3GPP RAN WG2 Meeting #131bis R2-250XXXX

Prague, Czech Republic, October 13th – 17th, 2025

Agenda Item: 8.9.1

Source: Nokia

Title: Remaining Open issues for Idle mode IoT-NTN Operation

Document for: Discussion, Decision

# 1.Introduction

The following document includes a list of open issues according to the following email discussion:

* [Post130][308][R19 IoT NTN] [TS 36.304 CR (Nokia)

Scope: discuss the running TS 36.304 CR

Intended outcome: Endorsed CR and list of remaining open issues

**Deadline:** Long

Companies are invited to provide feedback on open issue list by: TBD

# 2.Remaining open issues for specification 36.304

## 2.2 Initial List of open Issues : Based on RAN2-131bis outcome

**1. Final Views related to NOTE on using SF mode parameter of neighbour cell for cell reselection.**

The agreed CR based on the last post e-mail discussion maintained the text related to the optional UE behaviour on deprioritising the cells operating in SF mode for cell selection as NOTE. There are some views expressed in the e-mail discussion to make the NOTE as normative text. Companies can indicate whether they need to convert the NOTE to normative text. Based on majority views this issue can be concluded. Based on the outcome the changes if needed will be change the NOTE to normative. As the text for the NOTE is already agreed , we can only focus on if there is real need to change this as normative text.

**Q1.**

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| Company | Whether NOTE in 5.2.4.4 can be maintained OR To be changed as normative text. If Not indicate the reasons for the same. |
| vivo | No strong view is held. We are fine to keep it as a NOTE so as to avoid non-ensential correction. |
| Huawei | We think anyway it seems difficult to mandate the UE on the deprioritization behaviour. In this sense, a NOTE should be sufficient. |
| Qualcomm | If UE finds a better cell it can go to that regardless. Note is fine but we prefer clear text for NB-IoT what is prioritization meant here. |
| CATT | No strong view. But since the Note is agreed, we don’t think there is a real need to change it as a normative text. |
| Google | Althoug we prefer to have clear normartive text, specifying the deprioritization behavior can be complicated and may take time to complete. Hence we are fine to keep the existing NOTE at this stage. |

**Rapporteur Conclusion : The NOTE in** 5.2.4.4 **agreed in current version is not changed**

**2. Use of NAS Configured Satellite list for relaxation of idle mode operations.**

In RAN2-131 it was concluded that the Satellite list configured via NAS signalling is not considered for cell reselection procedure. RAN2 agreed to indicate the servign satellite ID to NAS layer to enable NAS layer to take appropriate action. However the usage of NAS configured satellite list for idle mode relaxation such as paging monitoring is not concluded. It was marked for further discussion in RAN2-132.

Following is the text in TS23.401 related to NAS provided information related to SF mode operation and the relevant notes.[Section : 4.13.9]

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| For a UE which indicates support of Store and Forward Satellite operation and when an MME is operating in S&F Mode:  - If the MME cannot complete a NAS procedure with the information currently available on the satellite e.g. when the MME does not have UE security context or, if the MME needs to retrieve UE-specific authentication vectors or subscription information from the ground network, it shall reject the NAS procedure. In this case, the MME shall include a reject cause indicating the NAS rejection is due to Store and Forward Satellite operation.  - If the UE is rejected with a reject cause indicating it is due to S&F operation, the UE’s EMM state shall remain unchanged.  - The MME may provide to the UE a S&F Wait Timer, a S&F Monitoring List or both when accepting or rejecting a NAS procedure. The MME may provide S&F Monitoring List to the UE as part of detach procedure.  NOTE 4: How the MME determines the S&F Wait Timer and S&F Monitoring List is up to MME implementation, e.g. based on feeder link (un)availability period, service link (un)availability period, UE power saving requirements, Communication Pattern parameters, UE location, UE mobility, etc.  - When the S&F Wait Timer expires, the UE may perform a NAS procedure, which can be a subsequent NAS procedure or a reattempt of a NAS procedure previously rejected with a S&F reject cause, with a satellite of the same PLMN that is operating in S&F Mode.  NOTE 5: When the S&F Wait Timer is running, the power consumption optimization behaviours, if any, are left for UE implementation e.g. whether to listen to paging or deactivate its Access Stratum functions.  The S&F Monitoring List includes satellite(s) which belong to the same PLMN and indicates the satellite(s) that the UE may (re)attempt NAS procedures or receive MT data from.  - The MME may indicate to the UE that it should delete any previously provided S&F Monitoring List for the current PLMN. When the S&F Monitoring List is deleted then the UE may use any satellite(s).  NOTE 6: The S&F Wait Timer or S&F Monitoring List doesn’t affect the UE when accessing an eNodeB that does not broadcast an indication of operating in S&F Mode.  NOTE 7: How UE behaves when receiving the S&F Monitoring List is up to UE implementation. When a UE receives a S&F Monitoring List and the UE access a satellite that supports Store and Forward Satellite operation that is not on the S&F Monitoring List there is increased probability that it will not be able to complete the NAS procedure. The UE can continue to use the previously provided S&F Monitoring List, if the MME did not send one and the UE has previously been provided with one.  - The MME may indicate to the UE an Estimated S&F UL Delivery Time in a NAS accept messages (i.e. Attach Accept, TAU Accept or Service Accept messages).  NOTE 8: The Estimated S&F UL Delivery Time is an estimate of the time required to deliver the data or signalling sent by the UE to the ground. The Estimated S&F UL Delivery Time is associated with the satellite that provides it and how UE uses this information is left for UE implementation. |

As per the above description the Wait Timer and NAS configured satellite list is used by NAS layer for resuming the pending NAS procedure. However it is not completely clear that whether this list also indicate that the UE context is not available outside the NAS configured list and the the Wait timer window. The paging optimisation intended using this information is mainly based on the assumption that the UE context is not available at the satellite outside this list and window and MT traffic is not possible. Hence it would be good to confirm RAN2 understanding on the possibility of MT traffic outside the NAS configured list.

**Q2. Provide company views on whether MT Traffic is possible outside the NAS configured satellite list. Also indicate whether any other NAS signalling possible from these satellite ( like update of NAS configured satellite list).**

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| Company | Views on MT Traffic /Signalling possibility |
| vivo | As concluded by SA2, this is left to UE implementation. It is preferred not to conduct further discussions on any enhancements for this, especially considering that the WI has been completed. |
| Huawei | The SA2 note is targeting a different scenario from what RAN2 is discussing. SA2’s intention is that the UE behaviour during **S&F Wait Timer running** is up to UE implementation. And during this timer running, there should be no cell for UE to access.  What we are discussing is when the S&F Wait Timer expires and UE has accessed a cell indicated by the NAS monitoring list.  In this case, it is possible there is no paging, DL data or SI update in this cell. Forcing UE to monitor paging in this case is bad for UE power conumption, especially for IoT UEs.  There was a comment that there may be impact to other WGs but we think not. When feeder link resumes, if there is DL paging/data, it will be delivered to RAN as lagacy before RAN covers the UE. And RAN can make the decision whether to indicate the Ues to monitor paging. |
| Qualcomm | SA2 and CT1 already concluded on the use of the list of satellite. We suggest bringing problem/issue what is missing from CT1/SA2 solution. |
| CATT | From our perspective, the NW will not send MT data and signalling outside the NAS configured satellite list. It is meaningful for the UE to relax the idle mode task when there is no satellite in the NAS configured satellite list is passing over the UE.  Althougt S&F Wait Timer can be configured in the NAS layer, the S&F Wait Timer cannot work well when there is more than one satellites in the NAS configured satellite list. For instance, the NAS configured satellite list={satellite 1, satellite 2}. At the UE location, the start serving time of satellite 1 and satellite 2 are T1 and T2 seperately. The NW should configure S&F Wait Timer no later than T1. After the S&F Wait Timer expires, the UE keeps performing idle mode tasks, even during the coverage gap between satellite 1 and satellite 2, which is not energy efficient.  Since we have detailed serving time and satellite coverage information in AS layer, why not use these information to achieve better energy consumption performance for the UE. |
| Google | MT Traffic from a satellite outside the NAS configured satellite list is possible, provided the satellite is operating in normal mode (i.e., not S&F mode). We support the proposal to relax idle mode tasks based on the NAS-configured satellite list; however, we believe this relaxation must also be conditioned on the S&F mode indication associated with the satellites listed in SIB32, which is currently unavailable. |

If MT traffic is not possible one simple relaxation possible for idle mode is to avoid monitoring the paging from these satellites. However the system information modification related notification need to be addressed.

**Q3. If MT Traffic is not possible on the satellite list outside NAS configured list. companies to provide views on the UE behaviour for paging relaxation in satellite which is outside the configured list.**

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| **Company** | **Views on UE based solution for paging relaxation. Need for additional changes if any.** |
| vivo | This is left to UE implementation. Further discussions on any enhancements to be specified are not preferable. |
| Huawei | See comments to Q2. |
| Qualcomm | Why UE goes to satellite outside of list and does not perform TAU update? We suggest to find answer in SA2 not in RAN2. |
| CATT | If S&F Monitoring list is configured by upper layers, and if the UE has determined that it is out of coverage of all the satellites in S&F Monitoring list (using the available satellite assistance information), the UE may further not need to perform any idle mode tasks related to NTN. |

**Rapporteur conclusion : No consensus on introducing specification changes for paging relaxation on the satellites outside the NAS configured satellite list. RAN2 to discuss based on contributions at RAN2-131-bis.**

**2. Indication in system information for paging monitoring relaxation for cells operating in SF mode without MT data.**

RAN2 also agreed to further consider the possibility for paging relaxation for the cases where the satellite does not have stored MT data for paging. One of the proposal discussed in last meeting is to introduce indication in system information. Following are the additional issues pointed out during the discussion.

* Handling of system information modification related paging.
  + For this issue,One possible solution indicated in the meeting :
    - The NW can decide to include the flag based on its intention to modify system information when it does not have MT data. If the NW intend to modify system information this parameter can be switched off and paging can be triggered.
* Interface changes needed between ENB and MME related to pending data.
  + Whether the solution further requires RAN3 changes need to be investigated.
* Interworking of this Flag with SF mode transition.
  + When SF mode is transitioned to Normal mode the UE can implicitly start paging monitoring irrespective of this flag. In other words making this flag applicable for SF-mode indication can resolve this issue.

**Q4.**

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| **Company** | **Support for Introduction of indication in system information for paging relaxation. If yes additional changes needed beyond the indication and its handling.**  **If No, Indicate the main challenges /issues for this indication.** |
| vivo | No. It is not advisable to discuss any new functions after the WI has been completed. |
| Huawei | Yes. No other changes are needed.  For the listed issues:   1. There is no impact to other WGs. When feeder link resumes, if there is DL paging/data, it will be delivered to RAN as lagacy before RAN covers the UE. And RAN can make the decision whether to indicate the UEs to monitor paging. 2. UE can derterme when the cell transits from SF to Normal mode based on the timing information. And in normal mode, UE monitors paging which is legacy behavior. So there is no problem. 3. For the WI completion, we think it is not an issue as we left this as an FFS for the next meeting and the ASN.1 review is ongoing now. |
| Qualcomm | No. Paging for MT call is from network, SA2 needs to make decision. eNB should not be one to buffer DL data. Network needs to be very clear when UE is reachable. While UE is released to IDLE mode, MME can already decide, i.e., configuring eDRX/PSM/wait timer etc. for power saving. |
| CATT | No.  This indication is usful only when the satellite does not stores any UE’s DL data/signalling, which is corner case from our perspective. Additionally, the “NAS configured satellite list”-based solution is sufficient, if the satellite does not store DL data/signalling for an UE, the MME will not include this satellite in the NAS configured satellite list for the UE. There is no need to introduce an indication in system information for paging monitoring relaxation. |
| Google | We prefer NOT to have this enhancement, provided that the NW may still need to page the UEs for notifying the system information modification. The rapporteur's proposed solution requires the UE to continuously monitor a new flag in the system information, which would make the overall power saving gain marginal. |

**Rapporteur conclusion : No consensus on introducing SIB indication for paging relaxation. RAN2 to discuss further during online discussion. Following key issues needs to be addressed by the proponents for better conclusion on this issue in the online meeting**

* **Handling of system information changs and its impact to paging monitoring.**
* **Clarification on the probability of the scenario in SF architecture to establish the benefits**

## 2.3 Additional Issues

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| Company | Issue description |
| Qualcomm | Since acceptable cell is now supported, we suggest network also to indicate whether NB-IoT RATs support SIB10/11/12 or not. Legacy NB-IoT RATs may not have been updated to support SIB10/11/12 or PWS. Otherwise, UE will camp on an useless acceptable cell.  Rapp : This will be late change to system information changes. Moreover when the acceptable concept is extended for emergency calls in future release this flag will not be beneficial as the UE need to camp to any cell for emergency call. OR the indication need to be generic for both PWS and emergency call support. This requires more discusison in RAN2. Hence propose not to consider this enhancement in this release. |
| CATT | We observed that NB-IoT does not support inter-RAT cell (re)selection and measurements.   |  | | --- | | 4.4 NB-IoT functionality in Idle Mode  This specification is applicable to NB-IoT, except for the following functionality which is not applicable to NB-IoT:  [unrelated part omitted]  - Inter-RAT Cell Selection and Reselection including measurements in other RATs |   Hence, the RAT related text in the following part can be removed. 5.2.8a Any Cell Selection state for NB-IoT In this state, the UE shall attempt to find a suitable cell of any PLMN to camp on and searching first for a high quality cell, as defined in clause 5.1.2.2. If the cell selection process fails to find a suitable cell after a complete scan of all frequency bands supported by the UE and the UE is capable of PWS reception, the UE shall attempt to find an acceptable cell of any PLMN to camp on and searching first for a high quality cell, as defined in clause 5.1.2.2.  Rapp : Thanks. This can be included in the next version of Rapporteur CR. Will include in the draft CR for second round review |
| CATT | The behaviour of UE capable PWS reception cannot be covered by the following text. 5.2.8a Any Cell Selection state for NB-IoT [unrelated part omitted]  The UE not capable of PWS reception, which is not camped on any cell, shall stay in this state until a suitable cell is found.  Suggest making the following modifications:  The UE, which is not camped on any cell, shall stay in this state until a suitable cell or an acceptable cell (only applicable to PWS capable UE) is found.  Rapp : The modified part is already reflected in the change in second paragraph. Hence this change is not essential |
| Google | For UEs not supporting S&F, the goal is to keep these UEs on normal-mode cells for as much as possible. Therefore, when a UE not supporting S&F camps on a normal-mode cell and receives an indication that S&F mode is about to start, it should trigger intra-/inter-frequency measurements. To this end, we suggest adding the following description (similar to t-Service) into subclause 5.2.4.2. 5.2.4.2 Measurement rules for cell re-selection If t-ModeSwitching is present in SystemInformationBlockType31 of the serving cell and sf-OperationMode is absent in SystemInformationBlockType1 of the serving cell, UE not supporting the satellite S&F operation shall perform intra-frequency, inter-frequency or inter-RAT measurements, before the time t-ModeSwitching regardless of the distance between the UE and serving cell reference location, and regardless whether the serving cell fulfils Srxlev > SIntraSearchP and Squal > SIntraSearchQ, or Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ. The exact time to start measurements before t-ModeSwitching is up to UE implementation and t-ServiceStartNeigh if present in SystemInformationBlockType33 may be used to decide on when to start measurements.  Rapp : We agreed for NOTE to cover the UE behaviour in general for all the possible cases. Hence normative change is not needed.  [Google] We are not sure which NOTE the rapporteur was referring to. If it is the new NOTE in 5.2.4.4, we think they are irrelevant. The new NOTE in 5.2.4.4 is related to how the UE deprioritizes a cell during the cell evaluation process (i.e., after the UE has detected and measured neighbor cells). The issue here, however, is related to when to tigger the neighbor cell measurement. |
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## 3 Second Round

**Conclusion based on views for Section 2: Deadline Sept 27.**

Based on the company views for section 2 if there is consensus on issue the above issues, high level spec changes can be discussed in this round.

On the additional issues, if there is common issue to be addressed the solution part can be discussed or agree on the list of issue for online discussion in this round.

First round conclusion :

* **The NOTE in** 5.2.4.4 **agreed in current version is not changed**
* **For paging monitoring relaxation at satellites outside NAS configured list, RAN2 to discuss based on contributions at RAN2-131-bis.**
* **For paging monitoring relaxation at satellites outside NAS configured list, RAN2 to discuss further during online discussion. Following key issues needs to be addressed by the proponents for better conclusion on this issue in the online meeting**
  + **Handling of system information changs and its impact to paging monitoring.**
  + **Clarification on the probability of the scenario in SF architecture to establish the benefits**
* Additional changes suggested for 5.2.8a is considered in Rapporteur CR.

# Conclusions