**3GPP TSG-RAN WG2 Meeting #109 electronic R2-200xxxx**

**Elbonia, 24 Feb – 6 Mar 2020**

**Agenda item: 6.9.3.6**

**Source: Intel Corporation**

**Title: Report of [AT109e][212][MOB] CHO configuration and execution details (Intel)**

**Document for: Discussion and Decision**

# Introduction

This is the email discussion report on below email discussion:

* [AT109e][212][MOB] CHO configuration and execution details (Intel)

Scope:

* + - Agreeing on the proposals as per [R2-2002040](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109_e/Docs/R2-2002040.zip).
    - Discuss open items as per [R2-2002040](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109_e/Docs/R2-2002040.zip) to seek companies feedback on open issues of CP for CHO.

Intended outcome:

* + - Proposals with consensus that can be incorporated (if needed) in the running CR(s) (aim to agree to those over email)
    - List of remaining open issues that need to be pursued in next meeting (if any).
    - Issues that should no longer be pursued

Deadline for providing comments and for rappporteur inputs:

* + - Companies input: Thursday, Feb. 27th 3:00 CET
    - Rapporteur proposals: Friday, Feb. 28th 12:00 CET
    - Comments on proposals: Monday March 2nd by 17:00 CET

# Discussion

### 2.1 Agreements proposed to be agreed in this meeting (from all sub-topics)

As proposed in [38], below proposal is considered as easy agreement.

**Proposal S4\_1::**The UE shall autonomously remove measObject(s) only associated to CHO upon suspend/release, CHO/HO execution and re-establishment;

**Question 1: Do companies agree the proposal S4\_1 listed above? If no, pls indicate your reason.**

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| **Company** | **Yes/No** | **Remark** |
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### 2.2 Open items proposed to be further discussed in this meeting (from all sub-topics)

**DISC S1\_1:**For “and” condition, further discussion on which option should be selected, Option A, B, C, D or E.

Option A: event 1 still satisfy entry condition after its TTT expires when event 2 TTT expires.

* This option has the most companies support during email discussion. However, there are no contribution submission in this meeting.

Option B: consider event satisfies entry condition during TTT as fulfilled and consider event not satisfies entry condition during TTT as not fulfilled. Only both events fulfilled starts CHO.

* This option is in the email discussion and have some support. However, there are no contribution submission in this meeting.

Option C: Similar to Option B, but “not fulfilled” is determined based on leaving condition instead of entry condition; [1] [7];

* Supporting companies: Ericsson, Intel

Option D: based on single TTT. “Not fulfilled” similar to C. The second event satisfy entry condition to start single TTT [5]

* Supporting company: futureWei
* This is also same as original Ericsson proposal in the email discussion

Option E [20]: CHO is executed when both events fulfil its entry condition for corresponding TTTs preceding the time of triggering CHO execution.

* Samsung

**Question 2: For “and” condition, which option should be selected, Option A, B, C, D or E.?**

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| **Company** | **A, B, C, D, E?** | **Remark** |
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**DISC S1\_2:**Further discussion on whether different measurement object in A3+A5 combination is supported or not.

**Issue 2: [1] raised for A3/A5 combination, whether original agreements “same RS type” for multiple trigger events is still valid or not, in addition whether different measurement Object is allowed.**

* Is different RS type in A3+A5 combination supported?
* Is different measurement object in A3+A5 combination supported?

Contribution [1] indicated that whether different measurement objects are allowed to be configured with CHO has not been discussed before. For same/different RS type, RAN2 have spent lots of time on this. It would be good not revise agreement unless it is necessary. It would be good to only have further discussion on measObject.

**Question 3: Should different measurement object be supported or not in A3+A5 combination?**

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| **Company** | **Yes/No** | **Remark** |
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**DISC S2\_1:**To discuss whether the UE shall stop the evaluating the execution condition during legacy HO/CHO. Or the UE shall not apply CHO configuration when a new execution condition is met during HO/CHO;

**CHO execution condition is not fulfilled when T304 is running:**

* Supporting companies: **LG**

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| In contribution [32], According to the previous agreement, the network can send the HO command after sending CHO configuration. However, in our view, there is a leak point in the stage-3 running CR in that the CHO can be triggered while performing the HO [3].  The reason why the UE faces a situation that the CHO execution condition is met while performing the HO is due to the time difference between receiving the HO command and detaching the source cell. Because of the time difference, the UE can monitor candidate cells until the source cell configuration is replaced by the target cell configuration.  Then, according to the current Running CR, the CHO monitoring procedure leads to the CHO execution procedure regardless of whether the HO is performed.  To avoid unexpected UE behavior, we propose to mandate UE behaivor in this case. There may be various ways to mandate UE behavior, but we think the most proper and simple way is to mandate the UE not to perform CHO while performing HO. It can be achieved by specifying the UE to perform CHO only when the T304 is not running. |

The relevant agreements are:

*Agreement 1: 3 If UE receives conventional handover command, it will execute the handover command regardless of stored (configured) conditional handover command. This applies if the HO cmd is received before any CHO triggering condition is satisfied.*

*Agreement 2“UE is not required to continue evaluating the triggering condition of other candidate cell(s) during CHO execution”.*

So far, agreement 2 is UE implementation, i.e. the UE may still continue the evaluating the execution condition when T304 is running (i.e. during legacy HO or CHO). To address the issue raised by LG:

**Option 1**: change agreement 2 to ““UE shall stop evaluating the triggering condition of other candidate cell(s) during CHO/HO execution”..

* We still need to capture it in the specification.

**If not:**

**Option 2** [32]: the UE shall not apply CHO configuration when a new execution condition is met during HO/CHO.

Ask RAN2 to discuss whether the UE shall stop the evaluating the execution condition during legacy HO/CHO. Or the UE shall not apply CHO configuration when a new execution condition is met during HO/CHO. .

**Question 4: Shall the UE stop the evaluating the execution condition during legacy HO/CHO,i.e. option 1? Or shall the UE not apply CHO configuration when a new execution condition is met during HO/CHO, i.e. option 2?**

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| **Company** | **Option 1 or 2?** | **Remark** |
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**DISC S3\_2:** to discuss whether the cho-ExecutionCond is also OPTIONAL, Need S?

**Yes [1] Ericsson**

The issue was not discussed in the email discussion 108#66. It would be good to confirm in RAN2.

**Question 5: Shall the cho-ExecutionCond also be OPTIONAL, Need S?**

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| **Company** | **Yes/No** | **Remark** |
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**DISC S3\_3:** should we allow CHO configuration without cho-ExecutionCond?

The issue is raised in [3]. Company wants to have CHO candidate cell only for failure handling instead of normal CHO.

* Supporting company: vivo

**Question 6: should we allow CHO configuration without cho-ExecutionCond?**

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| **Company** | **Yes/No** | **Remark** |
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**DISC S5\_1:** to discuss whether CHO (MCG) can work together with MR-DC, i.e. receive CHO when MR-DC is configured, and receive SCG addition WHEN CHO condition is configured;

Two cases are raised in contribution [2]:

* Case 1) UE operating in MR-DC receives a CHO configuration (from MN, so this is not about PSCell change, but about handover);
* Case 2) UE monitoring CHO conditions is configured to start operating in MR-DC (e.g. SCG addition).
* Supporting company: Ericsson

The question is whether these two cases are allowed or not. **If yes, to avoid RAN3 impact, the UE shall autonomously release MR-DC upon execution of CHO.** It would be good to discuss this in the meeting.

**Question 7: Can CHO (MCG) work together with MR-DC, i.e. receive CHO when MR-DC is configured, and receive SCG addition WHEN CHO condition is configured;?**

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| **Company** | **Yes/No** | **Remark** |
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**DISC S5\_2:**To discuss whether CHO (MCG) configuration can contain SCG configuration or not; If yes, we need to clarify only Pcell can be candidate cell.

**Question 8: Can CHO (MCG) configuration contain SCG configuration or not?; If yes, do you agree that we need to clarify only Pcell can be candidate cell?**

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| **Company** | **Yes/No** | **Remark** |
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### 2.3 Rel-16 Mob can work without these optimization, and proposed not be treated in this meeting

In [38], some issues are considered as non-essential issues, and suggested not treated in this meeting. But it would be good to take this chance to check companies’ view since anyway we have email discussion on open issues.

**Optimization S16\_1:**Discuss whether signalling optimization on legacy HO command is needed or not based on the solution if the network wants to trigger a conventional handover to one of the configured CHO candidate cells, one target cell indication (e.g. candidate cell index) can be included in the conventional HO command to trigger the ~~CHO execution~~normal handover of the indicated candidate cell. **[13][20]**

* **Supporting companies: ZTE, Saumsung:**

**Question 9: Is the solution described above needed? i.e. if the network wants to trigger a conventional handover to one of the configured CHO candidate cells, a target cell indication (e.g. candidate cell index) can be included in the conventional HO command to trigger the normal handover of the indicated candidate cell.?**

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| **Company** | **Yes/No** | **Remark** |
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**Optimization S16\_2:**Discuss whether CHO execution condition is defined based on the existing measID+additional a3-Offset or a5-Threshold in CHO-ExecutionCond, i.e. we do not need to introduce cho-trigger event in reportConfig.

**to reduce the overhead on measurement configuration, the network can configure the existing measID with additional a3-Offset or a5-Threshold as the CHO execution condition in the RRCReconfiguration/RRCConnectionReconfiguration message, for instance:[14]**

* **Supporting company: ZTE**

CHO-ExecutionCond-r16 ::= SEQUENCE {

measID MeasID,

a3-Offset MeasTriggerQuantityOffset, OPTIONAL, -- Need R

a5-Threshold1 MeasTriggerQuantity, OPTIONAL, -- Need R

a5-Threshold2 MeasTriggerQuantity, OPTIONAL, -- Need R

...

}

-- TAG-CHO-CONFIGTOADDMODLIST-STOP

-- ASN1STOP

**Question 10: Is the solution described above needed? that is CHO execution condition is defined based on the existing measID+additional a3-Offset or a5-Threshold in CHO-ExecutionCond, i.e. we do not need to introduce cho-trigger event in reportConfig?**

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| **Company** | **Yes/No** | **Remark** |
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**Optimization S16\_3:**Discuss whether multiple CHO execution condition (using or) of a single candidate cell is allowed.

**Allow configuring multiple CHO execution conditions (using “or”) of a single candidate cell. [14]**

* **Supporting company: ZTE:**

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| ***[14] Although the current signaling structure allows to configure multiple CHO candidates with the same CHO container but different execution conditions (i.e. actually triggering CHO execution of the same candidate cell under different execution conditions), the redundant CHO container configuration shall largely increase signaling overhead. Thus, we think it’s better to allow configuring multiple triggering conditions (using “or”) linked with a single candidate cell (i.e. a single CHO container). Besides, based on proposal 1, it’s easy to configure multiple execution conditions for a single candidate cell by just configuring different threshold/offset values with the same measID.*** |

**Question 11: Is the network allowed to configuring multiple CHO execution conditions (using “or”) of a single candidate cell?**

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| **Company** | **Yes/No** | **Remark** |
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**Optimization S16\_4:**Discuss whether introduce measurements results (including beam level results) in HO complete message.

**measurement results (including beam leavel) in HO complete message. [23]**

* **Ericsson**

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| ***[23] One way to mitigate that could be to include measurements in an RRCReconfigurationComplete transmitted from the UE to the target upon CHO execution, so the target has a chance to immediately re-configure the UE’s e.g. by adding and/or removing and/or activating/deactivating SCell(s).*** |

**Question 12: Is it needed to contain the measurement results (including beam level results) in HO complete message?**

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| **Company** | **Yes/No** | **Remark** |
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**Optimization S16\_5:**Discuss whether an RRCReject is allowed in response to an RRCReconfigurationComplete upon CHO execution.

**Reject CHO for load reason or race condition [23]**

* **Supporting company: Ericsson**

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| ***[23] The main purpose of that was to minimize signalling in overload situations where the target decides to release its allocate resources for CHO. It is indeed possible that a target candidate accepts an incoming UE for CHO and after some time decides not to accept. It may also happen that while the target tries to cancel a CHO, the UE fulfils an execution condition and tries to access that same target.***  ***Observation 1 Upon CHO execution, UE may try to access target that is trying to cancel the procedure e.g. due to overload.***  ***One simple solution for that could be if the target simply responds an RRCReconfigurationComplete upon CHO execution with an RRCReject.*** |

**Question 13: Upon CHO execution, Is it allowed that the network sends RRCReject message in resonse to an RRCReconfigurationComplete message?**

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| **Company** | **Yes/No** | **Remark** |
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**Optimization S16\_6:**Discuss whether add serving radio link status information in measurement report.

**extending the measurement report with serving radio link status information [28]**

* **Supporting company: Nokia**

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| ***[28]*** To mitigate the risk described in the preceding subsection, measurement reports may contain more information to help the serving node in taking the appropriate decision. In the simplest form, the indication could say whether T310 or T312 has been initiated for this serving link. Such knowledge is currently not available to the NW together with the MR, whereas it could seriously impact the final decision whether it is still acceptable and safe to configure the CHO, or the quality of the link is already so bad that the immediate HO shall be commanded. |

**Question 14: Is it needed to add serving radio link status information in measurement report?**

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| **Company** | **Yes/No** | **Remark** |
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**Optimization S16\_7:**Discuss whether return CHO is supported or not;

This is new proposal and not aligned with agreements “UE autonomously releases CHO configuration upon successful HO/CHO or reestablishment”.

The proposal is [8]:

* Supporting company: Apple

Enabling RCHO requires following enhancements:

* If RCHO is enabled, the UE will record full configurations of the serving cell and keep it after CHO to a target cell.
* UE shall inform the target cell if it has RCHO configured when sending *RRCReconfigurationComplete* to the target cell
* Network can provide CHO conditions for return CHO back to the previous serving cell right after receiving *RRCReconfigurationComplete* message by sending a new *RRCReconfiguration* message
* Target cell informs the source about utilizing RCHO based on RAN3 decision.

The question is whether we support it in Rel-16 or not.

**Question 15: Is it needed to support retrun CHO?**

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| **Company** | **Yes/No** | **Remark** |
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**Optimization S16\_8:**To discuss whether CHO can be configured in the resume message;

As discussed in the email discussion 108#66,

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| **Proposal 12** CHO configuration stored in UE shall be removed by the UE when entering IDLE or INACTIVE; |

[2] proposed to support CHO configuration in resume message. It would be good to discuss this in the meeting. .

Supporting company: Ericsson

**Question 16: Is it needed to add CHO configuration in the resume message?**

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| **Company** | **Yes/No** | **Remark** |
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### 2.4 Open items proposed not be treated

As proposed in [38], below issues should not be treated since they have been solved or not aligned with agreements.

**2.1 Issue 2: [1] raised for A3/A5 combination, whether original agreements “same RS type” for multiple trigger events is still valid or not**

**2.4 Issue 3 [21]: to reverse the agreements, the UE shall not autonomously remove CHO configuration upon successful HO;**

**2.7 [4] raised issue on UE context discard upon successful reestablishment or CHO**

**2.9 [10] UE reports the CHO reconfiguration failure related information to the network side, e.g. the failure indication, the failure target cell ID, the specific failure configuration..**

**2.11 [12] ask RAN2 to define a list of reconfigurations that require and do not require coordination with the target cell. A corresponding signalling is expected to be designed by RAN3**

**2.13 Issue 1: continue the measurement reporting after receiving cho-config [25]**

**2.13 Issue 2: Modification of the measurement configuration in cho-config [25]**

**2.13 Issue 3: Leaving condition based CHO reporting to allow the network to de-configure the CHO candidate(s) [25]**

**2.13 Issue 4: handling when multiple cells meet the execution condition [26]**

**UE should ignore the difference of the measurement results derived from different rsType when more than one candidate cells meet each execution condition**

**The UE should evaluate candidate cells based on the RSRP, when more than one candidate cells meet each CHO execution condition, independent of the trigger quantity configured for them**

**The UE should ignore the number difference between different rsType when evaluates the number of the beam above the threshold if multiple cells meet each CHO execution condition**

**2.3 Issue, whether the restriction on cho-RRCReconfig should be captured in the procedure or as field description**

**2.14 Issue 1: the UE should only derive/update the security keys when conditional handover is being executed;**

**2.15 issue 1:** **whether CHO is supported for NR-U, and if yes whether introduce a new event based on the channel occupancy;**

**Question 17: Do companies agree that the issues listed above should not be treated? If no, pls indicate your reason.**

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| **Company** | **Yes/No** | **Remark** |
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### 2.5 Issues to be covered by other email discusions and should be treated based on email discussion report (Placeholder)

**Proposal 2-1: CHO+legacy HO command should be discussed based on email discussion 108#66;**

**Proposal 4-1: Handling of measID/reportConfig when the CHO configurations are autonomously released by the UE should be discussed based on email discussion 108#66;**

**Proposal 5-1: CHO+CPC should be discussed based on email discussion 108#67;**

**Proposal 8-1: The maximum candidate cells should be discussed based on email discussion 108#66;**

**Proposal 10-1: The support of CHO+DAPS should be discussed based on email discussion 108#66;**

**Proposal 12-1: The support of CHO+T312 should be discussed based on email discussion 108#66;**

There are clear majority in [38] for above issues. Rapporteur assume these issues can be solved based on email discussion.

**Question 18: Do companies have different view on above proposals? If no, pls indicate your reason.**

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| **Company** | **Yes/No** | **Remark** |
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# Conclusion

The followings are proposed:

# References

[1] R2-2000329 Major CHO issues discussed in [108#66][NR Mob] phase-2 Ericsson

[2] R2-2000330 Major CHO issues not discussed in [108#66][NR Mob] Ericsson

[3] R2-2000374 RRC remaining issues for conditional handover configuration vivo

[4]R2-2000375 Discussion on CHO release vivo

[5]R2-2000444 On CHO execution triggering with two joint events Futurewei

[6]R2-2000445 Resource limitation on number of CHO candidates Futurewei

[7]R2-2000468 "And" events for CHO Intel Corporation

[8]R2-2000592 Consecutive CHO Apple

[9]R2-2000653 On the need of including CHO configuration in HO command OPPO

[10]R2-2000922 Further consideration on CHO compliance check failure CMCC

[11]R2-2000923 Combination of CHO and DAPS HO CMCC

[12]R2-2001002 On reconfigurations when CHO is prepared Nokia, Nokia Shanghai Bell

[13]R2-2001257 Conventional HO overriding a CHO command ZTE Corporation, Sanechips

[14]R2-2001258 CHO triggering configuration ZTE Corporation, Sanechips

[15]R2-2001259 Applicable CHO configuration ZTE Corporation, Sanechips

[16]R2-2001384 Discussion on configuration aspect for CHO Huawei, HiSilicon, China Telecom

[17]R2-2001385 Discussion on remaining issues for CHO Huawei, HiSilicon

[18]R2-2001534 Consideration of HO Command including CHO LG Electronics Inc

[19]R2-2001584 Further details of CHO configuration and execution China Telecom

[20]R2-2001637 Remaining issues for CHO execution Samsung R&D Institute UK discussion

[21]R2-2001651 Autonomous release of conditional configuration Google Inc. discussion

[22]R2-2001654 On the target to configure conditional handover Google Inc. discussion

[23]R2-2000332 Other aspects of CHO Ericsson

[24]R2-2000377 Discussion on simultaneous connectivity in CHO vivo

[25]R2-2000855 Measurement reporting while CHO is configured PANASONIC R&D Center Germany

[26]R2-2000899 Further Discussion on Cell Evaluation for CHO Cell Selection CATT

[27]R2-2000918 Discussion on CHO for DC scenarios CMCC

[28]R2-2001004 On serving cell’s radio link status reporting for CHO preparation Nokia, Nokia Shanghai Bell

[29]R2-2001305 Timing of Key Derivation in Conditional Handover Futurewei

[30]R2-2001306 Draft LS on the Timing of AS Key Derivation in Conditional Handover Futurewei

[31]R2-2001386 Discussion on combination of simultaneous connectivity and CHO Huawei, HiSilicon

[32]R2-2001535 T304 Running Issue When CHO Execution LG Electronics Inc.

[33]R2-2001537 Measurement ID Handling for CHO and CPC LG Electronics Inc.

[34]R2-2001545 CHO in NR-U LG Electronics Inc.

[35]R2-2001553 Discussion on CHO for DC scenarios CMCC, **Rap, same as [27]**

[36] R2-2000459 UE feature list for LTE and NR mobility Intel Corporation

[37] R2-2000461 Report of [108#66][LTE NR Mob] Open issues for LTE and NR mobility Intel Corporation

[38] R2-2002040 Summary of CHO in AI 6.9.3.1 and 6.9.3.3 Intel Corporation