3GPP TSG-RAN WG2 Meeting #115 Electronic R2-21xxxxx

Elbonia, 16 – 27 August 2021

**Agenda item: 6.1.4.1.3**

**Source: ZTE corporation, Sanechips**

**Title: Report of [AT115-e] [026] [NR16] System Information and Paging (ZTE) – First round**

**Document for: Discussion and Decision**

# 1 Introduction

This is the summary of the following email discussion in RAN2#115-e meeting.

**[AT115-e][026][NR16] System Information and Paging (ZTE)**

 Scope: Determine agreeable parts and agree CRs, Treat R2-2107722 – R22107728, R2-2108107, R2-2107011, R2-2107934, R2-2108615.

 Intended outcome: Report, Agreed CRs.

 Deadline: Schedule 1

Discussions with Deadline **Schedule 1**:

A **first round** with **Deadline for comments Thursday Aug 19 1200 UTC** to settle scope what is agreeable etc

A Final round with **Final deadline Thursday Aug 26 1200 UTC.** to settle details / agree CRs etc. Additional check points etc if needed are defined by the Rapporteur. In case some parts of an email discussion need more time, doesn’t converge, need on-line treatment etc Rapporteur please contact chair.

# 2 Contact information

|  |  |
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# 3 Discussion

## 3.1 PO in INACTIVE

[R2-2107722](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2108_R2_115-e/Docs/R2-2107722.zip) PO determination in RRC\_INACTIVE for Rel-16 and later releases ZTE corporation, Ericsson,CMCC, China Telecom, China Unicom,vivo, Sanechips discussion Rel-16 NR\_newRAT-Core, LTE\_5GCN\_connect-Core

[R2-2107723](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2108_R2_115-e/Docs/R2-2107723.zip) Correction on PO determination for UE in inactive state-38.331 ZTE corporation, Ericsson,CMCC, China Telecom, China Unicom,vivo, Sanechips CR Rel-16 38.331 16.5.0 2736 - F NR\_newRAT-Core

[R2-2107724](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2108_R2_115-e/Docs/R2-2107724.zip) Correction on PO determination for UE in inactive state-38.304 ZTE corporation, Ericsson,CMCC, China Telecom, China Unicom,vivo, Sanechips CR Rel-16 38.304 16.5.0 0213 - F NR\_newRAT-Core

[R2-2107725](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2108_R2_115-e/Docs/R2-2107725.zip) Correction on PO determination for UE in inactive state-38.306 ZTE corporation, Ericsson,CMCC, China Telecom, China Unicom,vivo, Sanechips CR Rel-16 38.306 16.5.0 0614 - F NR\_newRAT-Core

[R2-2107726](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2108_R2_115-e/Docs/R2-2107726.zip) Correction on PO determination for UE in inactive state-36.331 ZTE corporation, Ericsson,CMCC, China Telecom, China Unicom,vivo, Sanechips CR Rel-16 36.331 16.5.0 4695 - F LTE\_5GCN\_connect-Core

[R2-2107727](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2108_R2_115-e/Docs/R2-2107727.zip) Correction on PO determination for UE in inactive state-36.304 ZTE corporation, Ericsson,CMCC, China Telecom, China Unicom,vivo, Sanechips CR Rel-16 36.304 16.4.0 0831 - F LTE\_5GCN\_connect-Core

[R2-2107728](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2108_R2_115-e/Docs/R2-2107728.zip) Correction on PO determination for UE in inactive state-36.306 ZTE corporation, Ericsson,CMCC, China Telecom, China Unicom,vivo, Sanechips CR Rel-16 36.306 16.5.0 1819 - F LTE\_5GCN\_connect-Core

### **Discussion history and agreements**

R2-2106771 Report of [AT114-e] [013] [NR15] Idle Inactive mode (ZTE) ZTE corporation, Sanechips discussion

**=> [013] 1: RAN2 understand the index of the PO (i.e. the i\_s) calculated based on the same UE ID may be different in inactive state and idle state when the DRX cycle for inactive and idle state are different. If a UE in inactive state only monitors the PO derived for inactive state, CN paging failure would happen in both NR and eLTE .**

**=> [013] 2: For Rel-15, it is up to NW implementation to ensure RAN and CN paging occasions overlap in both NR and eLTE**

**=> [013] Whether a standard solution should be supported in later releases (Rel-16 or Rel-17) for NR and eLTE, and if so, the choice of solution, is Postponed**

### **Baseline solution**

* Solution 1: UE monitor both RAN and CN PO, in case RAN and CN PO are not overlapped.
* Solution 2: UE in RRC\_INACTIVE should use the same i\_s to determine PO as for RRC\_IDLE

There has been discussion on the potential solutions at RAN2#114e with companies shown clear preference for solution 2 considering the limited impact in both NW and UE side, so it is proposed [1-7] to take solution 2 as a baseline to solve the PO misalignment in RRC\_INACTIVE and RRC\_IDLE in NR and eLTE.

**Q1.1: Do companies agree to take solution 2 as a baseline to address the RAN and CN paging PO mismatch problem identified in RAN2#114e?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Detailed Comments |
| Samsung | Yes with comments | We prefer to limit the PO change only in some DRX cycles i.e. UE in RRC\_INACTIVE uses the same i\_s as for RRC\_IDLE for PO determination only if RAN PO and CN PO are not overlapped in a certain DRX cycle. For example, if only RAN PO is there in a certain DRX cycle, UE does not need to shift it as for RRC\_IDLE.  |
| Apple | See comment | WE prefer a solution that does not change current UE’s legacy behavior. It is NW responsibility to ensure the PO overlaps. UE is assumed to receive RAN paging and/or CN paging in the same PO. We propose the alternative solution is to let NW to duplicate the paging message in both POs to ensure the message is delivered no matter which i\_s is calculated by UE. This change can be captured in the spec as NW-side requirements for state mismatch case, but there is no need for new UE capability or UE-side behavior change. |
| MediaTek | Yes | Solution 1 is not acceptable due to high power consumption.Solution 2 (with UE capability) is okay for us.  |
| Xiaomi | Yes | Solution 2 is OK. |
| OPPO | Yes |  |
| Nokia | See comment | one is missing solution 3 – NW implementation may solve this without UE impacts e.g. by not configuring different DRX in IDLE/INACTIVE and/or sending paging in both IDLE/INACTIVE opportunities |
| Huawei, HiSilicon | no | Baseline solution is already agreed for Rel-15 can be used in later releases also (i.e. NW implementation solution), therefore this new solution is an optimization rather than a correction. If there is a majority supporting introducing an optimization along these lines, we should go with solution 2 from R17.  |
| QCOM | No | This proposal is too late for Rel-16. In addition, this is a very corner case issue and there is an easy NW solution to address it (e.g. NW to duplicate the paging message in both POs). The proposed solution can be TEI-17 WI. |
| CATT | No | It is agreed that this can be solved in NW implementation in R15, and this could be used as baseline for later release.  |
| Ericsson | Yes | We agree that with certain network restrictions (same “DRX cycle for CN and RAN page”, or “Ns is set to 1”) as well as “Nw pages the UE both in IDLE and INACTIVE paging occasions”, the problem of not reaching the UE can be avoided.To avoid those restrictions, we agree to take Solution 2 as baseline. |
| Intel | Yes,  | Solution 1 will consume additional battery and we think solution 2 should be used..  |
| ITRI | No | We prefer using R-15 solution (i.e., NW implementation) to handle this.However, if a majority supporting introducing a new method other than NW implementation, we support solution 2. |
| ZTE | Yes | * Solution 2 has already been agreed as working assumption and will soon turn into formal agreement to address the same issue for eMTC (see [AT115-e][402][eMTC R16] Paging resource determination (ZTE)).
* The following examples have been identified to solve this mismatch problem via NW implementation but we have seen considerate impact on the paging efficiency thus would like to have a standardized solution.
* Example 1: Ns=1, in this case, the UE in RRC\_INACTVE and RRC\_IDLE would anyway monitor the same POs.
	+ Impact foreseen: Having one PO per PF would limit the paging capacity, which may result in paging congestion and increased paging delay.
* Example 2: RAN configured DRX cycle = Default DRX cycle, and RAN ensures the same Default DRC cycle in a RNA. In this case the T used in RRC\_IDLE would always equal T used in

RRC\_INACTVE and thus there is no PO misalignment issue in this configuration. * + Impact foreseen:

(1) The functionality of differentiated paging cycle to UE in INACTIVE and IDLE would be disabled. (2)1280ms has now been configured as the CN paging cycle in some area. If the same cycle applies for RAN paging to UE in RRC\_INACTIVE, there would be considerate delay in state transition from RRC\_INACTIVE. To ensure the QoS, NW may choose to keep UE in RRC\_CONNECTED as much as possible instead of releasing UE to RRC\_INACTIVE.(3)Shorter paging cycle, e.g. 320ms, has been configured for RAN paging to UE in RRC\_INACTIVE. If the same cycle applies for CN paging to UE in RRC\_IDLE, there would be considerate power consumption at UE side to wake up and monitor paging occasions frequently.* Example 3: Network takes care of the UE specific DRX cycle and UE ID to ensure overlapped RAN paging and CN paging PO.
	+ Impact foreseen: Having one PO per PF would limit the paging capacity, which may result in paging congestion and increased paging delay.
 |
| LGE | No | We think cells supporting this feature and cell not supporting it can be mixed in the RNA. The solution 2 doesn’t work if the serving cell doesn’t support it. Though UE supports the solution 2, the UE should monitor both RAN and CN PO not to miss the CN paging, if different DRX is configured. The solution 1 is not preferred also because it leads to additional UE power saving in INACTIVE. Therefore, this problem should be solved by NW implementation as mentioned by Nokia.  |
| CMCC | Yes | Solution 2 is more preferable than solution 1. |
| vivo | Yes | For option 1, it will introduce more power consumption at UE side if always tasking UE to monitor both RAN and CN PO.For the NW implementation solution mentioned by some companies, in addition to the restriction to NW, NW implementation will lead more UE power consumption:when NW pages one UE in both IDLE and INACTIVE paging occasions, two paging messages for a target UE are sent per DRX cycle in different POs, which will cause un-necessary PDSCH reception for the UEs have same PO with this target UE in either IDLE or INACTIVE PO.To avoid those restrictions to NW and impact to UE, we agree to take Solution 2 as baseline. Using same DRX cycle for CN and RAN page, NW may always configure the both DRX cycles according to the shorter one.  |
| China Telecom | Yes | We think solution 2 is more efficient for both UE and NW sides. |
| China Unicom | Yes | We understand solution 2 is better for both UE and NW. |

**Rapporteur’s summary:**

18 companies commented on this question with the views summarized below:

* Support solution 2 as baseline: Samsung/MediaTek/Xiaomi/OPPO/Ericsson/Intel/ZTE/CMCC/vivo/China Telecom/China Unicom (**11** companies)
	+ Samsung: UE in RRC\_INACTIVE uses the same i\_s as for RRC\_IDLE for PO determination only if RAN PO and CN PO are not overlapped in a certain DRX cycle.
* Prefer NW implementation also in later release: Apple/Nokia/Huawei/Qualcomm/CATT/ITRI/LGE(**7** companies）
	+ Huawei/Qualcomm: Fine to go for solution 2 from R17 if majority prefers to do so
	+ ITRI: Fine to go for solution 2 if majority support a new method.

The following proposal is given based on the majority’s preference:

**Proposal 1: Solution 2 (i.e. UE in RRC\_INACTIVE should use the same i\_s to determine PO as for RRC\_IDLE) is taken as a baseline to address the RAN and CN paging PO non-overlap problem.**

* **UE capability**

It is proposed [1-7] to introduce UE capability to indicate UE support for solution 2, i.e. using the same i\_s in PO determination in RRC\_INACTIVE state as in RRC\_IDLE state so that NW can identify such UE and send both CN paging and RAN paging in the overlapped POs.

**Q1.2: Do companies agree to introduce UE capability to indicate support for using the same i\_s in PO determination in RRC\_INACTIVE state as in RRC\_IDLE state?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Detailed Comments |
| Samsung | Yes | In [1], it mentioned that the last serving gNB needs to indicate useIdlePO to the new serving gNB. We wonder whether we need to send an LS to RAN3 if it is agreed.  |
| Agree | No | If adopts the NW-based solution as we explained in Q1.1, then there is no need for a new UE capability  |
| MediaTek | Yes |  |
| Xiaomi | Yes | gNB (including anchor gNB and target gNB) should be aware of UE capability so that it can be aligned between gNB and UE for paging procedure. |
| OPPO | Yes | New UE capability can help the network to configure a proper DRX cycle. |
| Nokia | No  | NW can solve this without UE impact |
| Huawei, HiSilicon | Yes, only if new solution is introduced | If we have the optimization then capability is needed, however we think solution is not really needed. |
| QCOM | Yes if CR is agreed | If this change is introduced into Rel-16 spec, so definitely capability is needed otherwise it will be an NBC. |
| CATT | Yes if new solution introduced |  |
| Ericsson | Yes | If Solution 2 is intrroduced |
| Intel | Yes |  |
| ITRI | Yes |  |
| ZTE | Yes |  |
| LGE | No |  |
| CMCC | Yes | gNB should be aware of which PO to use, according to UE capability. |
| vivo | Yes |  |
| China Telecom | Yes | NW needs to be aware of this UE capability for paging |
| China Unicom | Yes |  |

**Rapporteur’s summary:**

18 companies commented on this question with the views summarized below:

* Yes:Samsung/MediaTek/Xiaomi/OPPO/Huawei,HiSilicon/Qualcomm/CATT/Ericsson/Intel/ITRI/ZTE/CMCC/vivo/China Telecom/China Unicom (**15** companies)
	+ Huawei,HiSilicon/Qualcomm/CATT: UE capability is needed if we have new solution
* No: Apple/Nokia/LGE (**3** companies)

The following proposal is given based on the majority’s preference:

**Proposal 2: UE capability should be introduced to indicate support for using the same i\_s in PO determination in RRC\_INACTIVE state as in RRC\_IDLE state**

* **Inter-operability between UE and NW**

The following options have been proposed [1-7] for inter-operability between UE and NW:

* Option 1: Introduce a per UE indication in RRCRelease message to enable the use of the same i\_s in both RRC\_INACTIVE and RRC\_IDLE in PO determination.
* Option 2: Introduce a per cell indication in system information showing NW support for using the same i\_s in both RRC\_INACTIVE and RRC\_IDLE in PO determination.
* Option 3: Other

**Q1.3: Which option do companies prefer to enable or indicate NW support for the use of the same i\_s in both inactive and idle mode?**

|  |  |  |
| --- | --- | --- |
| Company | Option 1/2/3 | Detailed Comments(Please explain details in this column if you select option 3: other) |
| Samsung | Option 3 | For our clarification, we have some questions. 1/ If we go for Option 1 only, the issue still remains unless all the cells within the RNA suport the new feature. It may unnecessarily restrict NW flexibility to configure RNA. We wonder whether this restriction is OK to all. 2/ If we go for Option 2 only, the issue may remain in a certain scenario i.e. if the last serving gNB sending RRCRelease to UE does not understand the UE capability of this new feature so the new gNB where UE now camps on does not receive it from the last serving gNB but broadcasts a per cell indication.Hence, we are wondering whether both options may be needed. One side note is that we may specify when UE deletes a per UE indication as well if we go for Option 1. |
| Apple  | Option 3 | We propose to solve this as NW implementation, i.e., let NW to duplicate the paging message in both POs to ensure the message is delivered no matter which i\_s is calculated by UE. For Option 1, we have the same concern as Samsung that this needs be configured in all the cells of a RAN notification area.We wonder if it is worth to introduce such new signaling in Option1 or Option 2 to address a corner case issue with low probability (i.e., INACTIVE state mismatch + unequal i\_s value). |
| MediaTek | Option 1 | We understand option 1 only works if all cells within RNA supporting this feature.In addition, we understand that* For legacy UE and UE does not support this feature, the NW uses old PO to page the UE(s).
* For new UE that supports UE this feature, the NW enable this new PO calculation (in *RRCRelease*) and uses new PO to page the UE(s).

We don’t know how solution 2 works for (legacy) UE that does not support this new feature but camping on a cell that enable this new function. |
| Xiaomi | Option 2 | But for per cell indication in system information, we wonder when UE reselect to another target gNB, whether the anchor gNB can send RAN PAGING message carrying the useidlePO information via Xn interface to target gNB, if UE indicate the anchor gNB its capability of using the same i\_s. If so, we go with option 2 as there are some cases when cell reselection happens: Case 1: UE indicate to anchor gNB supporting useidlePO and target gNB also broadcast supporting useidlePO. Then when receiving RAN PAGING via Xn the target gNB will page UE using same i\_s.Case 2: UE indicate to anchor gNB not supporting useidlePO and target gNB broadcast supporting useidlePO. Then when receiving RAN PAGING via Xn (i.e. will not carry the useidlePO information) the target gNB will page UE not using same i\_s.Case 3: UE indicate to anchor gNB supporting useidlePO but target gNB broadcast not supporting useidlePO. Then when receiving RAN PAGING via Xn the target gNB will page UE not using same i\_s anyway.However, if all cells within RNA supporting this feature, then option 1 is also OK for us. |
| OPPO | Option 3 | We think both per cell and per UE indicator is not needed if UE already reports the capability defined in Q1.2 to network. Once the network gets this capability, network implementation can guarantee that a proper inactive DRX cycle will be configured in RRC release message/NAS message to achieve the same PO between idle and inactive. This method is workable and has less spec effort than Option1 and Option2. Either Option1 and Option2 will introduce extra spec effort and/or implementation limitation from network side, which is unnecessary. |
| Nokia |  | If anything is needed then this should be part of the regular PCCH configuration i.e. wherever PCCH is configured this should be part of that |
| Huawei, HiSilicon | 1 | The new IE should be a part of SuspendConfig not CellReselectionPriorities |
| CATT | Option 1 | Option 1 is simpler and fine to us. |
| Ericsson | Optiion 2 |  |
| Intel | Option 2 | Option 2 can be used if all the cells of an RNA supports this new functionality – that is, network will have to set this bit uniformly across all the cells of an RNA. Option 2 may also work if only a subset of cells of the RNA support this functionality but this will require checking with RAN3 on how the target gNB is aware of the anchor gNB capability. Option 1 will only work if all the cells of the RNA support this functionality. So we think option 2 provides more flexibility.  |
| ITRI | Option 2 |  |
| ZTE | Either is fine, slightly prefer option1 | For option1, we share similar understanding with MediaTek that this feature will be enabled when all the cells within RNA supports.Option 2 is also acceptable to us as it provides more flexibility for NW. |
| CMCC | Option 1 | Network only send the indication to UE if UE report the capability. |
| vivo | Either is fine, also option 3 is acceptable | Option 2 is more flexibility from NW perspective.Meanwhile, we could also accept option 3: not to have indication from network.In our understanding, * When UE does not support this feature:
	+ UE follows the R15 behavior to monitoring paging, no matter gNB supports this feature or not.
* When UE supports this feature:
	+ If gNB doesn’t support this feature, it should up to NW implementation (e.g. using same DRX cycle or duplication paging in both PO) to ensure paging could be received.
	+ If gNB supports this feature, the new mechanism should be used to ensure paging could be received.

Anyway, UE follows the same behavior to monitor paging, regardless NW supports this feature or not. |
| China Telecom | Option1 | We prefer option1 from the perspective of saving SI overhead. |
| China Unicom | Option 1 |  |

**Rapporteur’s summary:**

16 companies commented on this question with the views summarized below:

* Option 1: MediaTek/Huawei,HiSilicon/CATT/ZTE/CMCC/ChinaTelecom/ChinaUnicom/vivo (**8** companies)
* Option 2:Xiaomi/Ericsson/Intel/ITRI/vivo (**5** companies)
	+ Xiaomi: Option 1 is also fine if all the cells within RNA supports this feature.
* Other: Samsung/Apple/OPPO/Nokia/vivo (**5** companies)
	+ OPPO/vivo: not to have indication from network.
		- When UE does not support this feature:
			* UE follows the R15 behavior to monitoring paging, no matter gNB supports this feature or not.
		- When UE supports this feature:
			* If gNB doesn’t support this feature, it should up to NW implementation (e.g. using same DRX cycle or duplication paging in both PO) to ensure paging could be received.
			* If gNB supports this feature, the new mechanism should be used to ensure paging could be received.

There has been slight preference for option 1 (8 VS 5 VS 5), thus the following proposal is given:

**Proposal 3: Introduce a per UE indication in RRCRelease message to enable the use of the same i\_s in both RRC\_INACTIVE and RRC\_IDLE in PO determination.**

* **Applicable scenarios for option 1 and option 2**

In Option 1, the *useIdlePO* will be configured with value “true” when all the cells within the configured RNA support such enhancement so that UE can monitor CN paging and RAN paging in overlapped POs within the RNA.

In option 2, the *ranPagingInIdlePO* is valid within a cell so it seems to be allowed to configure a RNA within which some cells support such functionality while others do not. However, the PO mismatch problem can only be solved when both UE and NW supports to use the same i\_s in RRC\_INACTIVE and RRC\_IDLE for PO determination.

To avoid the compatibility issue at NW side (i.e. some NW nodes support such functionality while others do not) and minimize the complexity, it is recommended [1] to deploy this feature at NW side when all the cells within the RNA supports to send RAN paging and CN paging in the overlapped Pos (i.e. the idle Pos) so that the PO mismatch problem can be solved via either option 1 and option 2.

**Q1.4: Do companies agree that this feature (*i.e. solution 2:******UE in RRC\_INACTIVE use the same i\_s to determine PO as for RRC\_IDLE*) will only be deployed at NW side when the feature is supported by all the cells within the RNA?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Detailed Comments |
| Samsung | Yes or No | We wonder whether this restriction is OK to all.  |
| Apple | Yes | This assumption is needed for Option 1 to work. |
| MediaTek | Yes |  |
| Xiaomi | Yes | It can make things simple, also suitable for option 1. |
| OPPO | No | See answer in Q1.3, this limitation is unnecessary from our side. |
| Nokia | No | This cannot be assumption in multivendor deployments it is difficult to ensure all the cells support exactly same set of feature at exactly same time |
| Huawei, HiSilicon | No | In general this is likely in most situations but we don’t think any agreement is necessary |
| CATT | Yes | We think such assumption is needed for option 1. |
| Ericsson | Not sure | In practice (e.g. multi-vendor scenario) hard to ensure feature is supported in all cells of RNA. We agree this assumption is needed for Solution 1.Need to study the required additions to inter-note ptimizat more.for Solution 2 |
| Intel | Depends | It depends also on RAN3. As commented in Q1.3, from the UE ptimiza point of view, it is sufficient to use option 2, that is, UE applies this if it supports this and the bit is set in SIB. |
| ZTE | Yes | We understand this assumption is needed at least for solution 1. |
| LGE |  | If the solution 2 is accepted, all cells should support this feature. |
| CMCC | Yes |  |
| vivo |  | Based on the above discussion, it seems not required. But we are open to discuss. |
| China Telecom | Yes |  |
| China Unicom | Yes |  |

**Rapporteur’s summary:**

16 companies commented on this question with the views summarized below:

* Yes: Apple/MediaTek/Xiaomi/CATT/ZTE/CMCC/ChinaTelecom/ChinaUnicom (**8** companies)
	+ Apple/Xiaomi/CATT: This assumption is needed for option 1
* No: OPPO/Nokia/Huawei,HiSilicon (**3** companies)
	+ Huawei,HiSilicon: In general this is likely in most situations but we don’t think any agreement is necessary
* Not sure/Depends: Samsung/Ericsson/Intel/vivo/LGE (**5** companies)
	+ Ericsson: This assumption is needed for Solution 1.

The majority understand this assumption is needed for solution 1, thus the following proposal is given:

**Proposal 4: NW will enable the use of the same i\_s in both RRC\_INACTIVE and RRC\_IDLE in PO determination via the indication in RRCRelease message when all the cells within the RNA supports this enhancement.**

### **When to support the baseline solution**

Per the discussion at RAN2#114e, there has been different views on when to support such solution, Rel-16 or Rel-17. According to the time plan, Rel-17 ASN.1 will be frozen in June 2022. If it is decided to support such solution from Rel-17, the UE vendors have to wait until then or even later to start implementation. And it has been observed that the PO mismatch problem is solved at the sacrifice of paging efficiency and the UE power consumption if we leave it to NW implementation

Considering the stability of the ASN.1, it is proposed [1] to fix the PO mismatch problem and apply such functionality to the market as soon as possible and UE should be allowed to implement the *solution 2 (i.e. UE in RRC\_INACTIVE to use the same i\_s as for RRC\_IDLE in PO determination)* from Rel-16, which can be achieved by the following options:

* Option 1: Support solution 2 from Rel-16.
* Option 2: Support solution 2 from Rel-17 with early implementation

**Q1.5: On when to support the baseline solution, which option do companies prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Option 1/2 | Detailed Comments |
| Samsung | None | We think that the issue is not critical i.e. missing CN PO is a corner case. Hence, we prefer to introduce this new feature from Rel-17 if the majority wants to have it.  |
| Apple | None | As explained in Q1.1 and 1.3, we support alternative solution based on NW implementation w/o introducing new signaling. If NW implementation needs to specified to bring a closure to this issue, it can be done in R16 spec. If the majority view insists to have new RRC signaling to be introduced for solving this problem, we prefer to start this in R17. |
| MediaTek | Option 1 | Early implementation does not help too much in this case. |
| Xiaomi | Open |  |
| OPPO |  | If our suggestion in Q1.3 is agreed, we’re fine to start from R16, otherwise, if Option1 or Option2 is adopted in Q1.3, we prefer to start this in R17. |
| Nokia | None | Issue is not critical and can be solved by NW implementation. So no solution is needed |
| Huawei, HiSilicon | Option 3 | Baseline solution is already supported from R15. If we have any standards change it should be TEI17 and it is not clear any ptimization is urgent enough to justify allowing early implementation.  |
| QCOM | TEI17 |  |
| CATT | TEI17 |  |
| Ericsson | TEI17 | We can agree issue is not critical to fix earlier.  |
| Intel | Option 2 should be sufficient.  |  |
| ITRI | TEI 17 |  |
| ZTE | As early as possible  | TEI17 is also acceptable if preferred by the majority. |
| CMCC | Either is ok |  |
| vivo | Option1 | We prefer to fix the issue earlier, as NW implementation solution leads to paging resource waste, more UE power consumption and restrictions to NW side. |
| China Telecom | Option1 |  |
| China Unicom | Either is fine |  |

**Rapporteur’s summary:**

17 companies commented on this question with the views summarized below:

* R17: Samsung/Apple/OPPO/Qulacomm/CATT/Ericsson/Intel/ITRI/ZTE (**9** companies).
* R16: MediaTek/ZTE/vivo/CMCC/China Telecom/China Unicom (**6** companies)
* Open: Xiaomi
* No solution: Nokia

The following proposal is given based on the majority’s preference:

**Proposal 5: Solution 2 will be supported from R17. Work on the CRs R2-2107723 – R22107728 to capture P1-P3 in phase 2 and the revised CRs will be agreed as TEI17 CRs.**

## 3.2 NR-U

[R2-2108107](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2108_R2_115-e/Docs/R2-2108107.zip) MIB correction on subCarrierSpacingCommon Ericsson CR Rel-16 38.331 16.5.0 2754 - F NR\_unlic-Core

**Reason for change:**

For operation with shared spectrum channel access, the following is captured for *subCarrierSpacingCommon* signalled in MIB:

|  |
| --- |
| ***subCarrierSpacingCommon***Subcarrier spacing for *SIB1*, Msg.2/4 for initial access, paging and broadcast SI-messages. […]For operation with shared spectrum channel access (see 37.213 [48]), the subcarrier spacing for SIB1 is same as that for the corresponding SSB |

However, according to the RAN1 agreement, this does not only apply to SIB1, but also to the other messages for which *subCarrierSpacingCommon* is defined:

|  |
| --- |
| RAN1#96 agreement* The SCS for all SSBs and Coreset #0 on a carrier is always the same for operation of NR in unlicensed spectrum.
 |

Also, the updated consolidated parameter list for Rel-16 as captured in R1-2005050, states the following for *subCarrierSpacingCommon*:

|  |
| --- |
| For NR-U, only support coreset #0 SCS same as SSB SCS. |

**Solution:**

Clarify that not only the SCS for SIB1, but also the SCS for Msg.2/4 for initial access, paging and broadcast SI-messages is derived from the corresponding SSB.

**Q2: Comments on the issues and the solution of CR in R2-2108107?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Agree issue/Disagree issue | Agree solution/Disagree solution/Agree with modification | Detailed Comments |
| Samsung | Agree | Agree |  |
| Apple | Agree | Agree |  |
| MediaTek | Agree | Agree |  |
| OPPO | Agree | Agree |  |
| Nokia | Agree | Agree |  |
| Huawei, HiSilicon | Agree | Agree |  |
| ZTE(Eswar) | Agree | Agree with modification | 2-step RA should also be considered (i.e. MSGB). In addition, for licensed spectrum, 2-step should also be added. Hence, it may be modified as below:---------------**subCarrierSpacingCommon**Subcarrier spacing for SIB1, Msg.2/4 and   MSGB for initial access, paging and broadcast SI-messages. If the UE acquires this MIB on an FR1 carrier frequency, the value scs15or60 corresponds to 15 kHz and   the value scs30or120corresponds to 30 kHz. If the UE acquires this MIB on an FR2 carrier frequency, the valuescs15or60 corresponds to 60 kHz and the value scs30or120 corresponds to 120 kHz. For operation with shared spectrum channel access (see 37.213 [48]), the   subcarrier spacing for SIB1, Msg.2/4 and   MSGB for initial access, paging and broadcast SI-messages is same as that for the corresponding SSB and this field instead is used for deriving the QCL relation between SS/PBCH blocks as specified in TS 38.213 [13], clause 4.1.--------------- |
| QCOM | Agree | Agree |  |
| CATT | Agree | Agree |  |
| Ericsson (proponent) | Agree | Agree |  |
| Intel | Agree | Agree |  |
| ITRI | Agree | Agree |  |
| LGE | Agree | Agree |  |
| vivo | Agree | Agree | Agree with ZTE’s modification |

**Rapporteur’s summary:**

14 companies commented on this CR and all of the companies agree with the issues. 12 companies also agree with the proposed change while 2 companies would like to modify a little bit with 2-step RA covered.

The following proposal is given based on the majority’s preference:

**Proposal 6: The CR R2-2108107 is pursued with the modification suggested by ZTE.**

## 3.3 NPN

### **SIB validity**

[R2-2107011](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2108_R2_115-e/Docs/R2-2107011.zip) Corrections to SIB validity for NPN only cell Samsung Electronics Co., Ltd CR Rel-16 38.331 16.5.0 2709 - F NG\_RAN\_PRN-Core

**Reason for change:**

Procedure to validate stored SIB (according to 5.2.2.2.1 in TS 38.331) is specified as follows:

----------------------------------------------------------------------------------

The UE shall:

1> delete any stored version of a SIB after 3 hours from the moment it was successfully confirmed as valid;

1> for each stored version of a SIB:

1. 2> if the *areaScope* is associated and its value for the stored version of the SIB is the same as the value received in the *si-SchedulingInfo* for that SIB from the serving cell:

3> if the UE is NPN capable and the cell is an NPN-only cell and the first NPN identity included in the *NPN-IdentityInfoList*, the *systemInformationAreaID* and the v*alueTag* that are included in the *si-SchedulingInfo* for the SIB received from the serving cell are identical to the NPN identity, the *systemInformationAreaID* and the *valueTag* associated with the stored version of that SIB:

4> consider the stored SIB as valid for the cell;

3> else if the first *PLMN-Identity* included in the *PLMN-IdentityInfoList*, the *systemInformationAreaID* and the v*alueTag* that are included in the *si-SchedulingInfo* for the SIB received from the serving cell are identical to the *PLMN-Identity*, the *systemInformationAreaID* and the *valueTag* associated with the stored version of that SIB:

4> consider the stored SIB as valid for the cell;

1. 2> if the *areaScope* is not present for the stored version of the SIB and the *areaScope* value is not included in the *si-SchedulingInfo* for that SIB from the serving cell:

3> if the UE is NPN capable and the cell is an NPN-only cell and the first NPN identity in the *NPN-IdentityInfoList,* the *cellIdentity* and *valueTag* that are included in the *si-SchedulingInfo* for the SIB received from the serving cell are identical to the NPN identity*,* the *cellIdentity* and the *valueTag* associated with the stored version of that SIB:

4> consider the stored SIB as valid for the cell;

3> else if the first *PLMN-Identity* in the *PLMN-IdentityInfoList,* the *cellIdentity* and *valueTag* that are included in the *si-SchedulingInfo* for the SIB received from the serving cell are identical to the *PLMN-Identity,* the *cellIdentity* and the *valueTag* associated with the stored version of that SIB:

4> consider the stored SIB as valid for the cell;

----------------------------------------------------------------------------------

According to this procedure, if UE is NPN capable and the cell is an NPN-only cell, UE performs operation highlighted in green if condition highlighted in grey is not satisfied (e.g. PLMN identity may match but NID may not match). The consequence is that UE may incorrectly apply the stored SIB from a non NPN cell.

**Solution:**

5.2.2.2.1 is updated so that following conditions are not performed for NPN-only cell:

----------------------------------------------------------------------------------

"else if the first *PLMN-Identity* included in the *PLMN-IdentityInfoList*, the *systemInformationAreaID* and the v*alueTag* that are included in the *si-SchedulingInfo* for the SIB received from the serving cell are identical to the *PLMN-Identity*, the *systemInformationAreaID* and the *valueTag* associated with the stored version of that SIB"

"else if the first *PLMN-Identity* in the *PLMN-IdentityInfoList,* the *cellIdentity* and *valueTag* that are included in the *si-SchedulingInfo* for the SIB received from the serving cell are identical to the *PLMN-Identity,* the *cellIdentity* and the *valueTag* associated with the stored version of that SIB"

----------------------------------------------------------------------------------

**Q3.1: Comments on the issues and the solution of CR in R2-2107011?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Agree issue/Disagree issue | Agree solution/Disagree solution/Agree with modification | Detailed Comments |
| Samsung (Proponent) | Agree  | Agree  |  |
| Apple | Agree | Agree |  |
| OPPO | Agree | Agree |  |
| Nokia | Agree | Agree |  |
| Huawei, HiSilicon | Agree | Agree | Need to add “if” at the start of the (new) bullet “>4” |
| QCOM | Agree | Agree |  |
| CATT | Agree | Agree | Agree with Huawei that add a “if” at the start of each new added “4>” |
| Mediatek | Agree | Modification to add the missing “if”  | 4>If the first NPN identity included in… |
| Ericsson | Agree | Agree with modifications | The intention is correct, yet as pointed out by Huawei/HiSilicon, there is a missing *if*, i.e., “4> if the first NPN identity…”  |
| Intel | Agree  | Agree |  |
| LG | Agree | Agree | Agree with Huawei’s correction |
| vivo | Agree | Agree with modifications | Agree with the above companies |

**Rapporteur’s summary:**

12 companies commented on this CR and all of the companies agree with the issues. 6 companies also agree with the proposed change while 6 companies suggest to add “if” at the start of the (new) bullet “>4”.

The following proposal is given based on the majority’s preference:

**Proposal 7: The CR R2-2107011 is pursued with “if” added at the start of the (new) bullet “>4.**

### **NPN-IdentityInfoList**

[R2-2107934](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2108_R2_115-e/Docs/R2-2107934.zip) Clarification on the NPN-IdentityInfoList Samsung Electronics Co., Ltd CR Rel-16 38.331 16.5.0 2746 - F NG\_RAN\_PRN-Core

**Reason for change:**

In RAN2#109-e meeting, the following CR was agreed to add the limitation on NW side i.e. A PLMN-Identity can be included only once, and in only one entry of the *PLMN-IdentityInfoList*.

----------------------------------------------------

R2-2002183 Clarification on the PLMN-IdentityInfoList ZTE Corporation, Sanechips CR Rel-15 38.331 15.8.0 1440 1 F NR\_newRAT-Core

**[AT109e][006][NR15] Agreed**

=> Coversheet update by MCC: WI code = NR\_newRAT-Core

=> Revised in R2-2002305

R2-2002305 Clarification on the PLMN-IdentityInfoList ZTE Corporation, Sanechips CR Rel-15 38.331 15.8.0 1440 2 F NR\_newRAT-Core

=> **Agreed**

----------------------------------------------------

It is not clear whether same limitation should be applied to SNPN and PNI-NPN i.e. whether NW can include one SNPN or PNI-NPN in more than one entry of the *NPN-IdentityInfoList*.

Besides, two editorials are to be fixed i.e. there is no field *NPN-IdentityList* and update the NPN index description.

**Solution:**

* Add the limitation that "A PNI-NPN and a SNPN can be included only once, and in only one entry of the *NPN-IdentityInfoList*."
* Fix two editorials i.e. change *NPN-IdentityList* (and *npn-IdentityInfoList)* into *npn-IdentityList* (and *NPN-IdentityInfoList*).

**Q3.2: Comments on the issues and the solution of CR in R2-2107934?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Agree issue/Disagree issue | Agree solution/Disagree solution/Agree with modification | Detailed Comments |
| Samsung (Proponent) | Agree  | Agree  |  |
| Apple | Agree | Agree |  |
| OPPO | Agree | Agree |  |
| Nokia | Maybe | Agree | This is a useful clarification; it is not a real technical change. Note that in *NPN-Identity* it is stated that "All CAG IDs associated to the same PLMN ID are listed in the same *cag-IdentityList* entry*.".* This implicitly means that a PNI-NPN is only listed once. |
| Huawei, HiSilicon | Agree | Agree |  |
| QCOM | Agree | Agree |  |
| CATT | Agree | Agree |  |
| Mediatek | Agree | Disagree, the sentence is not clear and makes the paragraph too complex. | Suggest it is replaced with the following sentence:“A PNI-NPN or SNPN entry is not repeated within the NPN\_IndentityInfoList.”(Possibly as a separate note). |
| Ericsson | Agree | Agree |  |
| Intel | Agree  | Agree |  |
| LG | No | Agree with only second change | For the 1st change, we agree with Nokia. The restriction “All CAG IDs associated to the same PLMN ID are listed in the same *cag-IdentityList* entry*” already implies that same PNI-NPN cannot appear more than once.* The second changes can be merged in rapporteur CR |
| vivo | Agree | Agree |  |

**Rapporteur’s summary:**

12 companies commented on this CR and 10 companies agree with the issues. 10 companies also agree with the proposed changes.

The following proposal is given based on the majority’s preference:

**Proposal 8: The CR R2-2107934 is pursued.**

### **Encoding format for HRNN**

[R2-2108615](file:///D%3A/Documents/3GPP/tsg_ran/WG2/RAN2/2108_R2_115-e/Docs/R2-2108615.zip) Clarification on encoding format for HRNN Huawei, HiSilicon CR Rel-16 38.331 16.5.0 2783 - F NG\_RAN\_PRN-Core

**Reason for change:**

In current specification, it is not specified which encoding format (e.g., ASCII, Unicode, UTF-8) is used for the HRNNs in SIB10. As a result, the UE does not know how to decode the HRNNs. Therefore, a specific encoding format for HRNNs should be specified to align the encoding/decoding format between network and UE. As UTF-8 is a variable-length encoding format and applies to a wide range of languages, and the name of the home eNB in LTE also is coded in UTF-8, the HRNNs in SIB10 can be coded in UTF-8.

**Solution:**

Specify that the HRNNs in SIB10 is coded in UTF-8.

**Q3.3: Comments on the issues and the solution of CR in R2-2108615?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Agree issue/Disagree issue | Agree solution/Disagree solution/Agree with modification | Detailed Comments |
| Samsung | May be | May be | We think it is already specified in TS 23.003 i.e. HRNNs are coded in UTF-8 so it may not be essential. On the other hand, this clarification has been there in LTE RRC as well, we are OK to have this CR if the majority wants to.  |
| Apple | NO strong view |  |  |
| OPPO | No strong view |  |  |
| Nokia | May be | Agree (Cover page issue) | As HRNNs encoding is specified in 23.003, thus this is not a correction just a clarification. Cover page should clarify that this is just an alignment with 23.003, but no real technical change. |
| Huawei, HiSilicon | Agree | Agree |  |
| QCOM |  |  | already defined in TS 23.003 in a similar manner … not sure if needed |
| CATT | Agree | Agree | It is similar as the field description of encoding HRNN in LTE and can be accepted. |
| Mediatek | Agree | Agree |  |
| Ericsson | Disagree | Disagree | As pointed out above, this shouldn’t be needed. Already specified in 23.003 |
| Intel | Agree  | Agree (with comments) | Agree to make this change. Also agree with Nokia comments that the cover page should be updated to indicate this is an alignment. |
| LG | Agree | Disagree | Instead of specifying the encoding format, we prefer to simply refer to TS 23.003 in the IE description. In any case, no separate CR is needed but only the second change (our preferred change) can be merged in rapporteur CR.  |
| vivo | No strong view |  |  |

**Rapporteur’s summary:**

12 companies commented on this CR. 6 companies have no strong view on whether the existing text is problematic while 1 company understand the change is not needed as the HRNN has already been defined in TS23.003. 5 companies support the proposed changes.

The rapporteur agrees with the majority that the HRNN format has already been specified in TS23.003 but there seems to be no reference to TS23.003 when HRNN is mentioned in 38.331 thus the rapporteur would suggest to simply add TS23.003 as reference for the HRNN in 38.331. The suggested change is as follows:

|  |
| --- |
| ***SIB10* field descriptions** |
| ***HRNN-List***The same amount of HRNN [21] elements as the number of NPNs in SIB 1 are included. The n-th entry of *HRNN-List* contains the human readable network name of the n-th NPN of SIB1. The *hrnn* in the corresponding entry in *HRNN-List* is absent if there is no HRNN associated with the given NPN. |

**Proposal 9: The CR R2-2108615 is pursued with the change to add TS23.003 as reference for HRNN mentioned in 38.331.**

# 4 Conclusion

**Proposal 1: Solution 2 (i.e. UE in RRC\_INACTIVE should use the same i\_s to determine PO as for RRC\_IDLE) is taken as a baseline to address the RAN and CN paging PO non-overlap problem.**

**Proposal 2: UE capability should be introduced to indicate support for using the same i\_s in PO determination in RRC\_INACTIVE state as in RRC\_IDLE state**

**Proposal 3: Introduce a per UE indication in RRCRelease message to enable the use of the same i\_s in both RRC\_INACTIVE and RRC\_IDLE in PO determination.**

**Proposal 4: NW will enable the use of the same i\_s in both RRC\_INACTIVE and RRC\_IDLE in PO determination via the indication in RRCRelease message when all the cells within the RNA supports this enhancement.**

**Proposal 5: Solution 2 will be supported from R17. Work on the CRs R2-2107723 – R22107728 to capture P1-P3 in phase 2 and the revised CRs will be agreed as TEI17 CRs.**

**Proposal 6: The CR R2-2108107 is pursued with the modification suggested by ZTE.**

**Proposal 7: The CR R2-2107011 is pursued with “if” added at the start of the (new) bullet “>4.**

**Proposal 8: The CR R2-2107934 is pursued.**

**Proposal 9: The CR R2-2108615 is pursued with the change to add TS23.003 as reference for HRNN mentioned in 38.331.**

|  |
| --- |
| ***SIB10* field descriptions** |
| ***HRNN-List***The same amount of HRNN [21] elements as the number of NPNs in SIB 1 are included. The n-th entry of *HRNN-List* contains the human readable network name of the n-th NPN of SIB1. The *hrnn* in the corresponding entry in *HRNN-List* is absent if there is no HRNN associated with the given NPN. |

# 5 References

1. R2-2107722 PO determination in RRC\_INACTIVE for Rel-16 and later releases (ZTE corporation, Ericsson,CMCC, China Telecom, China Unicom,vivo, Sanechips)
2. R2-2107723\_38.331\_(R16)\_CR2736\_Correction on PO determination for UE in inactive state
3. R2-2107724\_38.304\_(R16)\_CR0213\_Correction on PO determination for UE in inactive state
4. R2-2107725\_38.306\_(R16)\_CR0614\_Correction on PO determination for UE in inactive state
5. R2-2107726\_36.331\_(R16)\_CR4695\_Correction on PO determination for UE in inactive state
6. R2-2107727\_36.304\_(R16)\_CR0831\_Correction on PO determination for UE in inactive state
7. R2-2107728\_36.306\_(R16)\_CR1819\_Correction on PO determination for UE in inactive state
8. R2-2108107\_MIB correction on subCarrierSpacingCommon (Ericsson)
9. R2-2107011\_Corrections to SIB validity for NPN only cell (Samsung)
10. R2-2107934\_Clarification on the NPN-IdentityInfoList (Samsung)
11. R2-2108615\_Clarification on encoding format for HRNN(Huawei, HiSilicon)