**3GPP TSG-RAN WG2 Meeting #112-e *R2-201xxxx***

**Online, 2–13 November 2020**

**Agenda item: 8.10.3.3**

**Source: ZTE Corporation, Sanechips**

**Title: Report of [AT112-e][105][NTN] RRC aspect (ZTE)**

**Document for: Discussion and Agreement**

# 1 Introduction

This is to report the result of the following email discussion in RAN2#112-e Meeting [1].

* [AT112-e][105][NTN] RRC aspects (ZTE)

Scope: Discuss remaining proposals from [R2-2009803](file:///C:\Data\3GPP\Extracts\R2-2009803_Report%20of%20%5bPost111-e%5d%20%5b911%5d%20%5bNTN%5d%20Connected%20mode%20aspects%20(ZTE).doc)

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

* + - List of proposals for agreement (if any)
    - List of proposals that require online discussions

Initial deadline (for companies' feedback): Monday 2020-11-09 17:00 UTC

Initial deadline (for rapporteur's summary in R2-2010767): Tuesday 2020-11-10 01:00 UTC

Proposals marked "for agreement" in R2-2010767 not challenged until Tuesday 2020-11-10 12:00 UTC will be declared as agreed by the session chair. For the rest the discussion will continue online.

# 2 Contact Information

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# Discussion

The following proposals from [R2-2009803](file:///C:\Data\3GPP\Extracts\R2-2009803_Report%20of%20%5bPost111-e%5d%20%5b911%5d%20%5bNTN%5d%20Connected%20mode%20aspects%20(ZTE).doc) [2] will be discussed in this offline:

* NTN specific CHO execution condition

Proposal 2.3a: location based CHO execution condition should be introduced for both moving cell and fixed cell scenario.

Proposal 2.3b: Timer based CHO execution condition should be introduced for moving cell scenario.

* RACH-less HO and DAPS HO

Proposal 3.1: From RAN2’s perspective, RACH-less HO should be introduced in NTN. An LS should be sent to RAN1 to confirm the feasibility of RACH-less HO in NTN.

Proposal 3.2a: DAPS HO for NTN is de-prioritized in this release.

* UE location report

Proposal 5.1: Permission from UE is needed for the network to collect the UE location information for the purpose other than SON/MDT. If the UE location information is collected for other purpose, the UE consent for SON/MDT cannot be reused and a similar but independent procedure for permission should be considered.

Proposal 5.2: The location information report should be supported in NTN for the purpose other than SON/MDT.

* Location-based measurement event

Proposal 6.1: The Location-based measurement event should be supported in NTN for both moving cell and fixed cell scenario.

Proposal 6.2a: For moving cell scenario, a relative area scope expressed as the distance between UE and satellite or cell center will be configured and measurement report will be triggered when UE moves out of or moves in the area scope configured.

Proposal 6.2b: For fixed cell scenario, an absolute area scope will be configured and measurement report will be triggered when UE moves out of or moves in the area scope configured.

## NTN specific CHO execution condition

The following NTN specific execution conditions for CHO has been studied in the SI phase.

* Condition 1: Location-based execution condition
* Condition 2: Timer based execution condition
* Condition 3: Timing advance based execution condition
* Condition 4: Elevation angle based execution condition

During email discussion [Post111-e][911] [NTN] Connected mode aspects (ZTE)[2], 29 companies showed preference for the above four candidate new execution conditions and the views are summarized in the following table.

|  |  |  |
| --- | --- | --- |
| **CHO execution condition** | **Number of supported companies** | |
| **Moving beam scenario** | **Fixed beam scenario** |
| #1 Location-based | 22 | 23 |
| #2 Timer based | 17 | 13 |
| #3 Timing advance based | 5 | 4 |
| #4 Elevation angle based | 1 | 1 |

The execution conditions with more than 50% support (i.e. with >=15 supported companies) is considered to be preferred by the majority: Location based CHO execution condition for both moving cell and fixed cell scenarios and timer based CHO execution condition for moving cell scenarios.

A proposal is given based on the majority’s preference (22/29 and 23/29): ***Proposal 2.3a: location based CHO execution condition should be introduced for both moving cell and fixed cell scenario.***

**Question 1.1**: do you agree with the above proposal:

|  |  |  |
| --- | --- | --- |
| Answers to Question 1.1 | | |
| Company | Yes/No | Comments  (Suggestions on the wording are also welcome if you agree with this proposal.) |
| CATT | Yes |  |
| Nokia | No | As commented during the online session, the mechanism cannot rely on the location alone. It needs to employ radio measurements as well (RSRP/RSRQ/SINR). So a combined metric can be used.  BTW, we wonder why CHO execution condition for NTN and measurement event triggering for NTN are actually discussed separately, if they in fact relate to the same part of NR measurement framework? |
| Panasonic | Yes |  |
| ericsson | yes | We also agree with Nokia that this is closely related to RRM and these should be discussed together.  Further, we could make in principle agreement to support and then progress towards next meeting to discuss details as well as CRs for supporting the feature. This can be done tgether with RRM part. |
| Sony | Yes |  |
| MediaTek | No | We think existing measurement based CHO approach is sufficient to address NTN connected mode mobility cases. Note that the difference in signal strength between source and target cell is implicitly a function of location and time and therefore would work for LEO deployments as well. Similarly, “Time to trigger” can be adjusted for Earth fixed vs Earth moving beams. |
| Lenovo | Yes | We also support combined CHO execution conditions e.g. location-based AND/OR measurement-based. |
| Spreadtrum |  | Agree with Nokia. We think that a combined metric is needed for both CHO and Measurement report triggering. |
| Xiaomi | Yes | We think the detail of location based CHO execution condition should be clarified. In the proposal, we are not clear how UE trigger CHO based on location. RAN2 should decide whether the CHO execution condition is based on the distance between UE and cell center or the distance between UE and satellite or other options.  If the location only including the cell coverage information, such as the distance between UE and cell center, we think location based CHO may be not feasible. Since the service interruption may occur due to effect of obstacles. For example, if the UE location triggers the CHO, but the RSRP/RSRQ of the target cell can’t satisfy the requiremnts of UE to connect to it due to the obstacles. So, we think the location information should include both cell coverage information and obstacle information. |
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**Conclusion:**

**To be added**

A proposal is given based on the majority’s preference (17/29): ***Proposal 2.3b: Timer based CHO execution condition should be introduced for moving cell scenario.***

**Question 1.2**: do you agree with the proposal?

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| --- | --- | --- |
| Answers to Question 1.2 | | |
| Company | Yes/No | Comments  (Suggestions on the wording are also welcome if you agree with this proposal.) |
| CATT | Yes |  |
| Nokia | No | Timer could be considered, but only in conjunction with the measurement results fulfilling a configured execution criteria. |
| Panasonic | Yes |  |
| Ericsson | unclear | Time or time could be considered but as with location, together with RSRP/RSRQ or even together with location.  The timer/time based trigger is very close to what is discussed in relation to service/feeder link use case. These should be discussed in one place to avoid duplicate or close to duplicate solutions. |
| Sony | yes |  |
| MediaTek | No | We see this idea as an optimization. It would be better to have a baseline working conditions first and consider such optimizations in a future release. Existing measurement based conditions will still work fine without optimization. |
| Lenovo | Yes | We also support combined CHO execution conditions e.g. timer-based AND/OR measurement-based. |
| Spreadtrum | No. | We think that RSRP combined with location metric is enough. |
| Xiaomi | Yes | We think the “Time(r)” can be used instead of “Timer” in proposal to include both Time and Timer based conditions.  Time(r) based CHO execution condition could be helpful for the feeder link switch. For feeder link switch, the location based CHO execution condition may not be available beacuse the satellite that communicates with UEs have not changed.Within the duration of the feeder link switch, many connected mode UEs need to be handed over. So UEs can trigger CHO based on different timers to avoid signalling storm and network congestion. In details, the timer can be configured to UE in a broadcast manner to reduce signalling overhead and UE could scale the timer based on service requirement or randomly.  We also agree with Ericsson that the timer based CHO execution condition and feeder link switch should be discussed in one place. |
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**Conclusion:**

**To be added**

## RACH-less HO and DAPS HO

There has been discussion on whether to support RACH-less HO and DAPS HO in NTN [2].

16 companies see the value in introducing RACH less HO in NTN while13 companies do not see urgent need to support it since 2-step RACH based HO, helpful in reducing the mobility interruption time, will be supported. Some companies show concern that supporting RACH less HO may be challenging in some cases (e.g. inter-satellite handover) and the feasibility should be confirmed by RAN1 first.

A proposal is given based on the majority’s preference (16/29): ***Proposal 3.1: From RAN2’s perspective, RACH-less HO should be introduced in NTN. An LS should be sent to RAN1 to confirm the feasibility of RACH-less HO in NTN.***

**Question 2.1**: do you agree with the proposal?

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| --- | --- | --- |
| Answers to Question 2.1 | | |
| Company | Yes/No | Comments  (Suggestions on the wording are also welcome if you agree with this proposal.) |
| CATT | No | we still doubt the accuracy of the satellite ephemeris for RACH-less HO, anyway 2-step RACH is in the scope, not so urgent now to introduce more optimization in this release. |
| Nokia | No | Agree with CATT. If 2-step RACH is already agreed and pursued then we believe we have no time for yet another solution in the same area. At least not in R17. |
| Panasonic | Yes | We prefer to keep only the first sentence in the proposal, as we are not sure why it is relevant to RAN1 when it comes to the challenge for the inter-satellite handover case. |
| Ericsson | yes | We can ask RAN1 as there is no need to decide now we cannot specify this due to lack of time. |
| Sony | yes |  |
| MediaTek | Yes | With UE-based pre-compensation that needs to be introduced with other user plane aspects, the UE will estimate the required TA for the target gNB. This information can be used to perform RACH-less handovers. |
| Lenovo | Yes |  |
| Spreadtrum | Yes | We have the same doubt on the accuracy of estimation of RTD. But we think it can be used in intra-Satellite handover. |
| Xiaomi | Yes | If the requirement of TA accuracy for RACH-less HO is satisfied, RACH-less HO can be introduced in NTN. |
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13 companies would like to support DAPS in NTN with R16 DAPS mechanism as a baseline while 15 companies are concerned about UE’s capability to simultaneously transmit/receive data from multiple satellites, co-existence of CHO and DAPS, complexity of the DAPS feature as well as impact on other RAN WG groups and would prefer to de-prioritize DAPS for NTN in this release.

A proposal is given based on the majority’s preference(15/28): ***Proposal 3.2a: DAPS HO for NTN is de-prioritized in this release.***

**Question 2.2**: do you agree with the proposal?

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| --- | --- | --- |
| Answers to Question 2.2 | | |
| Company | Yes/No | Comments  (Suggestions on the wording are also welcome if you agree with this proposal.) |
| CATT | Yes | DAPS HO is really beneficial, but for NTN mobility, mobility robustness seems more challenging than service interruption. If we use DAPS HO, that means CHO HO cannot use at the same time, we should focus on key challenge first at this release. |
| Nokia | Yes | Although we agree DAPS could bring benefits to NTN, we think that should not be our primary focus in R17. |
| Panasonic | Yes |  |
| Ericsson | yes | RACHless is a better candidate to use time for. |
| Sony | yes |  |
| MediaTek | No | In the original Email discussion 17 companies were in favour (e.g. “Yes” or “Yes but” or “Nice to have”) for DAPS HO as an optional feature.  We assume that all Rel.16 features are available as a baseline and there is no reason to make NTN-specific restriction in DAPS. |
| Lenovo | Yes |  |
| Spreadtrum | Yes |  |
| Xiaomi | Yes | In R16, DAPS and CHO can not be configured simultaneously. In NTN, CHO is important to reduce the effect of long RTT time. Since it is uncertain whether both DAPS and CHO can co-exist, DAPS HO for NTN should be de-prioritized. |
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## 3.3 UE location report

Whether any permission from UE is needed for the gNB to collect the UE location information for the purpose other than SON/MDT has been discussed via email [2].

29 companies showed preference on this topic. 27 companies agree that permission from UE is needed for the network to collect the UE location information for the purpose other than SON/MDT and the UE consent for SON/MDT cannot be reused if the location information collection is for other purpose, for which a similar but independent procedure for permission should be considered.

1 company consider it to be a SA3 or application layer issue while 1 company is not sure about whether to have such permission with the following consideration that for Aerial height based reporting UE can be configured to report location and it may also be that due to the nature of NTN, reporting location to network is mandatory to support.

A proposal is given based on the majority’s preference (27/29):***Proposal 5.1: Permission from UE is needed for the network to collect the UE location information for the purpose other than SON/MDT. If the UE location information is collected for other purpose, the UE consent for SON/MDT cannot be reused and a similar but independent procedure for permission should be considered.***

**Question 3.1**: do you agree with the above proposal:

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| Answers to Question 3.1 | | |
| Company | Yes/No | Comments  (Suggestions on the wording are also welcome if you agree with this proposal.) |
| CATT | Yes | UE privacy concern should be fixed. |
| Nokia |  | Not sure if this is a RAN2 topic, in fact? We should focus on the fact such reporting shall occur in NTN systems. |
| Panasonic | Yes |  |
| Ericsson | no | It is unclear for us why this SON/MDT related permission is relevant here. |
| Sony | No | Agree with Ericsson and Nokia. |
| MediaTek | Yes | Depending on regional policies, UE’s permission may be required for gNB to collect UE location report. |
| Lenovo | Yes | Collecting UE location info needs an independent permission from UE. |
| Spreadtrum | Yes |  |
| Xiaomi | Yes | UE privacy should be protected. |
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**Conclusion:**

**To be added**

Whether to support UE location report in NTN for purpose other than SON/MDT has also been discussed.

15 companies see the need for UE location report and the location information may be used in the following cases:

* Mobility and service continuity handling
* Measurement configuration
* Registration area management and paging
* Enforce country-specific policies
* Scheduling

14 companies do not see the benefit for UE reporting the location information for purpose other than SON/MDT in NTN and would like not to support it.

A proposal is given based on the majority’s preference (15/29):***Proposal 5.2: The location information report should be supported in NTN for the purpose other than SON/MDT.***

**Question 3.2**: do you agree with the above proposal:

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| --- | --- | --- |
| Answers to Question 3.2 | | |
| Company | Yes/No | Comments  (Suggestions on the wording are also welcome if you agree with this proposal.) |
| CATT | Yes | At least for mobility optimization, UE location report is benefitial. |
| Nokia | Yes |  |
| Panasonic | Yes |  |
| Ericsson | yes |  |
| Sony | Yes |  |
| MediaTek | No |  |
| Lenovo | No | We see no need of UE location info via report. |
| Spreadtrum | No |  |
| Xiaomi | Yes | Location information will be helpful for HO decision and measurement event.  Considering that gNB cannot locate UE through existing schemes, RAN2 should support UE report location information.  But, we think UE will only report location information when NW has received the permission from the UE. |
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## 3.4 Location based measurement event

There has been discussion on the location based measurement and 30 companies has shown preference [2].

27 companies agreed that the Location-based measurement event should be supported in NTN as complementary to pure RSRP/RSRQ based triggering condition for both moving cell and fixed cell scenario.

1 company state that the location based measurement event can only be configured for UE to report location information via measurement report. 1 company prefer to rely on the existing measurement events and prefer not to introduce location based measurement event while 1 company emphasize that location shall not be the only factor used in measurement triggering and the measurement triggering should still primarily based on radio measurements.

A proposal is given based on the majority’s preference (27/30)**: *Proposal 6.1: The Location-based measurement event should be supported in NTN for both moving cell and fixed cell scenario.***

**Question 4.1**: do you agree with the above proposal?

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| --- | --- | --- |
| Answers to Question 4.1 | | |
| Company | Yes/No | Comments  (Suggestions on the wording are also welcome if you agree with this proposal.) |
| CATT | No | At least A4 event is still workable, so we think it’s not so urgent to optimize this feature in the first NTN release. So for RRM purpose, the enhancement is not needed.  As for UE location info reporting, the Location-based measurement event can be considered. |
| Nokia | No | But this is tightly related to the question concerning CHO execution triggering (which is also based on the measurement event), so why is it asked separately?  We believe location-based event could be defined, but only in conjunction with radio measurement-based. Alternatively, the UE could just report its location (as argued by CATT). |
| Panasonic | Yes |  |
| Ericsson | yes | Actually event A4, neighbour becomes better than threshold may not work with same reason that A3 may not work. The RSRP level drops so slowly for an NTN beam.  For this reason a location triggered report should be considered. Whether ins conjunction with RSRP based even or not can be further discussed. |
| Sony | Yes | It’s better to rephase the proposal as “The location-based measurement reporting should be supported in NTN for both moving cell and fixed cell scenario” in order to make it clearer. |
| MediaTek | No | As explained in Question 1.1, measurement based approach can be viewed as a function of location. Thus, we think there is no need of any new measurement event. The existing measurement based CHO approach is sufficient to address NTN connected mode mobility cases. For example, difference in signal strength between source and target cell is implicitly a function of location and time and therefore would work for LEO deployments as well. Similarly, “Time to trigger” can be adjusted for Earth fixed vs Earth moving beams. |
| Lenovo | Yes | We also support combined measurement event e.g. location-based AND/OR measurement-based. |
| Spreadtrum | No | We think that a combined metric is needed instead of single location metric. |
| Xiaomi | Yes | In the earth fixed cell scenario, the speed and direction of UE should also be considered for high speed UE.  Location-based measurement could be combined with measurement based on signal strength, and RAN2 should discuss the ’AND/OR’ association between two measurement event. |
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**Conclusion:**

**To be added**

If location-based measurement event is supported, a measurement report will be triggered when UE moves out of or moves in the area scope configured. Regarding how to configure the area scope, the following alternatives have been discussed via email [2].

* Alt1: A relative area scope, in which case the area scope will change as the movement of satellite.
  + Alt1-1: The area scope is configured as the relative distance between UE and satellite.
  + Alt1-2: The area scope is configured as the relative distance between UE and the center of a cell.
* Alt2: An absolute area scope, in which case the area scope will not change unless new configuration is received.
  + Alt2-1: The area scope can be expressed as single reference location (represented by location coordinates) and a radius associated to the reference location.
  + Alt2-2: A list of location coordinates.
  + Alt2-3: A list of TAI (PLMN + TAC) of TN cells. As shown in Figure 2, a list of TAI of TN cell (e.g. TAI#1 and TAI#3) can be configured to represent the cell edge of the serving NTN cell and UE trigger measurement report when it moves in to this area.

Companies’ preference have been summarized in the following table:

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| --- | --- | --- | --- | --- | --- |
| **Alternatives for configuring the area scope** | | **Number of supported companies** | | | |
| **Moving beam scenario** | | **Fixed beam scenario** | |
| **Alt.1: A relative area scope** | Alt1-1 | 15 | / | 11 | / |
| Alt1-2 | 7 | 5 |
| **Alt.2: An absolute area scope** | Alt2-1 | 11 | 8 | 13 | 10 |
| Alt2-2 | 2 | 3 |
| Alt2-3 | 2 | 2 |
| **Other** | | 5 | | 4 | |

A proposal is given based on the majority’s preference (15/28) for moving cell scenario: ***Proposal 6.2a: For moving cell scenario, a relative area scope expressed as the distance between UE and satellite or cell center will be configured and measurement report will be triggered when UE moves out of or moves in the area scope configured.***

**Question 4.2a**: do you agree with the above proposal?

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| --- | --- | --- |
| Answers to Question 4.2a | | |
| Company | Yes/No | Comments  (Suggestions on the wording is also welcome if you agree with this proposal.) |
| CATT | No | A4 event is still workable, no enhancement is needed at this early release. |
| Nokia | No | This relates to our answer to the previous question. We do not see a need to use such criteria alone for measurement event triggering. |
| Panasonic | Yes |  |
| Ericsson | No | Proposal 6.2a expresses one example of configuring the event entry condition. It is also possible to define the event entry condition with respect to the target cell such that event entry condition is fulfilled when UE steps in the area. Further, in addition to circle, especially for fixed beam case, an elliptic shape might describe the actual area better. The radius, or in case of elliptic shape one or both of the radius may change as the satellite moves/elevation angle changes. |
| Sony | No | We think Alt.2-1 is more reasonable and can be based on UE’s location measurement. |
| MediaTek | No | We don’t see any need to configure location based measurement report. Please see our comment on 4.1 |
| Lenovo | No | We would like a unified solution for moving and fixed cell scenarios. If the area scope is broadcasted periodically or configured intime, an absolute area scope can work for moving cell as well. While for a relative area scope expressed as the distance between UE and satellite or cell center, the UE needs to calculate the distance all the time and thus more power consumption. |
| Spreadtrum | No | We think that a combined metric is needed instead of single location metric. |
| Xiaomi | Yes,but | Since the distance between UE and satellite is same for different cells in intra-satellite mobilty scenario, the area scope expressed as distance between UE and cell center should be considered with first priority. |
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In fixed cell scenario, considering that the number of supported companies for Alt2 is 13, a proposal is also given to see how far we can go: ***Proposal 6.2b: For fixed cell scenario, an absolute area scope will be configured and measurement report will be triggered when UE moves out of or moves in the area scope configured.***

**Question 4.2b**: do you agree with the above proposal?

|  |  |  |
| --- | --- | --- |
| Answers to Question 4.2b | | |
| Company | Yes/No | Comments  (Suggestions on the wording is also welcome if you agree with this proposal.) |
| CATT | No | A4 event is still workable, no enhancement is needed at this early release. |
| Nokia | No | Same as above. |
| Panasonic | Yes |  |
| Ericsson | No | Proposal 4.2a expresses one example of configuring the event entry condition. It is also possible to define the event entry condition with respect to the target cell such that event entry condition is fulfilled when UE steps in the area. Further, in addition to circle, especially for fixed beam case, an elliptic shape might describe the actual area better. The radius, or in case of elliptic shape one or both of the radius may change as the satellite moves/elevation angle changes. |
| Sony | Yes |  |
| MediaTek | No | Please see our comment on 4.1. |
| Lenovo | Yes | Absolute area scope is straight forward and workable. |
| Spreadtrum | No | Same as above. |
| Xiaomi | Alt2-1 | For fixed cell scenario, we prefer Alt2-1. The single reference location can be represented by cell center and the radius can be represented by the distance threshold between UE and the cell center.  For proposal 6.2a and proposal 6.2b, if the area scope is expressed as the distance between UE and cell center, it is not necessary to represent the area scope configurations of moving cell and fixed cell as two proposals.  We think that proposal 6.2a and proposal 6.2b can be expressed as “Proposal 6.2: For fixed and moving cell scenarios, a area scope expressed as the distance between UE and cell center will be configured and measurement report will be triggered when UE moves out of or moves in the area scope configured.” |
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# 4 Conclusion

**TBD**

# 5 References

[1] RAN2-112e - R16 eMIMO-CLI-PRN-RACS - R17 NTN-REDCAP (Sergio)\_2020\_11\_04\_1300.docx

[2] R2-2009803 Report of [Post111-e] [911] [NTN] Connected mode aspects (ZTE) ZTE corporation, Sanechips