**3GPP TSG-RAN WG2 Meeting #123 R2-23xxxx**

**Toulouse, France, August 21 – 25, 2023**

Agenda Item: 7.4.2.3

Source: CATT

**Title:** Report of [Post122][057][Mob18] 38.331 Running CR for CHO with candidate SCGs (CATT)

Document for: Discussion and Decision

# Introduction

This document is the report of the following email discussion.

* [Post122][057][Mob18] 38.331 Running CR for CHO including target MCG and candidate SCGs (CATT)

 Scope: Reflect agreements, attempt to converge on a 1st baseline CR. Capture identified open issues (e.g. in Editors Notes).

 Intended Outcome: Running CR, Report if applicable.

 Deadline: Long

|  |  |
| --- | --- |
| **Company** | **Name (Email)** |
| MediaTek | Felix Tsai (chun-fan.tsai@mediatek.com) |
| CATT | Rui Zhou(zhourui@catt.cn) |
| Samsung  | Weiwei Wang (ww1016.wang@samsung.com) |
| vivo | Jing Liang (liangjing@vivo.com) |
| ZTE | Mengjie Zhang (zhang.mengjie@zte.com.cn) |
|  |  |
|  |  |

# Open issues

In the phase 1 of RRC Running CR for CHO with candidate SCGs [1], Remaining issues are identified and captured in Editor’s note. This document is to collect companies’ view on the open issues.

Following are the open issues captured in EN in the RRC Running CR for CHO with candidate SCGs [1].

|  |  |  |
| --- | --- | --- |
| **Issue** | **Description** | **Relevant section in TS 38.331** |
| #1 | Editor’s note: FFS how to indicate the selected target SCG to the target MN (i.e. whether to reuse *selectedCondRRCReconfig-r17* or not), so that target MCG can forward the corresponding SCG RRCReconfigurationComplete message to the selected target SCG. | 5.3.5.3 |
| #2 | Editor’s note: FFS whether UE should remove the configuration for CHO including target MCG and candidate SCG configuration when SCG is to be released.  | 5.3.5.4 |
| #3 | Editor’s note: FFS whether the legacy CHO recovery mechanism applies to the configuration for CHO with candidate SCG(s). | 5.3.7.3 |
| #4 | Editor’s Note: FFS whether to stop conditional reconfiguration evaluation for CHO with Candidate SCG(s) upon initiating SCG failure information procedure. | 5.7.3.2 |
| #5 | Editor’s note: FFS whether to extend *maxNrofCondCells-r16* for CHO with candidate SCG(s). | 6.3.2*CondReconfigId* |
| #6 | Editor’s note: FFS how to ensure the total number of the candidate PCells and the candidate PSCells from each candidate MN and the candidate SN is within the maximum limation. | 6.3.2*CondReconfigId* |
| #7 | Editor’s note: FFS whether to support condEventA3 or condEventA5 for the execution conditions for candidate PSCells for CHO with candidate SCG(s). | 6.3.2*CondReconfigToAddModList* |
| #8 | Editor’s note: FFS which node (source MN or candidate MN) to initiate the preparation of the R18 CHO with candidate SCG(s). | 11.2.2*HandoverPreparationInformation* |
| #9 | Editor’s note: FFS which node (source MN or candidate MN) to recommend the candidate PSCells. | 11.2.2*HandoverPreparationInformation* |
| #10 | FFS whether to support recommendation of the candidate PSCells based on measurement results. | 11.2.2*CG-ConfigInfo* |
| #11 |  *Editor’s note: FFS if to stop evaluating the execution conditions once PSCell change is triggered.* | 37.340 CR,10.19.x |

## Issue#1

Editor’s note: FFS how to indicate the selected target SCG to the target MN (i.e. whether to reuse *selectedCondRRCReconfig-r17* or not), so that target MCG can forward the corresponding SCG RRCReconfigurationComplete message to the selected target SCG.

In rapporteur’s understanding, *CondReconfigId* which is referred by *selectedCondRRCReconfig-r17* is generated by source MN and target MN is not aware of it. It seems *selectedCondRRCReconfig-r17* cannot be reused.

**Question 1a: Do you agree that selectedCondRRCReconfig-r17 cannot be reused to indicate the selected target SCG to the target MN?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments if any** |
| MediaTek | No/Yes | We prefer to reuse *selectedCondRRCReconfig-r17* if possible. However, if this one cannot be understood by target MN, we are fine to discuss other method. Would it be possible to make candidate MN aware this ID preparation phase (see also our comment in issue#6)?  |
| CATT | Yes | In our understanding it is more complicated to align the *CondReconfigId* between source MN and candidate MNs. |
| Samsung  | Yes | As Rapp. Mentioned, the target MN cannot deduce the target SCG based on the CondReconfigId, which is assigned by the source MN. |
| vivo | No with comments | We have some sympathy on MediaTek’s comment that Source MN can indicate the IDs to be used for conditional reconfiguration (*CondReconfigId*) when it requests Target MN to prepare CHO with candidate SCGs. So that selectedCondRRCReconfig-r17 can be reused. |
| Nokia | Yes | At the current state, the selectedCondRRCReconfig-r17 cannot be used. One alternative would be to indicate to the target-MN a list of selectedCondRRCReconfig-r17 id, along with an XnID to provide a mapping between CHO configurations and the related IDs. Another alternative would be to indicate the selected target PSCell id as part of the RRCREeconfigurationComplete message |
| ZTE | Yes | Agree with Rapp. The target MN can not understand the CondReconfigId generated by the source MN, unless additional inter-node coordination is performed to align with the CondReconfigId between the source MN and the target MN. |

If selectedCondRRCReconfig-r17 is not used, the potential options to indicate the selected PSCell to target MN are as following,

Option 1: rrc-TransactionIdentifier

Option 2: cell information (e.g., physCellId,ARFCN-ValueNR) of the selected PSCell

**Question 1b: If your answer to Q1a is Yes, which option do you prefer to use?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option(option1,option 2)** | **Comments if any** |
| MediaTek |  | As indicated in Q1. Our preference is Source MN and target/candidate MN could coordinate the ID. If not, maybe option 2 is more suitable. It is not so clear to us how option 1 works. |
| CATT | Option 2 | For option 1, the space of the rrc-TransactionIdentifier is not larger enough, e.g., there are 5 candidate PSCells associated with the same candidate MN.  |
| Samsung  | Option 2 |  |
| vivo | None | See Q1a |
| Nokia | Option 2 |  |
| ZTE | Option 1 | In our understanding, each candidate cell configuration (i.e. the RRCReconfiguration message generated by the target MN) can be assigned with an unique rrc-TransactionIdentifier. Besides, each candidate cell configuration includes only one candidate PSCell. Thus, the target MN can know which candidate PSCell is selected via the rrc-TransactionIdentifier in the RRCReconfigurationComplete message to the target MN. |

## Issue#2

Editor’s note: FFS whether UE should remove the configuration for CHO including target MCG and candidate SCG configuration when SCG is to be released.

In rapporteur’s understanding, UE does not need to remove it. NW can indicate UE to release the configuration if NW thinks the configuration is not useful after SCG release.

**Question 2: Do you agree that UE does not remove the configuration for CHO including target MCG and candidate SCG configuration automatically when SCG is to be released?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments if any** |
| MediaTek | Yes | It should be up to NW. If NW think the CHO + SCG configuration could be reuse after SCG release (i.e. SCG part is somehow a complete configuration, could be used both for PSCell addition and PSCell change), NW could keep it. |
| CATT | Yes | It can be up to NW control |
| Samsung | Yes  | SCG release does not mean the SCG is not needed after the HO. |
| vivo | Yes | we can assume that UE can always rely on NW reconfiguration to release this CHO configuration + candidate SCG configuration. |
| Nokia | Yes | RAN3 has discussion to indicate to source MN and source SN whether the target configuration is a delta configuration. This information can be used by the source to determine whether the release of CHO configurations is needed, i.e., when target SCG configuration is configured as a delta to source SCG configuration |
| ZTE | Yes | It can be up to NW decision whether to release the configuration, e.g. according to whether the configuration is delta configuration or not. |

## Issue#3

Editor’s note: FFS whether the legacy CHO recovery mechanism applies to the configuration for CHO with candidate SCG(s).

In rapporteur’s understanding, it seems reasonable to apply CHO recovery to CHO with candidate SCGs and it does not bring too much spec impact.

**Question 3: Do you agree that the legacy CHO recovery mechanism applies to the configuration for CHO with candidate SCG(s)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments if any** |
| MediaTek | No | In general (starting from Rel-16 CHO), the UE can execute CHO upon two separate events:* Event 1: Regular CHO execution
* Event 2: CHO recovery

For both Event 1 and Event 2, the UE performs some **evaluation of the target PCell** signal level/quality:* Event 1: The evaluation is as per meas IDs defined by *condExecutionCond*
* Event 2: The evaluation is by leveraging suitable cell criteria

For Rel-17 CHO with target SCG, the UE **evaluates target PCell** **only** in both event 1 and 2. (Same as legacy CHO although PSCell is added this time)For Rel-18 CHO with candidate SCGs, the UE evaluates **both PCell and PSCell** criteria for Event 1. If Rel-18 CHO configurations with candidate SCGs were used for CHO recovery (i.e., Event 2), the Event 1 and Event 2 evaluations would no longer be ~equivalent with each other, since the UE only evaluates PCell quality (suitable cell criteria) in Event 2.For this reason, we think Rel-18 CHO configurations with candidate SCGs should not be used in CHO recovery.  |
| CATT | Yes | We see no issue to support it as it is very similar as applying CHO recovery the Rel-17 CHO with target SCG.If one PCell is selected during the recovery, UE just use one CHO configuration contains one MCG configuration (for the selected PCell) and one SCG configuration (for one of the associated candidate PSCell) if there are multiple candidate PSCells associated with one candidate PCell. |
| Samsung | Yes | There may still be some changes needed as there could be complementary conditional reconfiguration with only CHO. But agree that these changes won’t be large and  can be further discussed in the meeting. |
| vivo | Yes | Agree with rapp, we may utilize the configuration of CHO with CPAC to optimize the UE performance during the RRC re-establishment procedure and we do not see a big issue here.Moreover, during the recovery, UE may also check the CPAC condition evaluation result, i.e. whether the CPAC condition was met before during execution, to determine which associated SCG configuration should be applied if there are more than one.  |
| Nokia | Yes | Clarification for UE to select one of the multiple CHO configurations for the same PCell needs to be added. |
| ZTE | Yes | If there are multiple CHO configurations for the selected PCell during RRC re-establishment, it can be up to UE implementation to select one of them to perform CHO execution. |

## Issue#4

Editor’s Note: FFS whether to stop conditional reconfiguration evaluation for CHO with Candidate SCG(s) upon initiating SCG failure information procedure.

In rapporteur’s understanding, it seems not necessary to stop conditional reconfiguration evaluation for CHO with Candidate SCG(s) upon initiating SCG failure information procedure.

**Question 4: Do you agree to continue conditional reconfiguration evaluation for CHO with Candidate SCG(s) upon initiating SCG failure information procedure?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments if any** |
| MediaTek | Yes | We see no strong reason to stop evaluation. However, if A3/A5 is supported (see issue #7), maybe there is some impact. The evaluation of source PSCell during SCG failure is kind of strange.  |
| CATT | Yes |  |
| Samsung | No | Upon SCGFailure, UE stops conditional reconfiguration evaluation of CPAC. Thus the conditional reconfiguration evaluation for CHO with candidate SCG(s) will never be fulfilled as CPAC evaluation is stopped. So there is no need to continue  conditional reconfiguration evaluation for CHO with Candidate SCG(s) during SCG failure information procedure. In this case, the mobility needs to happen through complementary CHO only configuration or since the UE may report MCG and SCG measurements in SCGFailureInformation, network can perform mobility by sending ReconfigurationwithSync. |
| vivo | Yes | It’s better to under NW control. UE can continue conditional reconfiguration evaluation for CHO with Candidate SCG(s) upon initiating SCG failure information procedure. NW can reconfigure SCG and the conditional reconfiguration if needed.  |
| Nokia | Yes |  |
| ZTE | Yes | The initiation of SCG failure information procedure should not impact the CHO related procedure. |

## Issue#5

Editor’s note: FFS whether to extend *maxNrofCondCells-r16* for CHO with candidate SCG(s).

In rapporteur’s understanding, it seems there is no strong need to extend *maxNrofCondCells-r16* for CHO with candidate SCG(s).

**Question 5: Do you agree to reuse maxNrofCondCells-r16 for CHO with candidate SCG(s)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments if any** |
| MediaTek | TBD | No extension is fine to us. However, maybe we should also wait for S-CPAC discussion as this one also impacts S-CPAC. |
| CATT | Yes |  |
| Samsung | No | Current value is 8. However, for each CHO candidate, the target MN may have multiple candidate PSCells. In this sense, it is benefit to extend the value. |
| vivo | Yes with comments | It’s fine to reuse maxNrofCondCells-r16 for CHO with candidate SCG(s). We are open to extend it. |
| Nokia | Yes |  |
| ZTE | Yes |  |

## Issue#6

Editor’s note: FFS how to ensure the total number of the candidate PCells and the candidate PSCells from each candidate MN and the candidate SN is within the maximum limitation.

In rapporteur’s understanding, to ensure the total number of the candidate PCells and the candidate PSCells from each candidate MN and the candidate SN is within the maximum limitation, source MN should tell each candidate MN a maximum number of the candidate PSCells associated with the candidate PCell.

**Question 6: Do you agree that** **source MN should tell each candidate MN a maximum number of the candidate PSCells** **associated with the candidate PCell?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments if any** |
| MediaTek | Yes | Could MN also indicate the IDs to be used for conditional reconfiguration (*CondReconfigId*) in this step? In this way, maybe *selectedCondRRCReconfig-r17* could be reused to indicate the selected PSCell to the target MN (see issue#1). |
| CATT | Yes | But prefer to leave the details to RAN3, e.g., within Xn message. |
| Samsung | Ack the issue | This issue should be discussed in RAN3 after RAN2 concludes the necessity of having the maximum limitation. |
| vivo | Yes |  |
| Nokia  | No, see the comment | In our understanding, a single CHO configuration would count as one conditional configuration as target PSCell and PCell configuration is contained in a single container.The target MN can prepare a single connectivity configuration or a dual connectivity configuration. For this reason, the source MN should indicate maximum number of conditional handover configurations the target MN should prepare (not the number of candidate PSCells alone). |
| ZTE | No, see the comment | Agree with Nokia. Considering that the complementary CHO configuration may also be provided by the candidate MN, the source MN can simply indicate to the candidate MN the maximum number of CHO configurations that are allowed to configure.  |

## Issue#7

Editor’s note: FFS whether to support condEventA3 or condEventA5 for the execution conditions for candidate PSCells for CHO with candidate SCG(s).

In rapporteur’s understanding, the intention of the CHO with candidate SCGs is to ensure the accessed PSCell is accessible when perform CHO execution, thus the aim is to ensure the channel quality of the PSCell is good enough to access, so the agreed condEventA4 is sufficient.it is not necessary to support condEventA3 or condEventA5 for the execution conditions for candidate PSCells for CHO with candidate SCG(s).

**Question 7: Do you agree to not support condEventA3 or condEventA5 for the execution conditions for candidate PSCells for CHO with candidate SCG(s)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments if any** |
| MediaTek | Yes | Similar view as rapporteur, we agree not to support A3/A5.For CHO with candidate SCG, the PCell is changed and the source PSCell may not be a DC pair with target PCell. In our understanding, it is more likely multiple SNs are associated with one MN, not multiple MNs to be associated with one SN. Therefore, evaluating on source PSCell is not really needed and event A4 should be sufficient. |
| CATT | Yes |  |
| Samsung | No | We are not sure the Rapp.’s assumption, i.e., “PSCell is good enough to access”, is valid. In some cases, only supporting of condEventA4 may result in that the CPAC is hard to be executed even the candidate PSCell is acceptable by condEventA3 or condEventA5. |
| vivo | Yes | Similar view as rapporteur. we agree not to support A3/A5. In our understanding, * if to support event A3/A5, the source MN generates the corresponding execution conditions based on the source SCG MeasConfig to the UE, but not the source MCG MeasConfig. RAN2 had discussed the similar issue, finally it was decided not to support A3/A5 events in MN initiated inter-SN CPC procedure.

Furthermore, the candidate MN determines the parameters of the execution conditions for candidate PSCells. From the perspective of the candidate MN, as the UE has no SCG configured by the candidate MN yet, the SN addition procedure is more like a CPA procedure, but not CPC. hence, it’s natural to use A4 event, but not A3/A5. |
| Nokia | No | We believe especially event A3 is really useful when the source PSCell is configured as a target PSCell in one of the CHO configurations. Moreover, for the case where the source PSCell is configured as a target PSCell the A4 event cannot be used. Please be aware of the existing text for A3 and A5 in TS 38.331,*if the eventA3 or eventA5 is configured in the corresponding reportConfig:**5> if a serving cell is associated with a measObjectNR and neighbours are associated with another measObjectNR, consider any serving cell associated with the other measObjectNR to be a neighbouring cell as well;*This text is not there for event A4, as such no measurement event currently exists to be used for source PSCell. This calls for a change on the existing events, so we should treat this topic in R18 still. |
| ZTE | No | Currently, event A4 is usually used for PSCell change due to load balancing, without the comparison of serving PSCell’s quality. In order to select a suitable candidate PSCell when triggering the CHO execution and avoid the throughput drop due to the PSCell change failure, the event A3/A5 based condition could be considered, at least for CHO without SN change. In this case, the A3/A5 based execution condition can be generated by the source SN, i.e. based on the source SCG MeasConfig. |

## Issue#8

Editor’s note: FFS which node (source MN or candidate MN) to initiate the preparation of the R18 CHO with candidate SCG(s).

In rapporteur’s understanding, it seems straightforward for the source MN to initiate the preparation of the R18 CHO with candidate SCG(s) as the configuration including the execution condition is configured for UE by source MN.

**Question 8: Do you agree that source MN initiates the preparation of the R18 CHO with candidate SCG(s)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments if any** |
| MediaTek | Yes |  |
| CATT | Yes |  |
| Samsung | Yes, but | Precisely, the source MN initiates the CHO. However, whether the candidate SCG is needed or not depends on the target MN decision. |
| vivo | Yes |  |
| Nokia | Yes |  |
| ZTE | Yes |  |

## Issue#9

Editor’s note: FFS which node (source MN or candidate MN) to recommend the candidate PSCells.

In rapporteur’s understanding, the interface between candidate MN and candidate SN is transparent to the source MN, thus it seems more proper for the candidate MN to decide the candidate SN and recommend the candidate PSCells list to the candidate SN.

**Question 9: Do you agree that candidate MN recommends the candidate PSCells to candidate SN?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments if any** |
| MediaTek | Yes |   |
| CATT | Yes | The candidate MN can recommend the candidate PSCells based on the corresponding measurements results as provided by the source MN. |
| Samsung | Yes |  |
| vivo | Yes |  |
| Nokia | Yes |  |
| ZTE | Yes |  |

## Issue#10

Editor’s note: FFS whether to support recommendation of the candidate PSCells based on measurement results.

In legacy, recommendation of the candidate PSCells is based on measurement results. In case of MN initiated CPA or CPC, the field *candidateCellInfoListMN* in the Inter-node message *CG-ConfigInfo* contains measurement results information(i.e., *MeasResultList2NR*) regarding cells that the MN suggests the candidate target secondary node to consider configuring for MN initiated CPA or CPC.

**Question 10: Do you agree that recommendation of the candidate PSCells is based on measurement results?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments if any** |
| MediaTek | No strong view |  |
| CATT | Yes | We see no motivation to support the blind recommendation of the candidate PSCells. |
| Samsung |  | How to provide the recommendation is up to implementation. We don’t need to limit measurement result only. |
| vivo | Yes |  |
| Nokia | Yes |  |
| ZTE | Yes |  |

## Issue#11

*Editor’s note: FFS if to stop evaluating the execution conditions once PSCell change is triggered.*

The R16/R17 CHO evaluation shall be stopped once PCell change is triggered, but not for PSCell change. Currently, it’s unclear whether PSCell change shall stop the R18 CHO with candidate SCGs evaluation (including evaluation on both PCell and PSCell).

**Question 11: Do you agree that the evaluation of the execution conditions is stopped once PSCell change is triggered?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments if any** |
| MediaTek | No | We see no strong reason to stop the evaluation. The CHO with candidate SCG may trigger the required inter-SN PSCell change while MN is changed. It seems not necessary to stop the evaluation if there is intra-SN PSCell change. However, we would assume that NW should ensure the delta configuration is still valid after PSCell change (as in R17 CHO with target SCG). Otherwise, NW should release this configuration using explicit signaling.  |
| CATT | Yes | The delta configuration for the candidate SCGs included in the CHO configuration with candidate SCGs may be invalid after PSCell change. |
| Samsung | Yes | We didn’t consider the subsequent PCell/PSCell change for CHO+CPAC. Thus, this evaluation can be stopped. |
| vivo | No | Agree with MediaTek, NW may reconfigure UE if need in case of PSCell change.For CHO with CPAC, UE may continue to evaluate CHO and SCG candidates at least based on A4 event. |
| Nokia | No | We think is linked to Issue 2. |
| ZTE | No | We think the handling on R16/R17 CHO evaluation can be reused for R18 CHO with candidate SCG(s), considering that R17 CHO configuration can also include SCG configuration. |

# Reference

[1] R2-230xxxx RRC Running CR for CHO including target MCG and candidate SCGs