3GPP TSG-RAN WG2 Meeting #115 Electronic R2-21xxxxx

Online, 09 -27 August 2021

**Agenda item:**

**Source: CATT**

**Title: Summary of [Post114-e][233][eDCCA] Uu Message design for CPAC(CATT)**

**WID/SID: LTE\_NR\_DC\_enh2-Core - Release 17**

**Document for: Discussion and Decision**

# 1 Introduction

This is the report for the following email discussion:

[Post114-e][233][R17 DCCA] Uu Message design for CPAC (CATT)

      Scope: Discuss Uu message design for CPAC (e.g. based on [R2-2105990](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_114-e/Docs/R2-2105990.zip) and previous meeting discussion) and attempt to see if there is consensus on how the signalling towards UE is done.

      Intended outcome: Discussion report (may include also draft CRs if there is enough convergence)

      Deadline:  Long – 4th August 0900 UTC

Note that the discussion is focused on Uu message design for CPAC hence FFS on inter-node signalling is not addressed in this email discussion. In order to prepare the final email discussion report prior to the contribution submission deadline, the deadline for this email discussion is set as 4th August 0900 UTC.

# 2 Discussion

**2.1 Open issues applicable to all scenarios**

In this section, we discuss open issues which are applicable to all Rel-17 scenarios: CPA, MN initiated inter-SN CPC and SN initiated inter-SN CPC.

**Issue 1: Format for RRC message carrying conditionalReconfiguration for CPA/CPC**

The following agreement was made for format of RRC message carrying ‎conditionalReconfiguration in RAN2#113e.

The message carrying ‎conditionalReconfiguration for CPA/CPC is in MN format (i.e. contains ‎both MCG and SCG re-configurations). For the following cases: a). MN-Initiated CPA b). MN-Initiated inter-SN CPC c). SN-initiated inter-SN CPC.

As per the above agreement made for R17 CPAC, the RRC message carrying *conditionalReconfiguration* for CPA/CPC is in MN format for CPA, MN initiated inter-SN CPC and SN initiated inter-SN CPC. This allows for a unified signaling structure design for these three cases.

In Rel-16, the *conditionalReconfiguration* filed is used to configure the conditional reconfiguration for CHO and intra-SN CPC. In the *conditionalReconfiguration* filed, each candidate cell configuration (i.e. *condRRCReconfig/ condReconfigurationToApply*) is linked with the corresponding execution condition (*condExecutionCond/ triggerCondition*).

RRCReconfiguration-v1610-IEs ::= SEQUENCE {

[…]

 conditionalReconfiguration-r16 ConditionalReconfiguration-r16 OPTIONAL, -- Need M

[…]

}

*conditionalReconfiguration* filed can also be used to configure CPA, MN initiated CPC or SN initiated CPC in Rel-17.

**Question 1: Companies are requested to comment on reuse of the *conditionalReconfiguration* filed to configure CPA, MN initiated inter-SN CPC and SN initiated inter-SN CPC in Rel-17.**

|  |  |  |
| --- | --- | --- |
| Company | Reuse of the conditionalReconfiguration filed to configure CPAC (Agree/Disagree) | Comment |
| Ericsson | Yes.  | As we indicated in [5], some contributions propose that UE should support CPAC and CHO simultaneously. In that case, it needs to be discussed how the number of maximum number of candidates maxNrofCondCells-r16 (currently defined as 8) is to be split among CPAC and CHO candidates. It can be taken later. |
| MediaTek | Agree |  |
| CATT | Agree | We agree to the reuse of conditionalReconfiguration filed to configure CPAC (all scenarios) in Rel-17. |
| ZTE | Agree |  |

**Issue 2: MCG and SCG reconfiguration within CPA/CPC**

As discussed in [1,4],the final RRC message for CPAC may contain both MCG and SCG re-configurations since the MCG configuration may be impacted by the addition of candidate PSCell configuration (e.g. sk-Counter, DRB level configuration, etc.).

The MCG reconfiguration with SCG reconfiguration for each candidate PSCell can be configured using *condRRCReconfig* field to contain both MCG and SCG re-configurations [4].

The RRC message contained in the *condRRCReconfig/condReconfigurationToApply* is in MN format, in which the RRC message generated by the candidate SN is encapsulated in a RRC container (e.g. *mrdc-SecondaryCellGroup/nr-SecondaryCellGroupConfig*). The signaling structure of RRC message contained in the *condRRCReconfig* is similar to the legacy RRC message for non-conditional PSCell addition/change via SRB1.

**Question 2: Companies are requested to comment on reuse of the *condRRCReconfig* field for NR-DC/*condReconfigurationToApply* field for (NG)EN-DC to contain both MCG and SCG re-configurations for each candidate PSCell configuration. I.e. the RRC message contained in the *condRRCReconfig/condReconfigurationToApply* is in MN format, in which the RRC message generated by the candidate SN is encapsulated in a RRC container (e.g. *mrdc-SecondaryCellGroup/nr-SecondaryCellGroupConfig*).**

|  |  |  |
| --- | --- | --- |
| Company | Reuse of the condRRCReconfig*/condReconfigurationToApply* field to contain both MCG and SCG re-configurations for each candidate PSCell configuration. (Agree/Disagree) | Comment |
| Ericsson | Agree.  | This does not work without possibly having MCG and SCG configuration in the message to be applied upon fulfilment of the execution condition.However, while in legacy the MN re-configures the UE and waits an RRCReconfigurationComplete with a new MN/MCG configuration that has been just provided, in CPA and CPC that is not really possible, as the UE is allowed to continue transmitting messages to the MN (before it executes CPA or CPC) using the current configuration. One could argue that the MN would have to monitor messages according to the current UE’s configuration and the possibly applied upon execution. However, that might become quite cumbersome, especially if the UE is configured with different MCG/MN configurations for different target candidates (and different target candidates for CPA and/or CPC may have different capabilities, configure different measurements/ frequencies, requiring different gap re-configuration from the MN’s perspective, etc.).FFS How to address the issue that different MN/MCG configuration can be configured for the different target candidates in the message to be applied upon execution.[CATT]: this issue is somewhat addressed by Q4/5. Upon execution of CPAC, UE will indicate to the MN which set of MN configuration should be applied by including the selected target PSCell information into the RRC Reconfiguration Complete message to the MN. |
| MediaTek | Agree |  |
| CATT | Agree | Reuse of the condRRCReconfig/condReconfigurationToApply field to contain both MCG and SCG re-configurations for each candidate PSCell configuration |
| ZTE | Agree | The MCG and SCG re-configurations should be delivered to the UE together as a single candidate configuration (i.e. contained in one RRC container), to ensure the simultaneous activation of reconfiguration from both the MN side and the SN side upon execution of CPAC. And reusing the legacy signalling structure for normal PSCell addition/change message transmitted via SRB1 is a simple way. |

**Issue 3: MN generated execution condition**

Based on agreements from RAN2#112e, the MN determines the execution conditions per target candidate for CPA and MN-initiated CPC and their associated measurement configuration is in MCG MeasConfig. Similar to CHO, CPA and MN-initiated CPC can also reuse the field *condExecutionCond-r16/triggerCondition-r16* of SEQUENCE (SIZE (1..2)) OF MeasId for configuring the execution condition per target candidate [5].

For NR-DC:

CondReconfigToAddModList-r16 ::= SEQUENCE (SIZE (1.. maxNrofCondCells-r16)) OF CondReconfigToAddMod-r16

CondReconfigToAddMod-r16 ::= SEQUENCE {

 condReconfigId-r16 CondReconfigId-r16,

 condExecutionCond-r16 SEQUENCE (SIZE (1..2)) OF MeasId OPTIONAL, -- Cond condReconfigAdd

 condRRCReconfig-r16 OCTET STRING (CONTAINING RRCReconfiguration) OPTIONAL, -- Cond condReconfigAdd

 ...

}

For (NG)EN-DC:

CondReconfigurationToAddModList-r16 ::= SEQUENCE (SIZE (1.. maxCondConfig-r16)) OF CondReconfigurationAddMod-r16

CondReconfigurationAddMod-r16 ::= SEQUENCE {

 condReconfigurationId-r16 CondReconfigurationId-r16,

 triggerCondition-r16 SEQUENCE (SIZE (1..2)) OF MeasId

 OPTIONAL, -- Cond CondReconfigurationAdd

 condReconfigurationToApply-r16 OCTET STRING (CONTAINING RRCConnectionReconfiguration)

 OPTIONAL,-- Cond CondReconfigurationAdd

 ...

}

**Question 3: Companies are requested to comment on the following: For CPA and MN-initiated CPC, the execution conditions are configured in *condExecutionCond* for NR-DC, or *triggerCondition* for (NG)EN-DC and refer to an MCG MeasConfig.**

|  |  |  |
| --- | --- | --- |
| Company | For CPA and MN-initiated CPC, the execution conditions are configured in condExecutionCond/triggerCondition and refer to an MCG MeasConfig. (Agree/Disagree) | Comment |
| Ericsson | Agree. | However, one additional issue that needs to be addressed is concerning the following agreement from RAN2#112e:**Bulk Agreement**…**Proposal set 1B: trigger/ condition related**11 For conditional PSCell change, A3/A5 execution condition should be supported while for conditional PSCell addition, A4/B1 like execution condition should be supported.…The issue is that conditional A3 and conditional A5 needs to refer to the target candidate PSCell, and not the PCell (which is the case of in existing ReportConfigNR, as it was designed for CHO).[CATT] this issue is addressed in Q7 and Q8 |
| MediaTek | Agree | We can further discuss the A3/A5 issue in MN-initiated CPC in Q8. |
| CATT | Agree | Legacy condExecutionCond for NR-DC, or triggerCondition for (NG)EN-DC can be reused for the execution condition. For CPA or MN initiated CPC, it is the MN to configure the execution condition, thus should refer to the measurement configuration of MN. |
| ZTE | Agree |  |

**Issue 4: The execution of CPAC**

In CPAC, RAN2#113e has the following agreements:

10 In CPA and Inter-SN CPC, upon execution of CPAC, ‎the UE ‎shall ‎reply the RRCReconfigurationComplete/RRCConnectionReconfigurationComplete ‎message to ‎the MN ‎including an embedded RRC complete message to the SN, and then the MN informs the target SN.

In CPA and inter-SN CPC, upon execution of CPAC, the UE ‎shall ‎reply the RRC Reconfiguration Complete message to the MN including an embedded RRC reconfiguration complete message to the SN. Then the MN transfers the RRC complete message to the target SN. Considering multiple candidate SNs may be configured for a UE, the MN has no idea on which candidate SN should the SN RRC complete message be transferred to. One way to handle this is to include the selected target PSCell information (e.g. *condReconfigId/* *CondReconfigurationId*) in the RRC complete message to the MN, and then the MN can inform the target SN according to the indicated PSCell information [1,4,5].

**Question 4: Companies are requested to comment the following:**

**Upon execution of CPAC, the UE includes the selected target PSCell information (e.g. *condReconfigId/*** *CondReconfigurationId***) into the RRC Reconfiguration Complete message to the MN.**

|  |  |  |
| --- | --- | --- |
| Company | Upon execution of CPAC, the UE includes the selected target PSCell information (e.g. condReconfigId/ *CondReconfigurationId*) into the RRC Reconfiguration Complete message to the MN. (Agree/Disagree) | Comment |
| Ericsson | Agree | As different target candidate cells can be from different target candidate SN(s), the MN needs to know to which target candidate SN it needs to forward the embedded SN RRCReconfigurationComplete within the RRCReconfigurationComplete received from the UE. And consequently, the MN would need to know which CPA or CPC procedures would need to be cancelled. This is not a problem in Release-16 for CHO or intra-node CPC. In CHO the UE executes CHO and transmits the RRCReconfigurationComplete to the target node, which transmits the source with a HO Success message. In CPC, the MN receives the embedded SN RRCReconfigurationComplete but as CPC is limited to intra-node, there is only a single SN to forward that one. |
| MediaTek | Agree |  |
| CATT | Agree | For R16 CHO, UE transmits the RRCReconfigurationComplete message directly to the selected node upon CHO execution, or for SN initiated intra-SN CPC without MN involvement, there is only one SN node, and MN can directly forward the received SN RRCReconfigurationComplete message to the SN upon CPC execution. However for R17 CPAC, there may be multiple candidate SNs, upon the CPAC execution, MN should be aware of the PSCell that the UE access to, so that MN can transfer the embedded SN RRCReconfigurationComplete message within MN RRCReconfigurationComplete message to the corresponding SN. Moreover, for R17 CPAC, different MN/MCG configuration can be configured for the different target candidates in the message to be applied upon execution, MN needs to know which set of MN/MCG configuration shall be applied. |
| ZTE | Agree | Different from the R16 intra-SN CPC, multiple candidate SNs can be configured for the R17 CPAC. So the MN needs to know which candidate SN should the received SN RRC complete message be transferred to. |

According to [1][2][4][6], the following information to determine the accepted PSCells determined by the UE can be included within the RRC Reconfiguration Complete message to the MN:

Option 1: target PSCell identifier (PCI or PCI+frequency info)

Option 2: condReconfigId/CondReconfigurationId

Option 3: other

**Question 5: If the answer to Question 4 is agreed i.e. to include the selected target PSCell information into the RRC Reconfigutation Complete message to the MN, companies are requested to comment on which option is to be supported?**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Ericsson | Option 2 | Simpler |
| MediaTek | Option 2  |  |
| CATT | Option 2 | Compared with option 1, option 2 has less signalling overhead. |
| ZTE | Option 2 |  |

**Issue 5: Event configuration**

With regards to measurement events for CPAC, the followings were agreed.

**RAN2#112e**

**…**

**Proposal set 1B: trigger/ condition related**

11 For conditional PSCell change, A3/A5 execution condition should be supported while for conditional PSCell addition, A4/B1 like execution condition should be supported.

12 Allow having multiple triggering conditions (using “and”) for CPAC execution of a single candidate cell. Only single RS type per CPAC candidate is supported. At most two triggering quantities (e.g. RSRP and RSRQ, RSRP and SINR, etc.) can be configured simultaneously.

…

**RAN2#113e**

5 For CPC initiated by MN, A4/B1 like execution condition should be supported.

Considering only conditional NR PSCell addition or change is supported, only A4 like execution condition is applicable for CPA and MN initiated inter-SN CPC in NR-DC scenarios. For (NG)EN-DC, only B1 like execution condition is applicable for CPA and MN initiated inter-SN CPC.

As for the E-UTRAN MCG, the existing signalling in *ReportConfigInterRAT* can be enhanced to support B1 event for CPA and MN initiated CPC as follows:

ReportConfigInterRAT ::= SEQUENCE {

 triggerType CHOICE {

 event SEQUENCE {

 eventId CHOICE {

 eventB1 SEQUENCE {

 b1-Threshold CHOICE {

 b1-ThresholdUTRA ThresholdUTRA,

 b1-ThresholdGERAN ThresholdGERAN,

 b1-ThresholdCDMA2000 ThresholdCDMA2000

 }

 },

 eventB2 SEQUENCE {

 b2-Threshold1 ThresholdEUTRA,

 b2-Threshold2 CHOICE {

 b2-Threshold2UTRA ThresholdUTRA,

 b2-Threshold2GERAN ThresholdGERAN,

 b2-Threshold2CDMA2000 ThresholdCDMA2000

 }

 },

 ...,

 eventW1-r13 SEQUENCE {

 w1-Threshold-r13 WLAN-RSSI-Range-r13

 },

 eventW2-r13 SEQUENCE {

 w2-Threshold1-r13 WLAN-RSSI-Range-r13,

 w2-Threshold2-r13 WLAN-RSSI-Range-r13

 },

 eventW3-r13 SEQUENCE {

 w3-Threshold-r13 WLAN-RSSI-Range-r13

 },

 eventB1-NR-r15 SEQUENCE {

 b1-ThresholdNR-r15 ThresholdNR-r15,

 reportOnLeave-r15 BOOLEAN

 },

 eventB2-NR-r15 SEQUENCE {

 b2-Threshold1-r15 ThresholdEUTRA,

 b2-Threshold2NR-r15 ThresholdNR-r15,

 reportOnLeave-r15 BOOLEAN

 }

 },

 hysteresis Hysteresis,

 timeToTrigger TimeToTrigger

 },

 periodical SEQUENCE {

 purpose ENUMERATED {

 reportStrongestCells,

 reportStrongestCellsForSON,

 reportCGI}

 }

 },

 maxReportCells INTEGER (1..maxCellReport),

 reportInterval ReportInterval,

 reportAmount ENUMERATED {r1, r2, r4, r8, r16, r32, r64, infinity},

 ...,

 [[ si-RequestForHO-r9 ENUMERATED {setup} OPTIONAL -- Cond reportCGI

 ]],

 [[ reportQuantityUTRA-FDD-r10 ENUMERATED {both} OPTIONAL -- Need OR

 ]],

 [[ includeLocationInfo-r11 BOOLEAN OPTIONAL -- Need ON

 ]],

 [[ b2-Threshold1-v1250 CHOICE {

 release NULL,

 setup RSRQ-Range-v1250

 } OPTIONAL -- Need ON

 ]],

 [[ reportQuantityWLAN-r13 ReportQuantityWLAN-r13 OPTIONAL -- Need ON

 ]],

 [[ reportAnyWLAN-r14 BOOLEAN OPTIONAL -- Need ON

 ]],

 [[ reportQuantityCellNR-r15 ReportQuantityNR-r15 OPTIONAL, -- Need ON

 maxReportRS-Index-r15 INTEGER (0..maxRS-IndexReport-r15) OPTIONAL, -- Need ON

 reportQuantityRS-IndexNR-r15 ReportQuantityNR-r15 OPTIONAL, -- Need ON

 reportRS-IndexResultsNR BOOLEAN OPTIONAL, -- Need ON

 reportSFTD-Meas-r15 ENUMERATED {pSCell, neighborCells } OPTIONAL -- Need ON

 ]],

 [[

 useAutonomousGapsNR-r16 ENUMERATED {setup} OPTIONAL, -- Cond reportCGI-NR

 measRSSI-ReportConfigNR-r16 MeasRSSI-ReportConfig-r13 OPTIONAL -- Need ON

 ]],

 [[condTriggerConfig-r17 CondTriggerConfig-r17 OPTIONAL,-- Need ON

 ]]

}

CondTriggerConfig-r17 ::= SEQUENCE {

condEventId CHOICE {

 condEventB1 SEQUENCE {

 b1-ThresholdNR ThresholdNR-r15,

 hysteresis Hysteresis,

 timeToTrigger TimeToTrigger

 },

 ...

 }

}

**Question 6: Companies are requested to comment on whether the existing signaling in *ReportConfigInterRAT* can be modified (as shown above) to support B1 events for CPA and MN initiated CPC.**

|  |  |  |
| --- | --- | --- |
| Company | The existing signalling in ReportConfigInterRAT can be modified to support B1 events for CPA and MN initiated CPC (Agree/Disagree) | Comment |
| Ericsson | Agree | Seems fine. |
| MediaTek | Agree |  |
| CATT | Agree |  |
| ZTE | Agree |  |

As for the NR MCG, the existing signalling in ReportConfigNR can be enhanced to support A4 event for CPA and MN initiated CPC as follows:

CondTriggerConfig-r16 ::= SEQUENCE {

 condEventId CHOICE {

 condEventA3 SEQUENCE {

 a3-Offset MeasTriggerQuantityOffset,

 hysteresis Hysteresis,

 timeToTrigger TimeToTrigger

 },

 condEventA5 SEQUENCE {

 a5-Threshold1 MeasTriggerQuantity,

 a5-Threshold2 MeasTriggerQuantity,

 hysteresis Hysteresis,

 timeToTrigger TimeToTrigger

 },

 ...,

 [[

 condEventA4-r17 SEQUENCE {

 a4-Threshold MeasTriggerQuantity,

 hysteresis Hysteresis,

 timeToTrigger TimeToTrigger

 }

 ]]

 },

 rsType-r16 NR-RS-Type,

 ...

}

**Question 7: Companies are requested to comment on whether the existing signaling in ReportConfigNR can be modified (as shown above) to support A4 events for CPA and MN initiated CPC.**

|  |  |  |
| --- | --- | --- |
| Company | the existing signalling in ReportConfigNR can be modified to support A4 events for CPA and MN initiated CPC (Agree/Disagree) | Comment |
| Ericsson | Agree | Seems fine. |
| MediaTek | Agree |  |
| CATT | Agree |  |
| ZTE | Agree |  |

In RAN2#112e, an agreement was made such that A3/A5 events can be configured for inter-SN CPC. In addition, A4/B1 events were agreed to be applied for MN initiated inter-SN CPC in RAN2#113e. However, some companies argued that A3/A5 event would refer to the current serving cell, i.e., PCell for MN initiated inter-SN CPC. However, for MN initiated inter-SN CPC, it should be the PSCell to be evaluated, but not the PCell. Thus A3/A5 is not applicable for MN initiated CPC. Some companies propose to introduce enhancement to A3/A5 to make that to be applicable for MN initiated CPC. We think it is better to clarify whether A3/A5 like event can be configured for MN initiated inter-SN CPC besides A4/B1.

**Question 8: Companies are requested to comment on whether A3/A5 like events can be configured for MN initiated inter-SN CPC.**

|  |  |  |
| --- | --- | --- |
| Company |  Yes/No | Comment |
| Ericsson | Already agreed, the question should be how it is supported. | This has been already agreed in RAN2#112e:**Bulk Agreement**…**Proposal set 1B: trigger/ condition related**11 For conditional PSCell change, A3/A5 execution condition should be supported while for conditional PSCell addition, A4/B1 like execution condition should be supported.…The question is how this is supported. MN initiated CPC is sort of pointless without being able to support A3/A5 for a PSCell. If that is reverted, we should also revert MN initiated CPC (which could save some time in RAN3 perhaps).We wonder about the rapporteur text “…some companies argued that A3/A5 event would refer to the current serving cell, i.e., PCell for MN initiated inter-SN CPC”, as we wonder how this work i.e. change a PSCell based on PCell quality?!  |
| MediaTek | Prefer no for simplicity but open for discussion | We would like to clarify first, for MN initiated PSCell change **(not CPC**), does MN use A3 or A5 event in MCG measConfig for triggering? If no, it is a little weird that we add new triggering condition only for “conditional” case. |
| CATT | No | In our understanding, in RAN2#113e, the following agreement has been made, due to the problem that A3/A5 is for a serving cell, i.e., PCell for MN initiated inter-SN CPC:5 For CPC initiated by MN, A4/B1 like execution condition should be supported. if the support of A3/A5 execution is applicable for MN initiated inter-SN CPC, further enhancement needed to introduce to make the solution workable.Moreover, in legacy MN initiated PSCell change scenario, A3/A5 event are not used. It is better to follow legacy principles.  |
| ZTE | Prefer no for simplicity but open for discussion | In the legacy MN initiated inter-SN PSCell change, only A4/B1 event are used considering the MN initiated case is usually triggered due to load balance, instead of coverage problem. We wonder whether there is a realistic need to introduce A3/A5 event for MN initiated CPC? If needed, we think some enhancements on A3/A5 event can be considered to compare the neighbour cell with PSCell quality in MN initiated CPC, and the A3/A5 event should also be applicable to legacy MN initiated inter-SN PSCell change. |

If the answer to question 8 is yes, i.e.A3/A5 events can be configured for MN initiated inter-SN CPC, the serving cell refers to the PCell, but not the PSCell. To solve this problem, a solution was proposed in [5] to simply indicate that an A3/A5 events needs to compare a target candidate with the PSCell instead of the PCell, even if the configuration is a part of an MCG MeasConfig for CPC. An explicit solution could rely on a flag in ReportConfig e.g. *usePscell*.

 usePSCell-r12 BOOLEAN OPTIONAL, -- Need ON

**Question 9: Companies are requested to comment on how to configure/use A3/A5 events for MN-initiated inter-SN CPC.**

|  |  |
| --- | --- |
| Company | Comment |
| Ericsson | No strong view, as long as it is possible to indicate that PSCell is used in A3/A5 for CPC. The solution shown above is fine. The alternative would be the UE identify that the message to be applied is an SCG reconfiguration with sync (i.e. implicit, no need to extra signalling). |
| MediaTek | Adding a flag is ok if we want to support this kind of scenario. We would like clarify whether this report confirguation could use for measurement that is not  |
| CATT | In our view, A3/A5 event for MN initiated inter-SN CPC is not necessary. The target SN can always perform SN initiated inter-SN CPC to change the selected PSCell if required. |
| ZTE | No strong view. Both implicit and explicit solution can work if we want to support A3/A5 event for MN initiated CPC. |

**2.2 Open issues applicable to SN-initiated inter-SN CPC**

The following agreements were made for SN-initiated inter-SN CPC at RAN2 114-e.

* 1: For SN-initiated CPC, RAN2 confirms the source SN configuration may be updated (by source SN) when UE uses per FR measurement gap and is to be configured with CPC.
* 2: The source SN may provide the execution conditions (and/or SN measurement configuration) to the MN upon obtaining the information which cells have been ultimately prepared by the target SN.
* 3: Target SN chooses candidate target PSCell for CPC from the list of cells and/or measurements provided by the source SN/MN

Working assumption (to clarify agreements 1-3 above)

* 1. Upon SN initiated CPC configuration, S-SN indicates the CPC candidates to MN and for each an execution condition
* 2. S-SN can provide also measurements to MN/T-SN and this may include cells that are not CPC candidates
* 3. T-SN can either accept or reject the CPC candidates suggested by S-SN (as in 1) i.e. it cannot come up with any alternative candidates
* 4. S-SN is informed about which candidates were accepted/ rejected by T-SN
* 5. S-SN can subsequently update the (measurement) configuration. FFS for execution conditions.
* 6. S-SN can perform this update after the CPC configuration. FFS whether to support updating during the CPC configuration (i.e. solution 2). FFS whether nested procedure is supported

**Issue 6: The handling of UE measurements for CPAC purpose**

[4] discusses the handling of UE measurements for CPAC. As per the above agreements/working assumptions, Source–SN is informed about which candidate cells were accepted /rejected by the target-SN and the source–SN can subsequently update the (measurement) configuration. It was also agreed that Source-SN can perform this update after the CPC configuration. It is FFS whether to support updating of source–SN configuration during the CPC configuration based on accepted/ rejected candidate cells by the Target-SN.

Based on the agreements, it is possible that the NW may have not updated the unnecessary *measID* related with CPC that are not linked with the selected candidate PSCells before sending CPAC configuration to the UE. Some companies concerned that it may have some impact on the UE performance since the UE performs the unnecessary measurement on such *measID*. [4,5] discuss options that can be considered for the UE measurements in such case:

* Option 1: the UE automatically removes the *measID* related with CPC that are not linked with the applicable candidate PSCells;
* Option 2: specify that the UE shall ignore measId(s) that were not indicated in the *condExecutionCond/triggerCondition*.
* Option 3: it’s up to the UE implementation whether to perform measurements on the *measID* related with CPC that are not linked with the applicable candidate PSCells.

According to the current specification, although the UE can perform the measurement on the unnecessary *measID* related with CPC, but the measurement result shall not be used for the conditional reconfiguration evaluation since there is no applicable candidate cell linked with those *measIDs*. Therefore CPAC execution will not be triggered wrongly in such case.

[5] has provided an example of how to specify Option 2 such that the UE does not perform measurements for measId(s) in *MeasConfig* that are not indicated in the *condExecutionCond* associated to *condReconfigId*.

Considering the measurement results of these unnecessary *measIDs* will not be used and reported, it can anyway be up to the UE implementation whether to perform measurements on the *measID* related with CPC that are not linked with the applicable candidate PSCells or not (Option 3).

**Question 10: Companies are requested to comment on which option is to follow if the UE has the stored *measID(s)* related with CPC that are not linked with the applicable candidate PSCells.**

|  |  |  |
| --- | --- | --- |
| Company | Option  | Comment |

|  |  |  |
| --- | --- | --- |
| Ericsson | Option 2 is preferredOption 1 is acceptableOption 3 contradicts the current text in 5.5, not an acceptable option for us.  | We would like to highlight that the question assumes that the complicated stage-2 signalling with various options (that will create some extra work in RAN3) has been agreed, which is not clear to us. The simplest is still a procedure with always two steps.We are responding anyways under the assumption that the complicated solution with various options had been agreed (good luck RAN3 to finish this in time), which creates this additional issue.Option 1 is not the best, as we try to avoid UE autonomous actions for something where a signalling would be possible. And, these measId(s) are anyways deleted later upon successful execution or suspend/release. Option 3 leads to an inconsistent specification. Section 5.5 in RRC specifies when the UE shall perform measurements and without any changes, the sentence is no sense “it’s up to the UE implementation whether to perform measurements on the measID related with CPC that are not linked with the applicable candidate PSCells” as it would contradict what the specs says the UE shall perform these measurements. |
| MediaTek | Option 2 | Option 1 is not so preferred as we generally avoid UE autonomous release some configuration.Option 2 and 3 seems the same as UE would anyway not trigger this CPC. However, we prefer to have clear rule saying that UE is not required to do this measurement.In addition, we understand this S-SN should release the useless measurement ID once it is informed about which candidates were accepted/ rejected. So, this should not be a big issue. |
| CATT | Option2 preferred | Option 2 is easier, which can avoid UE autonomous behaviour and unnecessary measurement for the measID related with CPC that is not linked with the selected candidate PSCells. Moreover, we provide one possible solution for option 2 as following modifications:

|  |
| --- |
| 5.5.3 Performing measurements5.5.3.1 GeneralSkip unnecessary part……The UE shall:Skip unnecessary part……2> if the *reportType* for the associated *reportConfig* is *periodical*, *eventTriggered,* or:*2>*if the *reportType* for the associated *reportConfig* is *condTriggerConfig and* the *measId* is indicated in the *condExecutionCond* within *VarConditionalReconfig*:3> if a measurement gap configuration is setup, or3> if the UE does not require measurement gaps to perform the concerned measurements:4> if *s-MeasureConfig* is not configured, or4> if *s-MeasureConfig* is set to *ssb-RSRP* and the NR SpCell RSRP based on SS/PBCH block, after layer 3 filtering, is lower than *ssb-RSRP,* or4> if *s-MeasureConfig* is set to *csi-RSRP* and the NR SpCell RSRP based on CSI-RS, after layer 3 filtering, is lower than *csi-RSRP*:5> if the *measObject* is associated to NR and the *rsType* is set to *csi-rs*:Skip unnecessary part…… |

 |
| ZTE | Option 3 is preferredOption 2 is acceptable | Considering the measID only used for CPC shall be anyway removed after successful completion of CPC, there is no need to remove the measID related with CPC but not linked with the applicable cell upon reception of the RRC message for CPC (i.e. option 1).For option 2 and option 3, although the UE shall perform the measurements related to the unnecessary measID according to the current text, the measurement results shall not be used to trigger the CPC execution and not be reported to the NW. So we think it is simpler to let the UE implementation whether to perform the measurements, e.g. add a Note in the spec to allow different UE implementation from the current text (i.e. the UE can not perform the measurements). It seems that the option 3 has less spec impact than option 2. But if the majority wants to clearly specify this, we are also fine to go for option 2. |

Another potential issue which has been identified is that the *RRCReconfiguration* applied upon execution could be subjected to delta signalling resulting in potential ambiguity if *measConfig* is not updated in time [5]. However, that would not be an issue as long as the UE deletes CPC related *measConfig* upon successful execution, as it is done for CHO in Rel-16.

**Question 11: Companies are requested to comment on whether the UE should deletes CPC related measConfig upon successful CPC execution.**

|  |  |  |
| --- | --- | --- |
| Company | The UE should deletes CPC related measConfig upon successful CPC execution (Agree/Disagree) | Comment |
| Ericsson | Agree | As discussed earlier, this assumes we have agreed on the complicated solution with various options. If that is the case, we need to have something like that as in CHO. |
| MediaTek | Agree | It seems simpler to just follow the CHO design. |
| CATT | Agree | In R16, UE shall delete the CHO/CPC related measConfig upon successful CHO/CPC execution. The same principle can be reused for R17 CPAC. |
| ZTE | Agree | It’s fine to follow the similar principle for R16 CHO/intra-SN CPC. |

**Issue 7: Execution condition configuration for SN-initiated CPC**

The following agreement at RAN2#113 was made for the configuration of the execution condition for SN-initiated CPC.

Agreements

1 In SN initiated CPC with MN involvement, the source SN transfers the execution condition(s) to the MN. FFS whether MN needs to comprehend the execution condition set by the source SN. FFS on stage-3 detail of coding of execution condition(s) in the final message.

Whether MN needs to comprehend the execution condition set by the source SN is FFS. As discussed in [5], one potential advantage of MN comprehending the execution condition is that the MN could simply set the execution conditions to the existing field *condExecutionCond-r16/triggerCondition-r16* as in CPA and MN initiated inter-SN CPC. On the other hand, [3,4] argues that the mapping of *RRCReconfiguration* provided by the target SN to the execution condition provided by the source SN can be performed by the MN without comprehending the execution condition.

**Question 12: Companies are requested to comment on the following: the MN does not need to comprehend the execution condition set by the source SN. The MN can associate the execution condition configuration to an RRCReconfiguration message provided by the target –SN without comprehending the execution condition set by the source SN.**

|  |  |  |
| --- | --- | --- |
| Company | The MN does not need to comprehend the execution condition set by the source SN (Agree/Disagree) | Comment |
| Ericsson | It does not matter? | What matters is that the MN needs to indicate to the UE that the execution conditions (one or two measId(s)) should refer to an SCG MeasConfig. And, for that reason, we should define a new field or have some way to indicate that to the UE. Hiding or not hiding seems irrelevant in our view, maybe proponents could explain the point of hiding it. |
| MediaTek | No strong view | We have no strong view on whether MN should understand the execution condition set by S-SN. Similar view as Ericsson, what matters is the UU interface design. |
| CATT | Agree | The MN does not need to comprehend the execution condition set by the source SN. |
| ZTE | Agree | The MN does not need to comprehend the measurement configuration set by the source SN, also including the execution condition which refers to the measId(s) related with the SCG MeasConfig. |

In MN-initiated CPC, CPA and CHO, the execution condition in *condExecutionCond*/*triggerCondition* refers to *MeasID*(s) in the MCG *MeasConfig*. However, in the SN-initiated CPC, the execution condition needs to refer to an SCG *MeasConfig*. Hence, a new field is needed in *CondReconfigToAddMod*/*CondReconfigurationAddMod*, so the UE is aware that a given execution condition refers to the SCG *MeasConfig* [4, 5]. Considering the current field for the execution condition(s) just refers to a sequence of *measID*, a new field for the execution condition(s) set by the SN (e.g. *condExecutionCondSN*/*triggerConditionSN*) can be introduced as an octet string container [4]. The corresponding SN execution condition is provided in SN format and is not visible to the MN [1]. Then the current field *condExecutionCond*/*triggerCondition* is just used to indicate the execution condition(s) set by the MN. In this way, the UE can distinguish the MN initiated CPC from the SN initiated CPC.

**Question 13: Companies are requested to comment on whether to introduce a new field** **(e.g. condExecutionCondSN) in CondReconfigToAddMod for NR-DC, or a new field (e.g. *triggerConditionSN*) in CondReconfigurationAddMod for (NG)EN-DC to indicate that the execution condition refers to the SCG MeasConfig .**

|  |  |  |
| --- | --- | --- |
| Company |  Agree/Disagree | Comment |
| Ericsson | Agree | A new field needs to be introduced in *CondReconfigToAddMod* to indicate that the execution condition refers to the SCG MeasConfig.It could be something like that, in case people prefer to hide this from the MN:CondReconfigToAddModList-r16 ::= SEQUENCE (SIZE (1.. maxNrofCondCells-r16)) OF CondReconfigToAddMod-r16CondReconfigToAddMod-r16 ::= SEQUENCE {condReconfigId-r16 CondReconfigId-r16,condExecutionCond-r16 SEQUENCE (SIZE (1..2)) OF MeasId OPTIONAL, -- Cond condReconfigAdd[[condExecutionCond2-r17 OCTET STRING (CONTAINING CondReconfigExecCond-r17) OPTIONAL]],condRRCReconfig-r16 OCTET STRING (CONTAINING RRCReconfiguration) OPTIONAL, -- Cond condReconfigAdd...}CondReconfigExecCond-r17 ::= SEQUENCE (SIZE (1..2)) OF MeasId-- TAG-CONDRECONFIGTOADDMODLIST-STOP-- ASN1STOP |
| MediaTek | Agree | Otherwise, there is ambiguity. |
| CATT | Agree | Agree to introduce a similar field of condExecutionCond, i.e., condExecutionCondSN, which indicates the execution condition set by S-SN and refers to the SCG measConfig. |
| ZTE | Agree | A new field for the execution condition set by the source SN can help the UE to easily identify which MeasConfig (e.g. set by the MN or the SN) is referred to. And the new field can be defined as an octet string container considering the execution condition set by the source SN is transparent to the MN. |

**2.3 Any other open issue**

# 3 Conclusion

[TBA]

# 4 Reference

 [1] R2-2105990 Uu RRC message design in CPAC Huawei, HiSilicon discussion Rel-17

[2] R2-2105111 Details in conditional PSCell change and addition Apple discussion Rel-17

[3] R2-2104914 Discussion on the configuration of CPAC vivo discussion Rel-17 LTE\_NR\_DC\_enh2-Core

[4] R2-2105507 Further discussion on CPAC ZTE Corporation, Sanechips discussion Rel-17 LTE\_NR\_DC\_enh2-Core

[5] R2-2105898 UE procedures and signalling for CPAC Ericsson discussion LTE\_NR\_DC\_enh2-Core

[6] R2-2105261 CPAC procedures from UE perspective Qualcomm Incorporated discussion Rel-17

# 5 Annex

RAN#2 agreements on CPAC

**RAN2#111e**

**R2 assumes that the work Will follow what is in the WID, and initially focus on CPA and Inter-SN CPC**

**R2 assumes for now that LTE SCG is not included.**

**RAN2#112e**

**Bulk Agreement**

**Proposal Set 1A: general/procedure**

1. **Maintain Rel-15 principle that only one PScell is active at a time even with conditional PScell addition/change.**
2. **Usage of CPAC is decided by the network. The UE evaluates when the condition is valid.**
3. **The baseline operation for CPAC procedure assumes the RRC Reconfiguration message contains SCG addition/change triggering condition(s) and the RRC configuration(s) for candidate target PSCells. The UE accesses the prepared PSCell when the relevant condition is met.**
4. **CPAC execution condition and/or candidate PSCell configuration can be updated by modifying the existing CPAC configuration.**
5. **Support configuration of one or more candidate cells for CPAC.**
6. **UE is not required to continue evaluating the triggering condition of other candidate PSCell(s) during CPC/CPA execution.**
7. **For FR1 and FR2, leave it up to UE implementation to select the candidate PSCell if more than one candidate cell meets the triggering condition. UE may consider beam information in this.**
8. **No additional optimizations with multi-beam operation are introduced to improve RACH performance for CPAC completion with multi-beam operation.**

**Proposal set 1B: trigger/ condition related**

1. **For conditional PSCell addition, the MN decides on the conditional PSCell addition execution condition. FFS for PSCell Change.**
2. **The execution condition for CPAC is defined by a measurement identity which identifies a measurement configuration.**

**11 For conditional PSCell change, A3/A5 execution condition should be supported while for conditional PSCell addition, A4/B1 like execution condition should be supported.**

**12 Allow having multiple triggering conditions (using “and”) for CPAC execution of a single candidate cell. Only single RS type per CPAC candidate is supported. At most two triggering quantities (e.g. RSRP and RSRQ, RSRP and SINR, etc.) can be configured simultaneously.**

**13 Cell level quality is used as baseline for CPAC execution condition;**

**14 Only single RS type (SSB or CSI-RS) per candidate PSCell is supported for PSCell change.**

**15 TTT is supported for CPAC execution condition (as per legacy configuration)**

**Proposal set 1C: signalling related**

**16 Reuse the RRCReconfiguration/RRCConnectionReconfiguration procedure to signal CPAC configuration to UE following Rel-16 signalling.**

**17 Multiple candidate PSCells can be sent in either one or multiple RRC messages.**

**18 As part of the CPAC configuration to be sent to the UE, the RRC container is used to carry candidate PSCell configuration, and the MN is not allowed to alter any content of the configuration from the PSCell. Moreover, in case of SN change, source SN is not allowed to alter any content of the configuration from the target SN. FFS on which RRC format is used (can be considered in stage-3)**

**19 For conditional PSCell addition, the MN transmits the final RRCReconfiguration/ RRCConnectionReconfiguration message to the UE. FFS how the encapsulation is done exactly (can be considered in Stage-3).**

**Proposal 1D: FFS issues**

**FFS for conditional PSCell change, SN decides on the condition for SN-initiated procedures and MN decides on the condition on MN-initiated procedures**

**FFS whether we need coordination on exact execution conditions or just measurements.**

**FFS whether source or target SN knows the condition**

**FFS in which exact cases the condition needs to be indicated**

**FFS how many candidate cells (UE and network impacts should be clarified). FFS whether the number of candidate cells for CPAC different from that of CHO.**

**FFS on UE capability for triggering quantities**

**In MN initiated inter-SN CPC and CPA, the MN is not required to indicate the execution condition(s) to other involved entities (e.g. target SN, source SN).**

**For CPA and MN initiated Inter-SN CPC, the MN generates and transmits the conditional configuration message (i.e. RRCReconfiguration/RRCConnectionReconfiguration message) to the UE. The RRCReconfiguration provided by the candidate PSCell(s) is encapsulated in the final conditional reconfiguration message to the UE. The MN is not allowed to alter the RRCReconfiguration provided by the candidate PSCell(s).**

**Proposal 1: Option 1 should be used for the generation of conditional reconfiguration for SN initiated inter-SN conditional PSCell change.**

**Option 1: The MN generates CPC. The source SN sets the execution condition and communicates it to the MN. The MN generates the conditional reconfiguration message including the execution condition(s) provided by the source SN and RRCReconfiguration provided by the candidate PSCell(s).**

**Proposal 2: Send LS to RAN3 informing**

**- RAN2 agreements**

**- RAN2 findings on the limitation of providing addition/modification of multiple CPC candidate cells in inter-node RAN3 message (i.e. XnAP fields, not in RRC INM)**

* **From RAN2 perspective, the above limitation could be reasonable (at least for R17) but this is up to RAN3 to decide.**

**RAN2#113e**

**Agreements**

**5 For CPC initiated by MN, A4/B1 like execution condition should be supported.**

**6 FFS can be removed from the following agreement: " Compliance check for embedded RRCReconfiguration may be delayed until execution (up to UE ‎implementation). FFS if this introduces specification changes regarding compliance checking of ‎embedded Reconfiguration message containing configuration of conditional PSCell candidate.‎"**

**7 Non-conditional SCG RRC Reconfiguration can be sent in the same MN generated RRCRconfiguration message, which carries execution conditions and target candidate configurations. i.e. ‎the secondaryCellGroup can be sent in the same configuration message with the ‎conditionalReconfiguration for inter-SN CPC.**

**8a In case of CPA and MN initiated Inter-SN CPC, upon reception of ‎RRCReconfiguration/RRCConnectionReconfiguration message with CPAC configuration, UE responds with RRCReconfigurationComplete/RRCConnectionReconfigurationComplete message to the MN to inform ‎that the message has been received. The message does not include an embedded RRC complete message for source SN.**

**8b In case of SN initiated Inter-SN CPC, upon reception of ‎RRCReconfiguration/RRCConnectionReconfiguration message with CPAC configuration, UE responds with RRCReconfigurationComplete/RRCConnectionReconfigurationComplete message to MN. This message can include an embedded RRC complete message for source SN.**

**9 The message carrying ‎conditionalReconfiguration for CPA/CPC is in MN format (i.e. contains ‎both MCG and SCG re-configurations). For the following cases: a). MN-Initiated CPA b). MN-Initiated inter-SN CPC c). SN-initiated inter-SN CPC.**

**10 In CPA and Inter-SN CPC, upon execution of CPAC, ‎the UE ‎shall ‎reply the RRCReconfigurationComplete/RRCConnectionReconfigurationComplete ‎message to ‎the MN ‎including an embedded RRC complete message to the SN, and then the MN ‎informs the ‎target SN.**

**11 Working assumption: the configurations of all candidates PSCell configurations for CPA and Inter-SN PSCell change are ‎released upon the successful completion of CPAC, conventional PSCell change or conventional PSCell ‎addition.‎ This can be revisited if critical issues found in a later stage.**

**12 SCGFailureInformation procedure can be taken as the baseline for CPAC failure ‎handling in Rel-17 ‎scenarios.‎**

**FFS on the exact content of the message.**

**FFS if time allows on further ‎enhancements to CPAC failure handling‎**

**13 Send an LS to RAN3 informing RAN2 agreements.**

**Agreements**

**1 In SN initiated CPC with MN involvement, the source SN transfers the execution condition(s) to the MN.** **FFS whether MN needs to comprehend the execution condition set by the source SN. FFS on stage-3 detail of coding of execution condition(s) in the final message.**

**2 Only SRB1 can be used in CPA and Inter-SN CPC scenarios in Rel-17. The complete message upon CPAC execution for CPA and Inter-SN CPC in Rel-17 should be provided to the MN via SRB1.**

**3 For the transmission of CPAC configuration, upon reception of RRCReconfiguration/RRCConnectionReconfiguration message with CPAC configuration, the UE shall reply the RRCReconfigurationComplete/RRCConnectionReconfigurationComplete message to the MN to inform that the message has been received. FFS if the message contains an embedded RRC complete message to the SN.**

**4 UE checks the validity of CPAC execution criteria configuration immediately on receiving the CPAC Reconfiguration message.**

 **Compliance check for embedded RRCReconfiguration may be delayed until execution (up to UE implementation). FFS if this introduces specification changes regarding compliance checking of embedded Reconfiguration message containing configuration of conditional PSCell candidate.**

**RAN2#113bis-e**

**1 Source SN provides the candidate cells and it sets the execution condition per candidate cell. Signalling details are FFS (e.g. which messages and steps).**

**Blind Inter-SN CPC is not precluded (but we will not optimize it)**

**3 FFS whether it is possible for the target SN to come up with alternative candidate cells other than what suggested by the ‎source SN. ‎**

**RAN2#114-e**

**1: In order to exchange per-PSCell parameter by reusing existing inter-node RRC message for CPAC, a list of CG-Config associated to each candidate PSCell should be sent from candidate SN to MN.**

**FFS if a list of CG-ConfigInfo from MN to candidate SN is needed. FFS if a list of CG-Config from source SN to MN is needed.**

**Discuss in Stage-3 whether new message is useful or not (based on signalling details)**

**Working assumption (to clarify agreements 1-3 above)**

**1. Upon SN initiated CPC configuration, S-SN indicates the CPC candidates to MN and for each an execution condition**

**2. S-SN can provide also measurements to MN/T-SN and this may include cells that are not CPC candidates**

**3. T-SN can either accept or reject the CPC candidates suggested by S-SN (as in 1) i.e. it cannot come up with any alternative candidates**

**4. S-SN is informed about which candidates were accepted/ rejected by T-SN**

**5. S-SN can subsequently update the (measurement) configuration. FFS for execution conditions.**

**6. S-SN can perform this update after the CPC configuration. FFS whether to support updating during the CPC configuration (i.e. solution 2). FFS whether nested procedure is supported**