**3GPP TSG-RAN WG2 Meeting #121bis-edraft R2-2304248**

Electronic, 17th – 26th April, 2023

Agenda Item: 7.7.4.2

Source: Ericsson

Title: Report of [AT121bis-e][108][NR NTN Enh] Common (C)HO configuration (Ericsson)

Document for: Discussion, Decision

# Introduction

This document records the discussion and outcome for the following offline discussion.

* ****[AT121bis-e][108][NR NTN Enh] Common (C)HO configuration (Ericsson)****

Initial scope: Continue the discussion on potential pros and cons of a broadcast common (C)HO configuration

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)

Deadline for companies' feedback: Monday 2023-04-24 12:00 UTC

Deadline for rapporteur's summary (in R2-2304248): Monday 2023-04-24 18:00 UTC

Proposals marked "for agreement" in R2-2304248 not challenged until Tuesday 2023-04-25 08:00 UTC will be declared as agreed via email by the session chair (for the rest the discussion might continue online in the Tuesday CB session).

Rapporteur encourages the participating delegates to provide their contact information in this table.

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| Company | Name | Email Address |
| Ericsson | Ignacio Pascual | Ignacio.pascual.pelayo@ericsson.com |
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# Discussion

## Background

In both MEO and LEO deployments, mobility connected mode is expected to be heavily impacted by rapid satellite movements. The total number of handovers per second will likely be very high and cause a significant signalling load in the network. A possible solution to the signalling overhead problem is to provide in advance the common target cell configuration via broadcast (e.g., system information) given the following conditions specific to NTN:

* Most information provided to each UE in the (C)HO command describing target cell configuration is identical for all UEs accessing the same target cell.
* Most handovers are predictable in NTN because these occur due to the movement of cells and at regular intervals. Most of UEs in the source cell will perform handover to the same target cell. Only UEs moving closer to the cell border may need to perform handover to a different target cell.
* Certain target cell configurations such as C-RNTI or security keys need to be sent in a dedicated manner to each UE.
* From a deployment perspective, during service link switch in a quasi-Earth fixed cell or a feeder link switch in an Earth-moving cell, it can be assumed that the source cell and the target cell will be configured almost identically.

During RAN2#121, the following was agreed:

* Continue in the next meeting, to show the possible signalling gain of the proposal to have some common (C)HO configuration. FFS the number of cells that could be signalled. FFS whether broadcast or groupcast signalling could be used.

The objective of this offline is to evaluate the possible signalling gains of common signalling. Note that group-based handover proposals are to be treated separately.

## Analysis *ServingCellConfigCommon*

As noted by several companies, the IE, which is part of the *RRCReconfiguration* message with *ReconfigurationWithSync*, is used to configure cell specific parameters of a UE's serving cell and could be broadcasted to all UEs to reduce handover signalling overhead. [1] propose other parameters such as t304.

The major benefit, as noted by several companies [2,3,4,5,6,7,8], is that the use of common signalling can reduce the overhead to repeat the same configurations upon frequent and predictable handover. In addition, [9] argues that this new mechanism gives flexibility to the network to finally decide whether using unicast or broadcast common (C)HO configuration depending on the situation. [2] mentions that the reduced handover command size also helps to improve the success rate of reception of *RRCReconfiguration* message.

As expressed by other companies [9,10,11,12], the principal drawbacks or issues with this solution are:

* **Support of delta signalling**. [12] clarifies that the existing handover mechanism already allows delta configuration. Given the conditions presented in the background, this existing mechanism would result in a very reduced handover message. Thus, the gains are very limited. [13] wonders if this is possible.
* **Increased overhead due to frequent transmission.** Broadcasting in system information consumes radio resources and power for both network and UEs. Sending handover configuration via broadcast may not really reduce the overall signalling if it is transmitted too frequently. [14] notes that the frequency of broadcast may negatively impact UEs in the serving cell.
* **Issues with maximum SIB size** [4,12].Depending on the information that needs to be broadcast and the number of neighbour cells that should be included, there might be limitations with SIB’s transport block maximum size.
* **Minimal reduction of overhead**. [1] shows a technical analysis with field data (taken from a fullConfig intra-frequency handover). The size of *ServingCellConfigCommon* is around 500 bits, the size of the whole *RRCReconfiguration* message is around 500 bytes. The potential signalling saving amounts to only 12,5% of the message, 500 bits per UE, the remaining 440 bytes need to be sent via a dedicated *RRCReconfiguration* message. The case of handover using *fullConfig* shows the maximum possible savings. If delta configuration is taken into consideration, any potential savings are sharply reduced.
* **Exception procedure handling**. [12] wonders how a UE behaves when it does not receive the common configuration successfully and how network can ensure that the UE has read the common configuration in SIB.

## Way forward

**Q1) Do you agree that potential gain of providing common target cell configuration in the source cell does not offset the increased complexity and signaling for network and UEs?**

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| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes | From the overhead analysis, it is clear to us that gains are minimal. |
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**Q2) If the answer to Q1 is No, please explain how you would address the drawbacks presented in section 2.2 and why and which the benefits offset those drawbacks.**

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| **Company** | **Comments** |
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**Q3) If the answer to Q1 is No, should this enhancement be supported for:**

1. **Earth-moving cells,**
2. **quasi-Earth fixed cells,**
3. **or both?**

**Write in the comments how many neighbor cells should be included in SIB.**

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| **Company** | **A/B/C** | **Comments** |
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# Conclusions

**For agreement:**

**For discussion:**

# References

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2. R2-2303141, Consideration on HO enhancements in NTN, ZTE corporation, Sanechips, RAN2#121bis-e, April 2023.
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4. R2-2303768, Discussion on NTN Handover Enhancements, Samsung, RAN2#121bis-e, April 2023.
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6. R2-2303327, On handover enhancement for signalling overhead reduction in NR NTN, vivo, RAN2#121bis-e, April 2023.
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12. R2-2303099, Discussion on NTN handover enhancements, Huawei, HiSilicon, Turkcell, RAN2#121bis-e, April 2023.
13. R2-2303417, Signaling optimization on common HO configuration, Apple, RAN2#121bis-e, April 2023.
14. R2-2302697, Discussion on NTN 2-step handover, Intel, RAN2#121bis-e, April 2023.