**3GPP TSG RAN WG1 Meeting #102-e R1-2007079**

**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

|  |
| --- |
| 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

|  |
| --- |
| **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

|  |
| --- |
| 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

|  |
| --- |
| **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

|  |
| --- |
| **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

|  |
| --- |
| **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

|  |
| --- |
| 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

|  |
| --- |
| **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

|  |
| --- |
| 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

|  |  |
| --- | --- |
| **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

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **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.

|  |  |  |
| --- | --- | --- |
| **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

|  |
| --- |
| **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.

|  |  |  |
| --- | --- | --- |
| **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.

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **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  (case 1) | 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

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **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 |

|  |  |  |
| --- | --- | --- |
| **Company** | **Option 1 or 2** | **Comments for Q4** |
| Huawei/HiSilicon | Option2 | It is surprising to see we still have two options (at least for inter-frequency) when UE supports power sharing and the saying of option 2 reverting agreement of Reno is not appropriate to after intensive discussion in the last meeting. The fact might be the agreements were not formatted in a way to lead to an identical interpretation.  The essential concern is that why UE has to drop one when UE indicates support of power sharing/simultaneous transmission.  In addition, 38.133 states “For inter-frequency DAPS handover, no requirement applies if the BWP of target cell is overlapped with the BWP of source cell in frequency domain”, therefore, there is no need to further classify intra-band inter-frequency into whether there is overlapping in frequency because anyway no requirement is defined when UE transmits both when frequency overlaps for inter-frequency.  For intra-frequency, if UE has trouble to transmit both, then UE can not indicate support of simultaneous transmission. Otherwise, UE supports simultaneous transmission and power sharing, UE should be supposed to transmit both subject to power sharing. |
| ZTE | Option 1 | We prefer option 1 to align with the previous agreements. But we can accept option 2 for progress.  In our understanding, a UE supporting power sharing means it can simultaneously transmit signals on the different frequency resources but not on the same frequency resource. |
| Qualcomm | Option 1 | We do not prefer to modify RAN1 agreements at this stage |
| Ericsson | Either option is fine |  |
| Samsung | Option 1 with case 1 change to C | In our understanding, the quote from 38.133 from HW does not rule out the case overlapping in frequency in intra-band inter-frequency DAPS HO. In RAN1-101E We have a similar proposal targeted to rule out this case based on RAN2’s capability signaling structure but other companies didn’t agree.  Let’s assume now the frequency overlapping in intra band inter-frequency case still happens. Consider a UE has difficulty to support simultaneously transmission with two transmission overlapping in time and frequency, but it has no problem to simultaneously transmit signals on the different frequency resources. Then:  Option 2🡪 UE cannot not support any power sharing mode for inter-frequency DAPS-HO  Option1🡪 UE can support any power sharing mode for inter-frequency DAPS-HO  The consequence of Option 2 is to force UE underreporting its power sharing capability during inter-frequency HO. This is due to the fact that there is no separated capabilities associated with “intra-band inter frequency” and “inter-band inter-frequency”.  For case 1), we now think behavior C makes sense with the introducing the separated intra-frequency power sharing capability in recent meetings. If UE behavior for both entries in the intra-frequency case are both A, there is no meaning for the capability of intra-frequency power-sharing. |
| Huawei/HiSilicon2 | Option 2 | **More clarification to address Samsung’s comment:**  By citing the statement from 38.133, I intended to say there is no requirement defined for the overlapping frequency case for inter-frequency cases although this case may happen. If UEs can do power sharing for inter-frequency DAPS with no frequency overlapped for two transmission, UEs do it also when two transmissions have frequency overlapped because there is no requirement defined for this case anyway, so it does not force UE underreporting its power sharing capability during inter-frequency HO. From UE implementation perspective, further classifying inter-frequency for “with and without frequency overlapped” is not necessary but complicate UE implementation and UE behavior descriptions in the spec.  Again, this is not modifying RAN1 agreement as we discussed in the last meeting between Daewon and me. If helpful, R1-2004748 can be referred which documented the details of the discussion on exchanging the interpretations of the agreements of Reno. |
| MTK | Option 1 | We still think we should stick to the previous RAN1 agreement. The logic of previous RAN1 agreement is the same as the reason we define FG 21-2d UL transmission cancellation. Even if the UE can simultaneously transmit signals on the same frequency resource to source and target cell, the two transmissions interfere with each other and may possibly both become useless for gNB since they are not decodable. However, we are open to discuss the possibility of Option 2 if companies can address my concern. |
|  |  |  |

Moderator Summary:

* Based on input received so far, good majority of companies think we should keep to the RAN1 agreements as per described by Samsung.
* Moderator notes that Huawei does not believe option 2 is necessary against the RAN1 agreements, and has a different interpretation.
* Moderator would like to ask Huawei if they may be able to accept Samsung’s suggested comprise, which is adoption option 1 with case 1 updated as behavior C.

Moderator Proposal:

* See if the following behavior definition (below) is agreeable by all.
  + *Option 1 with Case (1) updates as behavior C*
* **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

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **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 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).

|  |  |
| --- | --- |
| **Company** | **Comments on Moderator proposal** |
| Huawei/HiSilicon3 | No.  **Try to address MTK’s concern firstly:**  I am not sure the reason of introducing cancelation is relevant here. In my understandingly, as long as UE is not supporting power sharing/simultaneous transmission but supporting of cancelation or not required (e.g., power sharing disabled) or transmission power is zero under power sharing, UE can do the cancelation.  As Samsung noted for case 1, behavior C makes sense. For inter-frequency case, as explained to Samsung, further classifying inter-frequency for “with and without frequency overlapped” is not necessary but complicate UE implementation and UE behavior descriptions in the spec because no requirement is defined for the overlapping frequency case for inter-frequency cases anyway. |
| MTK | We prefer to stick to RAN1 agreement but can accept HW’s suggestion. |
| Apple | We still prefer the option1, strict following previous agreements.  Regarding how to interpret the previous meeting agreements, it should base on the current specification, this should be the common ground. Now we introduce the “non- power sharing mode” and UL transmission cancellation capability, we just make the specification complete, it’s better not to reinterpret the agreements or to do some optimizations. |
| Huawei/HiSilicon4 | **Addressing comments from Apple**:  The common ground is that UE behaves A for no-power sharing with UL transmission cancelation capability. Specification needs to be complete for power sharing mode and UE should naturally transmit both in power sharing mode which seems kind of fact needs to be respected. Further classifying inter-frequency for “with and without frequency overlapped” as in **option 1 is more like “optimization”** and is not necessary but complicate UE implementation and UE behavior descriptions in the spec. |
| Nokia | Just a late note that we would have also been fine with either options above (before the moderator proposal). Assuming that inter-frequency intra-band frequency domain overlap case is precluded by RAN4 we don’t see a big difference. Regarding Case1, while I’m fine with going with behavior C, in my recollection the earlier agreement was more leaning towards behavior A. That being said, we don’t have a strong view. |
| Samsung | We prefer to stick to RAN1 agreement regarding inter frequency DAPS HO.  The fact that there is no RAN4 requirement now does not mean that the case is not supported in RAN1 perspective. It is also possible that the requirement comes later for such scenario, and then the scenario gets broken since RAN1 removed appropriate consideration of such scenario. |
| Ericsson | From a NW perspective, the important thing it to avoid behavior B.  Having said that, it would seem appropriate to follow RAN1 agreements. Also, it would seem natural that the UE performs power sharing if the UE can do that, and the NW configures power sharing. |
| ZTE | We think it would be better to follow the RAN1 agreements. But we also can accept the updates for case 1 |

Moderator comments and summary:

* Basically we really need to conclude on this issue. We have basically three choices on the table, **(please edit your views)**
  + Option 1
    - ZTE, Samsung, Apple, MediaTek
  + Option 2
    - Huawei, HiSilicon,
  + Option 3: Option 1 with Case (1) changed to behavior C
    - ZTE, [Samsung?], MediaTek
* Let me ask companies to see if option 3 (option 1 with case (1) changed to behavior C) is acceptable. I think this is the best comprise between option 1 and 2. For the majority of the cases, there should not be any frequency overlap for the inter-frequency DAPS. So UE should follow behavior C. Therefore, unless I am mistaken, the overall behavior for Option 3 should be identical to option 2.
* If the above is not acceptable, as I would lean towards keeping RAN1 agreements which is option 1. Of course, I understand Huawei and HiSilicon’s interpretation of RAN1 agreements may not be strictly option 1. However, from my reading of the comments almost all companies do agree that option 1 is following RAN1 agreements. I don’t think there is really any other option in the lack of consensus.
* **Can companies provide views bit more explicitly as well for option 1, 2, and 3?** So that I may be able to get a better assessment? You can directly edit the views above if you like.
* Please note that after this we still need to complete the TP. So we do not have a lot of time for this.

|  |  |
| --- | --- |
| **Company** | **Comments on Moderator proposal** |
| Huawei/HiSilicon | Option 2.  As noted, the agreement unfortunately does not lead to an identical interpretation. Except that, I failed to see the technical argument for not allowing UE to transmit both when UE has power sharing capability given we have defined the UE behavior for UE not supporting power sharing or power sharing being disabled. Further differentiating UE behaviors for inter-frequency with/without frequency overlapping is not necessary but complicates UE implementation as well as spec description. The cases may happen but RAN4 does not define the requirements for these particular case. The requirements not defined for inter-frequency case with frequency overlapping does not mean such cases will not happen. Granted RAN4 may define the requirements in the future as Samsung argued, it does not make sense the requirements will be more stringent than for the cases that frequency non-overlapped. Therefore, UE transmitting both when power sharing capable seems more forward compatible. |
| Nokia | A minor question that if the power sharing capability is per BC, how do we interpret that for intra-frequency DAPS? If we cannot not do this with current capability signaling, would it be simplest to restrict the intra-frequency case to behavior A? It would not be preferable to go adding new capabilities. |
| Samsung | Both Option3 and Option1 are ok for us.  We have same understanding as Moderator’s interpretation above. We do prefer Option 3 now due to better usage of the “intra-frequency DAPS HO” capability signaling. But we are fine to be stick to RAN1 agreements which is Option 1. |
| Qualcomm | We prefer option 1. We have the same question as Nokia on power sharing capability per BC. DAPS leveraged NR-DC power sharing which would be suitable for inter-frequency DAPS. We’re not sure how NR-DC power sharing can work for same frequency i.e., intra-frequency DAPS. |
| ZTE | Our first preference is option 1 and we can accept option 3 as second preference. |
| Huawei/HiSilicon | **To respond the comments from Nokia and Qualcomm**, if the expected UE behavior for intra-frequency is behavior A, then the UE will not indicate the capability for power sharing which has been covered in the table.  I tried and I believe I addressed people’s comments and I welcome more new arguments for further discussion. I also suggest and respect people can be constructive for further technical argument instead of simply repeating the preference or sticking to one interpretation of the agreements that is not unanimous. |

**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

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments for Q5** |
| Huawei/HiSilicon | No. | Similar to the reason of Scell being released during DAPS HO for sake of low cost/complexity UE. Also, try not to introduce additional UE capability at late stage. |
| ZTE | Yes | In our understanding, there also should be set of Ues who are only able to support either DAPS or mTRP. |
| Qualcomm | No | Supporting both DAPS and mTRP is very complicated at UE. Also note that mTRP is quite equivalent to CA when one TRP can be viewed as virtual CC. Furthermore, supporting both DAPS and mTRP would ask us to discuss at least PDCCH monitoring.  Supporting DAPS and CA was discussed and it was decided that CA was not supported together with DAPS. |
| Ericsson | Yes | Our first preference is that the capabilities are independent |
| Huawei/HiSilicon2 | -- | As capability in UE feature normally does not define it is a capability with or without considering the capability for other features for now.  We also does not intend to do so. Therefore, we can skip this issue and assume we have what we have in the UE feature. |
| Samsung | No | We share the view from HW and QC on the similarity with Scell/CA restriction for DAPS. Simultaneous operation of DAPS and mTRP complicates UE implementation. |
| MTK | No | UE should not be required to perform mTRP during DAPS-HO, but does not seem to require to divide Ues into two sets. UE also should not be required to perform DC/CA during DAPS-HO, and we did not divide UE sets for that. |
| Nokia | [Tentative Yes] | It would be preferable to be able to consider these independently |

**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?

|  |  |  |
| --- | --- | --- |
| **Company** | **Capability bit needed? (Yes/No)** | **Comments for Q6** |
| ZTE | No | There has been a capability indication to indicate the support of mTRP. And there has been another capability indication to indicate the support of DAPS. These two capability indications are independent and can indicate any type of Ues. It is not necessary to introduce an additional capability to separate the mentioned two types of Ues. |
| Ericsson | No | There should not be a capability |
|  |  |  |

**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)?

|  |  |  |
| --- | --- | --- |
| **Company** | **Support DAPS+mTRP simultaneously (Yes/No)** | **Comments for Q7** |
| Huawei/HiSilicon | No | As explained the reason is similar to release Scell during HO for low cost/complexity UE. Also, UE hardware would be doubled to support both which is very costly from UE vendor point of view especially when considering handover is a short-period operation. |
| ZTE | Yes | In our understanding, it is possible to enable DAPS and mTRP simultaneously for a UE as long as the UE supports both of them. |
| Qualcomm | No | Please see our view in Q5 |
| Ericsson | Yes | First preference is to support both |
| Samsung | No |  |
| MTK | No | Same view as HW |
| ZTE2 | Yes | In our understanding, it is possible to enable DAPS and mTRP simultaneously for a UE as long as the UE reports that both DAPS and mTRP are supported and more than 2 cells for a band/BC are supported. |

**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 alternative to TP#1-11 are the latte case of the question above. If so, what is your preference?

|  |  |  |
| --- | --- | --- |
| **Company** | **TP#1-9, or TP#1-11, or other alternative TP, or no TP needed** | **Comments for Q8** |
| Huawei/HiSilicon | 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. |
| ZTE | No TP needed | From the perspective of physical layer, DAPS is quite same as NR-DC. The coexistence of DAPS and mTRP is quite same as the coexistence of NR-DC and mTRP. The UE cost and corresponding solution has been discussed for the coexistence of NR-DC and mTRP in eMIMO WI since both mTRP and NR-DC are long time state. One of the solutions is to consider the second TRP as an independent cell. If a UE is configured with mTRP operation for one cell, it leads to the number of cells that can be configured for the UE decreases by one. So the UE cost is not increased. Therefore, allowing simultaneous configuration of mTRP and DAPS does not mean the UE cost should be increased. It is up to the network to ensure the configuration does not exceed the UE capability.  Regarding the UE using a common set of hardware module for DAPS and mTRP operation as said by HW, we understand this UE only supports two cell. There is no more resource for processing the communication with the second TRP. In this case, the second TRP should be disabled. However, simultaneous configuration of mTRP and DAPS should be supported by the specification since there may be much more Ues supporting operation of more than two cells simultaneously. There is no reason to prohibit the simultaneous configuration of mTRP and DAPS just because there may be some Ues that does not support it. Therefore, we prefer that it is up to network to configure mTRP to UE during DAPS handover via RRC signaling according to the UE capability.  It also should be noted that, in most cases, RRC reconfiguration for the source cell is necessary to change the configuration of the source cell. For example, RRC reconfiguration is needed to release the scells of source MCG, if any, or to avoid the PDCCH overbooking for the source MCG and target MCG in a slot, or to avoid the semi-persistent UL signals/channels (e.g., P-SRS, SP-SRS, CG PUSCH, etc) overlapping as agreed by RAN1.  Therefore, we think the best way is to leave to network implementation. No TP is needed. |
| Qualcomm |  | TP1-11 is clear for both single DCI and multi-DCI cases in mTRP.  TP1-9 seems cover multi-DCI case in mTRP only since *CORESETPoolIndex* is not defined for single DCI case. |
| Ericsson | Maybe | If there is a really strong desire from UE vendors, we can compromise to limit the configuration explicitly during DAPS, relying on the RRC reconfigurations that are anyway needed. As ZTE notes, this is the principle used for SCells. As Huawei notes, the RRC messages can come in the same TTI, so there is no additional delay. |
| Huawei/HiSilicon2 | TP1-9 | **Reply to ZTE’s comment:**  As commented also from Qualcomm, it is complicated for UE to support both. Also, support of mTRP is indicated per FSBC and support of DAPS is per BC, UE can report both but not expected to work in both at the same time. Otherwise, UE has to double the hardware just in case DAPS and mTRP are configured in the same serving cell.  Regarding whether RRC reconfiguration is necessary, we also have a CR in RAN2 to automatically release Scell in DAPS without RRC reconfigure, PDCCH overbooking does not necessitate it either because overbooking is allowed at least for one Pcell, semi-persistent uplink does not either because cancelation is defined for DAPS.  All in all, RRC reconfiguration should also be avoided from NW perspective as much as possible.  **Reply to Qualcomm’s comment:**  TP1-9 covers both single DCI and multi-DCI cases. “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” covers multi-DCI when CORESETPoolIndex configured. “ 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” covers a single DCI which DCI indicates two TCI states in a codepoint.  **Reply to Ericsson’s comment:**  Though two RRC messages theoretically can come in the same TTI for reducing the latency, clearly it restricts NW to schedule them as so. Also, it cause additional signaling overhead. All these are caused by RRC reconfiguration which is really concerned from NW perspective, which I believe Ericsson as NW vendor should concern as well. |
| Samsung |  | From E///’s above clarification, it seems additional delay may not be an issue for TP1-11. |
| MTK | Slightly prefer TP1-9 | Both options seem fine. I think we should choose one of them at this meeting for better spec completeness. According to HW’s reply, RAN2 is discussing to automatically release Scell in DAPS without RRC reconfiguration; then TP1-9 has the potential to decrease RRC reconfiguration delay. |
| ZTE2 |  | It is not mandatory that the UE should support DAPS and mTRP at the same time if the UE reports the support of DAPS and mTRP. If a UE reports that more than 2 cells are supported for a band/BC additionally, then the network can configure DAPS and mTRP for the UE simultaneously, e.g. source cell with mTRP + target cell. The UE complexity to support a cell with mTRP is smaller than the complexity to support two cells, which is the understanding in mTRP. If a UE reports that only 2 cells are supported for a band/BC additionally, the network cannot configure DAPS and mTRP for the UE simultaneously. The configuration of mTRP can be deleted by the network during DAPS handover, if any. It should be noted the number of supported cells should be reported for a band/BC in DC.  The UE complexity is not increased since it is not required that the UE should support more than 2 cells.  For the RRC reconfiguration, it should be discussed in RAN2. RAN2 has agreed that two RRC signaling is supported. One is for the source MCG and the other one is for the target MCG. We don’t receive a RAN2 agreement that the RRC signaling for the source MCG should be avoided. I haven’t checked the new progress in RAN2. Could anyone provide the new progress in RAN2?  PDCCH overbooking is not allowed for the source MCG and target MCG in a slot as discussed in another email thread. UE behavior B and B-2 does not allow UL transmission overlapping, which should be guaranteed by configuration. |
| Nokia |  | We share the view with Ericsson, if something is needed it can be handled by RAN2 |

Based on feedback received, it seems to be pretty clear that no capability signaling should be introduced for this issue. So, the discussion boils down to the following.

**Option 1)** UE supporting mTRP and DAPS, shall support mTRP while performing DAPS, or

* ZTE, Ericsson (1st preference)
* Moderator question: TP needed or not?

**Option 2)** UE supporting mTRP and DAPS, disable mTRP while performing DAPS

* Samsung, MediaTek, Qualcomm, Huawei, HiSilicon
* **Option 2A)** Default back mTRP to non-mTRP cases automatically when performing DAPS (UE to turn off mTRP when DAPS is enabled by gNB) **(TP#1-9)**
  + Huawei, HiSilicon, MediaTek
* **Option 2B)** Have the specification state that UE does not expect to be configured with mTRP while performing DAPS (therefore gNB to turn off mTRP when enabling DAPS) **(TP#1-11)**
  + Ericsson (can accept)

Moderator Proposal:

* No new capability is introduced to indicate joint support of mTRP and DAPS features.
* Down-select among option 1/option 2a/option2b

|  |  |
| --- | --- |
| **Company** | **Comments on Moderator proposal** |
| Huawei/HiSilicon | Ok with the proposal.  Note: I doubt “Ericsson (1st preference)” for option 1 correctly reflected Ericsson view, because Ericsson commented “We realize that simultaneous DAPS HO and mTRP may be complex” in the first round, which I suppose Ericsson also concerns operating DAPS and mTRP at the same time for a given UE.  **Regarding option1/2a/2b, I believe all concerns from other companies have been addressed in the above table. The following further to address ZTE’s last comment:**  As ZTE said “It is not mandatory that the UE should support DAPS and mTRP at the same time if the UE reports the support of DAPS and mTRP”, the problem is that UE does not know or UE is not guaranteed UE will not be required to work in both features and the proposal is targeting to solve this concern from UE implementation perspective.  ZTE is also seeming to propose “The configuration of mTRP can be deleted by the network during DAPS handover, if any”, I suppose you mean RRC reconfiguring UE to let UE know the mTRP configuration is “deleted”, then it seems the solution as Ericsson suggested.  Regarding RRC reconfiguration, what RAN2 has agreed is as long as source gNB is going to change the configuration for source gNB, then the source gNB has to send RRC reconfiguration msg to UE for changing configuration (or deleting as in your example) before sending another RRC reconfiguration msg carrying handover command. What RAN1 can do to avoid RRC reconfig is the thing in RAN1 and it is exact the thing we are proposing in option 2a. |
| MTK | Ok with the proposal. We can further down-select in next week. We slight prefer Option 2A. |
| Apple | We are ok with proposal.  In addition, I’m trying to understand the option 2A and 2B.  For 2A, UE receives the PDSCH from CORESETPoolIndex = 0, my question is the TRP corresponding to the CORESETPoolIndex = 0 maybe not the best TRP when UE is moving toward the target cell, or the orresponding beam is not the best beam among TRPs, or even beam is the worst beam. How to guarantee the HO performance?  For 2B, my understanding is two features can’t operate together. If UE is configured with mTRP, then UE can’t be configured with DAPS HO. Only after gNB disables the mTRP fist, then UE can be configured with the DAPS HO. RRC configuration may cause the delay, but the HO performance can be guaranteed. |
| Nokia | OK with the proposal. |
| Samsung | OK with the proposal. For options, we prefer 2B. |
| Ericsson | OK with proposal. |
| ZTE | OK with the proposal.  Our preference is option 1 and we would like to make the following modification to option 1.  Option 1: UE supporting mTRP, DAPS and more than two cells, shall support mTRP while performing DAPS.  Our intention is to let network implementation solve this issue since the network can ensure the configuration of the source cell and the target cell does not exceed the UE capability. The network can configure or not configure mTRP for a UE during DAPS handover according to its capability. Therefore, no TP is needed.  It is our understanding that if a UE reports that mTRP, DAPS and more than two cells is supported, the UE should have a capability of supporting two cells, where one cell is configured with mTRP. However, some companies still express their concerns that this may bring some problems to the UE implementation. At this stage, we also can accept option 2B to solve this issue for further progress as our second preference. |

The following seems to be agreeable by all.

Moderator Proposal:

* No new capability is introduced to indicate joint support of mTRP and DAPS features.

As for the exact method to handle mTRP and DAPS, we have the following options.

Moderator comments and summary:

* Basically we also really need to conclude on this issue. We have basically three choices on the table, **(please edit your views)**
  + Option 1) UE supporting mTRP, DAPS and more than two cells, shall support mTRP while performing DAPS.
    - ZTE
  + Option 2A) Default back mTRP to non-mTRP cases automatically when performing DAPS (UE to turn off mTRP when DAPS is enabled by gNB) **(TP#1-9)**
    - HW, HiSilicon, MediaTek
  + Option 2B) Have the specification state that UE does not expect to be configured with mTRP while performing DAPS (therefore gNB to turn off mTRP when enabling DAPS) **(TP#1-11)**
    - Samsung,
    - Can accept – ZTE, [Ericsson?]
* **Can companies provide views bit more explicitly as well for option 1, 2A, and 2B?** So that I may be able to get a better assessment? You can directly edit the views above if you like.
* There was a question on 2A from Apple. If Proponents of 2A provide some clairifcation to Apple’s question, that would be great. I’ve copy & pasted Apple’s comments below.

|  |  |
| --- | --- |
| **Company** | **Comments on Moderator proposal** |
| Apple | In addition, I’m trying to understand the option 2A and 2B.  For 2A, UE receives the PDSCH from CORESETPoolIndex = 0, my question is the TRP corresponding to the CORESETPoolIndex = 0 maybe not the best TRP when UE is moving toward the target cell, or the orresponding beam is not the best beam among TRPs, or even beam is the worst beam. How to guarantee the HO performance?  For 2B, my understanding is two features can’t operate together. If UE is configured with mTRP, then UE can’t be configured with DAPS HO. Only after gNB disables the mTRP fist, then UE can be configured with the DAPS HO. RRC configuration may cause the delay, but the HO performance can be guaranteed. |
| Huawei/HiSilicon | Firstly addressing the comments from Apple.  **Addressing the comment from Apple regarding the performance between options 2A and 2B**:  Falling back to CORESETPoolIndex = 0 is the consideration from signaling design, but it is not restricted to a specific physical TRP. All CORESETs will be associated with CORESETPoolIndex = 0 by default when UE enters DAPS in option 2A. Option 2B is to reconfigure UE with all CORESETs associated with CORESETPoolIndex = 0. The TRP with CORESETPoolIndex = 0 is up to NW management to use which physical TRP. Therefore, from performance perspective, options 2A and 2B are equivalent. Option 2A is clearly beneficial over option 2B in terms of no additional delay and signaling overhead.  From both Huawei and HiSilicon perspective, we do have concerns from both UE vendor and NW vendor. From NW perspective, RRC reconfiguration in option 2b is really concerned and we will definitely NOT be ok with it. I suggest NW vendors carefully think about it.  If option 2a is not agreeable, as a compromise, we will propose to have a UE capability indicating whether support mTRP and DAPS at the same time. Therefore, to us, either option 2A or define a new UE capability. |
| Apple | **Response to Huawei’s comment**  We don’t think the TRP is fully transparent to UE, it links to a TCI for UE to receive the beam, the TRP corresponds to CORESETPoolIndex=0 may not have the best beam. From this point, the handover performance could be impacted. In addition, “the first TCI state is applied to the PDSCH during DAPS operation”, the first TCI may not correspond to the best TRP as well. |
| Samsung | **Response to moderator’s request for further clarification the reason behind the option:**  We don’t have strong views on this issue. First, we acknowledge that asking UE to handle full m-TRP and DAPS-HO together is very complexed and needs more discussion on the details if we go this route. So we don’t prefer option 1.  For the option 2A and 2B, we think both are not perfect solutions and we also have the concern Apple addressed above:”The TRP corresponds to CORESETPoolIndex=0 may not be a good beam”. So option 2A may have impacts on DAPS HO performance itself. We also learned from E/// and Nokia’s responses that this can be somehow handled by NW or RAN2 with minimum impacts on delay. Based on the above reasons, we inclined to choose option 2B. |
| Qualcomm | We should focus discussion on Option 2A and Option 2B. We prefer Option 2B – TP#1-11. |
| ZTE | If a UE supports mTRP, DAPS and two cells, the network cannot configure mTRP for the UE during DAPS handover. If a UE supports mTRP, DAPS and more than two cells (e.g. three cells), the network can configure mTRP for the UE during DAPS, e.g., source cell with mTRP + target cell. We don’t see there needs additional UE complexity to support source cell with mTRP during DAPS handover if the UE has already supported mTRP, DAPS and three cells. Therefore, our preference is option 1.  However, if UE vendors have strong concerns on this. We can accept the solution that the second TRP is always disabled during DAPS handover for further progress. For option 2B, it is up to network to release the second TRP. Comparing to option 2B, option 2A is to disable the second TRP automatically for the source cell at the cost of flexibility when the UE receives the RRC reconfiguration (HO CMD) for the target cell. This may bring some problems as proposed by some companies. In addition, We don’t see any benefits of the option 2A. First, there are many other factors leading to the RRC reconfiguration for the source cell, e.g. scells release, PDCCH reconfiguration to avoid PDCCH overbooking for the source cell and the target cell in the same slot, SPS/P UL channels/signals reconfiguration to avoid UL overlapping as discussed above. Only disabling the second TRP automatically cannot avoid signaling overhead absolutely. Second, for the option 2B, the two RRC reconfiguration signaling can be transmitted at the same time, even on the same transport block. It is up to network implementation completely. There is little difference on the signaling delay between option 2A and 2B. Therefore, we can accept option 2B as our second preference. |
| Huawei, HiSilicon | **Respond to Apple’s response and the similar comment from Samsung**:  For mDCI based mTRP, UE is only aware of the CORESETPoolIndex, either 0 or 1 is assumed for CORESETPoolIndex irrespective of option 2A or 2B and this index does not bind to a specific physical TRP. For a single DCI based mTRP, MAC can carry two TCI states for a codepoint in DCI, the scheduling can use other codepoint of the DCI for better performance. On the other hand, MAC CE can quickly modify the mapping of codepoint and TCI states. RRC reconfiguration is really not need/should be avoided and it is also a reason for introducing the MAC CE for TCI states modification.  If option 1 can be ruled out now, it is ok to not define a new UE capability.  I believe I have addressed all arguments and welcome more new arguments for more constructive discussion. Not taking into account the responses but repeating the same old arguments is not constructive nor respected by us. |

**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?

|  |  |  |
| --- | --- | --- |
| **Company** | **New capability needed? (Yes/No)** | **Comments for Q9** |
| ZTE | No | In our understanding, the existed capability can be reused if the proposed TP is agreed. For a UE not supporting simultaneous transmission and reception for a BC as defined by a parameter as shown in TP 1-12 , the gap is needed as long as the source cell and the target cell belong to the BC. |
| Qualcomm | Yes | We prefer to define a new capability since there could be scenario where UE supports DAPS only but does not support other features with parameter shown in #TP 1-12. |
| Ericsson | Yes | We prefer to define a new capability, something like *simultaneousRxTxInterBandDAPS* with a similar definition as the ENDC version |
| Samsung | Yes | This question assumes we want to specify half-duplex operation and DAPS.  General question:  Since DAPS HO is targeting fast (0ms) and robust HO, half-duplex operation in DAPS seems not favorable operation. In this regard, similar with mTRP, do we need to support half-duplex for DAPS? |
| MTK | Yes | Same view as Ericsson/QC |
| Nokia | No | It is not clear if new capability is needed (instead of relying the existing), but if companies have strong view. |

**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.

|  |  |  |
| --- | --- | --- |
| **Company** | **TP acceptable (Yes/No)** | **Comments for Q9** |
| Ericsson | No | The current text in 38.211 already describes “group of cells”. That text applies also to the cells in two MCGs. |
|  |  |  |
|  |  |  |

#### #TP1-12

|  |
| --- |
| 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 >* |

All companies provided feedback seems to agree new capability is needed to resolve this issue. If the capability is introduced, then from moderator understanding it should be sufficient to add the capability to existing 211 text (TP#1-13).

Moderator Proposal:

* Introduce new capability, *simultaneousRxTxDAPS*, to indicate support of DAPS for half-duplex UE.
  + Assume to be indicated for per band (for intra-frequency DAPS), and per band combination (for inter-frequency DAPS).
* Agree to TP#1-13 in R1-2007079 for TS38.211

#### #TP1-13

|  |
| --- |
| 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, simultaneousRxTxDAPS, 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*, *simultaneousRxTxDAPS, 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 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 where is given by Table 4.3.2-3.  *< Unchanged parts are omitted >* |

|  |  |
| --- | --- |
| **Company** | **Comments on Moderator proposal** |
| MTK | Fine with the proposal. |
| Apple | We are ok with moderator’s proposal and TP1-13. |
| Nokia | We can accept this. |
| Ericsson | Fine with the proposal |
| Moderator | I have been trying to put together the capability bit for the half-duplex operation (assuming that companies are ok with this). As I was digging more into this, I came across some questions.  Before I get into the questions, I apologize, as moderator I should have paid bit more attention and asked this bit earlier.  The 21-1a and 21-1b intra-frequency and inter-frequency capability was agreed to have “no need of FDD/TDD differentiation”. So if we introduce a half-duplex capability, isn’t this the same as introducing a FDD/TDD differentiation? If so, why create another capability field for this? Maybe Qualcomm or some other company can provide some context to what they were initially thinking of.  I understand companies wanted to define a new capability, but could this be just done by adding the intra-frequency DAPS HO and inter-frequency DAPS HO (which is already per band and per BC) to the list for half-duplex constraints? As I understand this the half-duplex constraints are also covering TDD cases. I wasn’t sure if companies were talking about half-duplex in FDD, or talking about half-duplex in TDD (which is the only option).  Isn’t TP#1-10 applied to TS36.211 or TP#1-12 for 38.213 sufficient? or Is it correct understanding that companies now wish to enable TDD/FDD differentiation? Or maybe it is something else.  I apologize for the late questions, but I got sort of confused as I was putting everything together and reviewing all these things.  **Could companies clarify whether the newly introduced capability is same as TDD/FDD differetiator? Or whether it is meant to the something else?** |

Proposal:

* Introduce new capability, *simultaneousRxTxDAPS*, to indicate support of DAPS for half-duplex UE.

The following is Moderator’s understanding of the proposed new capability. Please comment on whether is this aligned with companies understanding or not.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | | Need for the gNB to know if the feature is supported | |
|  | 21-1a | Intra-frequency DAPS HO | Support of  intra-frequency DAPS-HO     1. Support of simultaneous DL reception of PDCCH and PDSCH from source and target cell in DAPS-HO 2. Support of PDCCH blind decoding capability in the first MCG and second MCG. 3. Support of cancelling UL transmission to the source cell for intra-frequency DAPS-HO | | DAPS  (Note: RAN2 feature) | | Yes |
|  | 21-1b | Inter-frequency DAPS HO | Support of  inter-frequency DAPS-HO    1) Support of simultaneous DL reception of PDCCH and PDSCH from source and target cell in DAPS-HO    2) Support of PDCCH blind decoding capability in the first MCG and second MCG. | | DAPS  (Note: RAN2 feature) | | Yes |
| 21. Mobility Enhancement | 21-3 | Simultaneous Rx Tx DAPS | Indicated support of intra-frequency or inter-frequency DAPS (as indicated by 21-1a or 21-1b) for half-duplex UEs | | 21-1a/21-1b | | Yes |
|  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
|  | 21-1a | N/A | The network cannot configure UE with DAPS HO | Per Band | No | N/A | N/A |  | Optional with capability signalling |
|  | 21-1b | N/A | The network cannot configure UE with DAPS HO | Per BC | No | N/A | N/A |  | [Optional with capability signalling] |
| 21. Mobility Enhancement | 21-3 | N/A | Half-duplex UEs are not able to perform DAPS | Per Band | No | N/A | N/A |  | Optional with capability signalling |
|  |  |  |  |  |  |  |  |  |  |

The moderator had some questions about the capability, it would be great if companies can provide some clarity.

* The 21-1a and 21-1b intra-frequency and inter-frequency capability was agreed to have “no need of FDD/TDD differentiation”. So if we introduce a half-duplex capability, isn’t this the same as introducing a FDD/TDD differentiation?
  + What is the difference between the new capability and TDD/FDD differentiation?
    - Maybe Qualcomm or some other company can provide some context to what they were initially thinking of.
* I understand companies wanted to define a new capability, but could this be just done by adding the intra-frequency DAPS HO and inter-frequency DAPS HO (which is already per band and per BC) to the list for half-duplex constraints?
  + As I understand this the half-duplex constraints are also covering TDD cases.
  + I wasn’t sure if companies were talking about half-duplex in FDD, or talking about half-duplex in TDD (which is the only option).
  + Can companies clarify whether this is targeting half-duplex in FDD? or half-duplex in general (including TDD)
* If the goal is target half-duplex in general (including TDD) Isn’t TP#1-10 applied to TS36.211 or TP#1-12 for 38.213 sufficient?

|  |  |
| --- | --- |
| **Company** | **Comments on Moderator proposal** |
| Huawei, HiSilicon | I do have similar questions as FL. I assume the half-duplex is for TDD, so differentiating FDD/TDD make work to my understanding at this moment. |
| Nokia | I would also have rather similar questions and tend to think that it would be preferable not to have new capability. The DAPS already has per band and BC specific capabilities, thus if UE does not support DAPS for given band/BC (due to e.g. half-duplex) it can be indicated. Also as these are per Band/BC, I don’t think we need FDD/TDD separation either (FDD/TDD is implicitly there). |
| Samsung | We have similar view with Nokia. Thus, no need to introduce new capability. |
| Qualcomm | We initially thought about TDD-related scenarios e.g., TDD-TDD HO or TDD-FDD HO scenarios where full-duplex UEs are not possible. Since intra-/inter-frequency DAPS HO is indicated BC, it seems UE/NW knows whether TDD-TDD or TDD-FDD or FDD -TDD or FDD-FDD based on indicated BC. Hence, we did not propose new capability in our Tdoc. Instead, we proposed TP#1-10 to TS 38.213. However, TP#1-10 to TS 38.211 is fine.  After further consideration, look like new capability may not be needed. |

# 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)

# Annex

RAN2 has Implemented 21-1a as part of BandCombinationList

BandParameters-v1610 ::=         SEQUENCE {

    srs-TxSwitch-v1610               SEQUENCE {

        supportedSRS-TxPortSwitch-v1610  ENUMERATED {t1r1-t1r2, t1r1-t1r2-t1r4, t1r1-t1r2-t2r2-t2r4, t1r1-t1r2-t2r2-t1r4-t2r4,

                                                         t1r1-t2r2, t1r1-t2r2-t4r4}

    }                                                                              OPTIONAL,

    intraFreqDAPS-Parameters-r16      SEQUENCE {

        intraFreqDiffSCS-DAPS-r16                        ENUMERATED {supported}    OPTIONAL,

        intraFreqDAPS-r16                                ENUMERATED {supported}    OPTIONAL,

        intraFreqAsyncDAPS-r16                           ENUMERATED {supported}    OPTIONAL,

        intraFreqMultiUL-TransmissionDAPS-r16            ENUMERATED {supported}    OPTIONAL,

intraFreqTwoTAGs-DAPS-r16                        ENUMERATED {supported}    OPTIONAL,

        intraFreqSemiStaticPowerSharingDAPS-Mode1-r16    ENUMERATED {supported}    OPTIONAL,

        intraFreqSemiStaticPowerSharingDAPS-Mode2-r16    ENUMERATED {supported}    OPTIONAL,

        intraFreqDynamicPowersharingDAPS-r16             ENUMERATED {short, long}  OPTIONAL

    }                                                                              OPTIONAL

}

Implemented 21-1b as CA-ParametersNR (which is per band combination, indicated for each band in BandCombinationList)

CA-ParametersNR-v1610 ::=           SEQUENCE {

     -- R1 9-3: Parallel MsgA and SRS/PUCCH/PUSCH transmissions across CCs in inter-band CA

    parallelTxMsgA-SRS-PUCCH-PUSCH-r16                ENUMERATED {supported}            OPTIONAL,

     -- R1 9-4: MsgA operation in a band combination including SUL

    msgA-SUL-r16                                      ENUMERATED {supported}            OPTIONAL,

    -- R1 10-9c: Joint search space group switching across multiple cells

    jointSearchSpaceGroupSwitchingAcrossCells-r16     ENUMERATED {supported}            OPTIONAL,

    -- R1 14-5: Half-duplex UE behaviour in TDD CA for same SCS

    half-DuplexTDD-CA-SameSCS-r16                     ENUMERATED {supported}            OPTIONAL,

    -- R1 18-4: SCell dormancy within active time

    scellDormancyWithinActiveTime-r16                 ENUMERATED {supported}            OPTIONAL,

    -- R1 18-4a: SCell dormancy outside active time

    scellDormancyOutsideActiveTime-r16                ENUMERATED {supported}            OPTIONAL,

    -- R1 18-6: Cross-carrier A-CSI RS triggering with different SCS

    crossCarrierA-CSI-trigDiffSCS-r16                 ENUMERATED {higherA-CSI-SCS,lowerA-CSI-SCS,both}    OPTIONAL,

    -- R1 18-6a: Default QCL assumption for cross-carrier A-CSI-RS triggering

    defaultQCL-CrossCarrierA-CSI-Trig-r16             ENUMERATED {supported}            OPTIONAL,

    -- R1 18-7: CA with non-aligned frame boundaries for inter-band CA

    interCA-NonAlignedFrame-r16                       ENUMERATED {supported}            OPTIONAL,

    simul-SRS-Trans-InterBandCA-r16                   INTEGER (1..2)                    OPTIONAL,

    daps-Parameters-r16                   SEQUENCE {

        asyncDAPS-r16                           ENUMERATED {supported}                  OPTIONAL,

        interFreqDAPS-r16                       ENUMERATED {supported}                  OPTIONAL,

        interFreqDiffSCS-DAPS-r16               ENUMERATED {supported}                  OPTIONAL,

        multiUL-TransmissionDAPS-r16            ENUMERATED {supported}                  OPTIONAL,

        semiStaticPowerSharingDAPS-Mode1-r16    ENUMERATED {supported}                  OPTIONAL,

        semiStaticPowerSharingDAPS-Mode2-r16    ENUMERATED {supported}                  OPTIONAL,

        dynamicPowersharingDAPS-r16             ENUMERATED {short, long}                OPTIONAL,

        ul-TransCancellationDAPS-r16            ENUMERATED {supported}                  OPTIONAL

    }                                                                                   OPTIONAL,

    codebookParametersPerBC-r16           CodebookParameters-v1610                      OPTIONAL

}