**3GPP TSG RAN WG1 Meeting #101-E R1-2004748**

**e-Meeting, May 25 – June 05, 2020**

**Source: Moderator (Intel Corporation)**

**Title: Summary of email discussions for [101-e-NR-Mob-Enh-02]**

**Agenda item: 7.2.9**

**Document for: Discussion**

# Introduction

In this contribution, we summarize the email discussion approved for discussion during RAN1 #101-E. Chairman has approved three email discussion threads for RAN1 #101-E. The following are the approved email discussions:

* [101-e-NR-Mob-Enh-01] Email discussion/approval of Issue #1 (UL cancellation for DAPS) and #3 (UL overlapping transmission) in R1-2003747 by 5/29; if necessary, endorse the associated TPs by 6/4 – Daewon (Intel)
* [101-e-NR-Mob-Enh-02] Email discussion/approval of Issue #5 (Power sharing mode for UL DAPS-HO) in R1-2003747 by 5/28; if necessary, endorse the associated TPs by 6/3– Daewon (Intel)
* [101-e-NR-Mob-Enh-03] Email discussion/approval of Issue #6 (PDCCH monitoring in DL DAPS-HO) in R1-2003747 by 5/28; if necessary, endorse the associated TPs by 6/2– Daewon (Intel)

This contribution summarizes the email discussion for [101-e-NR-Mob-Enh-02].

# Email Discussion [101-e-NR-Mob-Enh-02]

This discussion is regarding the power Sharing Mode for UL DAPS-HO (Issue #5 from [11]).

The main focus of the issue to finalize the specification based on agreement made in RAN1 #100bis-e:

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| **Agreement from RAN1 #100bis-e:**   * gNB can configure for the UE a specific power sharing mode for DAPS   + It is assumed that gNB shall only enable a power sharing mode for DAPS among the power sharing modes that the UE indicated support of. * gNB can disable power sharing between target and source MCG   + no power sharing between target and source MCG can be indicated by gNB not configuring *UplinkPowerSharingDAPS-HO-mode*. |

**Issue and Proposal Summary based on [1][2][4][5][6][7]:**

Several companies provided discussion on how to correct the power sharing mode description for UL DAPS-HO. The following are list of proposals and corresponding TPs:

* Proposal [1]: When no power sharing is configured by the network, a UE should cancel the source cell transmission in case of UL collision in the time domain.
  + The following is proposed TP:

## TP #1

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| 15 Dual active protocol stack based handover  <---------------------------Other parts are omitted ------------------------------->  If the UE indicates *UplinkPowerSharingDAPS-HO* = *Dynamic* and is provided *UplinkPowerSharingDAPS-HO-mode* = *Dynamic*, the UE determines a transmission power for the target MCG or for the source MCG as described in Clause 7.6.2 for *UplinkPowerSharingDAPS-HO* = *Dynamic* by considering the target MCG as the MCG and the source MCG as the SCG.  If  - the UE is not provided with *UplinkPowerSharingDAPS-HO-mode*, and  - UE transmissions on the target cell and the source cell are in overlapping time resources  the UE transmits only on the target cell.  <---------------------------Other parts are omitted -------------------------------> |

* Proposal [2]: When no power sharing is configured by the network, a UE should cancel the source cell transmission in case of UL collision in the time domain.
  + The following is proposed TP:

## TP #2

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| **15 Dual active protocol stack based handover**  < Unchanged parts are omitted >  If the UE is not provided *UplinkPowerSharingDAPS-HO-mode*, and  - UE transmissions on the target cell and the source cell overlap  the UE transmits only on the target cell. |

* Proposal [4]:
  + Agreement and capability signaling, the TS38.213 should add a separate text when gNB does not configure UplinkPowerSharingDAPS-HO-mode configuration, which should imply UE always performs dropping of the source cell transmission during transmission overlap in time domain.
  + Text that couples the UE capability with gNB configured mode can be cleaned up by having a generic text that states UE is not expected to be configured with power sharing mode that it does not support.
  + The following is proposed TP:

## TP #3

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| 15   Dual active protocol stack based handover *< Unchanged parts are omitted >*  If the UE ~~indicates~~ *~~UplinkPowerSharingDAPS-HO~~* ~~=~~ *~~Semistatic-mode1~~* ~~and~~ is provided *UplinkPowerSharingDAPS-HO-mode* = *Semi-static-mode1*, the UE determines a transmission power for the target MCG or for the source MCG as described in Clause 7.6.2 for *~~UplinkPowerSharingDAPS-HO~~NR-DC-PC-mode* = *Semi-static-mode1* by considering the target MCG as the MCG and the source MCG as the SCG.  If the UE ~~indicates~~ *~~UplinkPowerSharingDAPS-HO~~* ~~= Semistatic-mode2~~~~and~~ is provided *UplinkPowerSharingDAPS-HO-mode* = *Semi-static-mode2*, the UE determines a transmission power for the target MCG or for the source SCG as described in Clause 7.6.2 for *~~UplinkPowerSharingDAPS-HO~~NR-DC-PC-mode* = *Semi-static-mode2* by considering the target MCG as the MCG and the source MCG as the SCG.  If the UE ~~indicates~~ *~~UplinkPowerSharingDAPS-HO~~* ~~= Dynamic~~~~and~~ is provided *UplinkPowerSharingDAPS-HO-mode* = *Dynamic*, the UE determines a transmission power for the target MCG or for the source MCG as described in Clause 7.6.2 for *~~UplinkPowerSharingDAPS-HO~~NR-DC-PC-mode* = *Dynamic* by considering the target MCG as the MCG and the source MCG as the SCG.  [UE is not expected to be provided *UplinkPowerSharingDAPS-HO-mode* configuration that it did not indicate support of.]  If the UE is not provided with *UplinkPowerSharingDAPS-HO-mode,* and UE transmissions on the target cell and the source cell are in overlapping time resources, the UE transmits only on the target cell.  If ~~-   the UE does not provides~~ *~~UplinkPowerSharingDAPS-HO,~~* ~~and -~~ UE transmissions on the target cell and the source cell overlap, the UE transmits only on the target cell.  UE transmissions on the target cell and the source cell overlap if they are in  - overlapping time resources if the carrier frequencies for the target MCG and the source MCG are intra-frequency and intra-band  - overlapping time resources and overlapping frequency resources if the carrier frequencies for the target MCG and the source MCG are not intra-frequency and intra-band |

* Proposal [5]:
  + The following is proposed TP:

## TP #4

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| If the UE indicates *UplinkPowerSharingDAPS-HO* = *Semi-static-mode1* and is provided *UplinkPowerSharingDAPS-HO-mode* = *Semi-static-mode1*, the UE determines a transmission power for the target MCG or for the source MCG as described in Clause 7.6.2 for *~~UplinkPowerSharingDAPS-HO~~ NR-DC-PC-mode* = *Semi-static-mode1* by considering the target MCG as the MCG and the source MCG as the SCG.  If the UE indicates *UplinkPowerSharingDAPS-HO* = *Semi-static-mode2* and is provided *UplinkPowerSharingDAPS-HO-mode* = *Semi-static-mode2*, the UE determines a transmission power for the target MCG or for the source SCG as described in Clause 7.6.2 for *~~UplinkPowerSharingDAPS-HO~~ NR-DC-PC-mode* = *Semi-static-mode2* by considering the target MCG as the MCG and the source MCG as the SCG.  If the UE indicates *UplinkPowerSharingDAPS-HO* = *Dynamic* and is provided *UplinkPowerSharingDAPS-HO-mode* = *Dynamic*, the UE determines a transmission power for the target MCG or for the source MCG as described in Clause 7.6.2 for *~~UplinkPowerSharingDAPS-HO~~ NR-DC-PC-mode* = *Dynamic* by considering the target MCG as the MCG and the source MCG as the SCG.  *<unchanged text omitted>*  If  -   the UE does not provide *UplinkPowerSharingDAPS-HO*, or is not provided *UplinkPowerSharingDAPS-HO-Mode* and  -   UE transmissions on the target cell and the source cell are in overlapping time resources  or  -   the UE ~~does not~~ is provided *UplinkPowerSharingDAPS-HO-Mode*, and  -   UE transmissions on the target cell and the source cell overlap  the UE transmits only on the target cell  UE transmissions on the target cell and the source cell overlap if they are in  -   overlapping time resources if the carrier frequencies for the target MCG and the source MCG are intra-frequency and intra-band  -   overlapping time resources and overlapping frequency resources if the carrier frequencies for the target MCG and the source MCG are not intra-frequency and intra-band  For intra-frequency DAPS HO operation, the UE expects that an active DL BWP and an active UL BWP on the target cell are within an active DL BWP and an active UL BWP on the source cell, respectively.  The UE determines intra-frequency as described in Clause 9.2.1 of [10, TS38.133]. |

* Proposal [6]: When the gNB disables power sharing, the behaviour should be the same as when the UE does not provide UplinkPowerSharingDAPS-HO.
  + The following is proposed TP:

## TP #5

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| 15   Dual active protocol stack based handover *< Unchanged parts are omitted >*  If  - the UE does not provide *UplinkPowerSharingDAPS-HO*, or is not provided *UplinkPowerSharingDAPS-HO-mode,* and  - UE transmissions on the target cell and the source cell overlap  the UE transmits only on the target cell |

* Proposal in [7]:
  + If gNB disables the power sharing between target and source cell, UE would assume the UL transmission is in TDM manner to source and target cell. If any UL transmission collision, the UE behavior is not specified.
  + Define the UE capability for UL transmission cancellation.
  + NR-DC based UL power control adjustment timeline can be considered by UL transmission cancellation in DPAS HO.
  + The following is proposed TP:

## TP #6

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| 15 Dual active protocol stack based handover  If  - the UE is not provided with *UplinkPowerSharingDAPS-HO-mode*, UE does not expect the UL transmission on the target cell and source cell are overlapping in time resources  Or if  - the UE does not provide *UplinkPowerSharingDAPS-HO*, and  - UE transmissions on the target cell and the source cell overlap  the UE transmits only on the target cell  UE transmissions on the target cell and the source cell overlap if they are in  - overlapping time resources if the carrier frequencies for the target MCG and the source MCG are intra-frequency and intra-band  - overlapping time resources and overlapping frequency resources if the carrier frequencies for the target MCG and the source MCG are not intra-frequency and intra-band  For intra-frequency DAPS HO operation, the UE expects that an active DL BWP and an active UL BWP on the target cell are within an active DL BWP and an active UL BWP on the source cell, respectively. |

* Text Proposal in [8]:

## TP #7

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| If the UE indicates support for *~~UplinkPowerSharingDAPS-HO~~* ~~=~~ *~~Semistatic-mode1~~* semi-static power sharing mode1 and is provided *UplinkPowerSharingDAPS-HO-mode* = *Semi-static-mode1*, the UE determines a transmission power for the target MCG or for the source MCG as described in Clause 7.6.2 for *~~UplinkPowerSharingDAPS-HO~~NR-DC-PC-mode* = *Semi-static-mode1* by considering the target MCG as the MCG and the source MCG as the SCG.  If the UE indicates support for *~~UplinkPowerSharingDAPS-HO~~* ~~=~~ *~~Semistatic-mode2~~* semi-static power sharing mode2 and is provided *UplinkPowerSharingDAPS-HO-mode* = *Semi-static-mode2*, the UE determines a transmission power for the target MCG or for the source SCG as described in Clause 7.6.2 for *~~UplinkPowerSharingDAPS-HO~~NR-DC-PC-mode* = *Semi-static-mode2* by considering the target MCG as the MCG and the source MCG as the SCG.  If the UE indicates support for*~~UplinkPowerSharingDAPS-HO~~* ~~=~~ *~~Dynamic~~* dynamic power sharing and is provided *UplinkPowerSharingDAPS-HO-mode* = *Dynamic*, the UE determines a transmission power for the target MCG or for the source MCG as described in Clause 7.6.2 for *~~UplinkPowerSharingDAPS-HO~~NR-DC-PC-mode* = *Dynamic* by considering the target MCG as the MCG and the source MCG as the SCG.  If  - the UE is~~does~~ not provided *UplinkPowerSharingDAPS-HO-mode*, and  - UE transmissions on the target cell and the source cell overlap  the UE transmits only on the target cell  UE transmissions on the target cell and the source cell overlap if they are in  - overlapping time resources if the carrier frequencies for the target MCG and the source MCG are intra-frequency and intra-band  - overlapping time resources and overlapping frequency resources if the carrier frequencies for the target MCG and the source MCG are not intra-frequency and intra-band |

**Discussion Summary:**

The text proposals made in the submitted contributions can be largely categorized into 3 groups.

**Group 1)** Indication of no power sharing between target and source MCG

* Approach A) add new text separate from existing text that handles overlap signals for intra-band and intra-frequency cases.
  + TP#1, TP#3, and TP#4
* Approach B) add the text to the existing text (by stating “or”) that handles overlap signals for intra-band and intra-frequency cases
  + TP #5, and TP#6
* Approach C) change ‘UplinkPowerSharingDAPS-HO’ to ‘UplinkPowerSharingDAPS-mode’ in the existing text handles overlap signals for intra-band and intra-frequency cases (with other minor modification)
  + TP#2, and TP#7

**Group 2)** Clean-up of existing text by removing the RRC parameter name in “if UE indications UplinkPowerSharingDAPS-HO = xxx”

* Approach A) replace the “if UE indications UplinkPowerSharingDAPS-HO = xxx” with a generic “if UE indicates supports of xxx”
  + TP#7
* Approach B) delete the “if UE indications UplinkPowerSharingDAPS-HO = xxx” and add a generic text that states UE does not expected to be configured with modes that it does not support.
  + TP#3

**Group 3)** correction of ‘UplinkPowerSharingDAPS-HO’ with ‘NR-DC-PC-mode’

* All mentioned in TP#3, TP#4, and TP#7
* This seems to be editorial in nature and should be straightforward.

Companies are encouraged to provide comments on the issue group 1, group 2, and group 3.

* For example, whether they prefer Approach X in Group 1 issue, Approach B in Group 2 issue, and agrees with Group 3 issue.
* If companies have another resolution for Group 1 and/or 2 issue other than what was mentioned, please provide information as well.
* If companies have concerns with certain approaches, please provide explanation.
* Also, if companies have a merged proposal based on proposal from above companies, please do provide them below as well.

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| Company Name | Group 1  (approach A/B/C) | Group 2  (approach A/B) | Group 3  (agree/  disagree) | Comments/Views |
| Huawei, HiSilicon | C | B | agree |  |
| Ericsson | B or C | A | agree | It is an error case that the UE is configured with something it does not support, and error cases are typically not described in the RAN1 specifications. |
| Intel | A  (or B - TP#6 only) | A | agree | For group 1, the existing cases refer to intra-frequency and intra-band overlapping cases. gNB configuration of no power sharing would need to apply to any case (if configured). Therefore, we think changing the existing text either using approach B or C would not result in the same UE behavior.  For example, in approach C, TP#2 and #7, its not clear what happens when the UE is not configured with power sharing mode (i.e. no power sharing) but configured with DAPS in inter-frequency. The description is completely missing. The same situation for TP#5.  TP#6 is better in that it does not use the “overlap” definition that is defined by the existing text.  For group 2, we are open whether we need to describe error cases. |
| Samsung | A or B (TP#6 only) | A | Agree | For Group 1, we think both approach B or C do not match RAN1-99 agreement on cancellation condition.  The reason we came up with TP#6 in [5] is to avoid repeating the sentence “UE transmits only on the target cell”, which will be replaced by the long paragraph in issue#1. |
| Qualcomm | Need further discussion | A | Agree | For Group 1, we would like to have further discussion on UE behavior. If the UE needs to cancel UL Tx when the gNB does not configure any UL sharing mode, the UE needs to support UL cancellation capability FG 21-2d.  This is different from the scenario where UE does not indicate the UL power sharing capability where the UE may try to support one of the sharing modes to avoid UL cancellation behavior. |
| Nokia | C | A | Agree | In context of the power sharing modes, like noted in our paper, having the reference to reported UE capability is not absolutely necessary (while that is done also in Section 7.6.2) as it would be erroneous configuration. |
| Apple | Need further discussion | A | Agree | For Group 1, in our understanding, the first thing need to do is to define the UE behaviour for so called “no power sharing”, then how to capture it in the specification is just wording issue. |
| ZTE | A | A | Agree | For Group 1, we have same understanding with Samsung. |
| MTK | A | A | Agree | For Group 1, we can agree on A generally, but we share same view as QC that it may be related to UL cancellation capability FG 21-2d.  Besides, we see TP#1 as a general description and not limited to “intra-band and intra-frequency cases”. |

**Discussion Summary of all comments received by May 27, 11pm PDT (May 28, 6am UTC):**

Majority of the companies seem to prefer taking approach A for Group 2, and agree with issue discussed in Group 3. Moderator has remove the other aspects from TP#7 and suggests to agree to TP#8 as a conclusion for Group 2 and 3 issue.

Moderator Suggestion for Agreement:

* Agree TP #8 of R1-2004749

## TP #8

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| If the UE indicates support for *~~UplinkPowerSharingDAPS-HO~~* ~~=~~ *~~Semistatic-mode1~~* semi-static power sharing mode1 and is provided *UplinkPowerSharingDAPS-HO-mode* = *Semi-static-mode1*, the UE determines a transmission power for the target MCG or for the source MCG as described in Clause 7.6.2 for *~~UplinkPowerSharingDAPS-HO~~NR-DC-PC-mode* = *Semi-static-mode1* by considering the target MCG as the MCG and the source MCG as the SCG.  If the UE indicates support for *~~UplinkPowerSharingDAPS-HO~~* ~~=~~ *~~Semistatic-mode2~~* semi-static power sharing mode2 and is provided *UplinkPowerSharingDAPS-HO-mode* = *Semi-static-mode2*, the UE determines a transmission power for the target MCG or for the source SCG as described in Clause 7.6.2 for *~~UplinkPowerSharingDAPS-HO~~NR-DC-PC-mode* = *Semi-static-mode2* by considering the target MCG as the MCG and the source MCG as the SCG.  If the UE indicates support for*~~UplinkPowerSharingDAPS-HO~~* ~~=~~ *~~Dynamic~~* dynamic power sharing and is provided *UplinkPowerSharingDAPS-HO-mode* = *Dynamic*, the UE determines a transmission power for the target MCG or for the source MCG as described in Clause 7.6.2 for *~~UplinkPowerSharingDAPS-HO~~NR-DC-PC-mode* = *Dynamic* by considering the target MCG as the MCG and the source MCG as the SCG. |

For Group 1 issue, companies seem to be somewhat split. There are more companies that prefer approach A or B (TP#6). Moderator would like to ask companies to focus on approach A or B (TP#6 based solution) for further discussion so that we can conclude.

Moderator has taken the relevant text from TP #1, #3, and #4 and merged them as TP #9.

Moderator Suggestion for Agreement:

* Agree on TP #6 or #9 of R1-2004749

## TP #9

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| 15 Dual active protocol stack based handover  *<unchanged text omitted>*  If  - the UE does not provide *UplinkPowerSharingDAPS-HO*, or the UE is not provided with *UplinkPowerSharingDAPS-HO-mode*, and  - UE transmissions on the target cell and the source cell are in overlapping time resources  the UE transmits only on the target cell.  If  -   the UE ~~does not~~ provides *UplinkPowerSharingDAPS-HO,* and  -   UE transmissions on the target cell and the source cell overlap,  the UE transmits only on the target cell. |

**Discussion Summary after May 27, 11pm PDT (May 28, 6am UTC):**

Companies are encouraged to provide comments on the following proposal. Especially, whether they have concerns with the suggested proposal. Also, if the suggestion made are acceptable, then please provide preference between TP#6 and #9.

Moderator Suggestion for Agreement:

* Agree TP #8 of R1-2004749
* Agree on TP #6 or #9 of R1-2004749

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| Company Name | Comments/Views |
| Qualcomm | We are fine with TP#8  However, we’re not able to agree on either TP#6 or TP#9:   * UE behavior 1 (when the gNB does not configure any UL sharing mode, the UE cancels the source transmission): This behavior is fine as long as the UE indicates the support of UL cancellation. Alternatively, we can have UE behavior that when the gNB does not configure any UL sharing mode, the UE expects that the UL transmissions to source and target do not overlap. * UE behavior 2 (when the UE ~~does not~~ provides *UplinkPowerSharingDAPS-HO* and UE transmissions on the target cell and the source cell overlap, the UE cancels the source transmission): This is not necessarily true. It really depends on the UE RF e.g., if the UE has 2 TX chains, it can do simultaneous transmissions to source and target for this case. |
| Moderator (Intel) | It seems Qualcomm is suggestion a different alternative to what no power sharing mode should describe. I’ve tried to capture what I think Qualcomm was suggesting in TP#10.  Companies are encouraged to provide feedback.  For the 2nd issue that Qualcomm commented above, the ‘overlap’ definition already defined in specification seems to already handle the situations that Qualcomm is concerned about.  It would be good for Qualcomm to provide further feedback whether the ‘overlap’ definition define is sufficient or not. If not sufficient, then what further needs to be changed in specification. |

## TP #10

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| 15 Dual active protocol stack based handover  *<unchanged text omitted>*  If the UE does not provide *UplinkPowerSharingDAPS-HO*, or the UE is not provided with *UplinkPowerSharingDAPS-HO-mode*, UE is not expect transmissions on the target and source cell in overlapping time resources.  If  -   the UE ~~does not~~ provides *UplinkPowerSharingDAPS-HO,* and  -   UE transmissions on the target cell and the source cell overlap,  the UE transmits only on the target cell. |

# Conclusion of the Email Discussion [101-e-NR-Mob-Enh-02]

**Summary of email discussion outcome:**

* xxx

# Reference

1. R1-2003330, “Remaining issues on NR mobility enhancements in physical layer,” ZTE
2. R1-2003506, “Remaining issues on DAPS-HO,” Huawei, HiSilicon
3. R1-2003676, “Remaining issues on Physical Layer Aspects for DAPS-HO,” MediaTek Inc.
4. R1-2003748, “Corrections to Physical layer aspects of NR mobility enhancement,” Intel Corporation
5. R1-2003890, “Remaining issues for NR Mobility Enhancement,” Samsung
6. R1-2004202, “Remaining issues on mobility enhancements,” Ericsson
7. R1-2004235, “On remaining issues on NR mobility enhancements,” Apple
8. R1-2004580, “Remaining physical layer aspects of dual active protocol stack based HO,” Nokia, Nokia Shanghai Bell
9. R1-2003331, “Discussion on FR2 mobility interruption enhancements,” ZTE
10. R1-2004148, “Remaining PHY aspects for CHO,” Huawei, HiSilicon
11. R1-2003747, “Issue Summary for NR Mobility Enhancements,” Moderator (Intel Corporation)