**3GPP TSG-RAN WG2#117-e Draft R2-2203637**

**Online, 21 February - 3 March 2022**

**Source:** Samsung

**Title:** [AT117-e][223][DCCA] CPAC procedures from network perspective (Samsung)

**Agenda Item:** 8.2.3.1

**Document for:** Discussion and decision

# 1 Introduction

This document discusses on the remaining issues of CPAC procedure from network perspective based on the Tdocs submitted to 8.2.3.1, with the following information from WI chair:

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| **NR Rel-17 DCCA (started immediately at meeting start)** |

**[AT117-e][223][DCCA] CPAC procedures from network perspective (Samsung)**

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| * Scope: Attempt to resolve critical open issues for CPAC procedures from network perspective based on contributions to 8.2.3.1 |
| * Intended outcome: Discussion report in [R2-2203637](file:///C:\Users\terhentt\Documents\Tdocs\RAN2\RAN2_117-e\R2-220xxxx.zip). * NOTE: CR rapporteur (CATT) is allowed to submit updated CRs based on the report proposal to illustrate the impacts of the proposals |
| * Deadline: Deadline 3 |

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| **Deadline 3 (discussions for 2nd week Tue online):** |

* **Comment deadline:** FridayW1, 0800 UTC (for collecting views)
* **Rapporteur proposals:** Friday W1, 0900 UTC (proposed resolution of issues)
* **Document deadline:** Monday W2, 1200 UTC (report or agreed CRs)
* No extensions to this deadline for regular discussions. Discussions handling CRs may continue to short post-meeting email (based on chair decision).

Mainly issues related to the OpenIssueList [12] is first summarized and discussed, and then ones related to running CR are discussed next.

# 2 References

[1] R2-2202304, Discussion on CPAC procedures from NW perspective, RAN2#117-e, Vivo

[2] R2-2202468, Open issues on Rel-17 CPAC procedures from NW perspective, RAN2#117-e, Nokia, Nokia Shanghai Bell

[3] R2-2202577, On support of CPAC replace, RAN2#117-e, Lenovo, Motorola Mobility

[4] R2-2202702, CPAC procedures from network perspective, RAN2#117-e, Qualcomm Incorporated

[5] R2-2202824, Remaining issues on CPAC from NW perspective, RAN2#117-e, ZTE Corporation, Sanechips

[6] R2-2202914, Discussion on the CG-CandidateList, RAN2#117-e, Google

[7] R2-2202916, (Draft CR) Support modification and cancellation of C-PSCells in the CG-CandidateList, RAN2#117-e, Google

[8] R2-2203045, Discussion on support for coexistence of Rel16 and Rel17 CPC, RAN2#117-e, NTT DOCOMO, INC

[9] R2-2203100, Remaining issues on CPAC from NW perspective, RAN2#117-e, CATT

[10] R2-2203170, Remaining issues for CPAC in network perspective, RAN2#117-e, Samsung

[11] R2-2203432, CPAC network procedures, RAN2#117-e, Ericsson

[12] R2-2202029, Open issues for MR DC/CA further enhancements, RAN2#116bis-e, Huawei, HiSilicon

# 3 Discussion

## 2.1 Coexistence of R17 SN-initiated CPC and R17 MN-initiated CPC

While most of companies discuss about the coexistence of R16 and R17 CPC, there was opinion to discuss on the R17 MN-initiated CPC (MI-CPC) and R17 SN-initiated CPC (SI-CPC). Since these two sub features have different network side signalling, and possible have different capability at the UE. Moreover this is solely related to the R17 CPAC WI completion and more than the optimization. Therefore, it is worth to discuss this issue.

**Question 1. Do companies agree on the support of the coexistence between Rel-17 SN-initiated CPC (SI-CPC) and Rel-17 MN-initiated CPC (MI-CPC) ?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| CATT | No | We think R17 time is not enough to finish all the related work on coexistence. For example, we may need to consider the following issues:  Issue 1: FFS to extend the maximum number of candidate cells, and FFS to extend the conditionalReconfigurationID;  Issue 2: if answer to issue 1 is no, some coordination on the number of candidates that can be configured for MN initiated CPC and SN initiated CPC is required |
| Huawei, HiSilicon | No | unless this can be supported without any RAN2 or RAN3 impact |
| Lenovo, Motorola Mobility | No | Few more issues in addition to CATT’s comment, what if the same candidate PSCell is prepared by MI-CPC and SI-CPC separately but with different execution condition? Also, it has to be decided if MI-CPC has higher priority than SI-CPC upon execution. |
| LG | Yes | In order to support the coexistence between R17 SI-CPC and R17 MI-CPC, RAN2 needs to discuss the following issues:  1) What happens upon R17 MI CPC (or R17 SI CPC) execution for the other type of conditional configurations (i.e. R17 SI CPC (or R17 MI CPC configuration))?  🡪 LG view: In Rel-17, the UE releases other CPC configurations upon CPC execution when R17 SI-CPC and R17 MI-CPC are simultaneously configured.  2) What to do when candidate target cells between R17 MI CPC and R17 SI CPC are duplicated?  🡪 LG view: MN/SN coordination is necessary to resolve this issue. We think there is no problem because S-SN can avoid duplication issues via coordination.  3) What happens to both R17 MI CPC and R17 SI CPC triggering conditions are simultaneously satisfied?  🡪 LG view: It seems a corner case. If it happens, the target PSCell to which the UE will handover depends on the UE implementation when both CPC triggering conditions are simultaneously satisfied.  4) Whether to need additional signalling between MN and SN for splitting/negotiating the total number of target cells between R17 MI CPC and R17 SI CPC.  🡪 LG view: MN/SN coordination is necessary to resolve this issue. We think there is no problem because S-SN can avoid exceeding the total number of target cells issue via coordination. |
| Intel | No | The high priority is to finish existing open issues and complete R17 CPAC. For other coexistence optimizations, similar to R16 restriction (no support of the coexistence of CHO and CPC), we don’t have time to consider in this last stage-3 meeting. |
| Google | Yes/No | MN may be able to refuse the SN Change Required message. |
| Sharp | No | More effort will be needed to solve the issues due to support of such coexistence, we doubt whether there is enough time for this. |
| ZTE | Yes | We see no much spec work is needed for supporting the coexistence of R17 MI-CPC and R17 SI-CPC except for the MN/SN coordination on the number of candidate PSCells.  Regarding issues from CATT:  No need to extend the maximum number of candidate cells and conditionalReconfiguration ID.  For coordination on the number of candidate PSCells, the MN can simply decide the maximum number of candidate PSCells to be configured for SI-CPC and inform that to the S-SN.  Regarding issues from Lenovo:  It can be up to the NW implementation to avoid the same candidate PSCell is prepared by MI-CPC and SI-CPC, e.g. the T-SN can not select the same candidate which has been prepared via previous MI-CPC or SI-CPC procedure considering that MI-CPC and SI-CPC shall not be prepared via one SN addition request message.  Besides, regrading the UE behaviour related issues proposed by LG, i.e. issue 1) and 3), we share the same view with LG. |
| Ericsson | No | In our view this would not be a typical scenario. |

Obviously there also should be a discussion on the coexistence between Rel-17 CPA and Rel-17 CPC.

**Question 2. Do companies agree on the support of the coexistence among Rel-17 CPA, Rel-17 MI-CPC and Rel-17 SI-CPC ? (if no, please comment on the possible coexistence combination)**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| CATT | No | This is not very clear to us. CPA is for the case when a SCG does not exist yet, so there is no need for CPC… |
| Huawei, HiSilicon | No | unless this can be supported without any RAN2 or RAN3 impact |
| Lenovo, Motorola Mobility | No | Agree with CATT, we don’t see how CPA and CPC happen at the same time. |
| LG | See comments | It is necessary to clarify the scenario that R17 CPA coexists with R17 MI/SI CPC. In our understanding, CPA is for PSCell addition while CPC is for PSCell change, which means that CPA will be configured to the UE with SCG connection, on the other hand, CPC will be configured to the UE with SCG connection. We don’t see the case that R17 CPA coexists with R17 MI/SI CPC.  But we see some benefits when supporting the coexistence CPA and CPC, especially in the case of unexpected SCG disconnection scenarios like SCG failure. We think RAN2 may consider this scenario in R18. |
| Intel | No | similar comments as for Q1 |
| Google | No | It is also unclear to us how CPA and CPC coexist |
| Sharp | No | We also think the scenario is not clear. |
| ZTE | No | It is also unclear to us how CPA and CPC coexist. |
| Ericsson | No | See Q1. |

## 2.2 Coexistence of R16 CPC and R17 CPC

Now for the new behaviour, one of the representative consideration regarding R17 CPAC is to allow the coexistence between R16 CPC and R17 CPAC.

1. Coexistence of R16/R17 CPC supported?
   1. Y: Vivo, Nokia, ZTE, DOCOMO, Samsung
   2. N: CATT (NW implementation to guarantee that R16 CHO, CPC, Rel17 CPAC are not simultaneously configured)
   3. Partially support: Ericsson (Support for the coexistence between R16 CPC and R17 SI-CPC, but not between R16 and R17 MI-CPC.)

Most of companies support the coexistence of R16 and R17 CPC operation with the reason that better reliability on the connection with the network can be accomplished, which subsequently result in the less latency to recover the connection for pscell once deteriorates. However there is also the consideration on the specification impact for this coexistence compared to the short remaining time given, which is correct. Moreover also R17 CPC sub features can be impact to the coexistence combination with R16 CPC. Therefore, we need to find out possible combination first.

*Opt 1: No coexistence between R16 and R17 CPC, i.e., only R17 CPC can work without R16 CPC*

*Opt 2: partial coexistence: only R16 CPC and R17 SI-CPC*

*Opt 3: partial coexistence: only R16 CPC and R17 MI-CPC*

*Opt 4: full coexistence: R16 CPC and whole R17 CPC*

**Question 3. Which option do companies prefer to have?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Comments |
| CATT | Opt 1 | We think R17 time is not enough to finish all the related work on coexistence. For example, we may need to consider the following issues:  Issue 1 (for Opt 2/3/4): FFS coordination about the conditionalReconfigurationID between MN and SN;  Issue 2 (for Opt 2/3/4): FFS to extend the maximum candidate cells, and FFS to extend the conditionalReconfigurationID;  Issue 3 (for Opt 3/4): if issue 2 is not, some coordination on the number of candidates can be configured by MN and SN is required;  Issue 4 (for Opt 3/4): FFS how to indicate the MN upon R16 CPC is executed.  Issue 5 (for Opt 2/3/4): for delta configuration related issue, once one type of CPC is executed, the SCG configuration is updated, FFS how to handle other CPC configurations that not triggered. |
| Huawei, HiSilicon | 1 | 2 is also ok if feasible without new RAN3 signalling and no new UE behaviour is needed (besides discard all configurations)  3 and 4 require new RAN3 signalling, this is not feasible in Rel-17 |
| Lenovo, Motorola Mobility | Option 1 or Option 2 | SN initiated intra CPC and SN initiated inter CPC can coexist without much complexity, since it is the same SN determines how many PSCells to prepare etc. Should be able to support without much spec impact. |
| LG | Opt 4 | To support the coexistence between R17 CPC and R16 CPC, RAN2 needs to address the following potential issues:  1) Does the R17 CPC procedure depend on the R16 CPC procedure, and vice versa?  🡪 LG view: Considering ongoing discussion of R17 CPC so far, since R16 CPC and R17 CPC are likely to be configured by different message (i.e. SN *RRCReconfiguration* message for R16 CPC and MN *RRC(Connection)Reconfiguration* message for R17 CPC), both UE and network can distinguish R16 CPC and R17 CPC. So, R16 CPC and R17 CPC procedures are independent each other in procedural aspects.  2) Whether to need additional signalling between MN and SN for splitting/negotiating the total number of target cells between Rel-16 CPC and Rel-17 CPC  🡪 LG view: Since the S-SN is involved in both R16 CPC and R17 CPC procedures, the S-SN can prevent the problem occurring in excess of the total number of target cells without additional inter node signalling.  3) What to do when candidate target cells between Rel-16 intra-SN CPC and Rel-17 intra-SN CPC are duplicated?  🡪 LG view: In the same context described in above, the S-SN can resolve the duplicated candidate target cells between R16 intra-SN CPC and R17 intra-SN CPC.  4) What happens to both CPC triggering conditions are simultaneously satisfied?  🡪 LG view: In R17, the target PSCell to which the UE will handover depends on the UE implementation when both CPC triggering conditions are simultaneously satisfied.  5) What happens upon CPC execution for the other type of conditional configurations?  🡪 At least in Rel-17, the UE releases other CPC configurations upon CPC execution like our comments in Q4. |
| Intel | 1 | similar comments as for Q1 |
| Google | 1 or 2 |  |
| Sharp | Option 1 or 2 |  |
| ZTE | 2 or 4 | It makes sense to support the coexistence of intra-SN CPC and inter-SN CPC, which allows the NW to select candidate PSCells from the same/source SN and different SNs, as the legacy PSCell change.  For Opt 2, no need to coordinate the number of candidate PSCells and the execution of R16 CPC since the S-SN can control all number of candidate PSCells to be prepared by S-SN and know the execution of R16 CPC. But the coordination on the conditionalReconfiguration ID space is still required in NR-DC case since the same UE variable is used for R16 and R17 CPC. For simplicity, the MN can directly decide the ID space to be used for R16 CPC and inform that to the S-SN.  For Opt 4, MN/SN coordination on 1) the number of candidate PSCells (also required for R17 CPAC itself if the coexistence of MI-CPC and SI-CPC is supported), 2) the conditionalReconfiguration ID space and 3) the the execution of R16 CPC, may be required.  If companies want to avoid too much coordination, we are also fine to only support Opt2. |
| Ericsson | 2 | Option 1 may require more changes to specs than option 2. Option 1 would also mean that S-SN shall decide to only support intra-SN or inter-SN, which does not make sense as a feature, especially compared to legacy. Hence, if Option 1 is agreed, RAN3 needs to specify in 38.423 that this is not allowed to be included. Option 2 seems simple and reasonable. |

The estimated specification impact is to include UE behaviour on the configuration release upon one type of CPC execution, MN/SN coordination on the maximum number of conditional reconfiguration / conditional Reconfiguration ID assignment, and indication of intra-SN CPC execution to the MN.

1. Configuration release after other type CPC’s execution:
   1. Vivo:
      1. After R16 CPC execution, UE keeps R17 CPC configs if it includes A4/B1 execution conditions and does not depend on source SCG config. Otherwise it’s released.
      2. After R17 CPC execution, UE releases the R16 ones.
   2. ZTE: Upon any type of CPC executed, UE removes all stored CPC configs including R16 and 17.
   3. Samsung: UE releases R17 CPC configurations after successful R16 CPC execution, and vice-versa.

Once any type of co-existence i.e., full support of partial support is agreed, there should be a UE behaviour on CPC config release. Even the simplest one is that just release of all the stored CPC configs including R16 and R17, we need further to see the views from each company based on the options:

*Opt 1. UE keeps R17 CPC configs if it include A4/B1 execution conditions, and does not depend on source SCG config. Otherwise it’s released. After R17 CPC execution, UE release the R16 ones.*

*Opt 2. After R17 CPC execution, UE releases the R16 ones.*

*Opt 3. UE releases R17 CPC configurations after successful R16 CPC execution, and vice-versa.*

**Question 4. Which option do companies prefer to have?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Comments |
| CATT | Opt 3 | As per legacy. |
| Huawei, HiSilicon | 3 | This is the simplest |
| Lenovo, Motorola Mobility | Opt 3 | If the source PSCell changes due to intra SN CPC, the offset/threshold configured for the old source PSCell may not apply to the new source PSCell.  Also, if the source PSCell changes due to inter SN CPC, the intra SN CPC configured for the old source PSCell is no longer valid.  So it is cleaner to releases all stored R16 R17 CPC config if CPC is executed successful. |
| LG | Opt 3 | Due to lack of time in Rel-17, RAN2 needs to make consensus based on the legacy principle, which has less spec impact and may lead to little specification effort. According to the legacy principle, the UE will release other CPC configurations upon any CPC execution when R16 CPC and R17 CPC are simultaneously configured. |
| Google | Opt 3 | No specification impact for opt 3 |
| Sharp | Opt 3 | This is an easy way to go. |
| ZTE | Opt 3 | Opt 3 follows the legacy handling. |
| Ericsson | Opt 3 | It is simpler to keep the principle of releasing CPC in both cases. |

1. MN/SN coordination needed?
   1. Vivo: Needed (intra-SN CPC indication)
      1. For SN to inform MN of the R16 CPC execution when R17 CPC configuration is delta config based on the source PSCell config after R16 CPC execution.
      2. R17 CPC candidate cell configurations are full configuration (which doesn’t need the MN/SN configuration)
   2. Nokia: Needed (intra-SN CPC indication)
      1. MN first informs S-SN about MI-CPC, and then S-SN informs MN when intra-SN CPC is executed and includes new SCG configuration such that MN can use it for re-triggering the preparation of MN-initiated CPC.
      2. LS to R3 on this coordination signalling.
   3. ZTE: Needed (conditional Reconfig ID space assignment, and max # of CPAC)
      1. Conditional reconfiguration ID space to be determined by MN.
      2. The max number of CPAC candidate pscells is 8.
      3. MN and SN coordinates the maximum number of SI-CPC including inter-/and intra-SN CPC. In detail, consider inter node renegotiation procedure where MN indicates the max # of candidate pscell allowed to S-SN, and if S-SN wants more, S-SN can send the requested value to the MN. (with TP)
   4. DOCOMO: Needed (Xn message to carry the max number of the candidate pscells)
      1. if R16 CPC and R17 SI-CPC are simultaneously configured, S-SN set the max # of pscell to prepare in the SNChangeRequired message (to MN) by taking account of already configured Rel-16 CPC configs not to exceed the maxNrofCondCells. If Rel16 CPC and Rel17 MI-CPC are simultaneously configured, and total # of CPC config exceed the maxNrofCondCells, UE shall prioritize to apply rel-17 CPC config and discard Rel-16 configs.

Regarding intra-SN execution indication, there could be an indication to the MN from the SN because MN doesn’t have the information on this execution. For handling of related UE operation, we need the company view. This question also can be applied to the whole combinations of coexistence:

*Opt 1: No coexistence between R16 and R17 CPC, i.e., only R17 CPC can work without R16 CPC*

*Opt 2: partial coexistence: only R16 CPC and R17 SI-CPC*

*Opt 3: partial coexistence: only R16 CPC and R17 MI-CPC*

*Opt 4: full coexistence: R16 CPC and whole R17 CPC*

**Question 5. Please companies indicate which option(s) need the intra-SN execution indication between MN and SN among above options? (Please note that this is not conditional question, but for gathering possible spec impact, so all companies are required to answer.)**

|  |  |  |
| --- | --- | --- |
| Company | Options | Comments |
| CATT | Opt 3/Opt 4 |  |
| Huawei, HiSilicon | 3 and 4 |  |
| Lenovo, Motorola Mobility | Opt 3/Opt 4 |  |
| LG | Opt 4 | If R16 CPC has been configured, MN should always know the configuration before providing R17 CPC configuration. |
| Google | Opt 3 and 4 |  |
| Sharp | Option 3/4 |  |
| ZTE | Opt 3 and 4 |  |
| Ericsson | Opt 3/4 | But we do not support these options anyways. In case only R16 CPC + R17 SI-CPC is supported this is not needed, as upon intra-SN CPC execution, the S-SN is able to cancel CPC to the MN. |

Regarding the maximum number of CPAC candidate PSCells,

From ZTE’s proposal, the max number of CPAC candidate PSCell needs to be defined regardless of the coexistence issue, and first for R17 CPAC itself.

**Question 6. Do company agree that the maximum number of candidate pscells for R17 CPAC is 8? (Please note that this is not conditional question, but for gathering possible spec impact, so all companies are required to answer.)**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| CATT | Yes | In legacy, the maximum number of candidate configurations that the NW can configure for CHO or R16 CPC is 8, which is a trade-off among lots of factors, e.g. signalling overhead, future extension. From our perspective, the same principle should also apply to R17 CPAC. |
| Huawei, HiSilicon | Yes |  |
| Lenovo, Motorola Mobility | Yes |  |
| LG | Yes | We think RAN2 needs to newly define the maximum number of candidate PSCells for conditional mobility as 8 irrespective of that for PCell conditional mobility. That is, there are 8 candidate cells for CHO and 8 candidate cells for CPAC.  If the maximum number for PCell/PSCell conditional mobility is independently defined, there is no need to MN/SN coordination to arbitrate the maximum numbers of candidate PCells and PSCells. |
| Google | Yes |  |
| Sharp | Yes |  |
| ZTE | Yes |  |
| Ericsson | Yes | But it needs to be clarified if this is the number within a single CPC configuration, reflected by the variable in ASN.1, or the total number of candidates the UE monitors simultaneously. |

And if considering any type of coexistence, then there might be another opinion on this maximum number of CPAC candidate PSCells.

**Question 7. Do company agree that maximum number of candidate PSCells for R16 CPC and R17 CPAC is 8, if any type of coexistence of R16/17 CPC is agreed?**

**(Please note that this is not conditional question, but for gathering possible spec impact, so all companies are required to answer.)**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| CATT | Yes | In legacy, the maximum number of candidate configurations that the NW can configure for CHO or R16 CPC is 8, which is a trade-off among lots of factors, e.g. signalling overhead, future extension. From our perspective, the same principle should also apply to co-existence cases. |
| Huawei, HiSilicon | Yes |  |
| Lenovo, Motorola Mobility | Yes |  |
| LG | Yes | Since S-SN is involved in all the scenarios (i.e. R16 CPC and R17 CPAC), S-SN can handle the maximum number of candidate PSCells not to exceed 8. |
| Google | Yes |  |
| Sharp | Yes |  |
| ZTE | Yes |  |
| Ericsson | Yes |  |

Further ZTE’s proposal on MN/SN coordination on conditional Reconfiguration ID space is always needed for any type of coexistence of R16/R17 CPC, i.e. both partial coexistence and full coexistence, because MN handles the condReconfig ID assignment for R17 CPC (including both SI-CPC and MI-CPC) while S-SN handles the assignment for R16 CPC. If without MN/SN coordination, the MN and the SN may set the same condReconfig ID for different candidate PSCells configured via R16 CPC and R17 CPC. However there was also the counter argument from Huawei that there are separate variables in the UE (maybe *VarConditionalReconfiguartion*) for MN and SN’s configurations for conditional reconfiguration including condReconfig ID. There there will be no conflict on the condReconfig IDs assigned by MN and SN. Rapporteur need to see the company view on this with two options as below:

*Opt 1. MN/SN coordination on conditional Reconfiguration ID space is necessary*

*Opt 2. No need of coordination for conditional Reconfiguration ID conflict because of separate Variables in the UE.*

**Question 8. Which option do companies agree for possible conditional reconfiguration ID conflict?**

**(Please note that this is not conditional question, but for gathering possible spec impact, so all companies are required to answer.)**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comments |
| CATT | Opt 1 for NR-DC scenario | For NR-DC scenario, there is not separate variables, thus such coordination is always needed. |
| Huawei, HiSilicon | 2 | There are separate variables in the EN-DC case already (VarConditionalReconfig in 38.331 for SN and VarConditionalReconfiguration in 36.331 for MN), so it can be the same for NR-DC.  If companies prefer 1, we do not want any coexistence in Rel-17. |
| Lenovo, Motorola Mobility | Opt 2 | Tend to agree with Huawei’s argument. |
| LG | Opt 2 | As our comments in Q3, since both the UE and the network can distinguish R16 CPC and R17 CPC and R16 CPC and R17 CPC procedures are independent of each other in procedural aspects, conditional reconfiguration ID conflict has no issue. |
| Google | Opt 1 for NR-DC | The VarConditionalReconfig at the UE should be shared between MN and SN. |
| Sharp | Opt 1 for NR-DC | The coordination is needed in NR-DC case if a common variable is in the UE. |
| ZTE | Opt 1 for NR-DC | Agree that there is no conditional reconfiguration ID conflict issue in EN-DC case since different UE variables are used in 38.331 and 36.331.  But for NR-DC, the same UE variable VarConditionalReconfig is used for conditional reconfiguration from the MN (R17 CPC) and the SN (R16 CPC), so the coordination is required. Otherwise, we should define a separate UE variable for R17 CPAC, which also requires some spec work to distinguish the R16 CPC case and R17 CPAC case. And the same conditional reconfiguration ID conflict issue still exists in case of CHO+R16 CPC (the same UE variable is used) if such coexistence is supported. |
| Ericsson | Opt 2 | This could be solved without network coordination e.g. with a new UE variable for Rel-17 CPC. |

Regarding the coordination betweem MN and SN on the maximum number of candidate target PSCells allowed to S-SN

The node initiating the configuration procedure can control the number of candidate pscells to be prepared. MN initiate the procedure for MI-CPC and CPA while SN initiates the procedure SI-CPC. Since even R17 SI-CPC and MI-CPC might not be coexisted, this coordination between MN and SN on the max number of candidate tartget pscells allowed to S-SN is not straightforward. With the following coexistence options, we need the view on the necessity of the coordination between MN and SN on the max # of candidate target Pscells allowed to S-SN.

*Opt 1. Only R17 MI-CPC allowed*

*Opt 2. Only R17 SI-CPC allowed*

*Opt 3. Only R17 MI- and SI- CPC allowed*

*Opt 4. Only R16 CPC and R17 SI-CPC allowed*

*Opt 5. Only R16 CPC and R17 MI-CPC allowed*

*Opt 6. R16 CPC and whle R17 CPC allowed*

**Question 9. Which options do companies think the coordination between MN and SN on the maximum number of candidate target PSCells allowed to S-SN is necessary for?**

**(Please note that this is not conditional question, but for gathering possible spec impact, so all companies are required to answer.)**

|  |  |  |
| --- | --- | --- |
| Company | Options | Comments |
| CATT | Opt 3/5/6 if the maximum number can be configured is still limited to 8 |  |
| Huawei, HiSilicon | 3?, 5, 6 | In 3, the MN could just reject SN's requests when the number of cells is exceeded, although this is not optimal |
| Lenovo, Motorola Mobility | Opt 3, 5, 6 |  |
| LG | See comments | We think RAN2 needs to newly define the maximum number of candidate PSCells for conditional mobility as 8 irrespective of that for PCell conditional mobility. That is, there are 8 candidate cells for CHO and 8 candidate cells for CPAC.  If the maximum number for PCell/PSCell conditional mobility is independently defined, there is no need of the coordination between MN and SN to arbitrate the maximum numbers of candidate PCells and PSCells. |
| Google | Opt 3, 5, 6 |  |
| Sharp | 3,5,6 |  |
| ZTE | Opt 3, 5, 6 |  |
|  |  |  |

From DOCOMO’s proposal, it is assumed that there is no distinguished UE capability of maximum number of candidate pscells i.e., unified capability for R16 CPC and R17 SI-CPC or R16 CPC and R17 MI-CPC. Therefore there is a case that sum of the number of candidate pscell configured by SN and MN exceed the given threshold value. However, this issue can be further discussed when above Proposal 6 is once agreed.

1. Intra-SN CPC should be configured in R16 way ?
   1. Yes: Vivo, ZTE (keep legacy independent signalling for each R16/R17 CPC)
   2. No: Ericsson (support for the Intra-SN CPC including updates to the MCG configuration.)

The remaining issue was that there is any need to modify the R17 intra-SN CPC procedure related to the co-existence issue. There are two party to reuse the legacy and modify the intra-SN CPC by including the MCG configuration information. Further check on the company view on this issue with the following options.

*Opt 1. Reuse legacy independent signalling for intra-SN CPC for R17, i.e., no enhancing from R16 CPC*

*Opt 2. Support for intra-SN CPC including updates to the MCG configuration.*

**Question 10. Which option do companies agree for intra-SN CPC signalling for R17?**

**(Please note that this is not conditional question, but for gathering possible spec impact, so all companies are required to answer.)**

|  |  |  |
| --- | --- | --- |
| Company | Options | Comments |
| CATT | See comments | Not sure what the question is for. In R17, we haven’t agreed intra-SN CPC with MN involvement. |
| Huawei, HiSilicon | 1 | 2 would be ok if it has no RAN2 and no RAN3 change (i.e. same procedures like inter-SN CPC except that S-SN and T-SN are the same node). |
| Lenovo, Motorola Mobility | Opt 2. |  |
| LG | Opt 1 | Due to lack of time in Rel-17, RAN2 needs to make consensus based on the legacy principle, which has less spec impact and may lead to little specification effort. |
| Google | Opt 1 |  |
| Sharp | Option 1 |  |
| ZTE | Opt 1 |  |
| Ericsson | Both Opt 1 and Opt 2 | The options are not mutually exclusive, so it should be possible to support both. It is limiting intra-SN CPC cannot be as good as inter-SN CPC. And agreeing on option 1 would mean that RAN3 adds in 38.423 that the S-SN shall not include in the SN Change Require candidates from the S-SN. |

## 2.3 Coexistence of CHO and CPAC

Even WI rapporteur’s guidance on the submission contents i.e., AI 8.2.3.1 can only have NW perspective and coexistence of R16 and R17 CPC, there are several companies to submit this coexistence of CHO and CPAC issue which were guided to be submitted AI 8.2.3.2. Anyhow, this might further be discussed with **[AT117-e][224][DCCA] CPAC procedures from UE perspective (Nokia).** We can keep this section as a reference to be used later.

1. Coexistence supported ? :
   1. Yes: Vivo, Nokia, QC (implicitly), ZTE
   2. Partially: Ericsson (support for CHO and Rel-17 CPAC but not for CHO and Rel-16 CPC)
   3. N: CATT (NW implementation to guarantee that CHO and CPAC are not simultaneously configured)

Maybe the partial coexistence from Ericsson is from the easiness on the signalling in the network since there is no need to exchange between MN and SN. Rapporteur would like to know the view on this issue:

*Opt 1. No coexistence of CHO and any CPAC release*

*Opt 2. Partial coexistence of CHO and R16 CPC*

*Opt 3. Partial coexistence of CHO and R17 CPC*

*Opt 4. Full coexistence of CHO and R16 and R17 CPC*

**Question 11. Which option do companies prefer to have?**

**(Please note that this is not conditional question, but for gathering possible spec impact, so all companies are required to answer.)**

|  |  |  |
| --- | --- | --- |
| Company | Options | Comments |
| CATT | Opt 1 | We think R17 time is not enough to finish all the related work on coexistence. For example, we may need to consider the following issues:  Issue 1: FFS coordination about the conditionalReconfigurationID between MN and SN;  Issue 2: FFS to extend the maximum candidate cells, and FFS to extend the conditionalReconfigurationID;  Issue 3: if issue 2 is not, some coordination on the number of candidates can be configured by MN and SN is required;  Issue 4: FFS how to indicate the MN upon R16 CPC is executed.  Issue 5: for delta configuration related issue, once one type of CPC is executed, the SCG configuration is updated, FFS how to handle other CPC configurations that not triggered. |
| Huawei, HiSilicon | 1 | 3 is ok if there is no RAN2 and no RAN3 impact |
| Lenovo, Motorola Mobility | Maybe Opt 1 | Considering the valid issues raised by companies and to have fair treatment on other coexistence scenarios, maybe it’s good to not support CHO and CPAC coexistence in this release. |
| LG | Opt 4 | We prefer Scenario 1, i.e., the CHO and CPAC configuration are independent and the UE monitors the triggering conditions for the CHO and CPAC independently. |
| Intel | 1 | similar comments as for Q1 |
| Google | Opt 4 |  |
| Sharp | Opt 4 |  |
| ZTE | Opt 3 or 4 | We see almost all MN/SN coordination issues also exist for coexistence of different types of CPC, e.g. R16 CPC + R17 CPC, R17 MI-CPC + SI-CPC. So if the coexistence of different types of CPC is supported, the same solution can be reused for CHO + CPAC. |
| Ericsson | 3, but 1 is acceptable | We have proposed 3 as a compromise if there is really strong consensus from all others. But, if we need to add some specifications of that, we should go for 1. |

1. Prioritization over CHO and CPC
   1. Stop/suspending UE behaviour:
      1. Vivo; ZTE: CHO is prioritized, aborts on-going CPAC execution upon CHO execution. Stops condition evaluation for CPAC upon CHO execution. If triggered cells exists for both CHO and CPAC, UE selects one for CHO.
      2. Nokia : N/A
      3. QC: when CHO and CPA are triggered together, CHO is prioritized. Then CPA configs are discarded, and network start the related procedure (receiving HO success message from target MN, and S-MN initiates SN release procedure toward the T-SNs.) Here CPA can be replaced with the CPC with the straightforward modification.

When both CHO and any release CPC are configured, UE might need the specific behaviour as above listed. With options the following is need to be discussed:

*Opt 1. Aborts on-going CPAC execution (including fall-back to the source SCG/MCG configuration, if any)*

*Opt 2. Stops conditional evaluation for CPAC*

*Opt 3. CPAC configs are discarded.*

*Opt 4. If one conditional reconfiguration is executed, the other conditional reconfigurations should be released. Everything else is up to UE implementation.*

**Question 12. Which option(s) do companies prefer to have, if any type of coexistence of CHO/CPC is allowed? (can be multiple options)**

**(Please note that this is not conditional question, but for gathering possible spec impact, so all companies are required to answer.)**

|  |  |  |
| --- | --- | --- |
| Company | Options | Comments |
| CATT | See comments | Prefer to follow legacy principle, i.e., if one conditional reconfiguration is executed, the other conditional reconfigurations should be released. |
| Huawei, HiSilicon | 4 |  |
| Lenovo, Motorola Mobility | Opt 1, 2, 3 |  |
| LG | No need to prioritisation | We think it is very rare that the CHO and CPC triggering conditions are met simultaneously. Moreover, the network is not involved in determining which procedure the UE will perform, i.e. the UE selects between CHO and CPC execution by UE implementation when the CHO and CPC triggering conditions are met simultaneously. In most cases, CHO will be preferred over CPC for a reasonable UE. If the UE decides to execute CPC and discard the CHO configuration, the UE may experience an MCG failure due to inability to perform PCell mobility in time. Even in this case, the MCG link is recovered by the MCG failure information procedure through the SCG link. In the opposite case (i.e. the UE experiences an SCG failure if the UE chooses CPC and discard the CHO configuration), the SCG failure information procedure through the MCG link can recover the SCG link.  In our view, if the UE monitors CHO and CPAC candidate cells independently and the UE simply needs to perform mobility that met the execution condition first, there is no need to prioritise any procedure between CHO and CPAC. Also, in R17, if all conditional reconfiguration should be released after any conditional mobility is performed like the legacy, we think RAN2 save additional discussion time to specify new UE behaviors to stop or resume evaluation in these scenarios. |
| Google | Option 4 |  |
| Sharp | 1,2,3 | CHO should be prioritized. |
| ZTE | Opt 1,2,3 | CHO should be prioritized. |
| Ericsson | Opt 4 | This should be like in legacy, otherwise we do not support the co-existence. |

* 1. Release configuration:
     1. Vivo: Releasing all CPAC configs after CHO successful completion if CPAC config depends on the CHO configs.
     2. Nokia: may release all other conditional reconfig.
     3. QC:
        1. when CPA executed before CHO, Alt1. Discard CHO config, Alt 2. Keeps CHO config but doesn’t measure until receiving updated CHO configs from S-MN, Alt3. If a specific indication (per candidate target pscell in CPA) included in RRCReconfiguration message containing CHO or CPA configuration to keep the CHO config is received, UE keeps CHO configs. Same for CPC with straightforward modification
        2. When CHO executed before CPA, UE discard the CPA configs (UE perspective), S-MN initiates SN release procedures toward the T-SNs upon CHO successfully executed. Same for CPC with straightforward modification
     4. ZTE: Releasing all CPAC configs after CHO successful completion, vice-versa.

There are several proposals from companies to release behaviour on CHO/CPAC coexistence. Please indicate the company’s view on each proposals.

*Opt 1. Releasing all CPAC configs after CHO successful completion if CPAC config depends on the CHO configs.*

*Opt 2. Delete all other conditional reconfiguration when CHO/CPAC triggers.*

*Opt 3. When CPA executed before CHO, Alt1. Discard CHO config, Alt 2. Keeps CHO config but doesn’t measure until receiving updated CHO configs from S-MN, Alt3. If a specific indication (per candidate target pscell in CPA) included in RRCReconfiguration message containing CHO or CPA configuration to keep the CHO config is received, UE keeps CHO configs. When CHO executed before CPA, UE discard the CPA configs*

*Opt 4. Releasing all CPAC configs after CHO successful completion, vice-versa*

**Question 13. Which option(s) do companies prefer to have, if any type of coexistence of CHO/CPC is allowed?**

**(Please note that this is not conditional question, but for gathering possible spec impact, so all companies are required to answer.)**

|  |  |  |
| --- | --- | --- |
| Company | Options | Comments |
| CATT | Opt 4 | Prefer to follow legacy principle, i.e., if one conditional reconfiguration is executed, the other conditional reconfigurations should be released. |
| Huawei, HiSilicon | 4 | This is needed for inter-operability, detailed behaviour before completion is up to UE implementation |
| Lenovo, Motorola Mobility | Opt 4 |  |
| LG | Opt 2 |  |
| Google | Opt 2 |  |
| Sharp | Opt 2 |  |
| ZTE | Opt 4 |  |
| Ericsson | Opt 4 |  |

## 2.4 Support of NGEN-DC

As indicated in OpenIssueList, threre is FFS point whether to apply CPAC feature to NGEN-DC arthictecture.

CATT propose with TP: R17 CPAC does not apply to NGEN-DC as well as NE-DC architecture, i.e., it only applies to EN-DC and NR-DC architecture.

And Ericsson also propose with TP: CPAC is not supported for NGEN-DC in Rel-17.

**Question 14. Do companies agree on that CPAC is not supported for NGEN-DC in Rel-17?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| CATT | Yes |  |
| Huawei, HiSilicon | Yes |  |
| LG | No strong view |  |
| Intel | Yes |  |
| Google | No strong view |  |
| Sharp | Yes |  |
| ZTE | No strong view |  |
| Ericsson | Yes |  |

## 2.5 Issue related to running CR

The following proposals are related to the running CR. Therefore, we can discuss the proposals one-by-one based on the TPs in their contributions. The related TP is not attached for not making the summary to lengthy. Please refer each corresponding Tdoc including TPs.

From Nokia, with the TP in their Annex:

**Question 15. Do companies agree on the following proposal with the TP**[2]**?**

**“Source SN should always include the CPC execution condition for the suggested PSCell in *SN Change Required* message to MN. The Optional flag is to be removed from *condExecutionConditionSN-r17* in stage 3 CR for NR**.**”**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| CATT | Yes | RAN2 already agreed that the execution condition should be provided to MN in the first step, i.e., SN change request message. |
| Huawei, HiSilicon | Yes |  |
| Lenovo, Motorola Mobility |  | No strong view, but since we have solution 2 supported, we understand the S-SN is able to provide the missing execution condition in the 2nd step of solution 2. |
| Google | Yes |  |
| Sharp | Yes |  |
| ZTE | Yes |  |
| Ericsson | Yes, for first part. | We agree that the Source SN should always include the CPC execution condition for the suggested PSCell in SN Change Required message to MN. However, we could keep the IE optionality FFS, until we discuss how the update/cancel is specified Maybe we will need an AddMod/ Release structure for CandidateCellInfoListCPC. |

**Question 16. Do companies agree on the following proposal with the TP**[2]**?**

**“Capture in stage-2 CR that source SN can update the CPC execution conditions (for the accepted PSCells) after being informed about the accepted candidate PSCells.”**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| CATT | Yes |  |
| Huawei, HiSilicon | No | We see no need for such behaviour (the source SN can update the source configuration, in particular to delete the events for rejected cells, this is enough) |
| Lenovo, Motorola Mobility | Yes |  |
| Google | Yes |  |
| Sharp | Yes |  |
| ZTE | Yes |  |
| Ericsson | Yes | The accepted candidate PSCells are either received at SN Change Confirm or SN modification Request from the MN to the S-SN. In response, the S-SN should be able to modify execution conditions and SCG MeasConfig for CPC, without the MN needing to contact the Target Candidates SN(s). As it involves multiple nodes, it is good to capture in stage-2. |

**Question 17. Do companies agree on the following proposal with the TP**[2]**?**

**“Capture in stage-2 CR that the CPAC configuration may contain MCG and SCG reconfigurations.”**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| CATT | Yes |  |
| Huawei, HiSilicon | Yes | but this is already clear in stage 3 anyway |
| Lenovo, Motorola Mobility | Yes |  |
| Intel | Yes |  |
| Google | Yes |  |
| Sharp | Yes |  |
| ZTE | Yes |  |
| Ericsson | Yes |  |

**Question 18. Do companies agree on the following proposal with the TP**[2]**?**

**“Consider the FFS in stage 2 CR (TS 37.340) on what defines a successful reconfiguration procedure to be already addressed by the current wording (i.e. FFS to be deleted).”**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| CATT | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Lenovo, Motorola Mobility | Yes |  |
| Google | Yes |  |
| Sharp | Yes |  |
| ZTE | Yes |  |
| Ericsson | Yes |  |

Lenovo&MM and Google propose the same solution for the below issue. CG-CandidateList field was updated to support add/mod/cancle structure of candidate pscell configs in INM from SN to MN

**Question 19. Do companies agree on the following proposal with the TP [3](for Lenovo) and [7] (for google)?**

**“Target SN provides the prepared PSCell configurations in a delta manner (e.g., add/modify/cancel) instead of always providing a full list, as shown in the TP.”**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| CATT | No | We do not see strong need to enhance this. |
| Huawei, HiSilicon | Partially | On ASN.1: PhyCellId is not suitable for ToReleaseList, it must also include ssbFrequency.  On description: RAN3 agreement only applies for SN-initiated modification by T-SN, when CPC is already prepared, it does not apply for CPC preparation. So ToReleaseList may not be allowed in CPC preparation.  Besides, RAN2 agreement is that the T-SN can only prepare PSCells proposed by MN or S-SN, so it is unclear how "add PSCell" can be done by T-SN without any S-SN request.  So perhaps there needs to be restrictions on which PSCells can be included in a procedure. |
| Lenovo, Motorola Mobility | Yes in principle | The reason is that RAN3 agreed to allow target SN to add/modify/cancel some prepared PSCells in CPA and MN/SN initiated inter-SN CPC before execution. To answer Huawei’s question, on adding PSCells, RAN3 agreed that as long as the total number of prepared PSCells is below the max, target SN can add extra candidate PSCells, of course from the suggested list. While these have not been taken into account when drafting the running CR.  In the RRC running CR, when target SN provides the configurations of prepared PSCells, it always provides a full list of CG-CandidateInfo. That works for the first time of CPAC configuration while it is signaling heavy for any configuration modification or addition/cancel of some PSCells.  The proposed change is only to reduce the inter node signaling overhead. We can work on the implementation as Huawei suggested. |
| Google (proponent) | Yes | In [6], more RAN3 agreements are recapped for reference and MN-initiated SN modification also applies. The CG-CandidateList was originally designed for the addition purpose. We should also take the modification and cancel into account considering that CG-CandidateList is also included in the SN Modification Request Acknowledge message and SN Modification Required message. |
| ZTE | Yes in principle | Agree with Huawei that both PhyCellId and ssbFrequency should be included in ToReleaseList to identify the unique candidate PSCell. |
| Ericsson | Yes to the proposal, but no to TP (at least not yet). | It’s better to wait to see latest RAN3 details on the procedure first. Maybe we can agree on add/mod/release and avoid using the term delta signalling, might be a bit ambiguous. |

From ZTE, with the TP

**Question 20. Do companies agree on the following proposal with the TP[5]?**

**“RAN2 confirms the new inter-node RRC message that includes the full list of CG-Config(s) is only used from the target SN to the MN, i.e. not used from the source SN to the MN.”**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Huawei, HiSilicon | Agree with proposal but no need for any change (and see no related change in the TP in [5]) |  |
| Lenovo, Motorola Mobility | Yes |  |
| Google | Yes |  |
| ZTE | Yes | No need any change in the current running CR, just for confirmation. |
| Ericsson | No. We need to process latest RAN3 agreements (see comment) | The following has been agreed in RAN3:  **Single SN Change procedure is used during preparation phase for SN-initiated inter-SN CPC to prepare multiple T-SNs. A list of multiple target SN IDs will be added to SN CHANGE REQUIRED message meanwhile the legacy target SN ID is ignored. More stage-3 details will be finalized in second round.**  Hence, there needs to be a way the S-SN indicates CPC candidate cells SN ID, in a single SN Change Required. |

From CATT with TP

**Question 21. Do companies agree on the following proposal with the TP[9]?**

**“The following Editor’s Note for MN initiated CPA in the stage 2 running CR is removed.**

**Editor’s Note: it is FFS how to capture the following agreement: The message carrying ‎conditionalReconfiguration for CPA/CPC is in MN format (i.e. contains ‎both MCG and SCG re-configurations).”**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| CATT | Yes | We are proponent. |
| Huawei, HiSilicon | Yes | TP is just removal |
| Lenovo, Motorola Mobility | Yes |  |
| Intel | Yes |  |
| Google | Yes |  |
| Sharp | Yes |  |
| ZTE | Yes |  |
| Ericsson | Yes | Assuming Q17 is agreed. |

**Question 22. Do companies agree on the following proposal with the TP[9]?**

**“The following Editor’s Note for MN initiated CPA in the stage 2 running CR is removed.**

**Editor’s Note: it is FFS what defines a successful reconfiguration procedure.”**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| CATT | Yes | We are proponent. |
| Huawei, HiSilicon | Yes | TP is just removal |
| Lenovo, Motorola Mobility | Yes |  |
| Google | Yes |  |
| Sharp | Yes |  |
| ZTE | Yes |  |
| Ericsson | Yes |  |

# 4 Conclusions