3GPP TSG-RAN WG2 Meeting #118 electronic R2-2206191

Online, May 9 – 20, 2022

Agenda Item: 6.10.3.2.1

Source: Ericsson

**Title: [AT118-e][101][NTN] RRC CR (Ericsson)**

Document for: Discussion, Decision

# Introduction

**[AT118-e][101][NTN] RRC CR (Ericsson)**

Initial scope: continue the discussion on the NR NTN WI-specific RILs, also considering the submitted contributions

Initial intended outcome: Summary of the offline discussion with e.g.:

         List of resolved RILs

         List of RILs for online discussion

         List of RILs for further offline discussion

Deadline (for companies' feedback): Tuesday 2022-05-10 0800 UTC

Deadline (for rapporteur's summary in R2-2206191): Tuesday 2022-05-10 1000 UTC

In the first round of 101 the aim is to cover following RILs: E017,

# Contact Information

Respondents to the email discussion are kindly asked to fill in the following table.

|  |  |  |
| --- | --- | --- |
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# Discussion on selected RILs

## 3.1 E017 Configuration of number of tracking area codes across PLMNs

Current RRC CR in R2-2205463 has the below suggestion for the field description of the trackingAreaList introduced for Release-17 NTN:

#### – *PLMN-IdentityInfoList*

The IE *PLMN-IdentityInfoList* includes a list of PLMN identity information.

*PLMN-IdentityInfoList* information element

-- ASN1START

-- TAG-PLMN-IDENTITYINFOLIST-START

PLMN-IdentityInfoList ::= SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-IdentityInfo

PLMN-IdentityInfo ::= SEQUENCE {

plmn-IdentityList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity,

trackingAreaCode TrackingAreaCode OPTIONAL, -- Need R

ranac RAN-AreaCode OPTIONAL, -- Need R

cellIdentity CellIdentity,

cellReservedForOperatorUse ENUMERATED {reserved, notReserved},

...,

[[

iab-Support-r16 ENUMERATED {true} OPTIONAL -- Need S

]],

[[

trackingAreaList-r17 SEQUENCE (SIZE (1..maxTAC-r17)) OF TrackingAreaCode OPTIONAL -- Need R

]]

}

-- TAG-PLMN-IDENTITYINFOLIST-STOP

-- ASN1STOP

|  |
| --- |
| *PLMN-IdentityInfo* field descriptions |
| ***cellReservedForOperatorUse***  Indicates whether the cell is reserved for operator use (per PLMN), as defined in TS 38.304 [20]. This field is ignored by IAB-MT. |
| ***iab-Support***  This field combines both the support of IAB and the cell status for IAB. If the field is present, the cell supports IAB and the cell is also considered as a candidate for cell (re)selection for IAB-node; if the field is absent, the cell does not support IAB and/or the cell is barred for IAB-node. |
| ***trackingAreaCode***  Indicates Tracking Area Code to which the cell indicated by *cellIdentity* field belongs. The absence of the field indicates that the cell only supports PSCell/SCell functionality (per PLMN). |
| ***trackingAreaList***  List of Tracking Areas to which the cell indicated by *cellIdentity* field belongs. If this field is present, network does not configure *trackingAreaCode*. Total number of TACs across different PLMN-IdentityInfos shall not exceed *maxTAC*. |

**Q2: Please give your view whether a) implementation in CR R2-2205463 as presented above works b) there is issue that needs to corrected.**

|  |  |  |
| --- | --- | --- |
| Company | 1. Current CR works | 1. There is an issue that needs to be fixed, please explain why there is an issue and what is the resolution. |
| Huawei, HiSilicon |  | Maybe we can further clarify that same TACs contained in different PLMN-IdentityInfos do not count repeatedly. (One editorial suggestion: the PLMN-IdentityInfo should be italics.)  For instance: Total number of TACs across different *PLMN-IdentityInfo*s shall not exceed *maxTAC* with duplicated TACs counting only once. |
| vivo | OK with comments.  However, we want to further clarify that the absence of *trackingAreaCode* does not necessarily mean that the cell is an NTN cell, since NSA TN cell may not broadcast *trackingAreaCode* either. This leads to further changes on the field description of existing *trackingAreaCode.* |  |
| Qualcomm | ok | Ok to clarify case for duplicate TACs across different PLMNs. |
| Samsung |  | Agree to clarify, for example, “Total number of different TACs across different *PLMN-IdentityInfo*s shall not exceed *maxTAC”* |
| Apple | OK |  |
| Nokia | The changes above are fine, we also agree with vivo on the need to perhaps say a bit more, to differentiate from the NSA TN cell. |  |
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**Conclusion:**

## 3.2 V313 Use of RAN area code with tracking area list

For NTN, tracking area list has been introduced in IE PLMN-IdentityInfoList as follows:

#### – *PLMN-IdentityInfoList*

The IE *PLMN-IdentityInfoList* includes a list of PLMN identity information.

*PLMN-IdentityInfoList* information element

-- ASN1START

-- TAG-PLMN-IDENTITYINFOLIST-START

PLMN-IdentityInfoList ::= SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-IdentityInfo

PLMN-IdentityInfo ::= SEQUENCE {

plmn-IdentityList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity,

trackingAreaCode TrackingAreaCode OPTIONAL, -- Need R

ranac RAN-AreaCode OPTIONAL, -- Need R

cellIdentity CellIdentity,

cellReservedForOperatorUse ENUMERATED {reserved, notReserved},

...,

[[

iab-Support-r16 ENUMERATED {true} OPTIONAL -- Need S

]],

[[

trackingAreaList-r17 SEQUENCE (SIZE (1..maxTAC-r17)) OF TrackingAreaCode OPTIONAL -- Need R

]]

}

-- TAG-PLMN-IDENTITYINFOLIST-STOP

-- ASN1STOP

|  |
| --- |
| *PLMN-IdentityInfo* field descriptions |
| ***cellReservedForOperatorUse***  Indicates whether the cell is reserved for operator use (per PLMN), as defined in TS 38.304 [20]. This field is ignored by IAB-MT. |
| ***iab-Support***  This field combines both the support of IAB and the cell status for IAB. If the field is present, the cell supports IAB and the cell is also considered as a candidate for cell (re)selection for IAB-node; if the field is absent, the cell does not support IAB and/or the cell is barred for IAB-node. |
| ***trackingAreaCode***  Indicates Tracking Area Code to which the cell indicated by *cellIdentity* field belongs. The absence of the field indicates that the cell only supports PSCell/SCell functionality (per PLMN). |
| ***trackingAreaList***  List of Tracking Areas to which the cell indicated by *cellIdentity* field belongs. If this field is present, the UE shall ignore *trackingAreaCode*, if present. Total number of TACs across different PLMN-IdentityInfoLists shall not exceed *maxTAC*. |

The following RIL is added which needs discussion

**[RIL]**: V313 **[Delegate]**: vivo (Xiao) **[WI]**: NTN **[Class]**:2 **[Status]**: ToDo **[TDoc]**: None **[Proposed Conclusion]**: v02

**[Description]**: Introdction of per-TAC RAN area code configuration when *trackingAreaList* is configured

**[Proposed Change]**: In NTN, when the *trackingAreaList* is configured, it is possible that different TACs included in the list correspond to different RAN area codes. Therefore, the existing *ranac* included in *PLMN-IdentityInfo* may not be sufficient in this case.

It is proposed to introduce a per-TAC RAN area code configuration when *trackingAreaList* is configured, and it can be further determined whether for a given TAC more than one RAN area code can be configured.

It seems that the issue is about that a RANAC is associated with a tracking area (represented by PLMN ID TAC) and the RANAC is unique only within that tracking area, and if only one RANAC is broadcast in the cell while multiple TACs are broadcast in the same cell, then it is ambiguous which TAC the RANAC “belongs” to. And to remove this ambiguity it is proposed to configure a RANAC per broadcast TAC.

However, it is unclear why the broadcast RANAC could not be valid in all the tracking areas whose TACs are broadcast. After all, the same RANAC can be reused in every tracking area.

The supported TA list is signaled from the RAN to the AMF at NG setup and RAN configuration update. The NGAP signaling is as follows:

#### 9.2.6.1         NG SETUP REQUEST

This message is sent by the NG-RAN node to transfer application layer information for an NG-C interface instance.

Direction: NG-RAN node  AMF

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| --- | --- | --- | --- | --- | --- | --- |
| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
| Message Type | M |  | 9.3.1.1 |  | YES | reject |
| Global RAN Node ID | M |  | 9.3.1.5 |  | YES | reject |
| RAN Node Name | O |  | PrintableString  (SIZE(1..150, …)) |  | YES | ignore |
| **Supported TA List** |  | *1* |  | Supported TAs in the NG-RAN node. | YES | reject |
| **>Supported TA Item** |  | *1..<maxnoofTACs>* |  |  | - |  |
| >>TAC | M |  | 9.3.3.10 | Broadcast TAC | - |  |
| **>>Broadcast PLMN List** |  | *1* |  |  | - |  |
| **>>>Broadcast PLMN Item** |  | *1..<maxnoofBPLMNs>* |  |  | - |  |
| >>>>PLMN Identity | M |  | 9.3.3.5 | Broadcast PLMN | - |  |
| >>>>TAI Slice Support List | M |  | Slice Support List  9.3.1.17 | Supported S-NSSAIs per TAC, per PLMN or per SNPN. | - |  |
| >>>>NPN Support | O |  | 9.3.3.44 | If the *NID* IE is included, it identifies a SNPN together with the *PLMN Identity* IE. | YES | reject |
| >>>>Extended TAI Slice Support List | O |  | Extended Slice Support List  9.3.1.191 | Additional Supported S-NSSAIs per TAC, per PLMN or per SNPN. | YES | reject |
| >>Configured TAC Indication | O |  | 9.3.3.50 |  | YES | ignore |
| >>RAT Information | O |  | 9.3.1.125 | RAT information associated with the TAC of the indicated PLMN(s). | YES | reject |
| Default Paging DRX | M |  | Paging DRX  9.3.1.90 |  | YES | ignore |
| UE Retention Information | O |  | 9.3.1.117 |  | YES | ignore |
| NB-IoT Default Paging DRX | O |  | 9.3.1.137 |  | YES | ignore |
| Extended RAN Node Name | O |  | 9.3.1.193 |  | YES | ignore |

|  |  |
| --- | --- |
| Range bound | Explanation |
| maxnoofTACs | Maximum no. of TACs. Value is 256. |
| maxnoofBPLMNs | Maximum no. of Broadcast PLMNs. Value is 12. |

So, up to 256 TACs can be supported by a gNB, and up to 12 PLMNs can be broadcast per TAC. NGAP does not preclude any relation between the different TACs and different RAN area codes, i.e. no cross-check is specified.

Seems that the proposed per-TAC RAN area code would restrict this possible RAN area code space to avoid duplicates. It should be clarified why would be needed.

When the RANAC alternative is used for the RNA configuration, there is a list TACs and for each of these TACs there is one or more RANAC(s). If the UE can find a TAC broadcast in the cell that matches one of the TACs in its RNA configuration and one of the RANACs associated with that matching TAC in the RNA configuration is equal to the RANAC broadcast in the cell, then the UE would consider the cell as being part of the UE’s RNA.

That is, it seems unclear whether there actually is any issue to be solved. Please note that WI is closed and RAN2 should only work on corrections.

**Q2: Please give your view whether a) current specification works b) there is issue that needs to corrected.**

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| --- | --- | --- |
| Company | 1. Current specification works | 1. There is an issue that needs to be fixed, please explain why there is an issue and what is the resolution. |
| Huawei, HiSilicon | We prefer not to pursue enhancements related to RRC\_INACTIVE at this stage |  |
| vivo |  | Agree (proponent).  The motivations are two folded and straightforward:   1. Just like the cell moving across the boundary of different TAs, there is also the case that the cell is moving across the boundary of different RAN areas in NTN. Therefore, similar as why we introduced the multiple TAC configuration to avoid the signaling overhead of TAU, it is straightforward to introduce multiple RANAC config to avoid signaling overhead of RNA update. 2. Introducing per TAC RANAC configuration is not intended to restrict RAN area codes configuration as mentioned above by the Rapp in the discussion texts, but simply because, for a given PLMN, the multiple TAs covered by a cell do not necessarily own the same RANACs. In other words, if such per TAC RANAC configuration is not introduced, the NW deployment needs to ensure that the RANAC shared by multiple TACs for a given PLMN must be the same, which we are not sure is always practical in reality.   Of course, some of the TACs are also able to share the same RANAC, not necessarily having to correspond to different RANAC values. We have a related contribution submitted in R2-2204562, and the above motivations are respectively illustrated by figure 2 and 1 below.    Figure 1 RNA updated with moving cells (existing Spec)    Figure 2 RNA updated with moving cells (proposed) |
| Qualcomm | In our understanding, RAN3 does not want to work on any enhancement for RRC INACTIVE state in Rel-17. |  |
| Samsung | We think the current spec can work with less flexibility, since there is no restriction for the relation between the different TACs and different RAN area codes, then multiple TACs in TAC list can share the same RANAC. | We also share sympathy with vivo’s view. But since this is a new issue, we may not have enough time to specify any enhancement now. |
| Apple |  | We see the merit in Vivo’s argument, but are also OK to go with majority view given the late stage of the Release |
| Nokia |  | We understand the issue is the consequence of introducing the support for multiple TACs (soft TAC update), so we think vivo is right this should be a logical thing to do. But on the other hand, we wonder how feasible it is currently to fix that, with RAN3 involvement. |
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**Conclusion:**

## 3.3 V320 CGI reporting for NTN

**[RIL]**: V320 **[Delegate]**: vivo (Xiao) **[WI]**: NR\_NTN\_enh-Core **[Class]**:1 **[Status]**: ToDo **[TDoc]**: R2-22xxxxx **[Proposed Conclusion]**: v66

**[Description]**: Erroneous CGI reporting in case *tackingAreaList* is confiugred.

**[Proposed Change]**: If the concerned cell configured for CGI reporting includes *trackingAreaList* (i.e an NTN cell), the procedure here still requires the UE to report the legacy t*rackingAreaCode*. However, in case *trackingAreaList* is configured, the field description requires the legacy *trackingAreaCode* to be ignored by the UE, which means that the *trackingAreaCode* included may be an invalid/useless one. As a result, the existing procedure would lead to incorrect CGI information reported to the network, with the serving cell unable to tell whether the *trackingAreaList* is also configured, or tell the NW type of the concenred cell. As whether ANR is invovled in NTN or between TN and NTN was not really discussed in earlier meetings, we will bring a separate Tdoc to discuss this issue.

**[Comments]**: vivo (Xiao) v66: Note that RAN4 agreed the NTN operating bands n256 and 255 (as now captured in 38.101-5) which are respectively overlapped with the the legacy TN operating bands n65 (partially) and n24. This makes it possible that the concerned cell for which CGI reporting is configured by the serving cell is either a TN or an NTN cell (at least on the above frequencies).

When reporting CGI for measurement reports we have the following procedure:

3>  if the cell indicated by *cellForWhichToReportCGI* is an NR cell:

4>  if *plmn-IdentityInfoList* of the *cgi-Info* for the concerned cell has been obtained:

5>  include the *plmn-IdentityInfoList* including *plmn-IdentityList*, *trackingAreaCode* (if available), *ranac* (if available), *cellIdentity* and *cellReservedForOperatorUse* for each entry of the *plmn-IdentityInfoList*;

5>  include *frequencyBandList* if available;

4>  if *nr-CGI-Reporting-NPN* is supported by the UE and *npn-IdentityInfoList* of the *cgi-Info* for the concerned cell has been obtained:

5>  include the *npn-IdentityInfoList* including *npn-IdentityList*, *trackingAreaCode*, *ranac* (if available), *cellIdentity* and *cellReservedForOperatorUse* for each entry of the *npn-IdentityInfoList*;

5>  include *cellReservedForOtherUse* if available;

4>  else if *MIB* indicates the *SIB1* is not broadcast:

5>  include the *noSIB1* including the *ssb-SubcarrierOffset* and *pdcch-ConfigSIB1* obtained from *MIB* of the concerned cell;

Thus, UE would anyway include trackingarea code only if it is available. For NTN cell it would not be as UE is ignoring it but it is not clear what is the actual issue. RAN2 has not agreed to support CGI reporting in NTN and it is not part of the WID either.

As the work item is closed RAN2 should not add more features, hence rapporteur proposal is to reject the RIL V320.

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**Q3: Please give your view whether a) current specification works b) there is issue that needs to corrected.**

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| --- | --- | --- |
| Company | 1. Current specification works | 1. There is an issue that needs to be fixed, please explain why there is an issue and what is the resolution. |
| Huawei, HiSilicon | With the new description in E017 “ If this field is present, network does not configure *trackingAreaCode*”, this issue does not exist as the legacy field will not be available. |  |
| vivo |  | Agree (proponent).  As to HW’s comments above, even if the change in R2-2205463 is agreed for E017 in Q1 (i.e. if *trackingAreaList* is present, network does not configure *trackingAreaCode*), the current Spec still has problems, because the UE will find the *trackingAreaCode* for the concerned cell configured for CGI reporting is not available, and report neither *trackingAreaCode* or *trackingAreaList*. In this way, the serving cell still cannot know *whether the concerned cell is an NTN cell or an NSA TN cell* (as what we clarified in above Q1), and may suffer from erroneous ANR operation due to the lack of proper CGI related information.  We are open on whether to support CGI reporting/ANR functions for NTN cells in this release. However, even if RAN2 decides not supporting it, we think some Spec changes are needed to prohibit the UE from reporting NTN cell’s CGI information, lest inaccurate CGI information is provided to the serving cell. |
| Qualcomm |  | We are ok to clarify in NTN if trackingAreaList is present, the UE should report all tracking area codes (not just a random one). Then network should figure out what is the CGI in that region. |
| Samsung |  | We think whether to support CGI reporting/ANR functions for NTN cells should be decided first. There is spec impact in either case as Vivo mentioned. |
| Apple | Unclear why the network would broadcast an invalid *trackingAreaCode* |  |
| Nokia |  | Agree with vivo, the issue was not considered and not addressed, as we seem to struggle with specifying more basic NTN solutions. |
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**Conclusion:**

## 3.4 Location reporting event D1:L011, H801, X704

Couple of RILs were raised in context of D1 report

**[RIL]**: L011 **[Delegate]**: LGE(SungHoon) **[WI]**: NTN **[Class]**: 2 **[Status]**: ToDo **[TDoc]**: None **[Proposed Conclusion]**:

**[Description]**: A cell triggering event D1 is not included in the measurement report

**[Proposed Change]**: In the current formulation, MeasurementReport triggered by event D1 does not include the cell meeting event D1 and its cell. So we propose to add the procedure text to include the cell meeting event D1. There are a couple of ways to enable this, and we think it is most straightforward to include the cell in cellsTriggeredList, as similar to other event cases.

**[Comments]**:

In the event D1, there is no cell that triggers the event so it is unclear how cells could be added based on the triggering. A related RIL, acknowledges this and proposes to add PCI in the D1:

**[RIL]**: H801 **[Delegate]**: Huawei (Lili) **[WI]**: NTN **[Class]**: 1 **[Status]**: ToDo **[TDoc]**: Yes **[Proposed Conclusion]**: v167

**[Description]**: For event D1, there is a reference location of neighbour cell, but the UE does not know which neighbour cell it corresponds to.

In fixed cell scenarios, there is no problem.

However in moving cell scenarios, the UE needs to predict the trajectory of the reference location based on the ephemeris of the neighbour cell. So UE should know which cell the reference location belons to.

**[Proposed Change]**: Add a PCI in the configuration of event D1 and modify the field description accordingly.

We will submit a Tdoc addressing this issue.

However, it is unclear what is the use of the PCI here. Network knows which location it has configured as ”target cell location” and the event has measID associated. Thus, when report is sent, network knows which event triggered it. Note that it is not actually mandated that the reference location2 is associetd to any actual cell. It is just a location coordinate. Secondly, it should be further elaborated what does the UE do with the information of the PCI.

Note that WI is closed and only corrections or small additions that can be seen as FFS can be handled.

**Q4: Please give your view whether a) current specification works b) there is issue that needs to corrected.**

|  |  |  |
| --- | --- | --- |
| Company | 1. Current specification works | 1. There is an issue that needs to be fixed, please explain why there is an issue and what is the resolution. |
| Huawei, HiSilicon |  | For [H801], we would like to further clarify the intended UE behavior.  After PCI (the neighbor cell which the *referenceLocation2* corresponds to) is added, if the corresponding cell is a moving cell, the UE needs to predict the movement of *referenceLocation2* based on the ephemeris of the neighbor cell. If it is a fixed cell, the UE considers the *referenceLocation2* as fixed.  A related issue is how the UE can determine the PCI corresponds to a moving cell or fixed cell:  Option 1) the UE determines it by the presence/absence of reference location in SIB19 (it is pending on the discussion of adding neighbor cell reference locations into SIB19);  Option 2) the network explicitly indicate the cell type in event D1;  Option 3) If PCI is included in event D1, it implicitly indicates the neighbor cell is a moving cell. |
| vivo | For H801, we think current specification works, since once the event of a cell is fulfilled, measurement report is triggered, there is no need to associate the reference location2 with a cell. | For L011, we agree with the issue and the solution. |
| Qualcomm |  | For L011, ok same as other RRM events.  For H801, Measurement object can be associated with a cell or list of cells. But reference time for the reference location probably needed to be specified in case of moving cell. |
| Samsung | For L011, we are not clear about the reason to include PCI. | For H801, we think even if PCI is added, UE cannot predict movement of reference location based on ephemeris since the relation between reference location movement and satellite movement is unknown. More information is needed for UE to estimate the movement of the reference location of a moving cell. |
| Apple | Same view as Vivo |  |
| Nokia | Agree, we believe there is no need to associate the reference location with any particular cell/PCI. When the location-based event will trigger, the UE will report measurements, where cell ID can be found. |  |
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**Conclusion:**

Yet another RIL is as follows:

**[RIL]**:X704 **[Delegate]**: Xiaomi(Yi) **[WI]**:NTN **[Class]**:2 **[Status]**: ToDo **[TDoc]**: None **[Proposed Conclusion]**:

**[Description]**: Addition of a parameter *reportOnLeave-r17*

**[Proposed Change]**: The parameter *reportOnLeave-r17* which has been used for many report events, e.g. Event A3, Event A5. But it is not included in Event D1. Event D1 is used for NTN. When UE location satisfies the leaving condition of Event D1, triggering UE to report location and measurement results may be better for reliability of mobility. And the addition of *reportOnLeave-r17* enables NW has more control for UE report. Hence, we suggested to add *reportOnLeave-r17.*

**[Comments]**:

As WI is closed and RAN2 should only work on corrections, this addition can only be added if there is clear majority to do so. This addition is considered because it seems very simple to be added and could be viewed just as an FFS for the event D1 discussion.

**Q5: Please give your view whether reportonleave should be added to event D1**

|  |  |  |
| --- | --- | --- |
| Company | Ya/no | comment |
| Huawei, HiSilicon | No strong view | We think there is no critical issue if *reportOnLeave* is not introduced for event D1, but we can also accept aligning it with RRM events. |
| Qualcomm | Ok with it. |  |
| Samsung | Yes | We are fine to go with majority. |
| Apple | No |  |
| Nokia | Yes | Can be useful, but it is not critical to have it. |
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**Conclusion:**

# Conclusion

TBA

# References

1. RP-201256, “Solutions for NR to support non-terrestrial networks (NTN),” 3GPP TSG RAN #88e, June 2020.