**3GPP TSG RAN WG1 Meeting #102-e R1-2007039**

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

**Source: Moderator (Intel Corporation)**

**Title: Discussion summary #2 of [102-e-NR-Mob-Enh-01]**

**Agenda item: 7.2.9**

**Document for: Discussion**

# Introduction

In this contribution, we summarize the email reflector discussions for [102-e-NR-Mob-Enh-01]. Chairman has approved the following email discussion:

* [102-e-NR-Mob-Enh-01] Email discussion/approval on issues #2, #4 and #7 in R1-2005942 until 8/20; if necessary, endorse remaining TPs by 8/26 – Daewon (Intel)

# Recap of Issues from R1-2005942 [10]

## 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:

### #TP1-1

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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 . 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 after a last symbol of a CORESET where the UE receives a PDCCH providing a DCI format scheduling a transmission on the target cell. is the PUSCH preparation time for the corresponding PUSCH processing capability [6, TS 38.214] assuming , is a time duration corresponding to 2 symbols for SCS configuration , and 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 assuming SCS configuration .  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*.

|  |  |  |
| --- | --- | --- |
|  | UE is provided *UplinkPowerSharingDAPS-HO-mode* | UE doesn’t provide *UplinkPowerSharingDAPS-HO* or is not provided *UplinkPowerSharingDAPS-HO-mode* |
| NW sends an intra-frequency  DAPS-HO command to UE | UE behavior 🡺 Perform source UL transmission cancellation | UE behavior 🡺 Perform source UL transmission cancellation |
| NW sends an intra-band  inter-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 |

* + The following is proposed TP:

### #TP1-2

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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:

### #TP1-3

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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 . 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 after a last symbol of a CORESET where the UE receives a PDCCH providing a DCI format scheduling a transmission on the target cell. is the PUSCH preparation time for the corresponding PUSCH processing capability [6, TS 38.214] assuming , is a time duration corresponding to 2 symbols for SCS configuration , and 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 assuming SCS configuration .  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:

### #TP1-4

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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 . *<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:

### #TP1-5

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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-band  For intra-frequency DAPS HO operation, the UE expects that an active DL BWP and an active UL BWP on the target cell are within an active DL BWP and an active UL BWP on the source cell, respectively.  The UE determines intra-frequency as described in Clause 9.2.1 of [10, TS38.133].  ----omitted---- |

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

### #TP1-6

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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 . 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 after a last symbol of a CORESET where the UE receives a PDCCH providing a DCI format scheduling a transmission on the target cell. is the PUSCH preparation time for the corresponding PUSCH processing capability [6, TS 38.214] assuming , is a time duration corresponding to 2 symbols for SCS configuration , and 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 assuming SCS configuration .  ~~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:

### #TP1-8

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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 . 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 after a last symbol of a CORESET where the UE receives a PDCCH providing a DCI format scheduling a transmission on the target cell. is the PUSCH preparation time for the corresponding PUSCH processing capability [6, TS 38.214] assuming , is a time duration corresponding to 2 symbols for SCS configuration , and 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 assuming SCS configuration . 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 #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:

### #TP1-9

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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 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 symbols from a last or a first symbol, respectively, of a PRACH transmission on the source MCG. for or , for or , and 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 #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]:

### #TP1-10

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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 . 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 after a last symbol of a CORESET where the UE receives a PDCCH providing a DCI format scheduling a transmission on the target cell. is the PUSCH preparation time for the corresponding PUSCH processing capability [6, TS 38.214] assuming , is a time duration corresponding to 2 symbols for SCS configuration , and 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 assuming SCS configuration .  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 after the end of the last received downlink symbol in the other cell where 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 after the end of the last transmitted uplink symbol in the other cell where is given by Table 4.3.2-3 in TS 38.211.  <unchanged text omitted> |

# Discussions from 08/17 12:00 UTC to 8/19 12:00 UTC

**Issue #2)**

Since there are numerous TPs available for this issue, the moderator has constructed series of questions to facilitate the email discussions. From the proposed TP, it seems the underlying function that companies wish to implement is similar. So moderator suggest to first focus on clearly defining the behaviors and then finalizing the TP.

**Q1)** What is the behavior set corresponding to case (1) ~ (6)? Please provide inputs based on listed UE behavior A ~ D. If the case categorization below is not able to capture the different cases that specification needs to handle, please provide the categorization and corresponding UE behavior information.

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Power Sharing Mode** | **No Power Sharing Mode** |
| DAPS Scenario | support of *ul-TransCancellationDAPS-r16* | UE is provided *uplinkPowerSharingDAPS-Mode-r16*  *&*  (Assumes UE provided one or more of power sharing mode) | UE does not indicate support for any of semi-static power sharing mode1, semi-static power sharing mode2, and dynamic power sharing mode  OR  UE is not provided *UplinkPowerSharingDAPS-HO-mode-r16* |
| Intra-frequency DAPS | UE needs to support UL cancellation in intra-frequency DAPS | case (1) | case (2) |
| Intra-band Inter-frequency DAPS  &  Inter-band inter-frequency DAPS | UE doesn’t indicates support of *ul-TransCancellationDAPS-r16* | case (3) | case (4) |
| UE indicates support of *ul-TransCancellationDAPS-r16* | case (5) | case (6) |

* **UE behavior A**: when Tx overlap, UE transmits only on target cell and drops the source cell transmission (source cell Tx dropping timing/gap agreed apply)
* **UE behavior B**: UE does not expect gNB to schedule any overlapping target and source cell transmission
* **UE behavior C**: UE supports transmission of target and source cell transmissions using either semi-static or dynamic power sharing rules
* **UE behavior D**: undefined

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| --- | --- |
| **Company** | **Comments for Q1** |
| ZTE | We make some modifications on the UE behavior as shown below.  **UE behavior A:** when Tx overlaps in the time domain, UE transmits only on target cell and drops the source cell transmission (source cell Tx dropping timing/gap agreed apply)  **UE behavior E:** when Tx overlaps in the time domain and frequency domain, UE transmits only on target cell and drops the source cell transmission (source cell Tx dropping timing/gap agreed apply)  Case (1) - behavior A  Case (2) - behavior A  Case (3) - behavior C  Case (4) - behavior B  Case (5) - behavior C or behavior E  Case (6) - behavior A |
| Ericsson | We would also like to make one clarification of the behaviors:  **UE behavior C**: UE transmits to source and target cell using either semi-static or dynamic power sharing rules when Tc overlap  Case (1) – behavior C  Case (2) – behavior A  Case (3) – behavior C  Case (4) – behavior B  Case (5) – behavior C  Case (6) – behavior A |
| Intel | We are ok with ZTE’s modification to UE behavior A, and Ericsson changes to behavior C.  Case (1) – behavior C  Case (2) – behavior A  Case (3) – behavior C  Case (4) – behavior B  Case (5) – behavior C  Case (6) – behavior A  For UEs not supporting dual transmission in intra-frequency or inter-frequency, this can be supported by intra-frequency or inter-frequency DAPS capability indication. Therefore, even though RAN1 has agreed previously that UE would always drop the source cell transmission in intra-frequency case (1) and (2), we are ok of supporting behavior C. |
| Nokia | Case (1) – **behavior C** (like noted Intel, while not fully aligned with the earlier agreement, we are OK with this)  Case (2) – **behavior A**  Case (3) – **behavior C**  Case (4) – **behavior B**  Case (5) – **behavior C**  Case (6) – **behavior A** |
| Huawei, HiSilicon | Thanks FL for the efficient organization of the discussion.  Case (1) – behavior C  Case (2) – behavior A  Case (3) – behavior C  Case (4) – behavior B  Case (5) – behavior C  Case (6) – behavior A  We are ok with the modification from ZTE’s modification to UE behavior A, and Ericsson changes to behavior C. For case 1, before agreeing on a component feature of cancelation for intra-frequency DAPS HO, we perceived the UE behavior should be C per the agreement. Since that UE supporting intra-frequency DAPS HO always supports cancelation, if behavior A is more friendly to UE vendor, we could be ok with behavior A, but still prefer behavior C. |
| Qualcomm | ZTE’s modification to UE behavior A is only applicable to intra-frequency.  **UE behavior C**: UE supports transmission of target and source cell transmissions using provided *uplinkPowerSharingDAPS-Mode-r16*  Case (1) – behavior A or C  Case (2) – behavior B but ok with A for progress.  Case (3) – behavior C for the case no UL Tx overlap. However, it is undefined for the case UL Tx overlap.  Case (4) – behavior B  Case (5) – behavior E or C  Case (6) – behavior A |
| Samsung | Case (1) – behavior A (overlapping means overlapping in time resources)  Case (2) – behavior A (overlapping means overlapping in time resources)  Case (3) – behavior B for Intra-band Inter-frequency DAPS (overlapping means overlapping in time and frequency)  behavior C for Inter-band Inter-frequency DAPS  Case (4) – behavior B (overlapping means overlapping in time resources)  Case (5) – behavior A for Intra-band Inter-frequency DAPS (overlapping means overlapping in time and frequency resources)  behavior C for Inter-band Inter-frequency DAPS  Case (6) – behavior A (overlapping means overlapping in time resources)  Additional note: The above is based on our understanding of RAN1 agreements. The troubles we have to answer the above are:  1.“Intra-band Inter-frequency” and “Inter-band Inter-frequency” belong to different behavior. The “collision” for the inter frequency case (overlapping in time and frequency resources) only happens in “Intra-band Inter-frequency” but not in “Inter-band Inter-frequency”.  2. We still think “overlapping” can be “overlapping in time” or “overlapping in time and frequency” |
| MTK | We think Samsung’s reply is most aligned with previous RAN1 agreements (with one slide of illustration below). In the beginning RAN1 defined “collision” for intra-frequency and inter-frequency cases, but later the word “collision” is replaced by “overlap” with the same meaning in current spec. Hence, Samsung’s additional note helps to write spec in a more clear way. |
| Apple | We share the views with MTK that Samsung’s proposal is aligned with RAN1’s agreements.  We support Samsung’s proposal. It’s not desirable to define new UE behavior at this very late Rel.16 stage. |

Moderator Proposal:

* Agree to the following turquoise highlighted UE behavior for identified cases.
* discuss yellow highlight aspects in GTW

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| --- | --- | --- | --- |
|  | | **Power Sharing Mode** | **No Power Sharing Mode** |
| DAPS Scenario | support of *ul-TransCancellationDAPS-r16* | UE is provided *uplinkPowerSharingDAPS-Mode-r16*  *&*  (Assumes UE provided one or more of power sharing mode) | UE does not indicate support for any of semi-static power sharing mode1, semi-static power sharing mode2, and dynamic power sharing mode  OR  UE is not provided *UplinkPowerSharingDAPS-HO-mode-r16* |
| Intra-frequency DAPS | UE needs to support UL cancellation in intra-frequency DAPS | behavior A (4 company)  behavior C (4 company) | behavior A (6 company)  behavior B-2 (1 company)  behavior B (1 company) |
| Intra-band Inter-frequency DAPS  &  Inter-band inter-frequency DAPS | UE doesn’t indicates support of *ul-TransCancellationDAPS-r16* | behavior C (6 company)  behavior B-2 (3 company) | behavior B |
| UE indicates support of *ul-TransCancellationDAPS-r16* | behavior C (6 company)  behavior A-2 (intra-band) & behavior C (inter-band) (2 company)  behavior A-2 (2 company) | behavior A |

* **UE behavior A**: when Tx overlaps in the time domain, UE transmits only on target cell and drops the source cell transmission (source cell Tx dropping timing/gap agreed apply)
* **UE behavior B**: UE does not expect gNB to schedule any (time domain) overlapping target and source cell transmission
* **UE behavior C**: when Tx overlaps in the time domain, UE transmits to source and target cell using either semi-static or dynamic power sharing rules ~~when Tc overlap~~
* **UE behavior D**: undefined
* **UE behavior A-2:** when Tx overlaps in the time domain and frequency domain, UE transmits only on target cell and drops the source cell transmission (source cell Tx dropping timing/gap agreed apply)
* **UE behavior B-2**: UE does not expect gNB to schedule any (time and frequency domain) overlapping target and source cell transmission

**Issue #4)**

Newly brought up issue for merging of m-TRP and DAPS features in Rel-16 is discussed in issue #4.

**Q2)** Is TP#1-9 agreeable? If No, please provide comments on why. If need more information, please provide questions towards proponent company(ies) that you would like to seek or clarify. If yes with some modifications, please provide the changes. If there are other comments, please provide them as well.

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| **Company** | **TP#1-9 agreeable? (Yes/No/Need more information)** | **Comments for Q2** |
| ZTE | No | From the perspective of physical layer, the main impact of M-TRP is to increase the PDCCH monitoring overhead. However, it does not exceed the UE capability since the UE should support PDCCH blind decoding capability with 4 cells. It cannot lead to the extension of DAPS handover duration. In addition, M-TRP can improve the reliability especially for the UE on the edge of the cell. This is important for handover since it can reduce the possibility of handover failure. Therefore, it is not necessary to disable the second TRP operation during DAPS handover |
| Ericsson | No | We realize that simultaneous DAPS HO and mTRP may be complex. However, we propose to reuse the same paradigm as for SCells – the NW would have to release all SCells in the HO command, and reestablish them after HO. Similarily, the NW would have to turn of mTRP operation during DAPS HO.  For section 15 in 38.213, the TP would read  During DAPS operation, the UE is not expected to be configured with any CORESETs that are associated with *CORESETPoolIndex,* orto be indicated with two indicated TCI states in a codepoint of the DCI field ‘*Transmission Configuration Indication*’.  With regards to Huawei’s comment:  For issue #4 (the mTRP+DAPS issue), Ericsson would just like to highlight that DAPS operation starts and ends with RRC reconfigurations. In these RRC reconfigurations, the NW can change the configuration w.r.t. mTRP operation, and there is thus no extra delay involved. |
| Intel | yes | We are also ok with Ericsson’s suggestion for the alternative TP (above) |
| Nokia | No | We also share the view with Ericsson. |
| Huawei, HiSilicon | Yes | Addressing ZTE’s comment: simultaneous DAPS HO and mTRP in the raised issue means mTRP is configured in each cell, i.e., working in mTRP in both source MCG Pcell and target MCG Pcell. From UE implementation perspective, UE can indicate support of mTRP or DAPS but is not expected to have both concurrently.  Addressing Ericsson’s comment: From NW perspective, RRC configuration/reconfiguration is usually undesirable which cause additional signaling overhead but also extra air interface delay which deviates from the spirit of “0ms” interruption handover. This is motivation for the proposed approach/TP which can avoid the delay from additional RRC reconfiguration. |
| Samsung | Need more information | We are open to discuss this issue. But we want to hear other companies’ opinions whether m-TRP and DAPS co-existence is a common and valid scenario. |
| MTK | Yes | We support TP #1-9 to tackle the issue of simultaneous DAPS HO and mTRP. For Ericsson’s comment, RRC configuration is also a possible solution but may cause additional delay as HW mentioned. |
| Apple | Need more information | We slight prefer Ericsson’s proposal, not sure if DAPS UE has the Multiple TRP capability. |

Moderator Proposal:

* Discuss between TP#1-9(Huawei) and TP#1-11 (from Ericsson) in GTW

### #TP1-11

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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 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 symbols from a last or a first symbol, respectively, of a PRACH transmission on the source MCG. for or , for or , and is the SCS configuration of the active UL BWP for the PUSCH/PUCCH/SRS transmission to source MCG.  During DAPS operation, the UE is not expected to be configured with any CORESETs that are associated with *CORESETPoolIndex,* orto be indicated with two indicated TCI states in a codepoint of the DCI field ‘*Transmission Configuration Indication*’. |

**Issue #7)**

Newly brought up issue for supporting half duplex UEs for DAPS is discussed in issue #7.

**Q3)** Is TP#1-10 agreeable? If No, please provide comments on why. If need more information, please provide questions towards proponent company(ies) that you would like to seek or clarify. If yes with some modifications, please provide the changes. If there are other comments, please provide them as well.

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| **Company** | **TP#1-10 agreeable? (Yes/No/Need more information)** | **Comments for Q3** |
| ZTE | Need more information | First, a question should be resolved, i.e., whether the half duplex UE supports DAPS. We are not sure whether RAN1 can make a conclusion. If the answer is yes, the capability should be indicated by the UE. The second question is whether to reuse the current capability indication or introduce a separate capability indication for DAPS handover. |
| Ericsson | No | Our understanding is that the text in 38.211 applies also to DAPS. For sure, as long as the UE does not indicate any of *simultaneousRxTxInterBandENDC*, *simultaneousRxTxInterBandCA* *or simultaneousRxTxSUL* the gap will be applied. There may be a corner case where the UE supports simultaneous RxTx for one of the above cases but not for DAPS. The natural solution would be to add a capability for this.  If we cannot add a capability, the update should be in 38.211. |
| Intel | No | We believe the half duplex generic text in TS38.211 (see section 4.3.2) provides the information that half duplex UEs cannot perform immediate transmission.  If text needs to be updated, we prefer to update 211 where the other half duplex constraints are placed.  It should be noted that supporting DAPS for half duplex UEs without a separate capability may need further discussion in the UE feature list.  TS38.211 Section 4.3.2  “A UE not capable of full-duplex communication and not supporting simultaneous transmission and reception as defined by parameter *simultaneousRxTxInterBandENDC, simultaneousRxTxInterBandCA or simultaneousRxTxSUL* [10, TS 38.306] among all cells within a group of cells is not expected to transmit in the uplink in one cell within the group of cells earlier …” |
| Nokia | No | We share similar view as Intel above. |
| Huawei, HiSilicon | No/need more discussion | Tend to agree with Ericsson and Intel. If a spec change is needed, the suggestion from Intel may be sufficient. Also, may need to discuss the UE feature. |
| Qualcomm | We can have further discussion | We would like to address some points raised by companies so far   * whether the half duplex UE supports DAPS: We think it should. Any reason half duplex UE should not support DAPS? * Should we leverage on current RRC parameters e.g., *simultaneousRxTxInterBandENDC*, *simultaneousRxTxInterBandCA* *or simultaneousRxTxSUL*:UEs supporting DAPS HO do not necessarily support other features like ENDC, CA or SUL etc. DAPS should be independent feature. * Current text in 211 already covers the half-duplex for DAPS: We don’t think it covers DAPS. It basically only covers ENDC, CA and SUL.   We are open to discuss a separate capability and update 211 to enable half-duplex UE to support DAPS. |
| Samsung | Need more information | We can accept either adding half-duplex behavior in DAPS HO or letting full duplex capability be assumed in DAPS HO.  If it is decided to include half-duplex in DAPS-HO, we share the same view of Intel that this can be updated in 38.211. |
| MTK | Yes/more discussion | #TP1-10 seems reasonable and we are open to discuss a separate capability and update 211 if necessary |
| Apple | Discussion further | We are open to discuss the half duplex UE supporting DAPS HO. |

Moderator Proposal:

* Discuss further on whether a capability for half-duplex UEs for DAPS needs to be introduced in GTW
* Ask Qualcomm to provide a discussion TP for TS38.211 instead of TS38.213.

# Discussions after 8/19 12:00 UTC

**Issue #2)**

Based on discussion from GTW, moderator think the outcome be categorized into two options.

**Q4)** Among the options, please provide preference and reasons.

* **UE behavior A**: when Tx overlaps in the time domain, UE transmits only on target cell and drops the source cell transmission (source cell Tx dropping timing/gap agreed apply)
* **UE behavior B**: UE does not expect gNB to schedule any (time domain) overlapping target and source cell transmission
* **UE behavior C**: when Tx overlaps in the time domain, UE transmits to source and target cell using either semi-static or dynamic power sharing rules ~~when Tc overlap~~
* **UE behavior D**: undefined
* **UE behavior A-2:** when Tx overlaps in the time domain and frequency domain, UE transmits only on target cell and drops the source cell transmission (source cell Tx dropping timing/gap agreed apply)
* **UE behavior B-2**: UE does not expect gNB to schedule any (time and frequency domain) overlapping target and source cell transmission

Option 1) RAN1 agreements as they are.

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|  | | **Power Sharing Mode** | **No Power Sharing Mode** |
| DAPS Scenario | support of *ul-TransCancellationDAPS-r16* | UE is provided *uplinkPowerSharingDAPS-Mode-r16*  *&*  (Assumes UE provided one or more of power sharing mode) | UE does not indicate support for any of semi-static power sharing mode1, semi-static power sharing mode2, and dynamic power sharing mode  OR  UE is not provided *UplinkPowerSharingDAPS-HO-mode-r16* |
| Intra-frequency DAPS | UE needs to support UL cancellation in intra-frequency DAPS | behavior A | behavior A |
| Intra-band Inter-frequency DAPS  &  Inter-band inter-frequency DAPS | UE doesn’t indicates support of *ul-TransCancellationDAPS-r16* | behavior B-2 (t/f overlap),  otherwise behavior C\* | behavior B |
| UE indicates support of *ul-TransCancellationDAPS-r16* | behavior A-2 (t/f overlap),  otherwise behavior C\* | behavior A |

\* In case of inter-band, time/frequency overlap is not possible due to physical separation of bands. Therefore, the logical can be simplified to if time/frequency overlap X (intra-band) otherwise Y (inter-band).

Option 2) Some modifications of existing RAN1 agreement

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|  | | **Power Sharing Mode** | **No Power Sharing Mode** |
| DAPS Scenario | support of *ul-TransCancellationDAPS-r16* | UE is provided *uplinkPowerSharingDAPS-Mode-r16*  *&*  (Assumes UE provided one or more of power sharing mode) | UE does not indicate support for any of semi-static power sharing mode1, semi-static power sharing mode2, and dynamic power sharing mode  OR  UE is not provided *UplinkPowerSharingDAPS-HO-mode-r16* |
| Intra-frequency DAPS | UE needs to support UL cancellation in intra-frequency DAPS | behavior C | behavior A |
| Intra-band Inter-frequency DAPS  &  Inter-band inter-frequency DAPS | UE doesn’t indicates support of *ul-TransCancellationDAPS-r16* | behavior C | behavior B |
| UE indicates support of *ul-TransCancellationDAPS-r16* | behavior C | behavior A |

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| **Company** | **Option 1 or 2** | **Comments for Q4** |
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**Issue #4)**

From the discussions, companies had fundamental question on whether there should be any interaction between supporting DAPS and mTRP and related capability. For example, if there is some joint operation with DAPS and mTRP, whether there is separate UE who are not able to support them simultaneously or not. I have put a series of questions that may help us resolve some of this issues.

**Q5)** Should there be set of UEs who are NOT able to support DAPS and mTRP simultaneously, and a set of UEs what are able to support DAPS and mTRP simultaneously?

-- moderator assumes this may able to help us get information on whether some capability is needed

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| **Company** | **Yes/No** | **Comments for Q5** |
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**Q6)** Assuming answer to Q5 is Yes, does this require a capability indication (to separate the two types of UEs) to be supported in Rel-16? Alternatively, is the specification description able to automatically process these two types of UEs without needing a capability?

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| **Company** | **Capability bit needed? (Yes/No)** | **Comments for Q6** |
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**Q7)** Assuming answer to Q5 is No, should all UEs be able to enable DAPS and mTRP simultaneously (if DAPS and mTRP are separately supported)? Or should all UE not enable DAPS or mTRP at the same time (only support one or the other at a time)?

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| **Company** | **Support DAPS+mTRP simultaneously (Yes/No)** | **Comments for Q7** |
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**Q8)** Follow up of Q7. What is the required TP description needed to either DAPS and mTRP simultaneous together or alternatively not allow DAPS and mTRP simultaneously together?

Moderator assumes that TP#1-9 from Huawei and TP#1-11 suggested by Ericsson as a potential alterantive to TP#1-11 are the latte case of the question above. If so, what is your preference?

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| **Company** | **TP#1-9, or TP#1-11, or other alternative TP, or no TP needed** | **Comments for Q8** |
| Huawei | TP#1-9 | Firstly, **from UE vendor point of view**, it is too costly to double hardware just in case DAPS and mTRP might be configured to work simultaneously especially considering DAPS HO is a short time period which may and may not happen frequently depending on operator deployment, but UE implementation needs to take into account different deployment possibilities. Therefore, **to keep UE cost reasonable**, it is expected to use a common set of hardware resource for supporting mTRP and supporting DAPS in terms of receiving two PDSCH, but obviously cannot work in both at a given time.  Secondly, how to make mTRP fall back to a single TRP when goes to DAPS, there are two options: 1 is RRC reconfigure as suggested by Claes and 2 is automatic fallback without need of RRC reconfigure as our TP suggested.   * For option 1 (RRC reconfigure as **TP#1-11**),   Claes states “ DAPS operation starts and ends with RRC reconfigurations. In these RRC reconfigurations, the NW can change the configuration wrt mTRP operation, and there is thus no extra delay involved.”, but it is **NOT** true.  There were **agreements from RAN2 (see R2-2002501 and also as below) that source and target configuration cannot be sent in the same RRC message for DAPS HO. In other words, if source wants to change its configuration (i.e., reconfiguring UE to go back a single TRP if was working in mTRP in source cell for the concerned issue#4), the source could send two RRC messages in one TTI, i.e.,  DAPS handover command for target, and RRC reconfiguration message for source. Clearly, one extra RRC reconfigure msg is needed to make UE fallback to a single TRP operation.**   * For option 2 (automatic fallback to a single TRP as **TP#1-9)**,   As said, RRC reconfiguration is usually the thing needs to be avoided as much as possible **from NW side**, which cause long delay and signaling overhead especially considering DAPS HO is a short period.  For option 2, if UE was working in mTRP, without RRC reconfiguration before going to DAPS HO, UE automatically falling back to a single TRP seems a cleaner solution with obvious benefit of no additional delay nor signaling overhead.  **Agreements for DAPS (see R2-2002501):**   1. Source+target configuration cannot be sent in the same RRC message for DAPS HO. 2. If source wants to change it’s configuration during DAPS handover, the source could send two RRC messages in one TTI, i.e. DAPS handover command for target, and RRC reconfiguration message for source. But it is up to network implementation. 3. Following legacy handling on network configuration error if network (source+target) configuration exceeds the UE capability, no specification change is needed. |
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**Issue #7)**

Few companies mentioned capability for the half duplex operation. Moderator suggests resolving this issue as well. Also based on received feedback. Companies suggest to have a TP for 211 instead of 213, which might be more appropriate place to have information about half duplex operation.

**Q9)** Should there be a joint capability that indicates UE support half-duplex operation and DAPS? Or are existing capability indication for half-duplex and DAPS sufficient for Rel-16?

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| **Company** | **New capability needed? (Yes/No)** | **Comments for Q9** |
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**Q10)** If we assume a new capability is not needed, is TP#1-12 for TS38.211 (reformulation of TP#1-9 to match text in TS38.211) acceptable?

-- Moderator assumes if new capability is needed some further discussion will be needed on how the capability work and is defined.

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| **Company** | **New capability needed? (Yes/No)** | **Comments for Q9** |
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### #TP1-12

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| 4.3.2 Slots *< Unchanged parts are omitted >*  A UE not capable of full-duplex communication and not supporting simultaneous transmission and reception as defined by parameter *simultaneousRxTxInterBandENDC, simultaneousRxTxInterBandCA or simultaneousRxTxSUL* [10, TS 38.306] among all cells within a group of cells is not expected to transmit in the uplink in one cell within the group of cells earlier than after the end of the last received downlink symbol in the same or different cell within the group of cells where is given by Table 4.3.2-3.  A UE not capable of full-duplex communication and not supporting simultaneous transmission and reception as defined by parameter *simultaneousRxTxInterBandENDC*, *simultaneousRxTxInterBandCA* *or simultaneousRxTxSUL* [10, TS 38.306] among all cells within a group of cells is not expected to receive in the downlink in one cell within the group of cells earlier than after the end of the last transmitted uplink symbol in the same or different cell within the group of cells where is given by Table 4.3.2-3.  A UE not capable of full-duplex communication is not expected to transmit in the uplink earlier than after the end of the last received downlink symbol in the same cell and in the case of DAP HO operation, in the same or different cell, where is given by Table 4.3.2-3.  A UE not capable of full-duplex communication is not expected to receive in the downlink earlier than after the end of the last transmitted uplink symbol in the same cell and in the case of DAP HO operation, in the same or different cell, where is given by Table 4.3.2-3.  *< Unchanged parts are omitted >* |

# 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
10. R1-2005942, “Issue Summary for NR Mobility Enhancements,” Moderator (Intel Corporation)