3GPP TSG-RAN WG1 Meeting #114e Tdoc R2-2106534

May 19th - 23rd 2021

Agenda: 8.10.3.3

Source: Ericsson

Title: [AT114-e][104][NTN] CHO aspects and service continuity (Ericsson)

Document for: Discussion, Decision

# 1 Introduction

This is continuation of the offline 104 with below instructions

* [AT114-e][104][NTN] CHO aspects and service continuity (Ericsson)

Initial scope: Discuss the proposals from [R2-2106489](file:///C:\Data\3GPP\Extracts\R2-2106489%20%20%5bPre114-e%5d%5b104%5d%5bNTN%5d%20Summary%208.10.3.3%20-%20CHO%20and%20service%20continuity%20(Ericsson).docx)

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

* + - List of proposals for agreement (if any)
    - List of proposals that require online discussions
    - List of proposals that should not be pursued (if any)

Initial deadline (for companies' feedback): Friday 2021-05-21 10:00 UTC

Initial deadline (for rapporteur's summary in [R2-2106526](file:///C:\Data\3GPP\RAN2\Inbox\R2-2106526.zip)): Friday 2021-05-21 14:00 UTC

Final scope: Continue the discussion on p5 (to see whether the proposal to consider a time range can be agreed), p9, p10 and p12

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

* + - List of proposals for agreement (if any)
    - List of proposals to be postponed to the next meeting

Final deadline (for companies' feedback): Wednesday 2021-05-26 1000 UTC

Final deadline (for rapporteur's summary in R2-2106534): Wednesday 2021-05-26 1400

Proposals marked "for agreement" in R2-2106534 not challenged until Thursday 2021-05-27 0600 will be declared as agreed via email by the session chair (for the rest the discussion will continue in the next meeting).

[R2-2106526](file:///C:\Data\3GPP\RAN2\Inbox\R2-2106526.zip) [Offline 104] CHO aspects and service continuity Ericsson discussion Rel-17 NR\_NTN\_solutions-Core

# 2 List of agreements and proposals

Agreements made in RAN2#114 so far

Agreements via email (from offline 104):

1. Support CHO location trigger as the distance between UE and a reference location which may be configured as the serving cell reference location or the candidate target cell reference location. FFS if combination can be allowed.
2. The reference location for the event description is defined as cell center.

Agreements online:

1. For CHO, joint configuration of location and RSRP as well as time and RSRP triggers are supported.
2. For idle mode reselection, based on configuration NTN UE can prioritise TN over NTN. Configuration details FFS

Proposal Conc5 The CHO configuration includes time left to be served in serving cell as well as information when candidate target cell becomes available and when candidate target cell stops serving the area (FFS time range, two timers)

- Oppo suggests to reword as: "The CHO configuration includes time left to be served in serving cell as well as information when candidate target cell becomes available."

- Nokia thinks this does not move us forward, but instead we take several steps backwards, compared to what was already agreed at RAN2#113bis. With this Proposal we again have all options on the table (or even all options already supported and the time-based trigger becomes super complex, requiring at least three timers?). Why can’t we try to keep it simple?

- LGE thinks we should say it is "FFS whether the CHO configuration includes timing information when the candidate cell stops serving the area"

* Continue online

Note: R2#113bis-e agreement: "Timing information in CHO execution triggering for NTN describes the time after which the UE is allowed to execute CHO to the candidate target cell"

- VC wonders if we can extend the R2#113bis-e agreement saying that the "Timing information in CHO execution triggering for NTN describes the time range ~~after~~ during which the UE is allowed to execute CHO to the candidate target cell".

- Apple/Nokia support the time range proposal and we can link this to entry or leave conditions

- Ericsson thinks the end time in this case would have two meanings.

* Continue offline to see whether the proposal to consider a time range can be agreed

Proposal Conc10 RAN2 does not discuss further support of joint time and location trigger

- CATT disagrees as location based would be applicable for UE-moving switch and time based for satellite moving switch.

- Samsung disagrees

* Continue online
* Continue the discussion offline

Proposal Conc12 No limitations are specified for NTN-TN mobility thus same trigger conditions can be used within NTN and NTN-TN mobility. FFS for enhancements.

- Xiaomi thinks it is not clear whether “NTN-TN” means “from NTN to TN (hand-in)”or “from NTN to TN (hand-in) and from TN to NTN (hand-out)”.

* Continue offline

Proposal Conc9 RAN2 to discuss whether RAN2 declines the options that the network configures location or time CHO trigger without measurement trigger

* Continue offline

### 2.1 CHO time trigger definition

Related agreement from RAN2#113bis:

Agreements:

1. Timing information in CHO execution triggering for NTN describes the time after which the UE is allowed to execute CHO to the candidate target cell.

2. Working assumption: the timing information for CHO execution triggering in NTN is defined in the form of a timer/timers. This can be revised and a solution based on UTC/system frame number can be considered if problems are found (e.g. if the timer lacks accuracy due to RTT in NTN).

Discussion from RAN2#114

Proposal Conc5 The CHO configuration includes time left to be served in serving cell as well as information when candidate target cell becomes available and when candidate target cell stops serving the area (FFS time range, two timers)

- Oppo suggests to reword as: "The CHO configuration includes time left to be served in serving cell as well as information when candidate target cell becomes available."

- Nokia thinks this does not move us forward, but instead we take several steps backwards, compared to what was already agreed at RAN2#113bis. With this Proposal we again have all options on the table (or even all options already supported and the time-based trigger becomes super complex, requiring at least three timers?). Why can’t we try to keep it simple?

- LGE thinks we should say it is "FFS whether the CHO configuration includes timing information when the candidate cell stops serving the area"

* Continue online

Note: R2#113bis-e agreement: "Timing information in CHO execution triggering for NTN describes the time after which the UE is allowed to execute CHO to the candidate target cell"

- VC wonders if we can extend the R2#113bis-e agreement saying that the "Timing information in CHO execution triggering for NTN describes the time range ~~after~~ during which the UE is allowed to execute CHO to the candidate target cell".

- Apple/Nokia support the time range proposal and we can link this to entry or leave conditions

- Ericsson thinks the end time in this case would have two meanings.

* Continue offline to see whether the proposal to consider a time range can be agreed

Discussion in the online was about the definition of the second end of the “range”. It is possible to define it as the time when UE latest needs to perform the handover. As use case this means that the time is then related to time left to be served in serving cell in a feeder link switch scenario. Another possible definition is that it marks the time after which the CHO command for that candidate target cell is no longer valid. That is, it would be the time when the candidate target cell remains available. As this offline is one shot attempt to make an email agreement and there was last round more support to have this time related to the end time of serving cell, this definition is attempted to be agreed.

1. RAN2 to agree that CHO includes timing information when UE latest needs to perform CHO. Note this is in addition to already agreed information on when a candidate target cell becomes available.

**Question 1 Please comment here only if Proposal 1 cannot be agreed in your view.**

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| --- | --- | --- |
| **Company** | **Operation** | **UE information** |
| Huawei, HiSilicon | P1 is not exactly the same as Proposal Conc5. Do we need to discuss Proposal Conc5 instead?  We think the time when candidate target cell stops serving the area is not equal to the time when UE latest needs to perform CHO. It is just the end time of candidate cell, i.e. it provides the time information when the candidate target cell remains available. In our view, when multiple candidate cells fulfil the CHO trigger, UE may select the candidate target cell with the longest remaining serving time. | For Proposal Conc5, it’s not reasonable to provide all these time information in CHO configuration, as it needs network to know UE location. And considering the moving cell case, there is also transmission delay for UE location report. We think all these time information should be calculated in UE side, and network only provide assistance information. So we suggest to modify the wording of P5 as “~~The CHO configuration includes~~ time left to be served in serving cell as well as information when candidate target cell becomes available and when candidate target cell stops serving the area (FFS time range, two timers) are considered as CHO triggers” |
| Nokia | We do not think it needs to be debated whether the timer(s) are related to source cell coverage, etc. CHO is a connected mode procedure, where the UE may be given by the NW (source cell) a time window [t1, t2]. t1 (already agreed last meeting) denotes the time after which the candidate target becomes available (provided other conditions – RSRP/RSRQ – are met or should be met during that window. This can remain FFS). t2 denotes the end of the window, within which the UE should execute the CHO to that candidate cell. The UE shall not assume anything about the source cell’s coverage, e.g. whether it could be available after the expiry of t2. The UE can be given multiple CHO configurations for different CHO candidates, each equipped with such [t1, t2] window. |  |
| Thales | Such timing information probably corresponds to the time when the source cell will no longer be available | What about the following wording “**RAN2 to agree that CHO includes timing information when at latest UE ~~latest~~ needs to perform CHO.** ” |
| Samsung | We agree with Thales. Additionally, we think we need at least two times: (i) The earliest time the UE can execute CHO (to enable the gNB to distribute random access and RRC signaling load) and (ii) the latest time before which the UE can execute a CHO. For time (ii), we should have some margin between the true end time of the serving cell for quasi-Earth-fixed cell and the CHO execution instant so that the HO signaling between the UE and the current serving cell can be reliably completed. We would likely need maximum serving time for Earth-moving cells. We need some kind of “fallback handover” cell because handover must be performed even if no triggers are satisfied, because the serving cell would no longer be available and the place of the currently serving cell would be taken by “fallback handover cell.” These times are also needed for the feeder link switch for quasi-Earth-fixed beams and Earth-moving beams. | Edited (simplified with clarification) version of Proposal 1.  RAN2 to agree that CHO includes the latest time by which the UE needs to initiate the CHO execution. Note that this time is in addition to the already agreed information on when a candidate target cell becomes available for a given UE. |
| Intel | We are ok with the proposal 1 assuming that the other time is until when UE needs to perform CHO. We share the view explained by Nokia on the potential range [t1, t2] to be provided by the network (with its corresponding explanation as provided above).  We also share the view explained by Huawei that the time information could be given as assistance information for UE to consider for CHO triggers. |  |
| Apple | We are more inclined towards the Nokia view. The first timer provides the earliest time at which the UE can execute the CHO and second timer the latest time before which the CHO needs to be executed. This helps as an assistance beyond the current measurement configurations (of RSRP/RSRQ). As an added bonus, from the network perspective, these timers can be adjusted during configuration to ensure that handover load can be spread out in time in a reasonable and manageable way. |  |
| ZTE | We share similar understanding with Nokia that UE can simply be given a time window[t1, t2].   * t1 (already agreed last meeting) denotes the time after which the candidate target becomes available. * t2 denotes the end of the window, within which the UE should execute the CHO to that candidate cell.   There is no need to define whether t2 is cell expire time or not. NW can configure a t2 which is earlier than the exact cell expire time to distribute UE among cells with overlapped coverage. | We understand the chair’s suggested wording would be the clearest for this proposal:  **Timing information in CHO execution triggering for NTN describes the time range during which the UE is allowed to execute CHO to the candidate target cell** |
| OPPO | We agree that a time window [t1,t2] should be included in the CHO configuration for each candidate cell, where t1 should be no earlier than the time point when a candidate cell becomes available and t2 should be no later than the time point when the serving cell stops serving the area. The UE should execute CHO to a candidate cell during the time window corresponding to the candidate cell if other conditions, e.g., RSRP/RSRQ measurement are fulfilled. |  |
| Xiaomi | We agree with Nokia and ZTE. | We also prefer the chair’s suggested wording.  **“Timing information in CHO execution triggering for NTN describes the time range during which the UE is allowed to execute CHO to the candidate target cell”** |
| ITRI | We think the “range” given by the network represents a time window [*t1*, *t2*], where *t1* indicates the time for UE to start CHO condition evaluation and *t2* relates to the time the source cell would stop serving the area. | After *t1*, UE would initiate CHO evaluation.  After *t2* the UE should no longer apply CHO trigger events based on the RSRP/RSRQ of the source cell. |

### 2.2 Joint configurations

Proposal Conc10 RAN2 does not discuss further support of joint time and location trigger

- CATT disagrees as location based would be applicable for UE-moving switch and time based for satellite moving switch.

- Samsung disagrees

* Continue online
* Continue the discussion offline

Proposal Conc9 RAN2 to discuss whether RAN2 declines the options that the network configures location or time CHO trigger without measurement trigger

* Continue offline

Both of the above are basically about whether there is a specified network restriction to not allow certain events to be configured for same candidate target cell, or to specify a network restriction to mandate certain combination to be configured. Thus far the discussion has been about whether companies see a certain combination or induvial operation as useful or not. As it is quite hard to predict how the real deployment works and what will be feasible in certain situations, it is better to allow flexibility unless it comes with disadvantageous tradeoff like specification complexity, UE implementation issue etc. Here neither of these seem to be the case and allowing an option in the specification does not seem cause issues for deployments where only certain combinations are predicted to be used. Thus, it is proposed that RAN2 does not specify network restrictions on joint of individual configuration of CHO events.

1. RAN2 does not specify network restrictions on joint of individual configuration of CHO events.

**Question 2 Please comment here only if Proposal 2 cannot be agreed in your view.**

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| **Company** | **Operation** | **UE information** |
| Nokia | The full configuration flexibility is not always a desired outcome. Please beware that each of such combinations would have to be tested and corresponding requirements would have to be developed by RAN4/RAN5 colleagues. Thus, unless there is a good use case and credible justification, we should limit the number of supported combinations. We do not think a combination of time and location is needed, as whether the UE has moved significantly can be also derived from RSRP/RSRQ measurements, used in combination with either time or location. |  |
| Thales | Probably no need to support all combination of triggers simultaneously.  So 2 options should be sufficient for Rel-17: RSRP & time based or RSRP & location based |  |
| Samsung | We agree with Proposal 2 but would like to increase awareness about this issue on why this proposal is needed.  Consider the case of a quasi-Earth-fixed beam/cell or an Earth-moving cell/beam. Scenario 1. When a UE moves from one cell to another, such handover can benefit from (RSRP+location) trigger.  Scenario 2. When a stationary UE experiences an incoming cell due to the movement of the NTN cell, (RSRP+time) trigger is useful.  Since both scenarios are practical and will occur in practice, we should support both.  We understand the concern of contributors regarding “too many triggers.” We can short-list most useful trigger combinations and efficiently indicate them in RRC signaling. |  |
| Intel | We think that UE does not need to meet time or location triggers both at the same time. Therefore, if both criteria are configured, the UE only needs to meet one of them i.e. (time+RSRP) or (location+RSRP). |  |
| Apple | We agree with the others that the UE does not need assistance in the form of both time and location. One of the two with a RF based measurement configuration is sufficient in our view. Joint triggers are an optimization beyond baseline. |  |
| ZTE | * We understand one potential use case for having location and time based trigger together is the case that CHO is performed when UE moves farther than a distance threshold to the serving cell center and it is now within the valid time range of a candidate target cell. * So we actually prefer the CHO signaling to be flexible enough to support any combined conditions or standalone condition, it is left to network implementation to configure timer/location/radio condition alone or in combination. * In this case, we do not need to spend a lot of time discussing which standalone configuration or which combination is allowed and which is not allowed. * And this is the first release of NTN, it is really hard to say which combination would be more useful than the others as our experience for TN may not be fully applicable here.   In summary, we support this proposal. |  |
| OPPO | Firstly, we understand the intention of both location-based and time-based trigger is to mitigate the accuracy issue of RSRP/RSRQ measurement, so one of the two is sufficient for CHO triggering, we don’t need to support combination of these two triggers.  Secondly, neither of location-based and time-based trigger could reliably reflect the radio condition. If CHO execution is based on location/time-based trigger only, it may cause some performance issue, e.g. CHO failure. For better performance, we think location/time-based trigger should be always configured together with RSRP/RSRQ-based trigger. |  |
| Xiaomi | We support Proposal 2.  We share same views with ZTE. We also prefer a flexible framework for CHO configuration. All options including standalone triggering event and trigger combinations can be allowed. How to configure these options to UE can be left to network implementation. |  |
| ITRI | We share the same view with others. If no specific issue is identified, we think the two joint configuration (i.e., time+RSRP or location+RSRP) should be sufficient for Rel-17. Enhancements could be discussed in the following release. |  |
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Proposal Conc12 No limitations are specified for NTN-TN mobility thus same trigger conditions can be used within NTN and NTN-TN mobility. FFS for enhancements.

- Xiaomi thinks it is not clear whether “NTN-TN” means “from NTN to TN (hand-in)”or “from NTN to TN (hand-in) and from TN to NTN (hand-out)”.

* Continue offline

Here, the confusion was possibly only on the meaning of NTN-TN. Thus, clarified proposal is attempted to be agreed.

1. Same CHO trigger conditions and RRM events can be used within NTN and NTN-TN mobility provided these are supported by the UE. NTN-TN means both “from NTN to TN (hand-in)”or “from NTN to TN (hand-in) and from TN to NTN (hand-out). FFS for enhancements.

**Question 3 Please comment here only if Proposal 3 cannot be agreed in your view.**

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| **Company** | **option** | **comment** |
| Nokia | We just want to underline that with P3 we decide that e.g. location- or timing-based events will be used for the NTN->TN mobility and as a consequence e.g. the TN cell would have to also provide a reference location, etc.  It may be OK to agree P3, with the FFS in the end which indicates the details of each HO scenario would have to be studied (hopefully the time in Rel-17 allows) before making any related specification changes. |  |
| Thales | Agree provided that the following trigger combinations are possible:  RSRP  RSRP & time  RSRP & location | Hand-out: Trigger is probably TN serving cell’s RSRP below threshold and no available TN’s neighbouring cells corresponding to TN not available anymore  Hand-in: It can benefit from a combined Trigger based on RSRP & location |
| Samsung | We agree with Proposal 3.  We need to discuss this important issue in detail and address prioritization to meet NTN service provider’s prioritization requirements (e.g., TN prioritized or NTN prioritized per business objectives). We will also need to have different triggers for same network type handover and different network type handover by separating the triggers for (i) handover to TN neighbor cells and (ii) handover to NTN neighbor cells, because the thresholds would be different while doing a handover to a TN neighbor vs. an NTN neighbor.  There is some redundancy in the proposal text. So, we have cleaned it up in the next column. | Proposal 3 Same CHO trigger conditions and RRM events can be used within NTN and NTN-TN mobility provided these are supported by the UE. NTN-TN means both “from NTN to TN (hand-in) and “from TN to NTN” (hand-out). FFS for enhancements. |
| Intel | We understand that there are 2 possible approaches in proposal 3/Question 3:   * Approach 1) trigger/events are only applicable to mobility from NTN to TN (hand-in) * Approach 2) trigger/events are applicable to mobility “from NTN to TN (hand-in)” and “from TN to NTN (hand-out)”.   As baseline we can agree that it is applicable to all the scenarios (as per approach 2) but companies can still come back if concerns are found to apply NTN specific criteria/events to the mobility scenarios to/from TN. |  |
| Apple | Agree with Nokia. We can start as baseline and revisit this in case any additional issues are identified. We agree with P3. |  |
| OPPO | We agree with P3. |  |
| Xiaomi | We support same CHO trigger conditions and RRM events can be used within NTN and mobility from NTN to TN (hand-in).  For mobility from TN to NTN (hand-out), legacy procedures is enough. | Because the size of TN cell is much smaller than that of the NTN cell, TN system can select a suitable target NTN cell based on legacy procedures and network implementation for the connected mode mobility from TN to NTN (hand-out).  (For example, based on the location of the serving TN cell, TN system can know which NTN cell can provide radio coverage to the coverage area of the TN cell.)  So no enhancements are needed for connected mode mobility from TN to NTN (hand-out).  If location/time based CHO triggering event is used in mobility from TN to NTN (hand-out), UE need to evaluate its position and time information, which may increase power consumption, and the TN system need extra enhancements for these new CHO trigger conditions, which is not essential. |
| ITRI | Agree that the same CHO trigger conditions and RRM events can be used within NTN and NTN-to-TN mobility.  However, for TN-to-NTN mobility the legacy measurement based CHO trigger condition can apply. |  |
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# 5 References

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