**3GPP TSG RAN WG1 Meeting #102-e R1-2005942**

**e-Meeting, August 17th – 28th, 2020**

**Source: Moderator (Intel Corporation)**

**Title: Issue Summary for NR Mobility Enhancements**

**Agenda item: 7.2.9**

**Document for: Discussion**

# Introduction

In this contribution, we summarize all issues submitted on Rel-16 NR mobility enhancement WI for RAN1 #102-e meeting. Section 2 contain a summary of issues identified from contributions submitted to RAN1 #102-e [1] ~ [9]. The list of issues in Section 2 are **not** ordered in terms of criticalness/discussion priority.

Section 3 contain a summary of the discussion that took place during the preparation period for RAN1 #101-e meeting, and suggestions from the feature lead for the candidate set of issues for email discussion for RAN1 #101-e.

# Summary of Issues Identified from Contributions

## Issue #1) Overlapping UL transmission between source and target cells [1][6]

Two companies has discussed issues with overlapping uplink transmission between source and target cell. One issue was regarding use of the reference subcarrier spacing based on the active UL BWP of the source MCG. The other issue was regarding the handling of Msg 3 transmission. The following are proposed TPs from the contributions.

* Proposed TP from [1]:

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| 15 Dual active protocol stack based handover<---------------------------Other parts are omitted ------------------------------->For DAPS operation in a same frequency band, a UE does not transmit PUSCH/PUCCH/SRS to the source MCG in a slot overlapping in time with a PRACH transmission to the target MCG or when a gap between a first or last symbol of a PRACH transmission to the target MCG in a first slot would be separated by less than $N$ symbols from a last or first symbol, respectively, of the PUSCH/PUCCH/SRS transmission to the source MCG in a second slot. For DAPS operation in a same frequency band, a UE does not transmit PRACH on the source MCG in a slot overlapping in time with a PUSCH/PUCCH/SRS transmission on the target MCG or when a gap between the first or last symbol of a PUSCH/PUCCH/SRS transmission on the target MCG is separated by less than $N$ symbols from a last or a first symbol, respectively, of a PRACH transmission on the source MCG. $N=2$ for $μ=0$ or $μ=1$, $N=4$ for $μ=2$ or $μ=3$, and $μ$ is the SCS configuration of the active UL BWP for the PUSCH/PUCCH/SRS transmission ~~to source MCG~~.<---------------------------Other parts are omitted -------------------------------> |

* Proposed TP from [6]:

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| **Text proposal #2 for section 15 in TS38.213**----omitted----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, and cancels the transmission to source cell if the first symbol of source cell transmission is after Tproc,2+d. The UE does not expect to cancel the transmission on the source cell with first symbol that occurs, relative to a last symbol of a CORESET where the UE detects a DCI format scheduling a transmission on the target cell, after a number of symbols that is smaller than Tproc,2+d. Tproc,2 is the PUSCH preparation time for the corresponding PUSCH processing capability [6, TS 38.214] assuming d2,1 = 1 after a last symbol of a CORESET where the UE detects a DCI format scheduling the transmission on the target cell, d is the time duration of 2 symbols with SCS based on SCS configuration μ, and μ corresponds to the smallest SCS configuration among the SCS configuration of the PDCCH carrying the DCI format and the SCS configuration of the UE transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines Tproc,2 assuming SCS configuration μ=0. A UE does not expect to cancel a transmission on the source cell [in symbols from the set of symbols] that occur, relative to a last symbol of a PDSCH reception conveying a RAR message with a RAR UL grant on the target cell, after a number of symbols that is smaller than msec, where  is a time duration of  symbols corresponding to a PDSCH processing time for UE processing capability 1 when additional PDSCH DM-RS is configured,  is a time duration of  symbols corresponding to a PUSCH preparation time for UE processing capability 1 [6, TS 38.214] and the UE considers that  and  correspond to the smaller of the SCS configurations for the PDSCH on the target cell and the transmission on the source cell. For , the UE assumes  [6, TS 38.214].----omitted---- |

## Issue #2) Power Sharing Mode for UL DAPS-HO [1][3][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 from [1]
	+ gNB can disable power sharing between the source and target cell for a UE by not configuring UL power sharing mode. Power sharing mode is indicated by the network, UE should also cancel the source cell transmission in case of overlapping as agreed in RAN1#99.
	+ The following is proposed TP:

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| 15 Dual active protocol stack based handover<---------------------------Other parts are omitted ------------------------------->If the UE indicates support for dynamic power sharingand is provided *uplinkPowerSharingDAPS-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 *NR-DC-PC-mode* = *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.If - the UE is~~does not~~ provided with *UplinkPowerSharingDAPS-HO-mode*, and - UE transmissions on the target cell and the source cell overlap the UE transmits only on the target cell and cancels the transmission on the source cell if the first symbol of the transmission on the source cell is after $T\_{proc,2}+d$. The UE does not expect to cancel a transmission on the source cell if a first symbol of the transmission on the source cell is less than $T\_{proc,2}+d$after a last symbol of a CORESET where the UE receives a PDCCH providing a DCI format scheduling a transmission on the target cell. $T\_{proc,2}$ is the PUSCH preparation time for the corresponding PUSCH processing capability [6, TS 38.214] assuming $d\_{2,1}=1$, $d$ is a time duration corresponding to 2 symbols for SCS configuration $μ$, and $μ$ is the smallest SCS configuration between the SCS configuration of the PDCCH providing the DCI format and the SCS configuration for the transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines $T\_{proc,2}$ assuming SCS configuration $μ=0$.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<---------------------------Other parts are omitted -------------------------------> |

* Proposal [3]: The table below summarizes the expected UE behavior with respect to the provision or non-provision of *UplinkPowerSharingDAPS-HO-mode*.

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|  | UE is provided *UplinkPowerSharingDAPS-HO-mode* | UE doesn’t provide *UplinkPowerSharingDAPS-HO* or is not provided *UplinkPowerSharingDAPS-HO-mode* |
| NW sends an intra-frequencyDAPS-HO command to UE | UE behavior 🡺 Perform source UL transmission cancellation | UE behavior 🡺 Perform source UL transmission cancellation |
| NW sends an intra-bandinter-frequency DAPS-HO command to UE | UE behavior 🡺 Perform UL power sharing based on mode configured by *UplinkPowerSharingDAPS-HO-mode* | UE behavior 🡺1. if UE indicates UL transmission cancellation support, UE performs source UL transmission cancellation
2. if UE does not indicate UL transmission cancellation support and does not indicate UL power sharing support, UE expects PUCCH/PUSCH/SRS transmissions to be TDM-ed
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* + The following is proposed TP:

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| **15   Dual active protocol stack based handover**<unchanged text omitted>If* the carrier frequencies of target MCG and source MCG are not intra-band intra-frequency, and
* the UE does not support *[UplinkCancellationDAPS-HO]*, and
* the UE does not provide *UplinkPowerSharingDAPS-HO* or the UE is not provided with *UplinkPowerSharingDAPS-HO-mode*,

the UE does not expect transmissions on the target and source cell in overlapping time resources.If* ~~the UE does not provide UplinkPowerSharingDAPS-HO, and~~
* UE transmissions on the target cell and the source cell overlap, and
	+ the carrier frequencies of target MCG and source MCG are intra-band intra-frequency, or
	+ the carrier frequencies of target MCG and source MCG are not intra-band intra-frequency, and
	+ the UE supports *[UplinkCancellationDAPS-HO]*, and
	+ the UE does not provide *UplinkPowerSharingDAPS-HO* or the UE is not provided with *UplinkPowerSharingDAPS-HO-mode*,

the UE transmits only on the target cell, and cancels the transmission to source cell if the first symbol of source cell transmission is after *T*proc,2+d. < End of the text proposal > |

* Proposal from [4]
	+ For intra-frequency DAPS and for inter-frequency DAPS when the UE provides ul-TransCancellationDAPS-r16, the UE shall cancel the transmission to source unless it is configured to perform power sharing
	+ For inter-frequency DAPS when the UE does not provide ul-TransCancellationDAPS-r16, the UE does not expect UL transmissions in overlapping time resources.
	+ The following is proposed TP:

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| 15 Dual active protocol stack based handover*<unchanged text omitted>*If the UE indicates support for dynamic power sharingand is provided *uplinkPowerSharingDAPS-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 *NR-DC-PC-mode* = *Dynamic* by considering the target MCG as the MCG and the source MCG as the SCG.For intra-frequency DAPS operation, and for inter-frequency DAPS operation when the UE provides *ul-TransCancellationDAPS-r16, if* ~~If~~ - the UE does not provide *UplinkPowerSharingDAPS-HO*, or is not provided *uplinkPowerSharingDAPS-Mode,* and - UE transmissions on the target cell and the source cell overlap the UE transmits only on the target cell and cancels the transmission on the source cell if the first symbol of the transmission on the source cell is after $T\_{proc,2}+d$. The UE does not expect to cancel a transmission on the source cell if a first symbol of the transmission on the source cell is less than $T\_{proc,2}+d$after a last symbol of a CORESET where the UE receives a PDCCH providing a DCI format scheduling a transmission on the target cell. $T\_{proc,2}$ is the PUSCH preparation time for the corresponding PUSCH processing capability [6, TS 38.214] assuming $d\_{2,1}=1$, $d$ is a time duration corresponding to 2 symbols for SCS configuration $μ$, and $μ$ is the smallest SCS configuration between the SCS configuration of the PDCCH providing the DCI format and the SCS configuration for the transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines $T\_{proc,2}$ assuming SCS configuration $μ=0$.For inter-frequency DAPS operation*,* if - the UE does not provide *ul-TransCancellationDAPS-r16,* and- the UE does not provide *UplinkPowerSharingDAPS-HO*, or is not provided *uplinkPowerSharingDAPS-Mode*, and- UE transmissions on the target cell and the source cell overlap the UE does not expect to transmit on the target and source in overlapping time resources. 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----- omitted ------ |

* Proposal from [5]
	+ (1) UE transmits only on target cell and drops the source cell transmission,
	+ (2) UE does not expect gNB to schedule any overlapping target and source cell transmission,
	+ (3) UE supports transmission of target and source cell transmissions using either semi-static or dynamic power sharing rules.
	+ For Intra-frequency DAPS,
		- Apply case (3) if UE supports semi-static/dynamic power sharing and gNB configures semi-static of dynamic power sharing.
		- Otherwise,
		- Apply case (1). Uplink transmission cancellation support is mandatory for UE that support intra-frequency DAPS HO.
	+ For Inter-frequency intra-band and Inter-frequency inter-band DAPS,
		- Apply case (3) if UE supports semi-static/dynamic power sharing and gNB configures semi-static of dynamic power sharing.
		- Otherwise,
		- Apply case (1) if UE supports UL transmission cancellation.
		- Apply case (2) if UE does not support UL transmission cancellation.
	+ The following is proposed TP:

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| **15   Dual active protocol stack based handover***<unchanged text omitted>*If- the carrier frequencies for the target MCG and the source MCG are intra-frequency, or the carrier frequencies for the target MCG and the source MCG are inter-frequency and the UE indicates support of *ul-TransCancellationDAPS-r16*,-   the UE does not indicate support for any of semi-static power sharing mode1, semi-static power sharing mode 2, and dynamic power sharing mode, or the UE is not provided with *uplinkPowerSharingDAPS-Mode-r16 ~~UplinkPowerSharingDAPS-HO~~,* and-   UE transmissions on the target cell and the source cell are in overlapping time resources, the UE transmits only on the target cell and cancels the transmission on the source cell if the first symbol of the transmission on the source cell is after $T\_{proc,2}+d$. *<unchanged text omitted>*~~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~~If- the carrier frequencies for the target MCG and the source MCG are inter-frequency and the UE does not indicate support of *ul-TransCancellationDAPS-r16*, and-   the UE does not indicate support for any of semi-static power sharing mode1, semi-static power sharing mode2, and dynamic power sharing mode, or the UE is not provided with *uplinkPowerSharingDAPS-Mode-r16*,the UE does not expect transmissions on the target and source cell in overlapping time resources. |

* Proposal from [6]
	+ The following is proposed TP:

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| **Text proposal #1 for section 15 in TS38.213**----omitted----*<unchanged text omitted>*If -     the UE indicates support of cancelling uplink transmission for DAPS handover or the carrier frequencies of target MCG and source MCG are intra-frequency, and-     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, , and cancels the transmission to source cell if the first symbol of source cell transmission is after Tproc,2+d. The UE does not expect to cancel the transmission on the source cell with first symbol that occurs, relative to a last symbol of a CORESET where the UE detects a DCI format scheduling a transmission on the target cell, after a number of symbols that is smaller than Tproc,2+d. Tproc,2 is the PUSCH preparation time for the corresponding PUSCH processing capability [6, TS 38.214] assuming d2,1 = 1 after a last symbol of a CORESET where the UE detects a DCI format scheduling the transmission on the target cell, d is the time duration of 2 symbols with SCS based on SCS configuration μ, and μ corresponds to the smallest SCS configuration among the SCS configuration of the PDCCH carrying the DCI format and the SCS configuration of the UE transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines Tproc,2 assuming SCS configuration μ=0.If -    the carrier frequencies of target MCG and source MCG are inter-frequency, and -     the UE does not indicate support of cancelling uplink transmission for DAPS handoverand-     the UE does not provide *UplinkPowerSharingDAPS-HO* or the UE is not provided with *UplinkPowerSharingDAPS-HO-mode*, the UE does 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, and cancels the transmission to source cell if the first symbol of source cell transmission is after Tproc,2+d. The UE does not expect to cancel the transmission on the source cell with first symbol that occurs, relative to a last symbol of a CORESET where the UE detects a DCI format scheduling a transmission on the target cell, after a number of symbols that is smaller than Tproc,2+d. Tproc,2 is the PUSCH preparation time for the corresponding PUSCH processing capability [6, TS 38.214] assuming d2,1 = 1 after a last symbol of a CORESET where the UE detects a DCI format scheduling the transmission on the target cell, d is the time duration of 2 symbols with SCS based on SCS configuration μ, and μ corresponds to the smallest SCS configuration among the SCS configuration of the PDCCH carrying the DCI format and the SCS configuration of the UE transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines Tproc,2 assuming SCS configuration μ=0.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-bandFor 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].----omitted---- |

* Proposal from [7]:
	+ The following is proposed TP:

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| **15   Dual active protocol stack based handover***<unchanged text omitted>*If the carrier frequencies of target MCG and souce MCG are intra-frequency, and  if 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 carrier frequencies of target MCG and souce MCG are inter-frequency-   if UE transmissions on the target cell and the source cell are in overlapping time resources and overlapping frequency resources, and if the UE supports *UplinkCancellationDAPS-HO* , the UE transmits only on the target cell. Otherwise, the UE does not expect transmissions on the target and source cell in overlapping time resources.-   if UE transmissions on the target cell and the source cell are in overlapping time resources ,  - if the UE supports *UplinkCancellationDAPS-HO* , and the UE does not provide *UplinkPowerSharingDAPS- HO* or the UE is not provided with *UplinkPowerSharingDAPS-HO-mode*, the UE transmits only on the target cell. or - if the UE doesn’t support *UplinkCancellationDAPS-HO*, and the UE does not provide *UplinkPowerSharingDAPS- HO* or the UE is not provided with *UplinkPowerSharingDAPS-HO-mode*, the UE does not expect transmissions on the target and source cell in overlapping time resources. - elseif the UE provides *UplinkPowerSharingDAPS- HO* or the UE is provided with *UplinkPowerSharingDAPS-HO-mode*, the UE transmits on the target and source cell in overlapping time resources.~~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 and cancels the transmission on the source cell if the first symbol of the transmission on the source cell is after $T\_{proc,2}+d$. The UE does not expect to cancel a transmission on the source cell if a first symbol of the transmission on the source cell is less than $T\_{proc,2}+d$after a last symbol of a CORESET where the UE receives a PDCCH providing a DCI format scheduling a transmission on the target cell. $T\_{proc,2}$ is the PUSCH preparation time for the corresponding PUSCH processing capability [6, TS 38.214] assuming $d\_{2,1}=1$, $d$ is a time duration corresponding to 2 symbols for SCS configuration $μ$, and $μ$ is the smallest SCS configuration between the SCS configuration of the PDCCH providing the DCI format and the SCS configuration for the transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines $T\_{proc,2}$ assuming SCS configuration $μ=0$.~~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 from [8]
	+ The following is proposed TP:

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| 15 Dual active protocol stack based handover<unchanged text omitted>If the UE indicates support for dynamic power sharingand is provided *uplinkPowerSharingDAPS-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 *NR-DC-PC-mode* = *Dynamic* by considering the target MCG as the MCG and the source MCG as the SCG.The UE is not expected to be provided with *uplinkPowerSharingDAPS-Mode* that it does not indicate the support for.<unchanged text omitted>If * the UE does not ~~not provide~~ *~~UplinkPowerSharingDAPS-HO~~*indicate the support for power sharing or the UE is not provided with *uplinkPowerSharingDAPS-Mode*, and
* UE transmissions on the target cell and the source cell are in overlapping time resources

Or ~~I~~if - the UE  ~~notprovide~~ *~~UplinkPowerSharingDAPS-HO~~* is provided with *uplinkPowerSharingDAPS-Mode*, and - UE transmissions on the target cell and the source cell overlap, the UE transmits only on the target cell and cancels the transmission on the source cell if the first symbol of the transmission on the source cell is after $T\_{proc,2}+d$. The UE does not expect to cancel a transmission on the source cell if a first symbol of the transmission on the source cell is less than $T\_{proc,2}+d$after a last symbol of a CORESET where the UE receives a PDCCH providing a DCI format scheduling a transmission on the target cell. $T\_{proc,2}$ is the PUSCH preparation time for the corresponding PUSCH processing capability [6, TS 38.214] assuming $d\_{2,1}=1$, $d$ is a time duration corresponding to 2 symbols for SCS configuration $μ$, and $μ$ is the smallest SCS configuration between the SCS configuration of the PDCCH providing the DCI format and the SCS configuration for the transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines $T\_{proc,2}$ assuming SCS configuration $μ=0$. The UE cancels the transmission on the source cell according to its capability s *ul-TransCancellationDAPS-r16.*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<unchanged text omitted> |

## Issue #3) PDCCH monitoring in DL DAPS-HO [1][4][5]

In RAN1 #101-e meeting, RAN1 agreed to in principle TP that corrected the UE assumption on overbooking configuration for source and target cell. However, the except TP was not captured into the latest CR due to issues with interpretation of the text and issues raised by the editor. In this meeting several companies has provided text proposal that resolve the concerns raised during the email discussion of the 38.213 CR.

Moderator notes that many of the TP are similar and expect the issue to be resolved quickly.

* Text Proposal from [1]
	+ PDCCH overbooking is not allowed for source cell and target cell in any case

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| 15 Dual active protocol stack based handover<---------------------------Other parts are omitted ------------------------------->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.If the UE is provided search space sets on both the target MCG and the source MCG, the UE does not expect to have in any slot from both the source cell and the target cell a USS set that results to corresponding total numbers of monitored PDCCH candidates and non-overlapped CCEs per slot that exceed the corresponding maximum numbers per slot on the target MCG or the source MCG.<---------------------------Other parts are omitted -------------------------------> |

* Text Proposal from [4]:

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| **15 Dual active protocol stack based handover**< Unchanged parts are omitted >If the UE is provided search space sets on both the target MCG and the source MCG, the UE does not expect to have in any slot - a USS set on the target MCG that results in that the total number of monitored PDCCH candidates and non-overlapped CCEs per slot exceeds the maximum number per slot for the target MCG, and- a USS set on the source MCG that results in that the total number of monitored PDCCH candidates and non-overlapped CCEs per slot exceeds the maximum number per slot for the source MCG. |

* Text Proposal from [5]:

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| **15   Dual active protocol stack based handover***<unchanged text omitted>*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. If a UE is provided search space sets on both the target MCG and the source MCG, the UE does not expect to have in any slot USS sets that result to corresponding total numbers of monitored PDCCH candidates and non-overlapped CCEs per slot or per span for a cell that exceed the corresponding maximum numbers per slot or per span for a cell, respectively, on both the target MCG and the source MCG. |

* Text Proposal from [7]:

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| **15   Dual active protocol stack based handover**……..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.If a UE is provided search space sets on both the target MCG and the source MCG, in any slot the UE does not expect to have USS sets on both the target MCG and the source MCG that result to the number of monitored PDCCH candidates and non-overlapped CCEs in each cell that exceed the corresponding maximum numbers per slot. |

* Proposal from [9]:
	+ It appeared in RAN1#101e that overbooking could be allowed in semistatic manner in one of the MCGs, source or target.
	+ Confirm the understanding of the intent of the the agreement made in RAN1 meeting #99 and allow overbooking in one of the MCGs, source or target at a time, during the DAPS HO.
	+ Adopt following TP to Section 15 of 38.213:

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| --- |
| If the UE is provided search space sets on both the target MCG and the source MCG, the UE does not expect to have simultaneously in both target MCG and source MCG any USS set without allocated PDCCH candidates. |

## Issue #4) DAPS HO with m-TRP [3]

One company has identified that some description is needed in order to fix the support of DAPS HO during multiple TRP operation scenarios. The following are the proposal and corresponding TP for the suggested correction.

* Proposal from [3]
	+ During DAPS-HO,
		- the scheduled PDSCH(s) for the UE is associated with CORESETPoolIndex = 0 and the UE shall monitor one or more CORESETs associated with CORESETPoolIndex = 0.
		- If the UE is indicated with two TCI states in a codepoint of the DCI field ‘Transmission Configuration Indication’, then only the first TCI state is applied to the PDSCH during DAPS-HO.
	+ The following is proposed TP:

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| **15 Dual active protocol stack based handover**< Unchanged parts are omitted >For DAPS operation in a same frequency band, a UE does not transmit PUSCH/PUCCH/SRS to the source MCG in a slot overlapping in time with a PRACH transmission to the target MCG or when a gap between a first or last symbol of a PRACH transmission to the target MCG in a first slot would be separated by less than $N$ symbols from a last or first symbol, respectively, of the PUSCH/PUCCH/SRS transmission to the source MCG in a second slot. For DAPS operation in a same frequency band, a UE does not transmit PRACH on the source MCG in a slot overlapping in time with a PUSCH/PUCCH/SRS transmission on the target MCG or when a gap between the first or last symbol of a PUSCH/PUCCH/SRS transmission on the target MCG is separated by less than $N$ symbols from a last or a first symbol, respectively, of a PRACH transmission on the source MCG. $N=2$ for $μ=0$ or $μ=1$, $N=4$ for $μ=2$ or $μ=3$, and $μ$ is the SCS configuration of the active UL BWP for the PUSCH/PUCCH/SRS transmission to source MCG. During DAPS operation, the scheduled PDSCH(s) for the UE is associated with *CORESETPoolIndex* = 0 and the UE shall monitor one or more CORESETs associated with *CORESETPoolIndex* = 0. If the UE is indicated with two indicated TCI states in a codepoint of the DCI field ‘*Transmission Configuration Indication*’, only the first TCI state is applied to the PDSCH during DAPS operation. |

## Issue #5) Clarification of frequency range applicable for DAPS HO [5]

Two companies mentioned that FR2-to-FR2 DAPS HO was agreed not be supported. However, the current specification text is bit ambiguous on whether this is supported or not and suggests an correction.

* Proposal from [3]
	+ Fix the source and target cell maximum power configurations
	+ The following is the proposed TP:

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| **15 Dual active protocol stack based handover**< Unchanged parts are omitted >If a UE is configured with ~~a target MCG and a source MCG using NR radio access in FR1 and/or in FR2,~~:* a target MCG using NR radio access in FR1 and a source MCG using NR radio access in FR1, or
* a target MCG using NR radio access in FR1 and a source MCG using NR radio access in FR2, or
* a target MCG using NR radio access in FR2 and a source MCG using NR radio access in FR1,

the UE is configured a maximum power $P\_{MCG}$ for transmissions on the target MCG ~~by~~ *~~p-DAPS-FR1~~* ~~and/or by~~ *~~p-DAPS-FR2~~*and a maximum power $P\_{SCG}$ for transmissions on the source MCG ~~by~~ *~~p-DAPS-FR1~~* ~~and/or by~~ *~~p-DAPS-FR2~~*: * by *p-DAPS-FR1* for the target MCG using NR radio access in FR1 and by *p-DAPS-FR1* for the source MCG using NR radio access in FR1, or
* by *p-DAPS-FR1* for the target MCG using NR radio access in FR1 and by *p-DAPS-FR2* for the source MCG using NR radio access in FR2, or
* by *p-DAPS-FR2* for the target MCG using NR radio access in FR2 and by *p-DAPS-FR1* for the source MCG using NR radio access in FR1,

and with an inter-CG power sharing mode by *UplinkPowerSharingDAPS-HO-mode* ~~for FR1 and/or by~~ *~~UplinkPowerSharingDAPS-HO-mode~~* ~~for FR2~~ for the frequency range combination used by the source and target MCGs. The UE determines a transmission power on the target MCG and a transmission power on the source MCG per frequency range. |

* + **Note from Feature Lead:**
		- The TP is based on old version of TS38.213.
* Proposal from [6]
	+ RAN1 spec is missing for inter-FR (FR1-FR2/FR2-FR1) DAPS HO scenarios whereas RAN4 spec already supports.
	+ The following is the proposed TP:

|  |
| --- |
| 15 Dual active protocol stack based handoverIf a UE indicates a capability for dual active protocol stack based handover (DAPS HO), the UE can be provided with a source MCG and a target MCG. If a UE is configured with an target MCG using NR radio access in FR1 or in FR2 and with a source MCG using NR radio access in FR2 or in FR1, respectively, the UE performs transmission power control independently per cell group as described in Clauses 7.1 through 7.5. |

## Issue #6) Correcting RRC parameter names [5][6]

RAN2 has updated the RRC parameter names related to DAPS and currently the RAN1 specification does not match what is defined in TS38.331.

* Proposed TP from [5]:

|  |
| --- |
| 15 Dual active protocol stack based handoverIf a UE indicates a capability for dual active protocol stack based handover (DAPS HO), the UE can be provided with a source MCG and a target MCG. If a UE is configured with a target MCG and a source MCG using NR radio access in FR1 and/or in FR2, the UE is configured a maximum power $P\_{MCG}$ for transmissions on the target MCG by *p-DAPS-Target-r16* and a maximum power $P\_{SCG}$ for transmissions on the source MCG by *p-DAPS-Source-r16* and with an inter-CG power sharing mode by *uplinkPowerSharingDAPS-Mode-r16* for FR1 and/or by *uplinkPowerSharingDAPS-Mode-r16* for FR2. The UE determines a transmission power on the target MCG and a transmission power on the source MCG per frequency range.If the UE indicates support for semi-static power sharing mode1and is provided *uplinkPowerSharingDAPS-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 *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 semi-static power sharing mode2 and is provided *uplinkPowerSharingDAPS-Mode-r16* = *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 *NR-DC-PC-mode* = *Semi-static-mode2* by considering the target MCG as the MCG and the source MCG as the SCG. The UE expects to be provided *uplinkPowerSharingDAPS-Mode-r16* = *Semi-static-mode2* only for synchronous DAPS HO operation [10, TS 38.133].If the UE indicates support for dynamic power sharingand is provided *uplinkPowerSharingDAPS-Mode-r16* = *Dynamic*, the UE determines a transmission power for the target MCG or for the source MCG as described in Clause 7.6.2 for *NR-DC-PC-mode* = *Dynamic* by considering the target MCG as the MCG and the source MCG as the SCG.*<unchanged text omitted>* |

* Proposed TP from [6]:

|  |
| --- |
| **Text proposal #5 for Section 15 of TS38.213**…If - the UE does not ~~provide~~ *~~UplinkPowerSharingDAPS-HO~~* indicate a capability for power sharing between source and target MCG in DAPS handover, and - UE transmissions on the target cell and the source cell overlap the UE transmits only on the target cell and cancels the transmission on the source cell if the first symbol of the transmission on the source cell is after $T\_{proc,2}+d$. The UE does not expect to cancel a transmission on the source cell if a first symbol of the transmission on the source cell is less than $T\_{proc,2}+d$after a last symbol of a CORESET where the UE receives a PDCCH providing a DCI format scheduling a transmission on the target cell. $T\_{proc,2}$ is the PUSCH preparation time for the corresponding PUSCH processing capability [6, TS 38.214] assuming $d\_{2,1}=1$, $d$ is a time duration corresponding to 2 symbols for SCS configuration $μ$, and $μ$ is the smallest SCS configuration between the SCS configuration of the PDCCH providing the DCI format and the SCS configuration for the transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines $T\_{proc,2}$ assuming SCS configuration $μ=0$.… |

## Issue #7) Correcting DAPS for half duplex operations [8]

One company identified that some description is needed to support DAPS for the half duplex operating UEs. Especially on cases to handle the transmission time period between Tx and Rx (and Rx to Tx) situations.

* Proposed TP from [8]:

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| --- |
| 15 Dual active protocol stack based handover<unchanged text omitted>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 and cancels the transmission on the source cell if the first symbol of the transmission on the source cell is after $T\_{proc,2}+d$. The UE does not expect to cancel a transmission on the source cell if a first symbol of the transmission on the source cell is less than $T\_{proc,2}+d$after a last symbol of a CORESET where the UE receives a PDCCH providing a DCI format scheduling a transmission on the target cell. $T\_{proc,2}$ is the PUSCH preparation time for the corresponding PUSCH processing capability [6, TS 38.214] assuming $d\_{2,1}=1$, $d$ is a time duration corresponding to 2 symbols for SCS configuration $μ$, and $μ$ is the smallest SCS configuration between the SCS configuration of the PDCCH providing the DCI format and the SCS configuration for the transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines $T\_{proc,2}$ assuming SCS configuration $μ=0$.For DAPS HO operation, a UE not capable of full-duplex communication is not expected to transmit in the uplink to a cell earlier than $N\_{Rx-Tx}T\_{c}$ after the end of the last received downlink symbol in the other cell where $N\_{Rx-Tx}$ is given by Table 4.3.2-3 in TS 38.211. A UE not capable of full-duplex communication is not expected to receive in the downlink from a cell earlier than $N\_{Tx-Rx}T\_{c}$ after the end of the last transmitted uplink symbol in the other cell where $N\_{Tx-Rx}$ is given by Table 4.3.2-3 in TS 38.211.<unchanged text omitted> |

## Issue #8) UE Capability [2]

One company has discusses an issue with DAPS mobility related UE capability, FG21-2.

* Proposal from [2]
	+ Set FG 21-2 (semi-static UL power sharing mode 1) as the prerequisite for FG 21-2a and FG 21-2b.

**Note from Feature Lead:**

* Moderator suggest Mediatek to bring this issue in the UE feature agenda, as it seems more appropriate in that agenda.

# Proposed set of Issues for discussion at RAN1 #101-e

The following are inputs received from interested companies on the above issues and their preferred priority for discussions.

|  |  |  |  |
| --- | --- | --- | --- |
|   | **High Priority Issues** | **Editorial or Quick Agreement Possible? (Yes/No)** | **Additional Comments** |
| **Issue #1** |  |   |  |
| **Issue #2** | Yes: **Intel, Ericsson** |  |  |
| **Issue #3** | Yes: **Intel, Ericsson** | Yes: **Intel, Ericsson**No: | **Intel**: TPs from companies are quite similar, and we expect a quick agreements on the TP |
| **Issue #4** |  |  |  |
| **Issue #5** |  | Yes: **Intel, Ericsson**No: | **Intel**: TP from Samsung seems to reasonable. We expect a quick agreement on the TP. |
| **Issue #6** |  | Yes: **Intel, Ericsson**No: | **Intel**: editorial in nature. Should be a quick agreement. |
| **Issue #7** |  |  |  |
| **Issue #8** | N/A | N/A | Moderator suggests discussing the capability in the UE feature list agenda. |

Based on discussion above, feature lead suggests the following three email discussion threads:

Email Discussion #1)

* xxx.

Email Discussion #2)

* xxx

# Reference

1. R1-2005422, “Remaining issues on NR mobility enhancements in physical layer,” ZTE
2. R1-2005627, “Remaining issues on Rel-16 mobility enhancement,” MediaTek Inc.
3. R1-2005794, “Remaining issues on DAPS-HO,” Huawei, HiSilicon
4. R1-2005843, “Remaining issues on mobility enhancements,” Ericsson
5. R1-2005855, “corrections to NR mobility enhancements,” Intel Corporation
6. R1-2006121, “Remaining issues on NR Mobility Enhancements,” Samsung
7. R1-2006498, “Remaining issue on NR mobility enhancements,” Apple
8. R1-2006785, “Maintenance on NR mobility enhancements,” Qualcomm Incorporated
9. R1-2006895, “Remaining physical layer aspects of dual active protocol stack based HO,” Nokia, Nokia Shanghai Bell