**3GPP TSG-RAN WG2 Meeting #116bis electronic  *draft R2-2201795***

**Online, Jan 17th – 25th 2022**

**Agenda item: 9.1.3**

**Source: ZTE (email discussion rapporteur)**

**Title: Report of [Post116bis-e][310][NBIOT/eMTC R17] Carrier Selection open issues (ZTE)**

**Document for: Discussion and Decision**

# Introduction

This document is the report of the offline email discussion “*[Post116bis-e][310][NBIOT/eMTC R17] Carrier Selection open issues*”, as indicated below:

* *[Post116bis-e][310][NBIOT/eMTC R17] Carrier Selection open issues (ZTE)*

 ***Scope:*** *Capture open issues on NB-IoT carrier selection based on the coverage level, and associated carrier specific configuration.*

***Intended outcome:*** *Open issues list in R2-2201795*

***Deadline:*** *Friday 2022-01-28 0800 UTC.*

The document would collect the open issues of the coverage level-based paging carrier selection topic.

The chair’s recommendations are as below:

* **Open Issues** are defined for **aspects that need to be closed**, important to make already agreed functionality work in a reasonable way. Not yet agreed optimisations that may not be needed are **not** be listed as Open Issues.
* For **immature areas**, e.g. UE capabilities for some WIs, it might not be useful/helpful to attempt define specific open issues. It might be better to address such area by company tdocs under an Agenda item (as usual) instead. Some Rel-17 WIs has major parts that may be too Immature to usefully define specific Open Issues.
* **Each open issue** should be associated with **suggested treatment/handling**.
	1. **Company input into Pre117-e-offline (i.e. no company tdocs)**
	2. Company tdocs invited.
	3. CR rapporteur handled issue (CR rapporteur will propose resolution as input to next meeting).
	4. Other, e.g. immature area, reference to dependency, unclear status etc.

# Contact information

Please provide your contact information when feedback:

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# Discussion

In RAN2#116bis e-meeting, we have achieved many agreements in coverage level-based paging carrier selection topic as below:

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| **Agreements [Online]*** UE can be enabled/disabled coverage-based paging carrier selection via dedicated signalling. Presence or absence of the coverage information can be implicit enable/disable indication.
* In SIB, the value range for Rmax (npdcch-NumRepetitionPaging) in R17 paging carrier (list) configuration can be ENUMERATED {r1, r2, r4, r8, r16, r32, r64, r128}.
* In SIB, coverage specific nB is supported, e.g., a common nB value is configured for the R17 paging carrier(s) with same Rmax (npdcch-NumRepetitionPaging).
* Coverage-specific default DRX cycle is not supported.
* Working assumption: In SIB, coverage specific ue-SpecificDRX-CycleMin is supported, e.g., a common ue-SpecificDRX-CycleMin value is configured for the R17 paging carrier(s) with same Rmax (npdcch-NumRepetitionPaging).
	+ (FFS check whether there are any issues with the UE specific minimum DRX cycle per coverage level, can confirm WA if no issues.)
* Paging weight can still be used in coverage-based paging carrier selection.
* In SIB, both non-mixed operation mode and mixed operation mode can be supported in R17 paging carrier list configuration. They can be configured separately (as legacy).
* The extension in SIB22-NB can be used for providing R17 paging carrier list configuration.
* No “offset” (headroom) would be introduced for the configured NRSRP threshold.
* A configurable cell specific timer period can be applied when UE compares its serving cell NRSRP with the NRSRP threshold. FFS how to signal and value range.
* It’s specified that UE does not switch paging carrier if it has stayed less than [xx] seconds on the carrier or within a PTW. FFS value of [xx] seconds
* Coverage based paging carrier selection is enabled implicitly, i.e., when relevant parameters are provided to the UE during release.
* The Rel-17 paging carriers can also be used as the DL carriers for random access.
* No need to introduce a subgroup of paging carriers for the more easily changed CE level.
* In SIB, at most 2 coverage levels can be configured in R17 paging carrier list, each coverage level has one NRSRP threshold
* Rmax may be configured per carrier or per carrier group (coverage level).
* A paging carrier group index, e.g., the index to one of the two lists which correspond to the 2 coverage levels in SIB, is provided to the UE in dedicated signaling (when UE is released to idle).
* UE measured NRSRP can be reported to network for assisting the network to provide suitable coverage level related information. FFS how.
* FFS whether to introduce a new paging carrier list, e.g., *DL-ConfigCommon-NB-r17*, or just to extend *PCCH-ConfigList-NB*.
* FFS whether to send LS to RAN3 (at the start of the next meeting)
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It can be seen there are still some FFSs. It’s straightforward to list these FFSs would as open issues.

## List of open issues

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| **Index** | **Open issue description** | **Rapporteur comment** |
| **Open Issue 1** | Whether there are any issues with the UE specific minimum DRX cycle per coverage level | During “*[Post116-e][311] NB-IoT carrier selection* (R2-2200030)” email discussion, this issue has been discussed in details. Based on companies’ inputs, the proposal is given that “*In SIB, coverage specific ue-SpecificDRX-CycleMin is supported*”.Companies are invited to double check whether there are any issue for supporting coverage specific *ue-SpecificDRX-CycleMin* and further provide comments in **Pre117-e-offline** discussion. Please note the usage of *ue-SpecificDRX-CycleMin* in R16 is that: T = min (default DRX value, max (UE specific DRX value, minimum UE specific DRX value broadcast in system information)). That may means, the configuration of *ue-SpecificDRX-CycleMin* need to be consistent with the configured repetitions of paging. Moreover, in order to avoid CSS overlapping, if the repetitions is relatively large, the small UE-specific DRX cycle would be "corrected" by this process: max (UE specific DRX value, minimum UE specific DRX value broadcast in system information), e.g., the small UE specific DRX cycle can no longer be used. |
| **Open Issue 2** | RAN2 has agreed “UE does not switch paging carrier if it has stayed less than [xx] seconds on the carrier or within a PTW”. Not only the value of [xx] seconds but also the details of UE behavior need to be further discussed. | Companies are invited to consider the following example questions and further provide comments in **Pre117-e-offline** discussion:* What’s the suggested value of [xx] seconds?
* Whether we need to specify kind of timer for this process? If yes, what’s the conditions for timer start/restart/stop? Or maybe in other word, whether UE needs to continuously check this [xx] seconds?
* Whether the UE needs to check [xx] seconds in both the following cases or only one case:
	+ After selecting R17 paging carrier
	+ After fallback to legacy paging carrier

Moreover, rapporteur understand some related discussion would happen in the TS 36.304 running CR review, e.g., how to specify the details in section “**7.X Coverage based paging carrier selection**”. The discussion there or suggestion from TS 36.304 rapporteur can also be taken into account. |
| **Open Issue 3** | RAN2 has agreed that UE measured NRSRP can be reported for assisting the network to provide suitable coverage level related information.It’s still FFS on the detailed report way. | During “*[AT116bis-e][301][NBIOT/eMTC R17] Carrier Selection* (R2-2201786)” email discussion, more companies (6/9) prefer the simple way, e.g., the Alt1. At the same time, some other companies think this is not enough and prefer Alt2 below:* **Alt1:** to make legacy Msg5 report mandatory.
* **Alt2:** to report an indication on whether the existing CQI report is suitable for coverage-based paging carrier selection.

Companies are invited to consider the usage and details (e.g., when to report and what’s the report format) of **Alt2** and further provide comments in **Pre117-e-offline** discussion |
| **Open Issue 4** | RAN2 has agreed most needed IEs for the R17 paging carrier list configuration in SIB. But how to organize the IEs in ASN.1 are still FFS.  | More details can be left to TS 36.331 rapporteur, but before that, rapporteur of this topic still suggest we firstly decide the high level direction, e.g., make decision between the below Alt1 and Alt2 on table:* **Alt1:** to introduce a new paging carrier list, e.g., *DL-ConfigCommon-NB-r17*
* **Alt2:** just to extend *PCCH-ConfigList-NB*

Some example questions are mentioned below for companies to consider and further provide comments in **Pre117-e-offline** discussion:* Whether legacy UEs are allowed to use the carriers in R17 paging carrier list as the RAR carrier?
* Whether R17 UEs are allowed to use the carriers in the legacy paging carrier list as the RAR carrier?
 |
| **Open Issue 5** | During the meeting discussion, company has mentioned that the assigned information to UE in dedicated signaling may also need to be delivered to core network. RAN3 has had some related discussion but pend to make agreement. It’s better RAN2 can provide some suggestion on how to provide such information? | Companies are invited to consider the following example questions and further provide comments in **Pre117-e-offline** discussion:* Whether the assigned information to UE in dedicated signaling also need to be delivered to core network and sent back to eNB in next paging?
* Which way is preferred to deliver this information:
	+ **Alt1:** in *UEPagingCoverageInformation* RRC container. This means RAN2 change.
	+ **Alt2:** in S1/NG signaling, e.g., in *Cell Identifier and Coverage Enhancement Level* IE in TS36.413 and in *Paging Assistance Data for CE Capable UE* IE in TS38.413. This means RAN3 change.

Based on the output of **Pre117-e-offline** discussion, RAN2 can further decide whether to send LS to RAN3. |

Companies are invited to provide your views on the open issues listed above:

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| **Company** | **Comments, if any** |
| Qualcomm | **Open Issue 1:** Main concern raised was that CN does not necessarily know the minimum UE specific DRX cycle supported in the cell hence CN’s paging repetition strategy may not take full advantage of UE specific DRX cycle. We think this issue exists from Release 16 and it can be handled by network implementation, and this should not be reason to block this feature from RAN2 specifications.**Open Issue 2:** Suggest to split this issue into two:* No paging carrier switching during PTW.
* Since the UE typically does measurements at/during paging occasions, it is sensible to define the minimum time the UE remains on the same paging carrier in units of DRX/eDRX. Otherwise UE may be required to perform additional measurements hence lead to increased power consumption. Decause eDRX can be significantly longer period than DRX, propose to have different values for UE operating in DRX (e.g., a range from 2 – 10 consecutive DRX cycles) than UE operating in eDRX (e.g., a range from 1 – 5 consecutive eDRX consecutive)

 **Open Issue 3:** We think Alt2 is better as it avoids interfering with ANR or link management procedures i.e., when the UE considers it has not been on the cell long enough to know the coverage is good enough for one of the coverage-based paging carrier group then NW can still send the report and network can use this for ANR/link management but would not use this to assign coverage-based paging carrier group.**Open Issue 4:** Now that we have a better idea of what information needs to be provided in SIB, we propose company contributions showing exactly the coding for Alt1 and/or Alt2 and then make a decision at RAN2#117e.**Open Issue 5:** We understand the issues is that when UE is configured with ‘Enhanced Coverage Restriction’ then CN may not provide the transparent container which contains *UEPagingCoverageInformation* to the eNB when sending paging request to RAN. This restriction is placed by SA2 and not by RAN3. In fact, we think it is wrong of SA2 to place this restriction for NB-IoT given that there is no definition of ‘normal coverage’ for NB-IoT in RAN2 specification. It is better if SA2 remove this restriction for NB-IoT and *UEPagingCoverageInformation* can be used to maintain the coverage-based paging carrier group index. |
| Huawei, HiSilicon | We are fine with the open issues, 1,2,3 and 5.open issue 4: we do not think we should discuss ASN.1 details in the offline. We expect that the RRC rapporteur to have a proposal in the running CR that can be discussed during the CR review. If companies do not agree with the proposal after review, they can come with a counter proposal at the meeting.We do not think this email discussion is intended to discuss how to resolve the open issues. This should take place during Pre117-e-offline discussions |
| Spreadtrum | We are ok with the mentioned open issues. |

**Summary:**

1 company has given some company's technical comments for each Open Issue. That’s not the intention of this email discussion. Then that part of comments would be skipped and companies can bring them back during Pre117-e-offline discussions.

All 3 companies are fine with Open issue 1, 2, 3 and 5. One company suggest to split Open issue 2 into 2 issues.

1 company think Open issue 4 is not needed and this can be discussed in ASN.1 details. The other 2 companies are fine with Open issue 4. Among them, one company think company contributions can be invited to show exactly the coding for Alt1 and/or Alt2. Rapporteur suggest we still keep this Open issue 4 with main purpose to discuss high level suggestion to ASN.1, e.g., whether to introduce a new paging carrier list, e.g., *DL-ConfigCommon-NB-r17*, or just to extend *PCCH-ConfigList-NB*. Rapporteur think it’s no need of company contributions on this. Companies can focus on the detailed examples for Alt1 and Alt2 and provide them to Pre117-e-offline.

Based on the above summary, the following Open issue list are given and all of them are for Pre117-e-offline:

* **[Open Issue 1]:** Whether there are any issues with the UE specific minimum DRX cycle per coverage level?
* **[Open Issue 2.1]:** How to specify that no paging carrier switching during PTW?
* **[Open Issue 2.2]:** How to specify that UE does not switch paging carrier if it has stayed less than [xx] seconds on the carrier, e.g., what’s the UE behavior and what’s the exact value, xx seconds or value in units of DRX/eDRX cycle?
* **[Open Issue 3]:** The detailed way for UE to report measured NRSRP for assisting the network to provide suitable coverage level related information.
* **[Open Issue 4]:** The high level suggestion for R17 paging carrier configuration in SIB in ASN.1, e.g., whether to introduce a new paging carrier list, e.g., *DL-ConfigCommon-NB-r17*, or just to extend *PCCH-ConfigList-NB*.
* **[Open Issue 5]:** Whether the assigned information to UE in dedicated signaling also need to be delivered to core network and sent back to eNB in next paging? If yes, whether there is RAN2 specification impact or it can be left to RAN3?

Please indicate any other open issues not discussed in the above.

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| **Company** | **Comments** |
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**Summary:**

No further open issue is mentioned.

# Conclusion

The following Open issue list is given and all of them are for Pre117-e-offline:

* **[Open Issue 1]:** Whether there are any issues with the UE specific minimum DRX cycle per coverage level?
* **[Open Issue 2.1]:** How to specify that no paging carrier switching during PTW?
* **[Open Issue 2.2]:** How to specify that UE does not switch paging carrier if it has stayed less than [xx] seconds on the carrier, e.g., what’s the UE behavior and what’s the exact value, xx seconds or value in units of DRX/eDRX cycle?
* **[Open Issue 3]:** The detailed way for UE to report measured NRSRP for assisting the network to provide suitable coverage level related information.
* **[Open Issue 4]:** The high level suggestion for R17 paging carrier configuration in SIB in ASN.1, e.g., whether to introduce a new paging carrier list, e.g., *DL-ConfigCommon-NB-r17*, or just to extend *PCCH-ConfigList-NB*.
* **[Open Issue 5]:** Whether the assigned information to UE in dedicated signaling also need to be delivered to core network and sent back to eNB in next paging? If yes, whether there is RAN2 specification impact or it can be left to RAN3?

# References

[1] R2-2201786, Report of [AT116bis-e][301][NBIOT/eMTC R17] Carrier Selection (ZTE), RAN2#116bise

[2] R2-2200030, Report of [Post116-e][311] NB-IoT carrier selection (ZTE), RAN2#116bise