3GPP TSG-RAN WG2 Meeting #109bis-e R2-200xxxx

Electronic, 20 – 30 April 2020

**Agenda item: 6.9.4.1**

**Source: CATT (offline discussion rapporteur)**

**Title: Report of [AT109bis-e][209][NR MOB] Resolution to remaining open issues of CPC**

**WID/SID: NR\_Mob\_enh-Core - Release 16**

**Document for: Discussion and Decision**

# 1 Introduction

This report is the outcome of the following discussion.

* [AT109bis-e][209][NR MOB] Resolution to remaining open issues of CPC (CATT)

Scope:

* + - Identify if any critical issues are remaining for the CPC based on this meeting’s contributions and attempt to identify company views to those

      Intended outcome:

* + - Discussion summary document in [R2-2003849](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003849.zip), including agreeable proposals for closing critical open issues (if possible) and list of non-critical issues that should no longer be pursued in Rel-16
    - The proposed agreements in [R2-2003849](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003849.zip) will be handled in the Monday 2020-04-27 Web conference session

      Deadlines for providing comments and for rapporteur inputs:

* + - Initial deadline (for companies' feedback):  Thursday 2020-04-23 12:00 UTC
    - Initial deadline (for rapporteur's summary in [R2-2003849](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003849.zip)):  Friday 2020-04-24 12:00 UTC

# 2 Remaining open issues of CPC

The open issues identified at the last meeting (RAN2#109-e) was discussed in email discussion [post109e@13][NR MOB] and these issues will be discussed online based on summary of email discussion [post109e@13][NR MOB] in [4]. This discussion is therefore focused on the newly identified open issues according to the contributions submitted to this meeting.

**Release of SCG**

In RAN2#109-e meeting, it was agreed to release all CPC-intra-SN configurations stored on the UE upon the successful completion of conventional PSCell change procedure and successful execution of CPC-intra-SN procedure. For CHO, it was agreed that CHO configuration stored in UE shall be removed by the UE when entering IDLE or INACTIVE. However, as pointed out in [1], there is no agreement on the handling of CPC configuration upon the release of SCG. [1] proposed to release the UE stored CPC configuration and the linked measurement configuration upon the release of SCG. According to the proposal in [1], the UE autonomously releases the stored CPC configuration and linked measurement configuration upon the release of SCG.

**Question 1: Companies are requested to comment on whether the UE autonomously releases the stored CPC configuration upon the SCG release.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| NEC | Yes | it is simple for UE to release the stored CPC configuration upon SCG release |
| Nokia | Likely OK | But to clarify: SCG is released by the MN which may not be aware of the configured CPC candidates? Or what is exactly the scenario here which would justify such action executed in autonomous manner? |
| Intel | Yes | Tend to agree with Nokia, the scenario should be MN triggered SCG release, and the MN has no idea whether CPC is configured. |
| ZTE | Yes | For the scenario, agree with Nokia and Intel. |
| Futurewei | Yes, but | Not clear the meaning of “..UE autonomously releases…? The release of SCG should be instructed by the network. Then, the release of SCG should include all CPC configurations. |
| OPPO | Yes | Autonomously or automatically? Agree with Futurewei that all CPC configurations should be released upon SCG release. |
| LG | Yes | Similar to CHO |
| Ericsson | Yes |  |
| Qualcomm | Yes | To Nokia: MN should coordinate with SN. If RAN3 introduces signalling to prevent CHO + CPC, then same signalling can be used. |
| Interdigital | Yes | The UE should release at least all entries in VarConditionalConfig when it contains a CPC configuration and the MCG releases the SCG. |
| Lenovo | Yes | CPC should be autonomously released since SCG has been released. |
| Sharp | Yes | It is simple that UE autonomously release all CPC configuration in all scenario including MN knows the CPC or MN is not aware of the CPC. |
| Samsung | Yes | It’s simple at least for Rel-16. |
| Huawei, HiSilicon | Yes |  |
| CATT | Yes | We tend to agree with Nokia and Intel that the release of SCG is sent by the MN where the MN may not be aware of whether CPC is configured or not. However, we think release of SCG should also clear stored CPC configuration. |

Summary of Q1: all the companies responded with yes. However few companies raised some concern on that MN may not be aware of CPC configuration when SCG is released. One company pointed out that MN may get the information that CPC is configured or not based on network signalling, if introduced.

**Proposal 1: The UE autonomously releases the stored CPC configuration upon the SCG release.**

If the CPC configuration stored in the UE is retained and not released when NR SCG is released, this would lead to a scenario where UE is no longer in MR-DC but still maintains the conditional configuration for PSCell change. Since simultaneous configuration of CHO and CPC cannot be provided to a UE, as pointed out in [1], there is only one variable defined for storing the conditional configuration. The received configuration is stored in a common variable i.e. CPC and CHO configurations are stored in VarConditionalConfig. This may create ambiguity to the UE if the stored CPC configuration is retained after SCG is released. [1] proposed that the UE stored CPC configuration should be released when NR SCG is released. Additionally, measID and reportConfig associated with CPC config, and measObject(s) only associated to CPC shall be removed when SCG is released. An example of required specification changes to enable the release of CPC configuration and relevant measurement configuration is shown below [1].

#### 5.3.5.4 Secondary cell group release

The UE shall:

1. as a result of SCG release triggered by E-UTRA (i.e. (NG)EN-DC case) or NR (i.e. NR-DC case):

2> reset SCG MAC, if configured;

2> for each RLC bearer that is part of the SCG configuration:

3> perform RLC bearer release procedure as specified in 5.3.5.5.3;

2> release the SCG configuration;

2> if CPC was configured,

3> remove all the entries within *VarConditionalConfig*, if any;

3> for each *measId* of the source SpCell configuration, if the associated *reportConfig* has a *reportType* set to *condTriggerConfig*:

4> for the associated *reportConfigId*:

5> remove the entry with the matching *reportConfigId* from the *reportConfigList* within the *VarMeasConfig*;

4> if the associated *measObjectId* is only associated to a *reportConfig* with *reportType* set to *cho-TriggerConfig*:

5> remove the entry with the matching *measObjectId* from the *measObjectList* within the *VarMeasConfig*;

4> remove the entry with the matching *measId* from the *measIdList* within the *VarMeasConfig*;

2> stop timer T310 for the corresponding SpCell, if running;

2> stop timer T312 for the corresponding SpCell, if running;

2> stop timer T304 for the corresponding SpCell, if running.

NOTE: Release of cell group means only release of the lower layer configuration of the cell group but the *RadioBearerConfig* may not be released.

**Question 2: Companies are requested to comment on whether measID and reportConfig associated with CPC config, and measObject(s) only associated to CPC shall be removed when SCG is released and also on the suggested specification change.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| NEC | Yes | firstly, we do not think this is the case. Only if the UE does not release CPC config, the proposed changes above would be mostly valid. For details of text, it seems better to rephrase the first “if” sentence like:  2> if CPC **configuration is stored** ~~was configured~~, |
| Nokia | Yes | OK to remove all content from VarConditionalConfig, as there should be no other elements there related to CHO/CPC (if CHO cannot be configured together with CPC). |
| Intel | Yes |  |
| ZTE | Yes |  |
| Futurewei | Yes |  |
| OPPO | Yes |  |
| LG | Yes | Similar to CHO.  However, we think some wording may be changed:  - For future expansion, we would like to specify to remove only CPC configuration clearly e.g. remove all the entries within *VarConditionalConfig* **for SCG**, if any  - *condTriggerConfig* and *cho-TriggerConfig* need to be aligned |
| Ericsson | Yes |  |
| Qualcomm | Yes |  |
| Interdigital | Yes |  |
| Lenovo | Yes |  |
| Sharp | Yes |  |
| Samsung | Yes | Same view with Nokia. |
| Huawei, HiSilicon | Yes |  |
| CATT | Yes |  |

Summary of Q2: all companies agree that measID and reportConfig associated with CPC config, and measObject(s) only associated to CPC shall be removed when SCG is released. A couple of companies suggested improve wording on the text proposal.

**Proposal 2: measID and reportConfig associated with CPC config, and measObject(s) only associated to CPC shall be removed when SCG is released. (wording may be improved in the text proposal in [1])**

**On informing the selected PSCell to the target gNB-CU in case of CU/DU split.**

[2] has highlighted a potential issue of CPC operation in CU/DU architecture. In case of intra-CU CPC, multiple candidate PSCells can be configured in one gNB-DU or multiple gNB-DUs linked with one gNB-CU. Upon triggering the execution of CPC, the UE shall perform RA to the selected PSCell resided in the target gNB-DU and send the RRCReconfigurationComplete message to the target gNB-DU if SRB3 is configured. Then the target gNB-DU shall send the UL RRC MESSAGE TRANSFER message to transfer the RRCReconfigurationComplete message (if any) to the gNB-CU over the F1-C interface. In case SRB3 is not configured, at the execution of CPC, the UE shall send a RRC message to the MN including an embedded RRCReconfigurationComplete message to the SN, and then the MN shall transfer the SN RRCReconfigurationComplete message to the SN gNB-CU via Xn/X2 signalling. However, if multiple candidate PSCells are configured in one gNB-DU, the gNB-CU may have no idea of which candidate PSCell is selected by the UE since there is no target cell information included in the existing UL RRC MESSAGE TRANSFER or RRCReconfigurationComplete message.

**Question 3: Do company acknowledge the potential problem highlighted in [2] where the gNB-CU may have no knowledge of which candidate PSCell is selected by the UE in case multiple candidate PSCells are configured in one gNB-DU?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| NEC | Yes | if more than one candidate PSCells are configured under one gNB-DU, the gNB-CU may not know which candidate is selected. |
| Nokia |  | The same problem is valid in the architecture without CU/DU split, so we are not sure why this particular case and architecture shall be our primary focus, at the end of WI, where we seem to specify an absolute minimum for CPC? |
| Intel |  | This can be discussed in RAN3 if the problem is valid or not. |
| ZTE | Yes |  |
| Futurewei |  | Agree there maybe issue to be addressed. But this appears to me is inter-SN issue. Is that in Rel-16 we only work on CPC-intra-SN? Or we don’t limit the scope? |
| OPPO |  | Should we clarify first that intra-SN-CPC means intra-gNB-DU CPC? And then we don’t have the asked issue? |
| LG | No | We think this is out of the RAN2 issue. The network already knows this situation when preparing CPC. Then the target network naturally configures SRB3 for this situation. The potential problem can be simply prevented by network implementation. |
| Ericsson |  | Agree with Intel. |
| Qualcomm | No | The CU can identify the correct cell from the RRC transaction ID. |
| Interdigital |  | We understand the scenario, but we are not sure that this is a problem (e.g. using the transaction ID as per QC, or sending the configuration to all of the DUs). In any case, we think this should be upto RAN3 to decide. |
| Lenovo |  | Agree with Intel. It can be solved in RAN3. |
| Sharp | No? | We agree with the scenario, but we are not sure whether there is real problem considering that it may be handled by the network e.g. as per QC’s comment. We actually think RAN3 should discuss this first. |
| Samsung |  | We also think this is the case even for normal HO, and the issue for RAN3. |
| Huawei, HiSilicon |  | The issue may be in RAN3 scope. |
| CATT |  | We agree with above company comments that this should be discussed in RAN3 to understand whether there is a problem or not. |

Summary of Q3: most companies see this topic should be first discussed in RAN3 to understand whether there is real problem or not. Some companies pointed out transaction ID can be used to identify the correct cell, while another company pointed out that use of SRB3 can be used by the network if a problem is identified.

**Proposal 3: whether there is any issue for the case where multiple candidate PSCells are configured in one gNB-DU should be first discussed in RAN3.**

If the answer to Q3 is yes, [2] suggested two different approaches to solve the ambiguity. The following alternative approaches could be used to indicate the selected PSCell to the target Gnb-CU:

**Alt. 1** (RAN2 based solution): include the indication of selected cell identification information (e.g. candidate conditional configuration index) in the RRCReconfigurationComplete message.

**Alt. 2** (RAN3 based solution): leave this issue to RAN3 and send one LS to inform RAN3 about this.

In Alt.1, the selected cell identification information is indicated in the RRCReconfigurationComplete message. Regardless of SRB3 or SRB1 is used to signal the RRCReconfigurationComplete, RRCReconfigurationComplete terminates at Gnb-CU. Thus, the Gnb-CU is made aware of the selected cell identification.

In Alt.2, RAN3 is asked to consider a solution on how to inform the selected target PSCell to the Gnb-CU for both cases where SRB1 or SRB3 is used to signal the CPC configuration.

**Question 4: Companies are requested to comment on which approach is to be used, in case of need for informing the gNB-CU of the selected target PSCell by the UE (i.e if the answer to Q3 is yes).**

|  |  |  |
| --- | --- | --- |
| Company | Alt 1/Alt 2 | Comment |
| NEC | Alt 1 | Our preference is Alt1 so that RAN2 can close this issue soon. The condConfigId could be one solution as indicated. |
| Nokia | None | Alt 1 could be considered, but not solely for CU/DU split. |
| ZTE | Alt. 1 & Alt. 2 | It seems Alt. 1 is more straightforward and can be directly decided by RAN2. However, considering the Gnb-CU may decide to start data transmission/scheduling in target PSCell before reception of RRCReconfigurationComplete message, we think it’s better to also inform RAN3 bout this issue. |
| Futurewei | Alt 1 if discussed in Rel-16 | If we include inter-SN CPC into the scope of Rel-16 CPC work. Slightly prefer Alt 1. |
| LG | None | Since we don’t think this is a RAN2 issue, sending LS to RAN3 is fine for us if it is really necessary. |
| Ericsson |  | Preferably discussed in RAN3. |
| Qualcomm | None |  |
| Interdigital |  | Can be discussed in RAN3. |
| Lenovo | Alt2 |  |
| Sharp |  | Leave it up to RAN3, and we prefer no LS is sent. |
| Samsung | Alt2. | This should be justified by RAN3. |
| Huawei, HiSilicon | Alt 1 | We have a slight preference of RAN2 based solution. Alt 1 is straightforward, and RAN2 can directly solve the issue via Alt1, i.e. including target PSCell id in the RRCReconfigurationComplete. One question for clarification: should we use condConfigId to indicate the selected target PSCell? |
| CATT |  | Discussion should be taken in RAN3 |

**Summary of Q4: as it was concluded under Q3 that this topic should be first discussed in RAN3 to understand whether there is real problem or not, further discussion in RAN2 should wait for RAN3 findings.**

**Target CPC configuration with legacy HO command**

In the last meeting, it was agreed to not to support target CHO configuration in legacy HO command or target CHO configuration in target CHO command in Rel-16. [2] requested a similar discussion should take place for CPC configuration. It should be discussed whether target CPC configuration in legacy HO command or target CPC configuration in target CPC command is supported or not. Even though RAN2 signalling support for such configuration may be straightforward, it may have potential impact on SA3 and RAN3 for inter-Gnb target PSCell candidates. Similar to CHO, the support of CPC configuration with legacy HO command or support of target CPC configuration with target CPC command could be left to future release.

**Question 5: Companies are requested to comment on whether support of target CPC configuration in legacy HO command or target CPC configuration in target CPC command should not be considered in Rel-16, i.e. such configuration support is left to future release.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| NEC | No | In Rel-16, it is sufficient to go for the same way as CHO. |
| Nokia | No | It seems companies do not want to even allow ‘normal’ SCG configuration in CHO command (as per 109#12 discussion), so it would be weird to allow inserting CPC config into the HO command or CPC command. |
| Intel | No |  |
| ZTE | No | It’s fine to follow the same principle as CHO in Rel-16. |
| Futurewei | No | Not for Rel-16. May be discussed in Rel-17. |
| OPPO | No |  |
| LG | No | Not in Rel-16, similar to CHO |
| Ericsson | Yes | We see no reason to restrict this. |
| Qualcomm |  | There is actually no risk of including CPC in legacy HO, which will take effect only after HO and will save one RRC reconfiguration procedure. For CHO in HO, there was an argument about ping-pongs, security. It is acceptable to do this in Rel-17 if majority prefers to. |
| Interdigital | No | Fine to follow CHO for this release. |
| Lenovo | No | Similar to CHO, not supported in Rel-16. |
| Sharp | No | Leave to future release |
| Samsung | No | Not in Rel-16 as the other optimization blocked. |
| Huawei, HiSilicon | No | Follow the legacy CHO agreement in Rel-16. |
| CATT | No | To follow CHO agreements. |

Summary of Q5: all companies except one commented that CPC configuration handling in this case should follow the handling agreed for CHO.

**Proposal 4: Support of target CPC configuration in legacy HO command or target CPC configuration in target CPC command should not be considered in Rel-16.**

**Simultaneous CHO +CPC configuration**

In [3], it was requested to reconsider the previous agreement on support of simultaneous CHO+CPC configuration.

S1\_5: Support of CHO and CPC-intra-SN configuration simultaneously is not considered in Rel-16. Leave it up to the network solution to ensure there is no simultaneous CHO and CPC configuration.

[3] argued that according to the current specification, there is no major issue of simultaneous CHO+CPC configuration as the conditional reconfiguration is deleted upon the execution of conditional configuration. This means that upon execution of CHO, all CHO and CPC configurations are deleted and upon CPC execution all CHO and CPC configurations are deleted. However, the UE behaviour has not been defined if the condition for CHO and CPC are met at the same time. [3] proposed to leave the decision to the UE implementation if the condition for CHO and CPC are met at the same time. [3] proposed to change the previous agreement and to allow simultaneous CHO+CPC configuration. If the previous agreement is changed, RAN3 should also be informed.

**Question 6: Should the previous agreement on simultaneous CHO+CPC configuration be changed? If so, this means that simultaneous CHO+CPC configuration is allowed and the decision on which procedure to follow is left to the UE implementation, in case of condition for CHO and CPC execution are met at the same time**. **RAN3 should also be informed.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| NEC | No | Upon receiving RAN2 LS, RAN3 is discussing the issue. RAN2 should not revisit this agreement in Rel-16. |
| Nokia | No | The LS was sent to RAN3. We should let them consider the topic. Moreover, the authors of [3] seem to simplify the entire issue, thinking this is just about how this is captured in the specification (i.e. as the same IE is used, this should be easy and doable), while we believe it is not so straightforward. For example, the UE would have to simultaneously monitor cells for CHO and CPC, etc. |
| Intel | No | Agree with Nokia. |
| ZTE | No | Even if we support simultaneous CHO+CPC configuration, there are still additional work should be considered if we allow the UE to delete all stored CHO/CPC configuration upon execution of CHO/CPC. We may need to first discuss whether the UE needs to inform the other node about the execution of CHO/CPC (i.e. the release of stored CHO/CPC configuration) considering the SN may be not aware of the execution of CHO in case of PCell change without SN involved and the MN may also be not aware of the execution of CPC in case SRB3 is used. |
| Futurewei | No | There are a lot of issues need to be resolved if we allow the simultaneous configuration of both CHO and CPC. We are not able to resolve all the issues in Rel-16. |
| OPPO | No | Agree that potential consequence of allowing CHO+CPC is not fully analysed yet, which may not be finished in Rel-16. |
| LG | No | Not in Rel-16 |
| Ericsson | Yes | We think it is an easier solution to allow simultaneous configuration, than to not allow it and introduce new network signalling. What is the additional complexity with monitoring e.g. 4 CHO configurations + 4 CPC configurations instead of 8 CHO configurations? It is all UE measurements of events for a certain cell. Anyhow, if companies think it needs to be analysed further, then that should be done first before introducing network signalling without the analysis. |
| Qualcomm | No | It is too late now. |
| Interdigital |  | We are fine to revisit this to avoid new network signalling. However, to avoid the issues mentioned by Nokia, at least for this release, the UE could drop the CPC configuration if a CHO is configured. Enhancements can then be considered in Rel17. |
| Lenovo | No | Not supported in Rel-16. |
| Sharp | No | Keep the original agreement in this release. |
| Samsung | No | Not in Rel-16 as other optimization blocked. |
| Huawei, HiSilicon |  | No supported due to lack of time in Rel-16. Can be revisited in Rel-17. |
| CATT | No |  |

Summary of Q6: all companies except one would like to keep the previous agreement.

**Proposal 5: reconfirm the previous agreement: Support of CHO and CPC-intra-SN configuration simultaneously is not considered in Rel-16.**

# 3 Conclusions

**Proposal 1: The UE autonomously releases the stored CPC configuration upon the SCG release.**

**Proposal 2: measID and reportConfig associated with CPC config, and measObject(s) only associated to CPC shall be removed when SCG is released. (wording may be improved in the text proposal in [R2-2003327]).**

**Proposal 3: Whether there is any issue for the case where multiple candidate PSCells are configured in one gNB-DU should be first discussed in RAN3.**

**Proposal 4: Support of target CPC configuration in legacy HO command or target CPC configuration in target CPC command should not be considered in Rel-16.**

**Proposal 5: Reconfirm the previous agreement: Support of CHO and CPC-intra-SN configuration simultaneously is not considered in Rel-16.**

# 4 Reference

[1] [R2-2003327](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003327.zip) Discussion on CPC configuration handling during SCG Release Samsung discussion NR\_Mob\_enh-Core

[2] [R2-2003423](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003423.zip) Remaining issues for CPC ZTE Corporation, Sanechips discussion Rel-16 NR\_Mob\_enh-Core

[3] [R2-2003038](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003038.zip) Remaining issues for conditional PSCell change Ericsson discussion NR\_Mob\_enh-Core

[4] [R2-2003440](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003440.zip) Report of [post109bis-e@13][NR MOB] Resolving open issues for CPC CATT discussion Rel-16 NR\_Mob\_enh-Core