriction. We’d better to do some research on them. | After introduction of CEL-based carrier selection, we suggest to also study what’s the coordination between DL carrier for paging and UL carrier for paging response and coordination between UL carrier for preamble transmission and DL carrier for RAR reception. |
| MediaTek | Yes.  UE can benefit from paging carrier selection based on the coverage, DRX configuration, etc. | Maybe,  UE can select NPRACH carrier based on the coverage level, no need further improvement regarding this concern. We don’t see any other needs of improvement about NPRACH carrier selection, but of course we are open to discuss. | No  No strong benefit |  |
| Qualcomm | Yes, main objective is to define paging carrier selection based on coverage level while maintaining both the UE power consumption and radio resource usage efficiencies. | Maybe  Each non-anchor carrier NPRACH resource can already be configured with coverage level less than supported by the anchor carrier and specification already defines that UE selects a PRACH resource from within the set of NPRACH carriers supporting the desired coverage level.  If further optimisation deemed necessary, it can considered as part of the WID objective. | No  WID objective is for carrier selection based on coverage level and not based on service. | The objective only applies selection of non-anchor carrier.  Anchor carrier should always support the maximum coverage level supported in the cell. |
| Sequans | Yes  As main objective, as it is clear benefits can be gained | Maybe  Agree with above, already quite flexible, but enhancements can be considered | No  Too high level a criterion. In practice already covered by the other two options. | Agree with QC |

**Summary: 6 companies provided their view.**

* **All the 6 companies want the work item to include Paging carrier selection Improvements**
* **All the 6 companies view is that NPRACH configuration is flexible however enhancements can be considered.**
* **5 companies view is that Service based carrier selection Improvements is not desired. Only one company supports this**
* **Further one company view is that there should be co-ordination between DL and UL carriers used for paging and random access respectively.**

1. Paging carrier selection Improvements is prioritized.
2. Enhancements for NPRACH Carrier selection carrier can be considered.
3. RAN2 to discuss the need of coordination between UL and DL carrier for NPRACH and Paging respectively
4. Service based carrier selection improvment is not considered in Rel-17.

## 3.2 Scope of Paging Improvements

Further for paging carrier selection the below parameters have been proposed to study/discuss

* CE Level Rmax (Latency)
* Carrier Specific DRX
* WUS
* GWUS

Companies are requested to provide their prioritization; in which particlualr parameter they would like to focus.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Company | CE Level Rmax | DRX | WUS | GWUS |
| Ericsson | Yes. 100%. We would like to focus paging improvements based upon CE level. | No. Having too many parameters for paging carrier selection improvement may risk or complicate so we would like to have only one focus area. | No. Having too many parameters for paging carrier selection improvement may risk or complicate so we would like to have only one focus area | No. Having too many parameters for paging carrier selection improvement may risk or complicate so we would like to have only one focus area |
| Huawei, HiSilicon | Yes  It is beneficial on paging latency for the UEs in normal coverage.  Note that if carrier specific Rmax is supported, we may need to have carrier specific nB also so that the density of paging occasions on the paging carrier with smaller Rmax can be higher. | Yes  Combining with carrier specific Rmax, it is possible to support both short paging latency and extreme coverage enhancement very well at the same time in a cell (i.e. the UEs with short DRX cycle can be assigned to the paging carrier with smaller Rmax). | Yes. Only focus on enabling/disabling  WUS is always enabled or disabled on all paging carriers. However, not all UEs benefit from WUS (e.g. UE in very good coverage or UE always paged). | No  GWUS can already be enabled on a carrier basis and paging based group selection already take into account some service aspect. |
| ZTE | Yes. CEL-based carrier configuration and carrier selection should be a priority.  Accordingly, for carriers configured for different CELs, some PDCCH parameters, e.g., nB, repetitionNum, DRX cycle can be configured differently for them. The carrier selection formula should also be changed accordingly.  Moreover, in order try to avoid paging failure, the scenario of CEL change and necessity of explicitly reporting CEL from UE to network or UE fallback to legacy paging carrier selection still need to be studied. | No or depends.  In our view, different *defaultDRXCycle* can be configured for different carrier groups with the benefit of making full use of the small UE specific DRX cycle and achieving less paging latency. But the pre-condition of this is that a certain carrier group is configured for a certain CEL. In other word, DRX cycle should only be part of CEL-based carrier configuration. For the carriers that are configured for a certain CEL, the DRX cycle for these carriers should be same.  If we allow purely per carrier DRX cycle configuration, we may need to study whether MME needs to aware such configuration and how and what’s impact on MME paging strategy. That’s undesired. Moreover, it may be unreasonable that for a carrier group configured for a certain CEL (bad CEL), some carriers in this group are with small DRX cycle while other carriers with large DRX cycle. | No. we are not crystal clear the motivation for further enhancement on WUS.  We think WUS can be beneficial on power saving for all the UE, no matter in good coverage or bad coverage. | No. R16 GWUS already can be configured per carrier. That’s enough. No other motivation for further enhancement. |
| MediaTek | Yes, but we need to be aware of that the inconsistence of understanding UE’s coverage level between UE and NW can either cost signaling overhead to synchronize the coverage level status, or lead to paging escalation. Solution may focus on this issue. | Yes  CSS overlapping issue can be alleviate by Paging carrier selection based on DRX cycle configuration. | No  No strong benefit from carrier selection based on WUS configuration. | No |
| Qualcomm | Yes.  The key objective is to limit coverage level for one or more non-anchor paging carrier to lower than maximum coverage level supported in the cell. | Yes  Paging carrier specific DRX can be a useful feature to allow network to tailor certain paging carriers for MT latency sensitive applications and at the same time avoid the CSS overlap issue. | No.  While WUS is supported on all or none of the paging carriers, but different WUS duration can be configured for each non-anchor paging carrier hence WUS can already be tailored to the coverage level supported by the non-anchor paging carrier. | No.  GWUS can already be supported on zero or more non-anchor paging carriers. It is also possible to configure different WUS duration for each non-anchor paging carrier hence GWUS can already be tailored to the coverage level supported by the non-anchor paging carrier. |
| Sequans | Yes  Agree with above | Yes  Secondary to the CEL-based criterion. Could help with CSS overlap issue | No  Already flexible configuration, no need to enhance | No  Already flexible configuration, no need to enhance |

**Summary: 6 companies provided their view.**

* **All the 6 companies want the Paging carrier selection Improvements based upon CE level**
* **5 companies view is that DRX based Paging carrier selection should be considered and out of those 5 companies 2 companies think that the DRX cycle can be considered as part of CE level. 2 companies think it can be considered separate to CE level. One companies view is that DRX cycle should not be considered.**
* **5 companies view is that Paging carrier selection based upon WUS is not needed. Only one company supports this. Out of 5 companies one of the company’s view is that it can be considered as part of CEL.**
* **All the 6 companies do not want the Paging carrier selection Improvements based upon GWUS.**

1. Paging carrier selection Improvements based upon CE level is prioritized.
2. Paging carrier selection Improvements based upon DRX cycle can be considered.
3. RAN2 to discuss whether DRX cylce is considered as part of CE level (Rmax) or can be also considered seperately.
4. Paging carrier selection Improvements based upon solely WUS or GWUS is not considered.

## 3.3 Other

Any other comments

Companies are requested to provide their view:

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |

# 4 Conclusion

Based on the discussion in the previous sections we propose the following:

[Proposal 1 Paging carrier selection Improvements is prioritized.](#_Toc49349768)

[Proposal 2 Enhancements for NPRACH Carrier selection carrier can be considered.](#_Toc49349769)

[Proposal 3 RAN2 to discuss the need of coordination between UL and DL carrier for NPRACH and Paging respectively](#_Toc49349770)

[Proposal 4 Service based carrier selection improvment is not considered in Rel-17.](#_Toc49349771)

[Proposal 5 Paging carrier selection Improvements based upon CE level is prioritized.](#_Toc49349772)

[Proposal 6 Paging carrier selection Improvements based upon DRX cycle can be considered.](#_Toc49349773)

[Proposal 7 RAN2 to discuss whether DRX cylce is considered as part of CE level (Rmax) or can be also considered seperately.](#_Toc49349774)

[Proposal 8 Paging carrier selection Improvements based upon solely WUS or GWUS is not considered.](#_Toc49349775)

# 5 References

1. R2-201306, Additional enhancements for NB-IoT and LTE-MTC, RAN#88e, Reno, June 2020.