**3GPP TSG RAN WG1 Meeting #101-E R1-2003747**

**e-Meeting, May 25 – June 04, 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 #101-E meeting. Section 2 contain a summary of issues identified from contributions submitted to RAN1 #101-E [1] ~ [10]. 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) Uplink cancellation in UL DAPS-HO [1][2][3][5][6][8]

In RAN1 #100bis-e, TP on uplink cancellation rules for UL DAPS was agreed. However, the TP contained various brackets left for confirmation. Several companies have provided input on this issue. The following is a summary of proposals from contributions.

* Proposal [1]:
	+ The timeline for cancellation is defined as PUSCH preparation time assuming d2,1 = 1 and SCS is the smallest SCS between the SCS configuration of PDCCH in the target cell and the SCS configuration of the UE transmission on the source cell.
	+ Symbol-based cancellation should be supported for DAPS handover.
	+ UL cancellation should be mandatory for a UE supporting DAPS handover and no separate UE capability is needed.
	+ The following is the proposed TP:

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| 15 Dual active protocol stack based handover<---------------------------Other parts are omitted ------------------------------->If - the UE is~~does not~~ provided with *UplinkPowerSharingDAPS-HO-mode*, and - UE transmissions on the target cell and the source cell overlapthe UE transmits only on the target cell, and cancels the transmission to source cell after the PUSCH preparation time *T*proc,2 for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 after a last symbol of a CORESET where the UE detects a DCI format scheduling the transmission on the target cell and μ corresponds to the smallest SCS configuration between 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 *T*proc,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 CORESET where the UE detects a DCI format scheduling a transmission on the target cell, after a number of symbols that is smaller than the PUSCH preparation time *T*proc,2 for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 and *μ* corresponds to the smallest SCS configuration between 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 *T*proc,2 assuming SCS configuration *μ*=0<---------------------------Other parts are omitted -------------------------------> |

* Proposal [2]:
	+ The complexity for DAPS cancellation is not the same as cancellation for SFI and suggest relaxing the cancellation timeline.
	+ The UE doesn’t need to treat UL transmissions sub-sequent to a cancelled UL transmission in a special manner.
	+ The following is the proposed TP:

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| < Start of the text proposal >**15 Dual active protocol stack based handover**< Unchanged parts are 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 after *T*proc,2+2, where *T*proc,2 is the PUSCH preparation time for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 after a last symbol of a CORESET where the UE detects a DCI format scheduling the transmission on the target cell and μ corresponds to the smallest SCS configuration among the SCS configuration of the PDCCH carrying the DCI format, the SCS configuration of the UE transmission on the target cell, 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 *T*proc,2 assuming SCS configuration *μ*=0. A UE does not expect to cancel a transmission on the source cell 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 *T*proc,2+2 for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 and *μ* corresponds to the smallest SCS configuration among the SCS configuration of the PDCCH carrying the DCI format, the SCS configuration of the UE transmission on the target cell, 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 *T*proc,2 assuming SCS configuration *μ*=0.< End of the text proposal > |

* Proposal [3]:
	+ UE either cancels the whole source UL transmission, or keep the whole source UL transmission, depending on the beginning time of the source UL transmission, relative to the ending time of received target CG DCI.



**Figure from [3]: Symbol level UL transmission cancellation from agreed TP for DAPS**

* + The following is the proposed TP:

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| 15 Dual active protocol stack based handoverIf - 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 whole transmission to source cell if the occasion of the first symbol of source cell transmission is after ~~[~~the PUSCH preparation time *T*proc,2 for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 after a last symbol of a CORESET where the UE detects a DCI format scheduling the transmission on the target cell and *μ* corresponds to the smallest SCS configuration between 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 *T*proc,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]~~ 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 the ~~[~~PUSCH preparation time *T*proc,2 for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 and *μ* corresponds to the smallest SCS configuration between 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 *T*proc,2 assuming SCS configuration *μ* = 0~~]~~. |

* Proposal [5]:
	+ *T*proc,2 provides a reasonable timeline requirement for UE for canceling.
	+ UE behavior for symbol based cancellation has already existed in Rel-15, there is no apparent reason that UE cannot support it. The system performance is clear better with the symbol based cancellation.
	+ Support UL cancellation rules for Msg 3.
	+ The following is the proposed TP:

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| **Text proposal #1 for section 15 in TS38.213**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]. |

* Proposal [6]: Consider reformulating the agreement to simply the interpretation. Remove the brackets around the time offsets.
	+ The following is the proposed TP:

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| **15 Dual active protocol stack based handover**< Unchanged parts are 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 the UE transmits only on the target cell, and cancels the transmission to source cell after the PUSCH preparation time *T*proc,2 for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 after a last symbol of a CORESET where the UE detects a DCI format scheduling the transmission on the target cell and *μ* corresponds to the smallest SCS configuration between 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 *T*proc,2 assuming SCS configuration *μ* = 0.The UE does not expect to cancel a transmission on the source cell the PUSCH preparation time *T*proc,2 for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 after a last symbol of a CORESET where the UE detects a DCI format scheduling the transmission on the target cell and *μ* corresponds to the smallest SCS configuration between 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 *T*proc,2 assuming SCS configuration *μ* = 0. |

* Proposal [8]:
	+ UL cancellation behaviour can be based simply to the defined timeline
	+ The following is the proposed TP:

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| 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 after the PUSCH preparation time *T*proc,2 for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 after a last symbol of a CORESET where the UE detects a DCI format scheduling the transmission on the target cell and μ corresponds to the smallest SCS configuration between 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 *T*proc,2 assuming SCS configuration *μ*=0. A UE does not expect to cancel a transmission to the source cell in symbols that occur, 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 the PUSCH preparation time *T*proc,2 for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 and *μ* corresponds to the smallest SCS configuration between 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 *T*proc,2 assuming SCS configuration *μ*=0. |

## Issue #2) Single UL transmission for DAPS HO [3]

RAN2 is proposing to introduce a singleUL-Transmission capability. Contribution [3] discuss the UE behavior when singleUL-Transmission capability is enabled. It was mentioned that is not clear that if UE indicates *singleUL-TransmissionDAPS-r16*, then UE can assume that NW would arrange scheduling to avoid UL collision, or UE still needs to handle collision if it happens while the handling is up to UE implementation since it is not specified in spec.

* Proposal [3]:
	+ Clarify that when UE indicates singleUL-TransmissionDAPS-r16 in DAPS-HO, it means
		- “UE can assume that NW would arrange scheduling to avoid UL collision”, or
		- “UE still needs to handle collision if it happens while the handling is up to UE implementation since it is not specified in spec”

## Issue #3) Overlapping UL transmission between source and target cells [1][2][4][5][8]

The issue for PRACH and PUSCH/PUCCH/SRS overlapping scenarios was discussed in RAN1 #100-E meeting. However, some companies have provided further input to the issue.

Contribution in [1] mentioned that that definition of overlapping slots for PRACH and PUSCH/PUCCH/SRS could be ambiguous when target and source cell are synchronized. Therefore, suggests updating the description.

* 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 ~~when the transmission would~~ 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. $N=2$ 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. |

Contribution in [2] noted that if the time gap between source and target cell PUSCH/PUCCH/SRS is too short UE may not be able to switch the transmissions, especially if UE is using the same RF chain to serve target and source cells.

 

**Figure from [2]: Gap between UL transmission to source MCG and UL transmission to target MCG**

* Proposed TP from [2]:

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| **<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 when the transmission would overlap 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. $N=2$ 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. For DAPS operation in a same frequency band, a UE does not transmit PUSCH/PUCCH/SRS to the source MCG in a slot when a gap between a first or last symbol of a PUSCH/PUCCH/SRS 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. $N=1$ for $μ=0$ or $μ=1$ or $μ=2$，$N=2$ for $μ=3$, and $μ$ is the SCS configuration of the active UL BWP for the PUSCH/PUCCH/SRS transmission to source MCG. |

Additionally, [4] and [5] mentioned the UE behaviour for when the UE needs to transmit PRACH in the source cell and PUSCH/PUCCH/SRS is missing from specification.

* Proposed TP from [4]:

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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 source MCG in a slot overlapping in time domain with PRACH transmission to target MCG or when a gap between the first or last symbol of a PRACH transmission to target MCG in a first slot is separated by less than *N* symbols from the last or first symbol, respectively, of a PUSCH/PUCCH/SRS transmission to source MCG in a second slot. *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 PUSCH/PUCCH/SRS transmission to the source MCG.For DAPS operation in a same frequency band, a UE does not transmit PUSCH/PUCCH/SRS to target MCG in a slot overlapping in time domain with PRACH transmission to source MCG or when a gap between the first or last symbol of a PRACH transmission to source MCG in a first slot is separated by less than *N* symbols from the last or first symbol, respectively, of a PUSCH/PUCCH/SRS transmission to target MCG in a second slot. *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 PUSCH/PUCCH/SRS transmission to the target MCG. |

* Proposed TP from [5]:

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| For DAPS operation in a same frequency band, a UE does not transmit PUSCH/PUCCH/SRS to the source MCG in a slot when the transmission would overlap 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. $N=2$ 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.For DAPS operation in a same frequency band, a UE does not transmit PRACH to the source MCG in a slot when the transmission would overlap in time with a PUSCH/PUCCH/SRS transmission to the target MCG or when a gap between a first or last symbol of a PUSCH/PUCCH/SRS 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 PRACH transmission to the source MCG in a second slot. $N=2$ 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 target MCG. |

* Proposal in [8]:
	+ When PRACH transmission in source cell would be scheduled to occur in same slot or be separated by less than N symbols from PUSCH/PUCCH/SRS in target cell, UE is not required to transmit PRACH in source UL BWP.
	+ The following is proposed TP:

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| For DAPS operation in a same frequency band, a UE does not transmit PUSCH/PUCCH/SRS to the source MCG in a slot when the transmission would overlap 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 in active UL BWP of source MCG in a same slot when the transmission would overlap in time with a PUSCH/PUCCH/SRS transmission to the target MCG or when a gap between the first or last symbol of a PUSCH/PUCCH/SRS transmission in active UL BWP of target MCG in a first slot is separated by less than $N$ symbols from the last or first symbol, respectively, of a PRACH transmission in active UL BWP of source MCG in a second slot. $N=2$ 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. |

## Issue #4) Power Control for FR2 to FR2 DAPS [2]

RAN2 has agreed to not support FR2 to FR2 DAPS HO in Rel-16. The current specification is generically written such that it could be applied to FR2 to FR2 DAPS HO scenarios. Therefore, further clarification to was suggested by [1].

* Proposal [2]: Clarify possible configurations of frequency ranges for source and target MCGs and avoid misleading term of “and/or” in the description of UL power sharing.
	+ The following is 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 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 and a maximum power $P\_{SCG}$ for transmissions on the source MCG: * 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 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. |

## Issue #5) Power Sharing Mode for UL DAPS-HO [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:

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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:

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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:

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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:

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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 overlapthe 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-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]. |

* 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:

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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:

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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-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. |

* Text Proposal in [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.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 |

## Issue #6) PDCCH monitoring in DL DAPS-HO [4][5][6][8]

Contribution in [4] mentioned that the overbooking rules for DAPS-HO is more stringent than what was agreed in RAN1 #99 and suggests changing the specification to limit the overbooking in the target MCG only. Contribution in [6] clarified on the overbooking rules for source and target. In addition, The PDCCH blind detection for MCG1 and MCG2 capability was decided to be removed since RAN2 decided to not support SCell during DAPS HO. Contribution [4] and [5] suggests removing the corresponding text from specification.

* Text Proposal from [4]:

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| 15 Dual active protocol stack based handover*< Unchanged parts are omitted >*~~The UE can provide~~ *~~pdcch-BlindDetectionMCG1-UE~~* ~~to indicate a capability to monitor a maximum number of PDCCH candidates per slot that corresponds to~~ $N\_{cells}^{target}$ ~~downlink cells for the target MCG and~~ *~~pdcch-BlindDetectionMCG2-UE~~* ~~to indicate a capability monitor a maximum number of PDCCH candidates per slot that corresponds to~~ $N\_{cells}^{source}$ ~~downlink cells for the source MCG.~~ 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 any USS set without allocated PDCCH candidates for monitoring on ~~both~~ the target MCG ~~and the source MCG~~. |

* Text Proposal from [5]:

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| **Text proposal #4 for section 15 in TS38.213**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 can provide~~ *~~pdcch-BlindDetectionMCG1-UE~~* ~~to indicate a capability to monitor a maximum number of PDCCH candidates per slot that corresponds to~~ $N\_{cells}^{target}$ ~~downlink cells for the target MCG and~~ *~~pdcch-BlindDetectionMCG2-UE~~* ~~to indicate a capability monitor a maximum number of PDCCH candidates per slot that corresponds to~~ $N\_{cells}^{source}$ ~~downlink cells for the source MCG.~~ 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 any USS set without allocated PDCCH candidates for monitoring on both the target MCG and the source MCG. |

* Proposal in [6]
	+ Confirm that the specification related to PDCCH overbooking during DAPS HO implies that overbooking is allowed in source or target.
* Proposal in [8]
	+ Clarify the agreement made in RAN1 meeting #99 and allow overbooking in source MCG during the DAPS HO.

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| The UE can provide *pdcch-BlindDetectionMCG1-UE* to indicate a capability to monitor a maximum number of PDCCH candidates per slot that corresponds to $N\_{cells}^{target}$ downlink cells for the target MCG and *pdcch-BlindDetectionMCG2-UE* to indicate a capability monitor a maximum number of PDCCH candidates per slot that corresponds to $N\_{cells}^{source}$ downlink cells for the source MCG. 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 any USS set without allocated PDCCH candidates for monitoring on ~~both~~ the target MCG ~~and the source MCG~~. |

# 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.

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|   | **High Priority Issues** | **Low Priority Issues** | **Additional Comments** |
| **Issue #1** | MTK, Ericsson, Apple, HW, Nokia, ZTE, Samsung |   | **MTK**: The outcome of this issue would affect whether we think keeping the capability for UL cancellation is necessary**Ericsson:** issue 1, 3, and 5 are tightly coupled. |
| **Issue #2** | MTK |   | **MTK**: This is related to desired behavior and should be clarified.**HW**: Not sure if singleUL-transmission capability coming from RAN2 is stable. To our understanding, the capability of indicating support of simultaneous transmission is expected. If UE is not indicating such a capability, it means UE is only able to transmit a single uplink. The UE behavior is what we are discussing in e.g., issues #5, #1, and #3.**Nokia**: We have a similar understanding as Huawei that this capability (if introduced) would not overwrite the need to do UL cancellation.**Apple:** Issue #2 can be covered by Issue #5 (discuss under issue #5) |
| **Issue #3** | Intel, MTK, HW, ZTE, Samsung |   | **Nokia**: could be handled together/after issue#1 |
| **Issue #4** |  | Intel | **Intel:** could be part of editorial update |
| **Issue #5** | Intel, Ericsson, Apple, HW, Nokia, ZTE, Samsung |   | **MTK**: This issue can be discussed after Issue 1 is resolved, since it involves the UL cancellation behavior |
| **Issue #6** | Intel, Ericsson, Apple, Nokia |  Samsung | **ZTE**: We are fine to additionally discuss this issue if we can merge some of the issues into one email discussion, e.g., issue #1 and issue #3.**Samsung**: Same as ZTE, we are okay to discuss this issue if some of other issues get combined. |

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

Email Discussion #1)

* Combine issue #1 and #3 as they seem to be highly correlated. Resolve them together.

Email Discussion #2)

* Discuss issue #5 – Power sharing mode issue

Email Discussion #3)

* Discuss issue #6 – PDCCH monitoring issue

# 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