3GPP TSG-RAN WG2 Meeting #115-e draftR2-2108887

Elbonia, Online, 16 – 27th of August 2021

**Agenda item: 8.10.3.1**

**Source: Nokia, Nokia Shanghai Bell**

**Title: Report from [AT115-e][107][NTN] Reply LS on TAC handling (Nokia)**

**WID/SID: NR\_NTN\_solutions-Core - Release 17**

**Document for: Discussion and Decision**

# 1 Brief scope of the paper

This document aims at collecting companies’ views regarding TAC handling in NTN:

* [AT115-e][107][NTN] Reply LS on TAC handling (Nokia)

Scope: Continue the discussion on p3 and p4 from [R2-2107520](file:///C:\Data\3GPP\Extracts\R2-2107520%20On%20Tracking%20Area%20Code%20handling%20for%20NTN.docx) and then draft reply LS response to CT1 and SA2

Intended outcome: Summary of the offline discussion with e.g.:

* + - List of proposals for agreement (if any)
    - List of proposals for further discussion

Initial deadline (for companies' feedback): Thursday 2021-08-19 1000 UTC

Initial deadline (for rapporteur's summary in R2-2108887): Thursday 2021-08-19 1600 UTC

Deadline for reply LSs: Week2 (after CB session)

Proposals marked "for agreement" in R2-2108887 not challenged until Friday 2021-08-20 1000 UTC will be declared as agreed via email by the session chair (for the rest the discussion will further continue offline until the CB session in Week2).

The following sections elaborate on the topics listed in the scope above.

# 2 One or multiple TACs indicated to NAS

At RAN2#113bis it was discussed what shall be sent to NAS from AS when there is more than a single TAC per PLMN. RAN2 has listed two options and shared them with CT1 and SA2 in [2]:

* Option 1: AS still reports only one TAC for one PLMN even if more than one TACs per PLMN are broadcasted in an NTN cell.
* Option 2: AS indicates all received TAC(s) for one PLMN to NAS layer.

SA2 and CT1 responded in [3] and [4], respectively. We have analyzed their responses in our TDoc [1]. In our understanding:

* SA2 [3] admits Option 2 is doable, while stating Option 1 is simpler as it does not require updates for NAS. At the same time they point at CT1, in their opinion, a group responsible for verifying Stage-3 requirements and the ultimate feasibility of Option 2. SA2 also sees a risk of Option 1, where a non-optimal TAC is selected and is signalled to NAS.
* CT1 [4] states Option 2 is feasible, but they ask, in addition to the registration area, what should be taken into account by the NAS in selecting a single TAC from multiple TACs indicated by AS.

Thus, RAN2 may conclude Option 2 is doable and shall be selected (as per RAN2 clear preferences expressed during RAN2#113bis). Companies are kindly asked to confirm this is a preferred option, in light of the response LSs from SA2 and CT1:

|  |  |  |
| --- | --- | --- |
| **Question 1: Considering the response LSs from SA2 [3] and CT1 [4], which option shall be selected by RAN2 if there is more than a single TAC per PLMN:**   * **Option 1: AS still reports only one TAC for one PLMN even if more than one TACs per PLMN are broadcasted in an NTN cell.** * **Option 2: AS indicates all received TAC(s) for one PLMN to NAS layer.** | | |
| **Company** | **Option 1/Option 2** | **Comment** |
| Vivo | Option 2 | We are OK to follow previous RAN2 preference which was confirmed by CT1 and SA2 to some extents. |
| ericsson | Option 1 | Also Option 2 requires the information on how to select one TAC from multiple thus it seems more straightforward AS does it directly. |
| MediaTek | Option 2 | Agree with Vivo that it was RAN2 preference and also confirmed by CT1 and SA2 to some extents. |
| Lenovo | Option 2 | Option 2 is RAN2 preference, and it should be NAS to decide which one is applied. |
| Xiaomi | Option 2 | Option 2 is RAN2 preference and both SA2 and CT1 think option 2 is feasible. |
| OPPO | Option 2 | Agree with vivo and MediaTek that it was RAN2’s preference and has been also confirmed by CT1 and SA2 to some extents. |
| ZTE | Option 2 |  |
| FGI, APT | Option 2 | Agree with the rapporteur that option 2 was the preferred option from RAN2 perspective. By reading the LS from SA2 and CT1, it seems they also recognize option 2 as a feasible option and has less risk compared to option 1. |
| Samsung | Option2 |  |
| LG | Option 2 | We should keep option 2. There is no reason to select certain TAC by AS. |
| Qualcomm | Option 2 | At this point we do not need to discuss the option 1. |
| NEC | Option 2 | We are fine to follow previous RAN2 preference. |
| Intel | Option 2 | We prefer keeping RAN2 agreement as CT1 and SA2 did not raise any concerns |
| Apple | Option 2 |  |
| Huawei, HiSilicon | Option 2 | Proponent |
| Spreadtrum | Option 2 | Option 2 is RAN2’s agreements, but the final agreement is due to SA2 and CT1. |
| CMCC | Option 2 | It is fine to follow RAN2 previous preference. |
| Sequans | Option 2 |  |
| ETRI | Option 2 |  |
| Rakuten Mobile | Option 2 |  |
| Nokia | Option 2 | Although we somewhat agree with Ericsson that if AS indicates additional factors to NAS which are taken into account in the selection process, then it does not differ much from Optionf 1. |
|  |  |  |
|  |  |  |
|  |  |  |

Summary for Q1:

* 21 responses provided. 20 companies want to keep the existing RAN2 preference for Option 2 (AS indicates all received TAC(s) for one PLMN to NAS layer)
* Thus, we propose to confirm it, in the light of received CT1 and SA2 inputs.

**Proposal 1: RAN2 confirms AS indicates to NAS layer all received TACs per PLMN.**

Assuming that RAN2 preferences have not changed and Option 2 is still supported by the majority, RAN2 shall consider what kind of factors may be taken into account when NAS is to select a single TAC value. Please note it has been indicated in the CT1 LS [4] that such further guidance from RAN2 is expected. In [1] it has been pointed out that the following aspects may be considered:

- registration area

- forbidden tracking areas

- service area restrictions

- local area data network (LADN) information.

- UE’s location information and information of geographical area of Tracking Areas

- Satellite trajectory

Please kindly indicate what RAN2 shall suggest in the response to CT1.

|  |  |
| --- | --- |
| **Question 2: Which factors should be taken into account and communicated to CT1 in the response LS to facilitate the TAI selection in case multiple TACs are broadcast per PLMN?** | |
| **Company** | **Answer** |
| vivo | From RAN2 perspective, we think *UE’s location information and information of geographical area of Tracking Areas* should be used by the NAS for TAI selection.  There was also a draft LS from Huawei (in R2-2107345) which indicates the above information is needed by NAS for TAI selection. We think such a reply from Huawei should be in a right way. Per our reading of the incoming CT1 LS, we understand that the question is asking, besides the TA related information already existing/available in the NAS as in the legacy (e.g. those listed in Nokia’s draft LS), what *other* information is needed from RAN2 perspective in this NTN-specific situation with multiple TACs available in the AS. Otherwise, if only the NAS information itself had been concerned, CT1/SA2 should have decided all by themselves without need of enquiring RAN2.  We think the need of location information for TAI selection is the direct consequence resulting from the support of earth-fixed TA planning in NTN as well as the support of earth-moving cells allowed to broadcast multiple TACs. The UE has to map its current location into the fixed TA where it is currently located, depending on its current location information available. Since TA/cell planning is related to RAN deployment, RAN2 should be the right WG to decide the need of such location information and geographical information of TAs for TAI selection, and inform this decision to CT1/SA2.  In addition to location information and geographical information of TAs, we may also inform CT1 that the need of other NAS layer information for TAI selection (e.g. those listed by Nokia above) can be up to CT1. |
| Ericsson | Selection has to respect the geographical area of TAC. If UE would have full knowledge on the geographical areas it is easy for the UE to select. Current discussion does not assume UE has it, timing information will help in this selection as UE can select the one that is going to be broadcasted longer time. Additionally restricted and forbidden areas should be taken into account. |
| MediaTek | AS can provide satellite trajectory information to NAS to aid area selection. Given that TAU is triggered on Cell Reselection, which will only take place for UEs on the edge of the area that the satellite is moving into, this can assist NAS in tracking area selection. |
| Lenovo | We think what CT1 expect is other information from AS (RAN2 perspective) to facilitate the TAI selection. Satellite ephemeris or trajectory may further help UE NAS in TAI selection, if only provided in AS. |
| Xiaomi | Since the TAC is earth fixed, the UE location can help NAS to determine the TAI. |
| OPPO | We think UE’s location information and information of geographical area of Tracking Areas can be provide to NAS for TAI selection. Whether any other information is needed should be up to CT1, since it is CT1 to decide how to perform TAI selection. |
| ZTE | We understand the TAC can be selected based on UE location, i.e. a TAC mapped to the geographical area UE is in should be selected.  Each TAC identifies a certain geographical area UE is in, which allows NW to be aware where to page UE. And TAU will not be triggered if UE stays still, which is also beneficial to avoid unnecessary TAU due to satellite movement while UE stays still,  Furthermore, we understand the TAC selected based on UE location can also be reported to gNB and gNB can then include this TAC in the ULI, which also answers the question from RAN3. |
| FGI, APT | The root cause of RRC reporting multiple TACs to NAS is because RAN2 has agreed the soft TAI switching mechanism, which aims to prevent the stationary UE from performing TAU. That is, we don’t want the UE to trigger TAU if one of the reported TACs is the registration area of the UE. With such intention, registration area should be the only one factor taken into account by NAS while selecting the TAC. However, since CT1 is asking what else should be taken into account in addition to ‘registration area’, we don’t need to list the registration area as it is already the essential factor from CT1 perspective.  Now companies may consider the case where UE might geographically move within the same cell but to a different TAC that does not belong to UE’s registration area. Therefore, companies may want UE NAS to pick a ‘correct’ TAC based on UE’s current geographical location. However, we would like to emphasize this should be a rare case as UE’s mobility can be neglected compared to satellite’s mobility. In most of the cases, UE would first detect the cell change and check the TACs broadcasted by the new cell, and perform TAU accordingly if it has moved to another geographical area. If none of the reported TACs belongs to UE’s registration area, NAS should trigger TAU and UE may need to provide UE’s geolocation information during the TAU instead of picking a TAC. |
| Samsung | We think UE location information and mapping information of geographical area of tracking areas would be required. |
| LG | We wonder if the reply LS is really necessary. The requested action to RAN2 is:  “CT1 kindly requests RAN2 to take the above answer into account for the future work and clarify what should be considered for TAI selection.”  So RAN2 just need to consider the option 2 in the further work and we think TAI selection is not RAN2 scope. Additionally, the listed four topics also do not need to be informed by RAN2. |
| Qualcomm | We also think this question is not in RAN2 scope. The question asks how the UE NAS layer can decide or select a TAC when multiple TACs are broadcast for a PLMN. We are aware of several DPs and CRs being provided at SA2#146 to address this specific question and should leave this up to SA2 and CT1 to resolve. |
| NEC | From RAN2 perspective, UE location should be one factor for TAI selection. We do not think geographical area of Tracking Areas is available to UE for TAI selection. |
| Intel | RAN2 could clarify that Tracking Area is coupled with geographical area (even for earth moving cells). For the selection, NAS should consider UE’s location as well as other satellite related information that may be available in UE (e.g. based on ephemeris or broadcast related information). In addition, we understand SA2 input/confirmation is also required for this topic from the system level. |
| Apple | We agree with with FGI, APTs view that all TACs should be considered “equivalent” by RAN2 and only in rare cases some kind of a fixed geographical area information covered by that TAC from the UE. That would be an optimization from our view. |
| Huawei, HiSilicon | Our view on the RAN2 reply is as below:  RAN2 believes that Tracking Area is coupled with geographical area, and the selected TAI should align with the Tracking Area where UE’s located. So in RAN2’s point of view, the information of geographical area of Tracking Areas and UE’s current location should be taken into account for TAI selection. |
| Spreadtrum | TAC is earth fixed, so the location of UE shall be applied to select the TAI. |
| CMCC | From our perspective, UE’s location information and information of geographical area of Tracking Areas are useful to help to select an appropriate TAC among the reported multiple TACs. Furthermore, forbidden tracking areas should also be considered. |
| Sequans | The UE location would be useful only if NAS knows the geographical area of TACs which is not the case. If parameter like broadcast time was agreed, it could be useful, otherwise no additional parameter. |
| ETRI | It is sufficient to inform that RAN2 supports ground fixed tracking areas in this release. |
| Rakuten Mobile | Geographical area mapping would be enough. |
| Nokia | Agree that the factors listed above, preceding this question, are CT1-specific (and RAN2 is not the right WG to confirm those can be taken into account). The assumption is that CT1 will consider them anyway.  The indication that TACs are fixed to geographical location and the UE location information can help in TAI selection in NAS. This can be formulated as RAN2 suggestion in the response LS. |
|  |  |
|  |  |
|  |  |
|  |  |

Summary for Q2:

* It has been noticed that factors mentioned in [1] are probably already available and known to CT1
* The most common proposal for RAN2 feedback was to indicate TACs in NTN are fixed to geographical location on Earth. In addition, it has been suggested UE location can be used by NAS to select TAI

**Proposal 2: RAN2 indicates to CT1 that TACs in NTN are fixed to geographical location on Earth and in addition, UE’s location information can be used for TAI selection.**

The discussion above shall lead to drafting the response LS to [3] and [4]. In this liaison statement RAN2 shall indicate the following:

1. Confirmation Option 2 has been selected by RAN2 after analysing the feedback from SA2 and CT1
2. If RAN2 converges on Question 2, factors that can be taken into account to facilitate the TAI selection
3. Other (please indicate)

Please note we have already provided a draft response LS in [5], which can serve as a basis for constructing the final response from RAN2.

Please provide your view on what to insert in the LS:

|  |  |  |
| --- | --- | --- |
| **Question 3: What kind of information to insert in the response LS to CT1 and SA2? Please select (multiple) options: a), b), c) and provide further details in the Comment column.** | | |
| **Company** | **a), b), c)** | **Comment** |
| Vivo | a), b), c) | As what was commented in Q2, c) can be telling CT1 what information needs to be considered for TAI selection at the NAS level is up to CT1. |
| Ericsson | C) | We should provide RAN2 outcome of the discussion |
| MediaTek | a), b), c) | Agree with vivo that we can tell CT1 that the information needed to be considered for TAI selection at the NAS level is up to CT1. |
| Lenovo | a), b), c) | Agree with vivo and MediaTek that the need of other NAS layer information for TAI selection can be up to CT1. |
| Xiaomi | a),b),c) | Agree with vivo that we should tell CT1 that the information for TAI selection is up to CT1. |
| OPPO | a),b),c) | Agree with vivo and MediaTek. |
| ZTE | 1. and b) | RAN2 outcome of the above Question 2 should be provided to CT1 and SA2. |
| FGI, APT | a), b) | At least a) can be provided; b) depends on whether we can converge on Q2 or not. |
| Samsung | a) and b) |  |
| LG | c) | CT1 already commented option 2 is feasible and TAI selection is up to CT1, so we think RAN2 does not need to confirm it. |
| Qualcomm | a) | We can also add that RAN2 assume that SA2 and/or CT1 will resolve b). |
| NEC | a), b), C) | Fine with vivo’s suggestion to tell CT1 that the NAS level information for TAI selection is up to CT1  Moreover, it would be helpful to inform them our agreements make so far relevant to soft TAC, e.g.:   * RAN2 assume UE does not do TAU if one of the currently broadcasted TAC belongs to UE’s registration area. * UE will be informed when there is a change of TAC(s) in SIB1 via SI update notification procedure as legacy behaviour. |
| Intel | a) b) | In general, the LS should capture RAN2 agreements relevant to TAC discussion in NAS as part of this or other offlines, if any. |
| Apple | a |  |
| Huawei, HiSilicon | a,b | Regarding what factors can be taken into account, our comment is same as for Q2. |
| Spreadtrum | a), b) | If selection is applied by gNB, the UE location information shall be taken into account to select the TAI. |
| CMCC | At least a) and b) |  |
| Sequans | a), b) |  |
| ETRI | a), b) |  |
| Rakuten Mobile | 1. , b) |  |
| Nokia | a and b | OK to confirm Option 2 and inform about additional factors that may help (discussed in Q2). |
|  |  |  |
|  |  |  |
|  |  |  |

Summary for Q3:

* 21 responses have been provided
* The most popular option is to include in the response LS a) and b), namely confirmation of Option 2 and additional information for selecting TAI, as stated in Proposal 2.

**Proposal 3: RAN2 responds to CT1 and SA2 with the confirmation AS indicates to NAS layer all received TACs per PLMN. In addition it is stated that TACs in NTN are fixed to geographical location on Earth and UE’s location information can be used for TAI selection.**

# 3 Conclusion

Based on the views expressed in the previous sections, we propose the following:

Proposals for e-mail agreement:

**Proposal 1: RAN2 confirms AS indicates to NAS layer all received TACs per PLMN.**

**Proposal 2: RAN2 indicates to CT1 that TACs in NTN are fixed to geographical location on Earth and in addition, UE’s location information can be used for TAI selection.**

**Proposal 3: RAN2 responds to CT1 and SA2 with the confirmation AS indicates to NAS layer all received TACs per PLMN. In addition it is stated that TACs in NTN are fixed to geographical location on Earth and UE’s location information can be used for TAI selection.**

# 4 List of referenced documents

1. R2-2107520 *On Tracking Area Code handling for NTN* 3GPP TSG-RAN WG2 Meeting #115 Electronic Elbonia, 16 – 27 of August 2021
2. R2-2104377 *LS on multiple TACs per PLMN* 3GPP TSG-RAN WG2 Meeting #113bis electronic, 12 – 20th of April 2021
3. S2-2104891 *LS Response to LS on multiple TACs per PLMN* 3GPP TSG SA WG2 Meeting #145E (e-meeting) May 17 - 28 2021
4. C1-213965 *LS reply on multiple TACs per PLMN* 3GPP TSG CT WG1 Meeting 130-e TDoc Electronic meeting, 20 - 28 May 2021
5. R2-2107523 *Response LS on Multiple TACs per PLMN* 3GPP TSG-RAN WG2 Meeting #115 Electronic Elbonia, 16 – 27 of August 2021

# Contact information

|  |  |
| --- | --- |
| Company | Delegate contact |
| Ericsson | Helka-Liina.maattanen@ericsson.com |
| MediaTek | Abhishek.Roy@mediatek.com |
| Lenovo | xumin13@lenovo.com |
| Xiaomi | lixiaolong1@xiaomi.com |
| OPPO | lihaitao@oppo.com |
| ZTE | gao.yuan66@zte.com.cn |
| FGI, APT | minghungtao@fginnov.com |
| Samsung | kyeongin.j@samsung.com |
| LG | aidoy.lee@lge.com |
| Qualcomm | bshrestha@qti.qualcomm.com |
| NEC | Yuhua.chen@emea.nec.com |
| Intel | marta.m.tarradell@intel.com |
| Apple | svangala@apple.com |
| Spreadtrum | Qufang.huang@unisoc.com |
| Sequans | omarco at sequans.com |
| ETRI | myyun@etri.re.kr |
| Rakuten Mobile | Awn Muhammad (Awn.muhammad@rakuten.com) |
| Nokia | jedrzej.stanczak@nokia.com |