3GPP TSG-RAN WG2 Meeting #117 Electronic R2-2200XXX

Elbonia, February 21-March 3 2022

**Agenda item: 9.2.5**

**Source: Nokia, Nokia Shanghai Bell**

**Title: Report on[AT117-e][064][IoT-NTN] UE capabilites (Nokia)**

**WID/SID: LTE\_NBIOT\_eMTC\_NTN - Release 17**

**Document for: Discussion and Decision**

# 1 Introduction

Following e-mail discussion was agreed to progress on potential agreements related to UE capabilities for IoT-NTN.

* [AT117-e][064][IoT-NTN] UE capabilites (Nokia)

Scope:

a) review the CR (it is new)

b) based on Input to 9.2.4, address the open issues. Determine agreeable parts, identify discussion points and pave the way for efficient on-line CB.

c)For OI4.4 focus for now on the need, rather than solutions, e.g. attempt to identify which capabilities should be indicated per deployment option, if any.

Intended outcome: Report

Deadline: In time for on-line CB W2 Tuesday

In this report, we consolidate company views for a) as direct comments to draft CR for minor updates and further views on any open issues to be addressed. For b) based on contributions potential proposals for agreements is identified for online discussion. For C) company views are sought on possible way forward.

**As the report needs to be submitted by WK2 Tuesday, response to the questions in this document by Monday WK2 EOB is appreciated.**

# 2 Discussion

## 2.1 Draft CR to 36.306 based on RAN2-116e Agreements

Draft running CR based on RAN2-116bis agreements is provided in [1]. The CR proposes changes to 4.3.Y for introducing single capability for NTN connectivity covering the essential RAN2 features agreed as per RAN2-116e and RAN1 features and optional capability for TA reporting. In section 6.Y new optional feature without capability indication is included.

**Q1. Please provide your views on the above changes for draft CR if any major changes are needed. For minor updates companies can provide the updates to draft CR directly.**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Changes to 4.3.Y (OK/minor comments (in draft CR directly) /Not OK with reason) | Changes to 6.Y (OK/minor comments /Not OK) | Comments |
| Intel | minor comments:  1. for physical layer features, only per UE capabilities can be incorporated to ntn-Connectivity-EPC-r17.  2. it’s not clear whether RAN1 will define per UE or per band UE capability for TA reporting. So maybe an editor note is needed. | ok |  |
| Qualcomm | Agree with Intel. |  |  |
| Huawei, HiSilicon | ntn-Connectivity-EPC-r17:  1. The usal wording is ‘ This field is only applicable if the UE supports UE category M1 or UE category M2 or any *ue-Category-NB*.’  2. should we replace ‘If the UE supports UE category M1 or UE category M2’ with ‘if the UE supports *ce-ModeA-r13*,’ as we have not excluded UE in CE  3. the usual wording is ‘A UE that supports *ntn-Connectivity-EPC-r17* shall also support the *standaloneGNSS-Location*  *4.* the support of *standaloneGNSS-Location* shall be restrictedto eMTC as there is no such capability in NB-IOT  ntn-TA-report-r17  1, Suggest rewording : This field indicates whether UE support Timing advance reporting in NTN cell as specified in TS 36.321 [XX] ~~for adjustment of downlink timing based on UE reported Timing advance~~.  2, should we add ‘ This feature is only applicable if the UE supports ntn-Connectivity-EPC-r17’. |  |  |
| Ericsson | 1. The agreement was to mandatorily support GNSS. As mentioned in R2-2201601 and by Huawei above, standaloneGNSS-location does not apply to NB-IoT and thus, for coherence, should not be used in eMTC either.  2. Agree with the rewording related to ntn-TA-Report as suggested by Huawei. |  |  |
| Lenovo | Agree with Intel and Huawei’s suggestions. |  |  |

**Rapporteur Summary:**

draft CR is updated for the above comments in V1. As the TA reporting capability is defined in RAN2 and not expected to be different across bands, this editor note is not included. If the TA reporting is decided as per-Band capability in RAN2, further versions can be updated accordingly.

**Proposal 0 : Updated CR in draft-CR-V1 considered as basis for further changes to running CR.**

## 2.2 Summary of Input contributions to 9.2.4

Following are the FFS based on RAN2-116bis-e meeting agreements.

* FFS whether Support for soft TA switching procedure is optional for IoT-NTN UE.
* FFS whether Support for PUR Timer modifications is optional for IoT-NTN UE that supports PUR for terrestrial case.
* FFS if the Existing CHO capability indication can be reused for IoT-NTN CHO (FFS if it can be applied to terrestrial case).
* FFS whether Capability Indication of existing IoT-Features until Rel-16 are reused in NTN, or to what extent they need to be duplicated to allow for different Interop Test (IOT) Status.

Need for duplicating the capability bits of existing IoT-Features to differentiate the capability for NTN and TN access will be discussed in next section. Only the first 3 open issues from the above list is considered in this section for arriving at potential agreements.

9 companies provided contributions related to above open point. Based on the input contributions to this meeting the company views for the above open issues is summarised in below table.

|  |  |  |  |
| --- | --- | --- | --- |
| **FFS Item** | **Support** | **Against** | **Other** |
| Soft TA Switching is mandatory capability for IoT-NTN UE | [7] [4] [6] [8] [9] |  | [3] Soft TA switching is essential sub-feature at-least for NGSO.  [5] Mandaotry for NGSO. For GSO reading and acquiring of SIB1 with multiple TAC is mandatory. Soft TA switch is optional. |
| PUR Timer modification is optional capability for IoT-NTN | [1] [3] [4] [5] [9] | [8] Existing PUR capability indication to be used with additional text to indicate enhanced capability |  |
| Existing LTE CHO Capability bit is reused for IoT-NTN | [3] [4] [6] [9] |  |  |

**Potential Proposals for Agreement.**

* **P1 (5/7): Support for reception of multiple tracking areas in system information and updating the TA list to NAS is considered as mandatory capability for NTN access.**
* **P2(5/6) : Timer modification for PUR operation for NTN is optional UE capability with separate UE capability indication.**
* **P3(4/4) : CHO capability for eMTC-NTN is indicated by the existing LTE CHO capability indication.**

**Q2: Do you agree to the above set of proposals? ( For companies which did not provide input contributions for the above issues )**

|  |  |
| --- | --- |
| **Company** | **OK / Not-OK (Specify proposal and reason)** |
| Intel | ok with P1 and P2  for P3, it also depends on the outcome of Discussion on OI4.4 |
| Qualcomm | P1 is ok.  P2: It is better to call the indication as support of PUR indication in NTN and timer modification is conditional mandatory on the support of PUR in NTN. This seems the right way to do. In either case, a capability bit is introduced.  P3 depends on OI4.4. Besides, why CHO cannot be supported in TN if a UE can support it in NTN. So this may soon discussed probably in the next release. So it is better to keep this for future and define new one for NTN. |
| Huawei, HiSilicon | OK  For P2: we do not think QC proposal works as there are multiple capabilities for PUR |
| Ericsson | OK.  For P2 agree with Huawei. |
| Lenovo | OK to P1 and P3, agree with Huawei in P2. |

**Rapporteur Summary:**

Additional responses related to the proposal also confirms to the base proposals except one company. So the proposals given for the Q1 can be considered for online agreement.

## 2.3 Discussion on OI4.4

One of the open issue to be resolved is whether separate capability bits are needed for existing IoT-Features to indicate its applicability for NTN access.

Analysis in [2] indicates that it is possible that some features which are introduced for TN may not be supported by UE for NTN access. One possible reason for such differentiation is indicated as lack of testing for NTN access. This differentiation is needed only in case of handover between TN and NTN is needed. For NB-IoT as handover is not supported such duplication is not needed. Proposals in [6] also support this view with examples that features such as RRM Relaxation is not reliable for NTN access and prefer to introduce separate capability.

Analysis in [10] indicates that all the existing features which does not require any changes for NTN access are already identifier. For these features existing capability indication is sufficient. If issues identified later separate capability can be introduced if needed. Proposals in [4] also support similar views of [10].

As there is no handover is supported for NB-IoT and UE capability containers are maintained for different RATs, reuse of existing capability indication can be agreed for NB-IoT as first step.

**Proposal 4: Capability indication of existing NB-IoT Features are reused for NB-IoT-NTN.**

Separate capability indication if required due to the reasons stated above is relevant for the connected mode mobility scenario. As connected mode mobility between TN and NTN is not essential for Rel-17, introduction of separate capability bits for NTN access can be considered in later releases. So companies can provide views for the following proposal which simplifies the UE capability indication for Rel-17

**Proposal 5A: All the existing capability indications of eMTC features are re-used for eMTC-NTN in Rel-17.**

As indicated in [10] and [6] IoT-NTN study already analysed the modifications needed for existing IoT-Features for NTN. As per RAN2 agreements no modifications are needed on these base features for IoT-NTN access. If some companies think possible exclusion of some features for IoT-NTN as indicated in [4], these features need to be identified for Rel-17. For other features separate capability indications can be included whenever issues are identified. If companies does not agree to 5A, below proposal allows the possibility of introducing duplicate capability bits for the features which is expected to have some impact for Rel-17.

**Proposal 5B: Reuse of existing capability indication for eMTC for eMTC-NTN is considered as basis. Features which requires separate capability indication for Rel-17 needs to be discussed and agreed explicitly.**

|  |
| --- |
| ***Proposal 4: Capability indication of existing NB-IoT Features are reused for NB-IoT-NTN.***  ***Proposal 5A: All the existing capability indications of eMTC features are re-used for eMTC-NTN in Rel-17.***  ***Proposal 5B: Reuse of existing capability indication for eMTC for eMTC-NTN is considered as basis. Features which require separate capability indication for Rel-17 is discussed and agreed explicitly.*** |

**Q3: Companies provide views on above set of proposals related to applicability of capability indication of IoT-Features for NTN.**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | P4 (OK/Not OK/Comments) | P5A (OK/Not OK/Comments) | P5B (OK/Not OK/Comments) |
| Intel | ok with comments.  We suggest to clarify if P4 means “Existing capability signalling is used but only valid in the network type it is reported to (e.g. when UE reports to NTN network the capability refers to NTN and not TN).” And if this is the case, we wonder if there is RAN3 impact, e.g., when RAN exchanges UE capability with CN, the UE capability type (TN or NTN) needs to be indicated), and RAN2 needs to send a LS to RAN3? | ok with comments.  RAN2 needs to confirm first that “connected mode mobility between TN and NTN is not supported for Rel-17”.  And the same comment on P4 is also applicable to P5A. |  |
| Qualcomm | Ok for NB-IoT. Ok to check with RAN3 and SA2. | No. | For eMTC, we could follow NR structure and wait NR NTN.  If new IoT bit fields are not present, obviously existing capability indication applies to both TN and NTN, this is baseline.  There is no need to play guessing game what happens in future. It has been the case from the beginning, IoT bit is needed. |
| Huawei, HiSilicon | We are not clear about the exact meaning of P4.  We do not agree with Intel’s clarification. We do not think it is needed from RAN2 point of view (i.e. we think the same capability container can apply to both TN and NTN network and there is no need to report separately). We can check with SA2/RAN3 what their assumption is. | Similar comment to P4 | OK |
| Ericsson | Yes, no changes to capability indication framework is needed. For unlicensed and many other cases we did not duplicate capabilities.  OK.  Agree with Huawei. In the event of HO between TN and NTN, the NTN node will require the UE to report again its UE capabilities. Thus, there is no possibility of confusion (no need to indicate whether is TN or NTN) nor impact to RAN3. | OK.  As we understand, the statement that connected mode mobility between TN and NTN is not essential for Rel-17 does not mean that it is not supported. | Not OK, unless only just a few capabilities are identified. Otherwise, it would double the size for capability signalling without a clear gain. |
| Nokia | OK. Same container can be used. Contents can differ depending on accessed network. As network obtain capability information in each access independently we don’t see spec impact here. | OK. For Rel-17 this is sufficient. |  |

**Rapporteur Summary:**

For NB-IoT, all companies agreed to reuse capability indication of existing features for NTN access. One company suggests that UE should be allowed use different capability indication of existing features across TN and NTN access. But companies have different views on whether specification changes needed to enable the same. 2 companies think RAN3/SA2 impacts to be checked. 3 companies indicate that specification changes are not needed and UE can use same container for TN and NTN access with different values. Hence we propose the following for NB-IoT UE capability indication for existing features.

* ***Proposal 4: Capability indications of existing NB-IoT Features are reused for NB-IoT-NTN.***
* ***Proposal 4A:RAN2 to discuss whether UE can use different values for the capability-indication values based on the network it access (TN or NTN). If allowed, whether specification changes are needed for the same.***

For eMTC one company indicated the need for having different capability container for NTN access as it will be required to differentiate the capabilities of UE during TN-NTN handover scenario. So two proposals are considered in the e-mail discussion. As there is split of views for these two options, we suggest the following proposal for online discussion. All the companies except one recommend not to duplicate the complete capability container of TN to NTN in different name. Features which requires some modification for NTN access needs to be identified and separate capability bits can be introduced only for them.

* ***Proposal 5: For Capability Indication of eMTC Features for eMTC-NTN, RAN2 to decide between following options.***
  + ***O1: All the existing capability indications of eMTC features are re-used for eMTC-NTN.***
  + ***O2: Reuse of existing capability indication for eMTC for eMTC-NTN is considered as basis. Only for the features which may need some changes for NTN access separate capability indication for Rel-17 is discussed and agreed explicitly.***

# 3 Summary

Based on the offline discussion, we make the following proposals.

For draft CR

* **Proposal 0: Updated CR in draft-CR-V1 considered as basis for further changes to running CR.**

For Optionality of NTN specific features.

* **P1: Support for reception of multiple tracking areas in system information and updating the TA list to NAS is considered as mandatory capability for NTN access.**
* **P2: Timer modification for PUR operation for NTN is optional UE capability with separate UE capability indication.**
* **P3: CHO capability for eMTC-NTN is indicated by the existing LTE CHO capability indication.**

For Open Issue 4.4

* **Proposal 4: Capability indication of existing NB-IoT Features are reused for NB-IoT-NTN.**
* **Proposal 4A:RAN2 to discuss whether UE can use different values for the capability-indication values based on the network it access (TN or NTN). If allowed, whether specification changes are needed for the same.**
* **Proposal 5: For Capability Indication of eMTC Features for eMTC-NTN, RAN2 to decide between following options.**
  + **O1: All the existing capability indications of eMTC features are re-used for eMTC-NTN.**
  + **O2: Reuse of existing capability indication for eMTC for eMTC-NTN is considered as basis. Only for the features which may need some changes for NTN access separate capability indication for Rel-17 is discussed and agreed explicitly.**

# Reference

[1]Remaining FFSs on UE Capabilities Spreadtrum Communications

[2]Open issues on UE capabilities for NB-IoT and eMTC Qualcomm Incorporated

[3]Remaining Issues on IoT NTN UE Capabilities CMCC

[4]Further analysis on remaining open issues for IoT-NTN Capabilities Nokia, Nokia Shanghai Bells

[5]Discussion on UE capabilities Xiaomi

[6]Discussion on IoT NTN UE capabilities OPPO

[7]OI 4.1 and OI 4.2: UE capabilities open issues Huawei, HiSilicon

[8] Remaining open issues of IoT NTN UE capabilities NEC Telecom MODUS Ltd.

[9] On IoT NTN capabilities Ericsson

[10] R2-2203225 OI 4.4: TN – NTN differentiation Huawei