**3GPP TSG RAN WG1 Meeting #103-e R1-200xxxx**

**e-Meeting, October 26 – November 13, 2020**

**Source: Moderator (Intel Corporation)**

**Title: [103-e-NR-Mob-Enh-01] Discussions Summary #1**

**Agenda item: 7.2.9**

**Document for: Discussion**

# Introduction

In this contribution, we summarize the email reflector discussions for [103-e-NR-Mob-Enh-01]. Chairman has approved the following email discussion:

* [103-e-NR-Mob-Enh-01] Email discussion/approval on the following until 10/29 with potential CRs by 11/4 – Daewon (Intel)
	+ Issue #2 in R1-2008871, clarification on intra-frequency DAPS definition
	+ Issue #3 in R1-2008871, issue on processing capability correction for Tx cancellation

# Recap of Issues from R1-2008871

## Issue #2) Intra-frequency DAPS definition clarification [2][4]

[2] provides an draft CR to clarify the intra-frequency DAPS definition. [2] notes that intra-frequency measurement definition for SSB and CSI-RS is different by nature, and therefore suggests clarifying to how to handle intra-frequency DAPS depending on which RS is used for the measurement and HO. [4] also points out RAN4 definition for intra-frequency is actually defined in Clauses 6.1.3.2 and the current specification should be updated to reflect this.

* TP from [2]

#### TP #2-1

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| 15 Dual active protocol stack based handover< Unchanged parts are omitted >The UE determines intra-frequency as described in Clause 9.2.1 of [10, TS38.133]. The carrier frequencies of target MCG and source MCG are intra-frequency if both SSB based measurement, if configured, and CSI-RS based measurement, if configured, are intra-frequency measurement. |

* TP from [4]

#### TP #2-2

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| 15 Dual active protocol stack based handover< Unchanged parts are omitted >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 *nrdc-PCmode-FR1-r16* = *Dynamic* by considering the target MCG as the MCG and the source MCG as the SCG.Intra-frequency DAPS handover is described in Clause 6.1.3.2 of [10, TS38.133].~~If~~ For DAPS handover that is not intra-frequency, if~~-~~ - the UE does not indicate support of *ul-TransCancellationDAPS-r16*, and- UE does not indicate a capability for power sharing between source and target MCG in DAPS handover 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.For intra-frequency DAPS handover, if ~~If~~ - the UE indicates support of *ul-TransCancellationDAPS-r16*, and~~- the carrier frequencies of target MCG and source MCG are not intra-frequency, and~~- UE does not indicate a capability for power sharing between source and target MCG in DAPS handover or the UE is not provided with *uplinkPowerSharingDAPS-Mode-r16*, 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 cellFor intra-frequency DAPS handover, if ~~If~~ ~~- the carrier frequencies of target MCG and source MCG are intra-frequency, 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 cellThe 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 $μ=0$. 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 $N\_{T,1}+N\_{T,2}+0.5$ msec, where $N\_{T,1}$ is a time duration of $N\_{1}$ symbols corresponding to a PDSCH processing time for UE processing capability 1 when additional PDSCH DM-RS is configured, $N\_{T,2}$ is a time duration of $N\_{2}$ symbols corresponding to a PUSCH preparation time for UE processing capability 1 [6, TS 38.214] and the UE considers that $N\_{1}$ and $N\_{2}$ correspond to the smaller of the SCS configurations for the PDSCH on the target cell and the transmission on the source cell. For $μ=0$, the UE assumes $N\_{1,0}=14$ [6, TS 38.214].~~The UE determines intra-frequency as described in Clause 9.2.1 of [10, TS38.133].~~For intra-frequency DAPS HO handover~~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.  |

## Issue #3) Processing capability for Tx cancellation [3][5]

[3] notes that processing capability for PUSCH can be different for different cells. In case of DAPS, the processing capability for source and target may be different. In such case, [3] claims that there is ambiguity in which processing capability should be applied for the Tx cancellation.

[5] notes that PUSCH cancellation due to collision with PRACH is performed based on symbol level cancellation. However, for PUSCH cancellation due to collision with other PUSCH, the cancellation is performed based on whole transmission level cancellation and suggest to align the two cancellation.

* TP from [3]

#### TP #3-1

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| 15 Dual active protocol stack based handover\*\*\* Unchanged text is omitted \*\*\*If - the carrier frequencies of target MCG and source MCG are intra-frequency, and - UE transmissions on the target cell and the source cell overlapping time resources, the UE transmits only on the target cell and cancels the transmission on the source cellThe 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 PUSCH processing capability is chosen from the processing capability of source or target cell resulting the larger *T*proc,2.\*\*\* Unchanged text is omitted \*\*\* |

* TP from [5]

#### TP #3-2

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| 15 Dual active protocol stack based handover< Unchanged parts are omitted >A UE does not expect to cancel a transmission on the source cell ~~[in symbols from the set of symbols] that~~ if the first symbol of source cell transmission occurs, 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]. |

# Summary of Discussions

**Issue #2)**

There are two sub-issues under this category. The first question would on whether intra-frequency DAPS definition needs clarification given that intra-frequency RRM measurements definition for SSB and CSI-RS is different. The second question is clean up of the intra-frequency DAPS terminology in the specification.

**Q1)** Is technical proposal in TP#2-1 agreeable?

“The carrier frequencies of target MCG and source MCG are intra-frequency if both SSB based measurement, if configured, and CSI-RS based measurement, if configured, are intra-frequency measurement.”

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|  **Company** | **TP#2-1 (Yes/No)** | **Comments for Q1** |
| Ericsson | No | RAN4 has provided a specific definition of intra-frequency DAPS. RAN1 should use that. |
| Qualcomm | No | RAN1 spec can reference to RAN4 definition |
| Huawei/HiSi | No | The intention of RAN1 spec is to isolated RAN4 definition to RAN1 spec impact, so it means whatever RAN4 defined is applied to RAN1 directly. Therefore, no change is needed.  |
| Nokia | No | As per drafting rules we should not duplicate concepts. Reference to RAN4 specification suffices. |
| ZTE | Yes | We agree that RAN1 should use the definition of intra-frequency and inter-frequency specified by RAN4. The problem is the handover type (i.e., intra-frequency or inter-frequency) is not clear according to RAN4 spec in case both of the CSI-RS and SSB are configured because the definition of intra-frequency and inter-frequency specified by RAN4 are different for SSB based measurement and CSI-RS based measurement. For example, case 3 and case 4 in R1-2007738 as shown below. It would be better to clarify the handover type for case 3 and case 4. Otherwise, the network cannot know the UE behavior when a power sharing mode is configured (i.e., cancel the source cell transmission in case of intra-frequency handover and transmit the signal of both of source cell and the target cell in case of inter-frequency handover).There may be two alternatives for case 3 and case 4.Alt 1: case 3 and case 4 are considered as intra-frequencyAlt 2: case 3 and case 4 are considered as inter-frequencyWe would like to hear more views or suggestions from other companies on this issue to avoid ambiguous UE behavior. The TP#2-1 can be updated if there are more reasonable inputs. |
| Apple | No |  Following RAN4 intra-frequency HO definition is enough. Otherwise it could cause discrepancy between two working groups.  |
| Samsung | No | We think the RAN4 definition for intra frequency DAPS HO in 6.1.3.2 (this is not the old reference refer to SSB measurement) would suffice. “A DAPS handover is intra-frequency if the centre frequency of the SSB of the source cell and the centre frequency of the SSB of the target cell are the same, and the subcarrier spacing of the two SSBs are also the same.”Based on this definition, the two cases from ZTE should be categorized as (given SCS of two SSBs are the same):Case3->intra-frequency DAPS HOCase4->inter-frequency DAPS HO |
| **Moderator** | - | Based on inputs so far, it seems TP#2-1 is not needed. |

Moderator proposal for conclusion:

* Conclude that TP#2-1 is not needed.

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|  **Company** | **Comments on moderator proposal** |
| Ericsson | Support |
| ZTE | RAN4 defines intra/inter-frequnecy for SSB and CSI-RS separately. The definition are shown below for reference.A measurement is defined as a **SSB based intra-frequency measurement** provided the centre frequency of the SSB of the serving cell indicated for measurement and the centre frequency of the SSB of the neighbour cell are the same, and the subcarrier spacing of the two SSB are also the same.A measurement is defined as an **SSB based inter-frequency measurement** provided it is not defined as an intra-frequency measurement according to clause 9.2.* + **CSI-RS based intra-frequency measurement:** a measurement is defined as a CSI-RS based intra-frequency measurement provided that:
		- the SCS of CSI-RS resources on the neighbour cell configured for measurement is the same as the SCS of CSI-RS resources on the serving cell indicated for measurement, and
		- the CP type of CSI-RS resources on neighbour cell configured for measurement is the same as the CP type of CSI-RS resources on the serving cell indicated for measurement, and
	+ It is applied for SCS = 60KHz
		- the centre frequency of CSI-RS resources on the neighbour cell configured for measurement is the same as the centre frequency of CSI-RS resource on the serving cell indicated for measurement

**CSI-RS based inter-frequency measurement:** a measurement is defined as a CSI-RS based inter-frequency measurement if it is not a CSI-RS based intra-frequency measurementIt should be noted case 3 includes SSB based intra-frequency measurement and CSI-RS based inter-frequency measurement. Case 4 includes SSB based inter-frequency measurement and CSI-RS based intra-frequency measurement. Before concluding that TP#2-1 or other clarification are not needed, we would like to know views from the other companies on case 3 and case 4, especially UE vendors, to see if the our understanding is aligned since it is important for the network to know the UE behavior as we said above. A clear clarification but not ‘referring to RAN4 definition’ is really helpful and appreciated.We guess the Samsung’s view is to determine the handover type only based on SSB. |

**Q2)** Is the corrections in TP#2-2 agreeable?

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|  **Company** | **TP#2-2 (Yes/No)** | **Comments for Q2** |
| Ericsson | Yes |  |
| Qualcomm | See comments | The direction of CR is fine. However, the following should be updated:* The second ”For” is not correct. It should be ” For DAPS handover that is not intra-frequency”
* The last change on ” intra-frequency DAPS HO handover~~operation~~” should be ” intra-frequency DAPS **~~HO~~** handover~~operation~~”

Also the first deleted bullet in the first ”For” should be visible for tracking. |
| Huawei/HiSi | Need update | As QC pointed out, the change for the second ”for” should be what QC suggested. Also, we have abbreviation of DAPS HO defined in the first paragraph of clause 15, so ok to have HO in this clause, so the last change of this TP is not necessary.  |
| Nokia | Update needed |  We are inprinciple fine but as noted by Qualcomm some changes are needed. Regarding the DAPS HO, neither DAPS nor HO are defined in Section 3, so it migth be good to check with spesfication Editor how he would like to handle this (add both/one terms to Section 3 or spell out in text) |
| ZTE  | Need updates | We are fine with the updates from QC |
| Apple | Need updates | We are fine with QC’s updates. |
| Samsung | Need updates | We are fine with QC’s updates. We are ok with keeping “HO” in the text as well. |
| **Moderator** | - | Created TP#2-3 based on Qualcomm’s updates. Added DAPS tot eh abbreviation list. |

#### TP #2-3

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| 3.3 AbbreviationsFor the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in [1, TR 21.905].BPRE Bits per resource elementBWP Bandwidth partCB Code blockCBG Code block groupCBR Channel busy ratioCCE Control channel element CORESET Control resource setCP Cyclic prefix CRC Cyclic redundancy check CSI Channel state information CSS Common search spaceDAI Downlink assignment indexDAPS Dual active protocol stackDC Dual connectivityDCI Downlink control informationDL DownlinkDL-SCH Downlink shared channel< Unchanged parts are omitted >15 Dual active protocol stack based handover< Unchanged parts are omitted >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 *nrdc-PCmode-FR1-r16* = *Dynamic* by considering the target MCG as the MCG and the source MCG as the SCG.Intra-frequency DAPS handover is described in Clause 6.1.3.2 of [10, TS38.133].~~If~~ For DAPS handover that is not intra-frequency, if~~-~~ - the UE does not indicate support of *ul-TransCancellationDAPS-r16*, and- UE does not indicate a capability for power sharing between source and target MCG in DAPS handover 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.For DAPS handover that is not intra-frequency, if ~~If~~ - the UE indicates support of *ul-TransCancellationDAPS-r16*, and~~- the carrier frequencies of target MCG and source MCG are not intra-frequency, and~~- UE does not indicate a capability for power sharing between source and target MCG in DAPS handover or the UE is not provided with *uplinkPowerSharingDAPS-Mode-r16*, 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 cellFor intra-frequency DAPS handover, if ~~If~~ ~~- the carrier frequencies of target MCG and source MCG are intra-frequency, 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 cellThe 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 $μ=0$. 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 $N\_{T,1}+N\_{T,2}+0.5$ msec, where $N\_{T,1}$ is a time duration of $N\_{1}$ symbols corresponding to a PDSCH processing time for UE processing capability 1 when additional PDSCH DM-RS is configured, $N\_{T,2}$ is a time duration of $N\_{2}$ symbols corresponding to a PUSCH preparation time for UE processing capability 1 [6, TS 38.214] and the UE considers that $N\_{1}$ and $N\_{2}$ correspond to the smaller of the SCS configurations for the PDSCH on the target cell and the transmission on the source cell. For $μ=0$, the UE assumes $N\_{1,0}=14$ [6, TS 38.214].~~The UE determines intra-frequency as described in Clause 9.2.1 of [10, TS38.133].~~For intra-frequency DAPS ~~HO~~ handover~~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.  |

Moderator proposal for conclusion:

* Agree to TP#2-3.
	+ Modification of TP#2-2 based on comments from Qualcomm. Added the abbreviation for DAPS, so that it may be used throughout the specification.

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|  **Company** | **Comments on moderator proposal** |
| Qualcomm | Support the proposal |
| Samsung | Support the proposal |
| Ericsson | Support the proposal |
| ZTE  | Support the proposal |

**Issue #3)**

There are two sub-issues under this category. The first issue is on which PUSCH capability to utilize for cancellation if the PUSCH capability for source and target cell is different. The second issue is on symbol level cancellation vs transmission level cancellation for the overlap between PRACH and other channel.

**Q3)** Is TP#3-1 agreeable?

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|  **Company** | **TP#3-1 (Yes/No)** | **Comments for Q3** |
| Ericsson | Yes |  |
| Qualcomm | Yes |  |
| Huawei/HiSi | Maybe not | We have ”$ 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.” I supposed the yellow highlighted aims to achieve the same goal as the proposed TP. No? |
| Nokia | Maybe not | As noted by Huawei, the quoted text seems to address the same issue? |
| ZTE | Yes |  |
| Apple | Maybe not |  Our understanding is here the $T\_{proc,2}$ is referring to the capability of source cell, i.e., whether the time is enough to cancel the transmission to source cell. The yellow highlight part by Huawei seems enough. |
| Samsung | Yes | The goal for this TP is to address the meaning of ”the corrsponding processing capability” when source and target cells are configured with different PUSCH processing capability. In other texts in spec associated with $T\_{proc,2}$, both uplink and downlink belong to the same cell so there are no such ambiguity. Is it fair to ask a UE to be equipped with fast enough DCI decoding in target cell just to handle this DAPS scenario if it only supports cap#1 PUSCH processing in target cell just because source cell supports cap#2? To us, this is unfair.**To HW and Nokia**: In 38.214, the processing capability 1 or processing capability 2 refer to different table for PUSCH preparation time. Right now, it is not clear which table a UE needs to use. The yellow part is just to determine SCS pairs assuming that the table to use is already clear. Something needs to be said one way or the other.**To Apple:** Our understanding is that ”PUSCH preparation time” includes both the DCI decoding time and PUSCH processing time, and the decoding of DCI here happens in target cell. Hence, we think using only source cell timing would be unfair. Even if we want to go with this route, the current statement is not enough as we mentioned above.  |
| **Moderator** | - | Based on discussion so far, it looks like we should clarify which cell’s capability to use for the PUSCH processing time.So either we agree on TP#3-1 or clarify that PUSCH processing time should be based on the source cell. For the latter, I’ve created TP#3-3. |

#### TP #3-3

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| 15 Dual active protocol stack based handover\*\*\* Unchanged text is omitted \*\*\*If - the carrier frequencies of target MCG and source MCG are intra-frequency, and - UE transmissions on the target cell and the source cell overlapping time resources, the UE transmits only on the target cell and cancels the transmission on the source cellThe 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 PUSCH processing capability is the processing capability of source cell.\*\*\* Unchanged text is omitted \*\*\* |

Moderator proposal for conclusion:

* Agree to one of the following:
	+ TP#3-1
	+ TP#3-3 (clarify the PUSCH processing time is refers the source cell PUSCH processing capability)
* *Moderator notes: given that TP#3-1 already has 4 supporting companies, I would recommend to agree to TP#3-1 unless there is new majority support for TP#3-3.*

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|  **Company** | **Comments on moderator proposal** |
| Qualcomm | Both TP#3-1 and TP#3-3 work. We prefer TP#3-3 since it is simpler. |
| Samsung | Both TP#3-1 and TP#3-3 solve the ambiguity on processing capability. We still prefer TP#3-1 due to the reason we stated in first round comment: TP#3-3 does not take into account the part of target cell processing time embedded in the $T\_{proc,2}$. |
| Huawei/HiSilicon | We would think then TP#3-3 makes more sense because it is canceling the transmission to the source cell.  |
| Ericsson | Both TP#3-1 and TP#3-3 work and are acceptable to us. |

**Q4)** Is TP#3-2 agreeable?

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|  **Company** | **TP#3-2 (Yes/No)** | **Comments for Q4** |
| Ericsson | Yes |  |
| Qualcomm | Yes |  |
| Huawei/HiSi | Yes |  |
| Nokia | Yes |  |
| ZTE | Yes |  |
| Apple | Yes |  |
| Samsung | Yes |  |
| **Moderator** | - | TP#3-2 seems to have good support. |

Moderator proposal for conclusion:

* Agree to TP#3-2

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|  **Company** | **Comments on moderator proposal** |
| Qualcomm | Support the proposal |
| Huawei/HiSilicon | Ok with the proposal.  |
| Ericsson | Support the proposal |

# Summary of Conclusions

To be filled once agreements/conclusions are made in RAN1.

# Reference

1. R1-2007593, “Remaining issues on DAPS,” Huawei, HiSilicon
2. R1-2007738, “Draft CR on intra-frequency DAPS handover,” ZTE
3. R1-2008144, “Draft CR on clarification of processing capability on DAPS HO dropping timeline,” Samsung
4. R1-2008209, “Correction to DAPS HO,” Ericsson
5. R1-2008502, “Remaining issues on per CC UE capability and UL cancellation for DAPS-HO,” MediaTek Inc.
6. R1-2008733, “Remaining physical layer aspects of dual active protocol stack based HO,” Nokia, Nokia Shanghai Bell
7. R1-2008871, “Pre-meeting Issue Summary for NR Mobility Enhancements,” Moderator (Intel Corporation)