3GPP TSG-RAN WG2 Meeting #112 Electronic DRAFT R2-200xxxx

Online, 2 – 13 November 2020

**Agenda item: 8.2.3**

**Source: CATT**

**Title: [Post111-e][920][eDCCA] Conditional PSCell Change and Addition (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:

* [Post111-e][920][eDCCA] Conditional PSCell Change and Addition (CATT)

Scope: Cover common grounds, e.g. confirm which old R16 agreements can be inherited now as “easy” agreements, and items that might need limited discussion.

Intended outcome: Report to next meeting

Deadline: Long - Thursday OCT 15 0700 UTC (please respect this deadline)

In RAN2#111e, the discussions on Conditional PSCell Addition and Change (CPAC) were started for Rel-17. After a brief discussion on the scope of the work, the following initial agreements were made.

* 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.

Following the above agreements, this email discussion **initially focuses on CPA and inter-SN CPC**. NR-DC and (ng)EN-DC deployment scenarios are considered. This includes:

- conditional PSCell addition

- MN initiated Inter-SN conditional PSCell change

- SN initiated Inter-SN conditional PSCell change

Note that the focus of this email discussion is primarily on the CPA and Inter-SN CPC procedures. Intra-SN CPC with MN involvement is not discussed while respecting the last meeting agreement to prioritise CPC and Inter-SN CPC. The intention is to discuss Intra-SN CPC after finalising the procedure for CPA and Inter-SN CPC.

# 2 Discussion

**2.1 Basic procedures**

At the initial discussion of Rel-16, all scenarios for CPAC were considered and some agreements were made. Due to the WI time limitation, Rel-16 scope was narrowed down only to introduce intra-SN conditional PSCell change without MN involvement. It is a good place to start the Rel-17 discussion from the CPAC agreements previously made in Rel-16 discussion.

At RAN2#107bis and RAN2#108 meetings, we have reached some agreements for general CPAC cases as follows:

***RAN2#107bis Chongqing***

**Agreements**

1. We will prioritize work in SN-initiated PSCell change for conditional PSCell change.
2. Maintain Rel-15 principle that only one PScell is active at a time even with conditional PScell addition/change.

2 For conditional PSCell addition, the MN decides on the conditional PSCell addition execution condition. The condition is defined by a measurement identity, given by a measurement configuration provided by the MN.

3 For conditional PSCell change, execution condition may be decided by MN (MN-initiated) or SN (SN-initiated)

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

5 For conditional SN change, the source SN configuration can be used as the reference in generation of delta signalling for the candidate SNs.

***RAN2#108 Reno***

**Agreements**

1. CPAC is defined as the UE having network configuration for initiating access to a candidate PSCell, either to consider the PSCell as suitable for SN addition or SN change including intra-SN change, based on configured condition(s).

2. Usage of CPAC is decided by the network. The UE evaluates when the condition is valid.

3. Support configuration of one or more candidate cells for CPAC;

o 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.

5. 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. FFS on UE capability

6. Define an execution condition for conditional PSCell change by the measurement identity which identifies a measurement configuration There is already an agreement for conditional PSCell addition

7. Cell level quality is used as baseline for Conditional NR PSCell addition/change execution condition;

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

h. At most two triggering quantities (e.g. RSRP and RSRQ, RSRP and SINR, etc.) can be configured simultaneously. FFS on UE capability.

i. TTT is supported for CPAC execution condition (as per legacy configuration)

8. No additional optimizations with multi-beam operation are introduced to improve RACH performance for conditional PSCell addition/change completion with multi-beam operation.

9. 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.

10. UE is not required to continue evaluating the triggering condition of other candidate PSCell(s) during conditional SN execution.

**For PSCell addition:**

4. 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.

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

b. 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.

c. Use add/mod list + release list to configure multiple candidate PSCells.

d. CPAC execution condition and/or candidate PSCell configuration can be updated by modifying the existing CPAC configuration.

e. Reuse the RRCReconfiguration/RRCConnectionReconfiguration procedure to signal CPAC configuration to UE.

FFS handling of conditional SN addition associated to the SN terminated bearer.

**Agreements for CPAC configuration related proposals**

2 For conditional PSCell addition, the MN transmits the final RRCReconfiguration/ RRCConnectionReconfiguration message to the UE, which includes the execution condition generated by the MN, and encapsulates the RRCReconfiguration provided by the candidate PSCells. FFS how the encapsulation is done exactly (can be considered in Stage-3)

3 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

5 Both the execution condition and the configuration for the candidate PSCell (as a container) can be included in the RRCReconfiguration message generated by the SN for intra-SN conditional PSCell change initiated by the SN (without MN involvement).

6 SRB1 can be used in all cases. SRB3 may be used to transmit conditional PSCell change configuration to the UE for intra-SN change without MN involvement.

The agreements above are mostly related to the general procedure for CPAC, e.g. the configuration of execution condition(s), the generation and transmission of CPAC configuration. In order to avoid the repetitive discussion for general CPAC procedure in Rel-17, the agreements reached in RAN2#107bis and RAN2#108 can be confirmed first.

**Question 1: Companies are requested to comment on applicability of the agreements for CPAC general procedure reached in RAN2#107bis and RAN2#108.**

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| **Company** | **Whether the above agreements are applicable or not?** | **Comments** |
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**2.2 Execution condition\ RRC message for CPA and MN initiated Inter-SN CPC**

The trigger condition for the conditional PSCell change is decided and provided by the SN in Rel-16 for intra-SN PSCell change. For Rel-17 scenarios, PSCell addition and MN initiated Inter-SN PSCell change, the MN should provide the trigger condition for CPAC execution to the UE [3, 4, 7,8]. And the trigger condition is defined by a measurement identity, given by a measurement configuration provided by the MN. As discuss in [4,9], for MN initiated inter-SN CPC and CPA, it’s up to the MN to decide the execution condition(s) and generate the final RRC message. Moreover as commented in [9], execution condition is only useful at UE side and does not help at the network side. Therefore, the node making decision of execution condition is aware of the execution condition, other nodes do not need to comprehend that information.

However in [11], it was proposed that an execution condition and configuration for a candidate PSCell is configured by the SN RRC message. According to this proposal, the MN transfers the execution condition to the candidate SN and the candidate SN generates the conditional configuration. The generated conditional reconfiguration message from the SN was sent to the UE transparently to the MN. The proposed procedure in [11] is significantly different from the convention PSCell addition procedure. As discussed in [16,17], conditional PSCell addition should take Rel-15 SN addition as baseline, e.g. reuse the existing signalling flows in 37.340 with minimal modifications.

In conclusion, the MN decides on CPAC execution condition for conditional PSCell addition and MN initiated Inter-SN CPC. The condition is defined by a measurement identity, given by a measurement configuration provided by the MN. This was agreed during Rel-16 discussion and further listed in question 1discussion for Rel-17 bulk agreements. For inter node communication of execution condition, it can consider that the MN is not required to indicate the execution condition(s) to other involved nodes (e.g. target SN, source SN) in MN initiated Inter-SN CPC and CPA.

**Question 2: Companies are requested to comment on below statement.**

**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).**

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| **Company** | **Agree/ disagree** | **Comments** |
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In Rel-16, the final RRC message carrying the CPC configuration is generated by the SN as the scenario considered is Intra-SN PSCell change without MN involvement. In Rel-17, the MN initiates CPA and MN-initiated Inter-SN CPC. In these scenarios, the conditional reconfiguration message should be generated by the MN [4,7,15]. The final conditional configuration message encapsulates the RRCReconfiguration provided by the candidate PSCell(s) and the conditional configuration message is provided to the UE in MN RRC format.

**Question 3: Companies are requested to comment on the below statement:**

**For conditional PSCell addition and MN initiated Inter-SN conditional PSCell Change, the MN generates and transmits the conditional configuration message (i.e. *RRCReconfiguration/RRCConnectionReconfiguration* message) to the UE, which the MN encapsulates the *RRCReconfiguration* provided by the candidate PSCell(s) as the *mrdc-SecondaryCellGroupConfig*/ *nr-SecondaryCellGroupConfig*. The MN is not allowed to alter the RRCReconfiguration provided by the candidate PSCell(s).**

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| **Company** | **Agree/ disagree** | **Comments** |
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**2.3 Execution condition\ RRC message for SN initiated Inter-SN CPC**

For SN initiated Inter-SN CPC, the SN should provide the CPAC trigger condition [3, 4,7]. Same as in Rel-16 CPC, the trigger condition in this case is defined by a measurement identity, given by a measurement configuration provided by the SN. This was agreed during Rel-16 discussion and further listed in discussion Question 1 for Rel-17 bulk agreements.

For SN initiated inter-SN conditional PSCell change, [15] discusses different options for generating the conditional configuration message. There are three main options:

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). The conditional configuration message is provided to the UE in MN RRC format.

Option 2: The target SN generates CPC. The source SN sets the execution condition and communicates it to the target SN. The target SN generates the conditional configuration message. The target SN generated conditional configuration message is provided to the MN (possibly in a transparent container) for transmission to the UE. The conditional configuration message in this option is provided to the UE in target-SN RRC format.

Option 3: The source SN generates CPC. The source SN sets the execution condition. The source SN communicates with target SN and receives RRCReconfiguration provided by the candidate PSCell(s). The source SN generates the conditional reconfiguration message and provides it to the MN (possibly in a transparent container) for transmission to the UE. The conditional configuration message is provided to the UE in the source SN RRC format.

The above options require inter-node communication for execution condition set by the source SN. Therefore, RAN3 input may also be required for the discussion. [15] proposes to wait for RAN3 inputs.

**Question 4: Companies are requested to comment on which option 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).**

**Option 2: The target SN generates CPC. The source SN sets the execution condition and communicates it to the target SN. The target SN generates the conditional configuration message. The target SN generated conditional configuration message is provided to the MN (possibly in a transparent container) for transmission to the UE.**

**Option 3: The source SN generates CPC. The source SN sets the execution condition. The source SN communicates with target SN and receives RRCReconfiguration provided by the candidate PSCell(s). The source SN generates the conditional reconfiguration message and provide it to the MN (possibly in a transparent container) for transmission to the UE**.

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| **Company** | **Option** | **Comments** |
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SN initiated Inter-SN CPC requires inter-node communication for execution condition set by the source SN whichever the option selected in question 4. It should be further discussed whether the MN or target SN needs to know the execution condition(s) decided by the source SN or not, i.e. whether the execution condition(s) is encapsulated into a container to the MN/ target SN or not.

Moreover as commented in [9], execution condition is only useful at the UE side and it may not help at the network side. Therefore, other nodes do not need to comprehend that information.

**Question 5: In SN initiated CPC with MN involvement, the source SN transfers the execution condition(s) to the MN or to the target SN (depending on selected option in question 4). Should the MN or the target SN need to comprehend the execution condition set by the source SN?**

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| **Company** | **Comprehend or not** | **Comments** |
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**2.3 Use of SRBs**

As discussed in [17], there are some differences in different CPAC scenarios, with regards to the use of SRB1 or SRB3 to transmit CPAC configurations to UE. SRB1 can be used in all CPAC scenarios, while SRB3 can only be used in the CPAC scenarios where MN is not involved. For CPA, only SRB1 can be used for CPA configuration transmission. For Inter-SN CPC (both SN initiated and MN initiated), the MN is involved with communication to the target SN. Therefore only SRB1 can be used for CPA and Inter-SN CPC.

In Rel-16, the complete message upon CPC execution is sent via SRB1 to the MN if the CPC configuration is transmitted using SRB1. Following Rel-16 principle, the complete message upon CPAC execution for CPA and Inter-SN CPC in Rel-17 should be provided to the MN via SRB1.

**Question 6: Companies are requested to comment on the below statement:**

**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.**

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| **Company** | **Agree/ disagree** | **Comments** |
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**2.5 Feedback message/ compliance check**

If SRB1 is used for the transmission, it’s up to the MN to generate the final RRC message including the conditional reconfiguration container. [4,5] discuss that upon reception of RRCReconfiguration/RRCConnectionReconfiguration message with CPAC configuration, the UE shall check the received MN RRC reconfiguration message and execution condition(s) included in the message, but not need to check the RRC reconfiguration message included in the container. Thus, the UE shall just reply the RRCReconfigurationComplete/RRCConnectionReconfigurationComplete message to the MN to inform that the message has been received, not including an embedded RRC complete message to the SN. The same principle was used in Rel-16 CPC.

**Question 7: Companies are requested to comments on the below statement:**

**If SRB1 is used 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. The message shall not include an embedded RRC complete message to the SN.**

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| **Company** | **Agree/ disagree** | **Comments** |
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Similar to Rel-16 principle, it is beneficial to check the validity of the different contents in the conditional PSCell addition/change RRC Reconfiguration message received over MN SRB1 at different times to not increase the RRC Reconfiguration processing delays.[16] proposes to reuse this principle for Rel-17 CPAC scenarios.

**Question 8. Companies are requested to comment on the below statements:**

* **UE checks the validity of conditional PSCell change execution criteria configuration immediately on receiving the CAPAC Reconfiguration message.**
* **Compliance check for embedded RRCReconfiguration may be delayed until execution (up to UE implementation). Introduce no specification changes regarding compliance checking of embedded Reconfiguration message containing configuration of conditional PSCell candidate.**

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| **Company** | **Agree/ disagree** | **Comments** |
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In Rel-16 CPC, when the condition is met, the UE sends the RRCReconfigurationComplete for SN embedded in the ULInformationTransferMRDC to the MN (when SRB1 is used). In Rel-16, only the Intra-SN without involving MN scenario was considered. In Rel-17, CPA and Inter-SN CPC, the MN may involve with the CPA/CPC configuration. Therefore, [5] proposes to further discuss the use of ULInformationTransferMRDC for the transmission of RRCReconfigurationComplete message upon the CPAC execution.

Upon execution of CPAC, since the UE may apply the configuration generated by the MN and the configuration generated by the SN simultaneously, the UE needs to provide the RRC complete message to both the MN and the (target) SN [5]. Thus, 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 SN.

**Question 9: If SRB1 is used for the transmission, 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 SN.**

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| **Company** | **Agree/ disagree** | **Comments** |
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**2.6 Events for execution condition**

[7, 8, 17] discuss the events should be used as execution condition for CPA and Inter-SN CPC. Event A3 and A5 use for configuration of conditional PSCell change condition. For conditional PSCell addition, event A4 (neighbour becomes better than threshold) is required to set PSCell addition condition in NR-DC and event B1(inter RAT neighbour becomes better than threshold) is required to support conditional PSCell addition in MR-DC (EN-DC or NGEN-DC). In conclusion, [7, 8, 17] propose that A3/A5 execution condition should be supported for conditional PSCell Change including new scenarios while A4/B1 based execution condition should be supported for CPA. This was agreed during Rel-16 discussion and further listed in question 1 for Rel-17 bulk agreements.

**Question 10: Companies are requested to comment on whether any additional event (in addition to A3/A5 for CPC and A4/B1 for CPA) should be considered for execution condition in CPA and Inter-SN CPC.**

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| **Company** | **Agree/ disagree** | **Comments** |
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**2.7 Release of CPA/CPC configuration**

For CPC, it was agreed to release the CPC configuration upon the completion of PSCell change in Rel-16 scenario: Intra-SN PSCell change. The same is applicable for Inter-SN CPC in Rel-17. For conditional SN addition, the MN configures the candidate SN cells. After completion of conditional SN addition, the candidate cell configuration provided by the MN for SN addition is no longer useful considering that single SN is active at a time. As discussed in [7], the configuration provided by the MN for conditional SN addition cannot be used for conditional SN change. Therefore, it is logical for the UE to release the conditional SN addition configuration upon the successful SN addition.

**Question 11: Companies are requested to comment on the below statement:**

**Baseline that 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.**

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| **Company** | **Agree/ disagree** | **Comments** |
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**2.8 CPAC failure handling**

In Rel-16 CPC, SCGFailureInformation procedure is used to inform the MN of conditional PSCell change failure. Additional scenarios to be introduced in Rel-17 are conditional PSCell addition and inter-SN PSCell change. As discuss in [7], the Rel-17 scenarios do not impose different requirements for failure handling procedure when compared to that of Rel-16 CPC scenario. Therefore, following Rel-16 procedure, SCGFailureInformation procedure can be taken as baseline for CPAC failure handling in Rel-17 scenarios.

**Question 12: Companies are requested to comment on the below statement.**

**Following Rel-16 procedure, SCGFailureInformation procedure can be taken as baseline for CPAC failure handling in Rel-17 scenarios.**

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| **Company** | **Agree/ disagree** | **Comments** |
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**2.9 Any other aspect**

# 5 Conclusion

[To be completed]

# 6 Reference

[1] R2-2006695 Scope and scenario for CPAC vivo discussion Rel-17 LTE\_NR\_DC\_enh2-Core

[2] R2-2006757 Coexistence of CHO and CPC at the UE InterDigital discussion Rel-17 LTE\_NR\_DC\_enh2-Core

[3] R2-2006805 Discussion on conditional PSCell change and addition OPPO discussion Rel-17 LTE\_NR\_DC\_enh2-Core

[4] R2-2006901 Discussion on conditional PSCell addition/change ZTE Corporation, Sanechips discussion Rel-17 LTE\_NR\_DC\_enh2-Core

[5] R2-2006976 Overview of conditional PSCell addition NEC discussion Rel-17 LTE\_NR\_DC\_enh2-Core

[6] R2-2006977 Inter-SN Conditional PSCell Change NEC discussion Rel-17 LTE\_NR\_DC\_enh2-Core

[7] R2-2007010 Scope and basic procedure for Conditional PSCell Addition/Change ??(CPAC)? CATT discussion Rel-17 LTE\_NR\_DC\_enh2-Core

[8] R2-2007052 Discussion on conditional PSCell addition or change Spreadtrum Communications discussion

[9] R2-2007089 Discussion on conditional PSCell change and addition Apple discussion Rel-17 LTE\_NR\_DC\_enh2-Core

[10] R2-2007130 Scenarios and General Principles of CPAC ETRI discussion Rel-17 LTE\_NR\_DC\_enh2-Core

[11] R2-2007237 Rel-17 Conditional PSCell Addition Intel Corporation discussion Rel-17 LTE\_NR\_DC\_enh2-Core

[12] R2-2007364 On the scope of Rel-17 CPAC Nokia, Nokia Shanghai Bell discussion Rel-17 LTE\_NR\_DC\_enh2-Core

[13] R2-2007439 Consideration on dormant SCG CMCC discussion Rel-17 LTE\_NR\_DC\_enh2-Core

[14] R2-2007553 Inter node CPAC procedure and configuration discussion Futurewei discussion Rel-17 LTE\_NR\_DC\_enh2-Core

[15] R2-2007599 Conditional reconfigurations Ericsson discussion LTE\_NR\_DC\_enh2-Core

[16] R2-2007624 Further enhancements on conditional configuration for R17 Samsung Telecommunications discussion Rel-17 LTE\_NR\_DC\_enh2-Core

[17] R2-2007679 Discussion on Conditional PSCell addition/change Huawei, HiSilicon discussion Rel-17 LTE\_NR\_DC\_enh2-Core

[18] R2-2007749 Conditional PSCell addition/change Qualcomm Incorporated discussion Rel-17

[19] R2-2007839 Conditional PSCell addition and change in MR-DC Potevio discussion LTE\_NR\_DC\_enh2-Core

[20] R2-2007985 Considerations of CPAC in Rel-17 LG Electronics discussion Rel-17

[21] R2-2008079 Remaining issues of Conditional PSCell Addition NTT DOCOMO INC. discussion Rel-17 LTE\_NR\_DC\_enh2-Core Late