**3GPP TSG RAN WG1 Meeting #101-E R1-2004747**

**e-Meeting, May 25 – June 05, 2020**

**Source: Moderator (Intel Corporation)**

**Title: Summary of email discussions for [101-e-NR-Mob-Enh-01]**

**Agenda item: 7.2.9**

**Document for: Discussion**

# Introduction

In this contribution, we summarize the email discussion approved for discussion during RAN1 #101-E. Chairman has approved three email discussion threads for RAN1 #101-E. The following are the approved email discussions:

* [101-e-NR-Mob-Enh-01] Email discussion/approval of Issue #1 (UL cancellation for DAPS) and #3 (UL overlapping transmission) in R1-2003747 by 5/29; if necessary, endorse the associated TPs by 6/4 – Daewon (Intel)
* [101-e-NR-Mob-Enh-02] Email discussion/approval of Issue #5 (Power sharing mode for UL DAPS-HO) in R1-2003747 by 5/28; if necessary, endorse the associated TPs by 6/3– Daewon (Intel)
* [101-e-NR-Mob-Enh-03] Email discussion/approval of Issue #6 (PDCCH monitoring in DL DAPS-HO) in R1-2003747 by 5/28; if necessary, endorse the associated TPs by 6/2– Daewon (Intel)

This contribution summarizes the email discussion for [101-e-NR-Mob-Enh-01].

# Email Discussion [101-e-NR-Mob-Enh-01]

This discussion is regarding the uplink cancellation and uplink transmission overlapping issue in UL DAPS-HO (Issue #1 and #3 from [11]).

**Issue and Proposal Summary:**

## Issue #1) Uplink cancellation in UL DAPS-HO [1][2][3][5][6][8]

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

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

### TP#1-1

|  |
| --- |
| 15 Dual active protocol stack based handover  <---------------------------Other parts are omitted ------------------------------->  If  - the UE is~~does not~~ provided with *UplinkPowerSharingDAPS-HO-mode*, and  - UE transmissions on the target cell and the source cell overlap  the UE transmits only on the target cell, and cancels the transmission to source cell after the PUSCH preparation time *T*proc,2 for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 after a last symbol of a CORESET where the UE detects a DCI format scheduling the transmission on the target cell and μ corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH carrying the DCI format and the SCS configuration of the UE transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines *T*proc,2 assuming SCS configuration *μ*=0.  A UE does not expect to cancel a transmission on the source cell in symbols from the set of symbols that occur, relative to a last symbol of a CORESET where the UE detects a DCI format scheduling a transmission on the target cell, after a number of symbols that is smaller than the PUSCH preparation time *T*proc,2 for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 and *μ* corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH carrying the DCI format and the SCS configuration of the UE transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines *T*proc,2 assuming SCS configuration *μ*=0  <---------------------------Other parts are omitted -------------------------------> |

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

### TP#1-2

|  |
| --- |
| < Start of the text proposal >  **15 Dual active protocol stack based handover**  < Unchanged parts are omitted >  If  - the UE does not provide *UplinkPowerSharingDAPS-HO*, and  - UE transmissions on the target cell and the source cell overlap  the UE transmits only on the target cell, and cancels the transmission to source cell after *T*proc,2+2, where *T*proc,2 is the PUSCH preparation time for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 after a last symbol of a CORESET where the UE detects a DCI format scheduling the transmission on the target cell and μ corresponds to the smallest SCS configuration among the SCS configuration of the PDCCH carrying the DCI format, the SCS configuration of the UE transmission on the target cell, and the SCS configuration of the UE transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines *T*proc,2 assuming SCS configuration *μ*=0.  A UE does not expect to cancel a transmission on the source cell that occurs, relative to a last symbol of a CORESET where the UE detects a DCI format scheduling a transmission on the target cell, after a number of symbols that is smaller than *T*proc,2+2 for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 and *μ* corresponds to the smallest SCS configuration among the SCS configuration of the PDCCH carrying the DCI format, the SCS configuration of the UE transmission on the target cell, and the SCS configuration of the UE transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines *T*proc,2 assuming SCS configuration *μ*=0.  < End of the text proposal > |

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



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

* + The following is the proposed TP:

### TP#1-3

|  |
| --- |
| 15 Dual active protocol stack based handover 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 whole transmission to source cell if the occasion of the first symbol of source cell transmission is after ~~[~~the PUSCH preparation time *T*proc,2 for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 after a last symbol of a CORESET where the UE detects a DCI format scheduling the transmission on the target cell and *μ* corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH carrying the DCI format and the SCS configuration of the UE transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines *T*proc,2 assuming SCS configuration *μ* = 0.~~]~~  A UE does not expect to cancel a transmission on the source cell ~~[in symbols from the set of symbols]~~ with first symbol that occurs, relative to a last symbol of a CORESET where the UE detects a DCI format scheduling a transmission on the target cell, after a number of symbols that is smaller than the ~~[~~PUSCH preparation time *T*proc,2 for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 and *μ* corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH carrying the DCI format and the SCS configuration of the UE transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines *T*proc,2 assuming SCS configuration *μ* = 0~~]~~. |

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

### TP#1-4

|  |
| --- |
| **Text proposal #1 for section 15 in TS38.213**  A UE does not expect to cancel a transmission on the source cell in symbols from the set of symbols that occur, relative to a last symbol of a PDSCH reception conveying a RAR message with a RAR UL grant on the target cell, after a number of symbols that is smaller than msec, where  is a time duration of  symbols corresponding to a PDSCH processing time for UE processing capability 1 when additional PDSCH DM-RS is configured,  is a time duration of  symbols corresponding to a PUSCH preparation time for UE processing capability 1 [6, TS 38.214] and the UE considers that  and  correspond to the smaller of the SCS configurations for the PDSCH on the target cell and the transmission on the source cell. For , the UE assumes  [6, TS 38.214]. |

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

### TP#1-5

|  |
| --- |
| **15 Dual active protocol stack based handover**  < Unchanged parts are omitted >  If  - the UE does not provide *UplinkPowerSharingDAPS-HO*, and  - UE transmissions on the target cell and the source cell overlap  the UE transmits only on the target cell  the UE transmits only on the target cell, and cancels the transmission to source cell after the PUSCH preparation time *T*proc,2 for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 after a last symbol of a CORESET where the UE detects a DCI format scheduling the transmission on the target cell and *μ* corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH carrying the DCI format and the SCS configuration of the UE transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines *T*proc,2 assuming SCS configuration *μ* = 0.  The UE does not expect to cancel a transmission on the source cell the PUSCH preparation time *T*proc,2 for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 after a last symbol of a CORESET where the UE detects a DCI format scheduling the transmission on the target cell and *μ* corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH carrying the DCI format and the SCS configuration of the UE transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines *T*proc,2 assuming SCS configuration *μ* = 0. |

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

### TP#1-6

|  |
| --- |
| If  - the UE does not provide *UplinkPowerSharingDAPS-HO*, and  - UE transmissions on the target cell and the source cell overlap  the UE transmits only on the target cell, and cancels the transmission to source cell after the PUSCH preparation time *T*proc,2 for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 after a last symbol of a CORESET where the UE detects a DCI format scheduling the transmission on the target cell and μ corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH carrying the DCI format and the SCS configuration of the UE transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines *T*proc,2 assuming SCS configuration *μ*=0.  A UE does not expect to cancel a transmission to the source cell in symbols that occur, relative to a last symbol of a CORESET where the UE detects a DCI format scheduling a transmission on the target cell, after a number of symbols that is smaller than the PUSCH preparation time *T*proc,2 for the corresponding PUSCH processing capability [6, TS 38.214] assuming *d*2,1 = 1 and *μ* corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH carrying the DCI format and the SCS configuration of the UE transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines *T*proc,2 assuming SCS configuration *μ*=0. |

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

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

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

* Proposed TP from [1]:

### TP#2-1

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

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

 

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

* Proposed TP from [2]:

### TP#2-2

|  |
| --- |
| **<Unchanged parts are omitted>**  For DAPS operation in a same frequency band, a UE does not transmit PUSCH/PUCCH/SRS to the source MCG in a slot when the transmission would overlap in time with a PRACH transmission to the target MCG or when a gap between a first or last symbol of a PRACH transmission to the target MCG in a first slot would be separated by less than symbols from a last or first symbol, respectively, of the PUSCH/PUCCH/SRS transmission to the source MCG in a second slot. for or , for or , and is the SCS configuration of the active UL BWP for the PUSCH/PUCCH/SRS transmission to source MCG.  For DAPS operation in a same frequency band, a UE does not transmit PUSCH/PUCCH/SRS to the source MCG in a slot when a gap between a first or last symbol of a PUSCH/PUCCH/SRS transmission to the target MCG in a first slot would be separated by less than symbols from a last or first symbol, respectively, of the PUSCH/PUCCH/SRS transmission to the source MCG in a second slot. for or or ， for , and is the SCS configuration of the active UL BWP for the PUSCH/PUCCH/SRS transmission to source MCG. |

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

* Proposed TP from [4]:

### TP#2-3

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

* Proposed TP from [5]:

### TP#2-4

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

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

### TP#2-5

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

## **Discussion:**

The issues and text proposals made in the submitted contributions can be largely categorized into 3 groups.

**Group 1)** Clarification on whether uplink cancellation should be for partial transmission (in units of symbols) or for the whole transmission

* Approach A) partial transmission
  + TP #1-1
* Approach B) whole transmission
  + TP#1-3, TP#1-2

**Group 2)** Supporting uplink cancellation timeline behavior for Msg 3

* RAN1 should determine whether or not such behavior needs to be explicitly defined or not.
* If need to be define whether TP #1-4 is acceptable.

**Group 3)** Reformulation the existing agreed text for better readability

* It was mentioned that the agreed text is quite difficult to parse and read. Suggests some reformulation (e.g. using ‘after’ in the first paragraph and ‘before’ in the second paragraph.
* TP#1-5
  + Feature lead note: may need to double check whether TP#1-5 is the intended text.
* Feature lead note: if the timeline boundary for determining when UE can perform cancellation and when UE does not expect to receive control signal is the same, the text proposal can be cleaned up. Therefore, FL suggests resolving Group 3 issue (reformulate for clarity) after other issues have been resolved.

**Group 4)** clarification of overlapping to avoid ambiguity for synchronized source and target MCG scenarios

* RAN1 should determine whether TP#2-1 is acceptable or not.

**Group 5)** Providing a protection gap between source and target MCG transmissions

 

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

* RAN1 should determine whether specification should support UE behavior so that UE does not need to handle cases with too short time gap between source and target PUSCH/PUCCH/SRS transmissions. Huawei has mentioned that time gap between source and target cell PUSCH/PUCCH/SRS is too short UE may not be able to switch the transmissions, especially if UE is using the same RF chain to serve target and source cells.
* If agreeable, RAN1 should determine whether TP#2-2 is acceptable or not.

**Group 6)** handling PRACH transmission in source MCG that overlaps with PUSCH/PUCCH/SRS transmission in target MCG

* RAN1 should determine whether specification should support the UE behavior to handle PRACH transmission in source MCG that overlaps with PUSCH/PUCCH/SRS transmission in target MCG. If need to be handled, which TP among TP#2-3, 2-4, or 2-5 is acceptable.

Companies are encouraged to provide comments on the proposal above. Please note comments for Group 1, 2, and 3, and Group 4, 5, and 6 are split into two different comment tables below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Company Name | Group 1  (prefer approach A/B) | Group 2  (agree/disagree in principle) | Group 3  (agree/disagree reformulation would help readability) | Comments |
| Ericsson | A | Disagree | Agree | For group 1, it is beneficial to stop UL transmission to source as soon as possible. Restarting the transmission to source after the transmission to target is unnecessary. |
| Huawei, HiSilicon | A | Need more discussion | Ok in principle | For group 2, More discussion is needed. Settling down the timeline for the general case should be prioritized. |
| Intel | A | agree | Agree in principle. | We may want to clean up the text a bit, as there were confusions with the TP in the previous meeting. |
| Samsung | A, TP1-1 is preferred | Agree in principle | disagree | For Group 1, as we stated in previous meeting and T-doc. We think partial cancellation benefits both UE & gNB. As for TP1-1 or TP1-2, we choose TP1-1 as we think is enough.  For Group 2, if agreed, the TP can be further improved once TP associated with Group1&3 group 1 is stable.  Group 3: We think the current text already exists in Claus 11.1 of 38.213 for some time and should be acceptable. However, we are okay if company provides better wording without changing the meaning. |
| Apple | B | Disagree | Agree in principle | For group 1, we support to cancel the whole UL transmission to source cell. For the timeline, Tproc,2 is not enough. DAPS is based on the DC structure, each CG would require one modem, thus two moderns need time to exchange the scheduling information. We prefer to re-use the NR-DC defined timeline, i.e., T\_offset. If UE supports dynamic power sharing, the UL cancellation is naturally supported without additional effort.  The late TP is showing below for your consideration.   |  | | --- | | 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 whole transmission to source cell if the occasion of the first symbol of source cell transmission is after 𝑇offset  after a last symbol of a CORESET where the UE detects a DCI format scheduling the transmission on the target cell, where 𝑇offset is defined in Clause 7.6.2,  The UE does not expect to have transmissions on the target cell that  - are scheduled by DCI formats in PDCCH receptions with a last symbol that is earlier by less than or equal to  𝑇offset from the first symbol of the transmission occasion on the source cell, and  - overlap with the transmission occasion on the source cell |   For Group 2, we don’t see the necessity to define additional timeline for msg3. If NR-DC timeline is re-used, the offset is larger enough according to UE report capability.  For Group 3, the wording can be updated after Group 1 is stable. |
| Nokia | A | Don’t see absolutely necessary | Agree in principle | Group#1: Like noted, partial cancellation is seen simpler .  Group#2: If seen absolutely necessary can be attempted to accommodate in the general timeline. |
| MTK | B | Need more discussion | Agree | For Group 1, we support Apple’s TP.  For Group 2, we do not see strong need but are open to discuss this issue. |
| ZTE | A | Disagree | Agree in principle. | For group 1, the symbol-based cancellation is more beneficial especially when cancellation occurs after source cell UL transmission has already started. Note, this is similar as symbol-based cancellation due to SFI in Rel-15  The main purpose of defining the timeline is to enlarge the time interval between the UL grant and PUSCH in the target cell. For group 2, the time interval between the RAR and msg3 is large enough (i.e.) since there is addition 0.5ms for the interval except for the PDSCH processing and PUSCH preparation time. The timeline for msg3 is not needed any more. |
| Qualcomm | A | Need more discussion | Agree | For group 3, the text “assuming *d*2,1 = 1 and *μ* corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH carrying the DCI format and the SCS configuration of the UE transmission on the source cell. If the UE transmits PRACH using 1.25 kHz or 5 kHz SCS on the source cell, the UE determines *T*proc,2 assuming SCS configuration *μ*=0.” is repeated 🡪 can reformulate the overall text by having only one such text. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Company Name | Group 4  (agree/disagree) | Group 5  (agree/disagree in principle) | Group 6  (agree/disagree in principle) | Comments |
| Ericsson | Disagree | Disagree | Agree | For group 4: there seems to be no difference.  For group 5: unnecessary: the dropping rule is sufficient |
| Huawei, HiSilicon | Need more discussion | agree | agree | For Group4, I failed to understand how the change is motivated by the concerned synchronized source and target MCG scenarios, so appreciated more explanation.  For group 5, the dropping rule is only for overlapping case, TP in group 5 intends to cover the case where source and target are not overlapping but with a gap. |
| Intel | Need discussion | disagree | agree | For group 4, not entirely sure what is being changed.  For group 5, we assumed the dropping rule will provide enough processing such that UE can cancel transmissions. Once the UE is aware, the cancellation of a transmission should be feasible. The gap (if needed) should be much smaller (a fraction) than the PA transient period. |
| Samsung | Agree and TP 2-1 is acceptable | disagree | Agree in principle  2-3 or 2-5 is preferred | For Group 4, we recalled TP 2-1 is indeed close to the final agreed TP in the email during RAN1-100e.  For Group 5, this is a new behavior we haven’t agreed before. From our point of view, this gap is only needed for some UE implementations. We think dealing with this issue could be part of the DAPS HO basic capability and not needed to be in the spec.  For Group 6, choice of TP really depends on which prioritization we want under this condition. (target cell PUSCH or source cell PRACH ). We prefer prioritizing for target cell transmission to be consistent with general principle in DAPS-HO. But we open to discuss the prioritization. |
| Apple | Open to discuss | Open to discuss | Agree | For Group 4, don’t see the difference, we are open to discuss it.  For group 5, the target cell and source cell are in the same band, not sure the RF retuning time is needed in this case. And if NR-DC timeline is re-used, the target cell UE would check whether UL transmission is collision/overlap before the transmission, so this case can be avoided. |
| Nokia | Disagree | Further discussion needed | Agree | Group#4: Not fully evident what is the problem.  Group#5: Can be considered, but the behavior should follow the agree UL prioritization principle  Group#6: We would prefer to follow the agreed UL prioritization principle. |
| MTK | Agree | Agree | Agree in principle  2-3 or 2-5 is preferred | Group#4: Spec seems more clear with the TP.  Group#5: Spec seems more clear with the TP.  Group#6: We prefer prioritizing for target cell transmission to be consistent with general principle in DAPS-HO. But we open to discuss the prioritization. |
| ZTE | Agree | Disagree | Agree | In RAN1#100-e, it was agreed that the collision is a slot of a source MCG overlapping with a PRACH in the target MCG, where PUSCH/PUCCH/SRS is transmitted on the slot. The agreed TP is copied below. However, it is changed by editor that the collision is the PUSCH/PUCCH/SRS in the source MCG overlapping with a PRACH in the target MCG. When a PUSCH/PUCCH/SRS in the source MCG does not overlap with a PRACH in the target cell but the slot of the PUSCH/PUCCH/SRS (e.g. occupying only a part of a slot) overlaps with the PRACH, the collision is still valid according to the agreement while not current spec. So, the correction is to align with our original intention.  ‘*For DAPS operation in a same frequency band, a UE does not transmit PUSCH/PUCCH/SRS to source MCG in a ~~same~~ [source MCG] slot overlapping in time domain with PRACH transmission to target MCG or when a gap between the first or last symbol of a PRACH transmission to target MCG in a first slot is separated by less than N symbols from the last or first symbol, respectively, of a PUSCH/PUCCH/SRS transmission to source MCG in a second slot. N = 2 for µ=0 or µ=1,  N=4 for µ=2 or µ=3, and µ is the SCS configuration of the active UL BWP for PUSCH/PUCCH/SRS transmission to the source MCG.*’  For group 5, we have the same understanding with Samsung. |
| Qualcomm | Agree | Can be further discussed | Need further discussion | For group 6, we would like to understand the use case of sending PRACH to source and other UL to target in DAPS HO. It was our understandings in RAN1#100e that we would revisit this issue if RAN2 concluded to support such use case. |

## **Summary of all comments received by May 27, 11pm PDT (May 28, 6am UTC):**

The following is a summary of company preferences for each issue group:

***Group 1***

* Approach A: Ericsson, Intel, Samsung (TP#1-1), Nokia, ZTE, Qualcomm
* Approach B: Apple (TP#1-7), MediaTek (supports TP#1-7), Huawei (TP#1-2), HiSilicon (TP#1-2)

### TP#1-7

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| If  - the UE does not provide UplinkPowerSharingDAPS-HO, and  - UE transmissions on the target cell and the source cell overlap  the UE transmits only on the target cell, and cancels the whole transmission to source cell if the occasion of the first symbol of source cell transmission is after 𝑇offset  after a last symbol of a CORESET where the UE detects a DCI format scheduling the transmission on the target cell, where 𝑇offset is defined in Clause 7.6.2,  The UE does not expect to have transmissions on the target cell that  - are scheduled by DCI formats in PDCCH receptions with a last symbol that is earlier by less than or equal to  𝑇offset from the first symbol of the transmission occasion on the source cell, and  - overlap with the transmission occasion on the source cell |

From the discussion, majority of the companies is leading towards support of symbol level transmission cancellation. TP#1-7 seems to be somewhat of a departure from what was agreed in last RAN1 meeting and approach A seems to be also aligned with what was agreed in last RAN1 meeting.

Moderator Suggestion for agreement for Group 1 issue:

* Agree in principle to support partial uplink transmission (in unit of symbols) cancellation for DAPS.
* Agree to TP#1-1 of R1-2004747

***Group 2***

* Agree: Intel, Samsung (in principle),
* Disagree: Ericsson, Apple, Nokia, ZTE
* More discussion needed: Huawei, HiSilicon, MediaTek, Qualcomm

The companies are split for group 2 issue. However, given that group 2 issue is an introduction of new UE behavior associated with Msg 3 and there are few companies who seems to be against such introduction of new UE behavior, Moderator suggests concluding to not introduce such functionality. Companies that have concerns with the suggestion are encouraged to provide further comments and motivations (that may have not been described or emphasized before).

Moderator Suggestion for agreement for Group 2 issue:

* Conclude to not introduce UE behavior description related to special handling of Msg 3 transmission in DAPS.

***Group 3***

* Agree in principle: Ericsson, Huawei, HiSilicon, Intel, Apple, Nokia, MediaTek, ZTE, Qualcomm
* Not needed (disagree): Samsung

Looks like companies are open to clean up the specification text once issues are resolved. Moderator suggest performing a review of all the text changes and perform a clean up at the end.

Moderator Suggestion for agreement for Group 3 issue:

* Once all issues are concluded and TP for each issue are endorsed, review the merged TP from all issues related to uplink cancellation and overlap, and (if needed) clean up the final TP.

***Group 4***

* Agree: Samsung (TP#2-1), MediaTek, ZTE, Qualcomm
* Disagree: Ericsson, Nokia
* More discussion needed: Huawei, HiSilicon, Intel, Apple

Although companies are somewhat split in views. From the comments, it seems companies that disagree with TP#2-1 believe there is no change with the TP. While companies who support think the change is better for clarity. If so there may not be a negative impact from agreeing TP#2-1. Moderator suggests to agree to TP#2-1. If companies have technical concerns on the TP, please provide comments.

Moderator Suggestion for agreement for Group 4 issue:

* Agree to TP#2-1

***Group 5***

* Agree: Huawei, HiSilicon, MediaTek
* Disagree: Ericsson, Intel, Samsung, ZTE
* More discussion needed: Apple, Nokia, Qualcomm

The companies are split for group 5 issue. However, given that group 5 issue is an introduction of new UE behavior associated with gap between source and target cell PUSCH/PUCCH/SRS transmission and there are few companies who seems to be against such introduction of new UE behavior, Moderator suggests concluding to not introduce such functionality. Companies that have concerns with the suggestion are encouraged to provide further comments and motivations (that may have not been described or emphasized before).

Moderator Suggestion for agreement for Group 5 issue:

* Conclude to not introduce UE behavior description related to gap between source and target cell PUSCH/PUCCH/SRS transmission.

***Group 6***

* Agree: Ericsson, Intel, Huawei, HiSilicon, Samsung (TP#2-3 or 2-5), Apple, Nokia, MediaTek(TP#2-3 or 2-5), ZTE
* Disagree: -
* More discussion needed: Qualcomm

Companies all seem to agree to the issue. Among TP#2-3 and #2-5, #2-5 seem to be more compact. Moderator suggest to see if TP#2-5 is agreeable.

Moderator Suggestion for agreement for Group 6 issue:

* Agree to TP#2-5

## **Discussion (after May 27, 11pm PDT/May 28, 6am UTC):**

The following are a summary of all Moderator suggestions.

Moderator suggestion for agreement:

* For Group 1 issue:
  + Agree in principle to support partial uplink transmission (in unit of symbols) cancellation for DAPS.
  + Agree to TP#1-1 of R1-2004747
* For Group 2 issue:
  + Conclude to not introduce UE behavior description related to special handling of Msg 3 transmission in DAPS.
* For Group 3 issue:
  + Once all issues are concluded and TP for each issue are endorsed, review the merged TP from all issues related to uplink cancellation and overlap, and (if needed) clean up the final TP.
* For Group 4 issue:
  + Agree to TP#2-1 of R1-2004747
* For Group 5 issue:
  + Conclude to not introduce UE behavior description related to gap between source and target cell PUSCH/PUCCH/SRS transmission.
* For Group 6 issue:
  + Agree to TP#2-5 of R1-2004747

Companies are encouraged to provide further comments on the above suggestion. Especially, if companies are encouraged to provide further information if they have concerns on the conclusion for Group 2 and Group 5.

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| Company Name | Comments/Views |
| Qualcomm | For Group 6, we suggest the following update to TP#2-5:  **Modified TP#2-5:**  For DAPS operation in a same frequency band, a UE does not transmit PUSCH/PUCCH/SRS to the source MCG in a slot when the transmission would overlap in time with a PRACH transmission to the target MCG or when a gap between a first or last symbol of a PRACH transmission to the target MCG in a first slot would be separated by less than 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 to the ~~in active UL BWP of~~ source MCG in a ~~same~~ slot ~~when the transmission would~~ overlapping in time with a PUSCH/PUCCH/SRS transmission to the target MCG or when a gap between the first or last symbol of a PUSCH/PUCCH/SRS transmission ~~in active UL BWP of~~ to the target MCG in a first slot is separated by less than symbols from the last or first symbol, respectively, of a PRACH transmission ~~in active UL BWP~~ ~~of~~ to the source MCG in a second slot. for or , for or , and is the SCS configuration of the active UL BWP for the PUSCH/PUCCH/SRS transmission to source MCG. |
| Moderator (Intel) | I’ve added the modification Qualcomm suggested to TP#2-5 in TP #2-6 (for referencing purposes). |
| Samsung | For group 6, we prefer TP#2-6 by Qualcomm, it is more symmetric with TP2-1 from #4. For the comments from QC in first round discussion, we think the following RAN2 agreement in last meeting makes group 6 a valid case.  **RAN2#109bis-e agreements:**  S3.9: RACH is allowed to source after RACH towards target is successful but it is up to RAN1 whether something is specified for the source RA + target UL collisions or left up to UE implementation. (No more RAN2 discussion on this until RAN1 decides.)  For group 2, we want to provide further information and companies are welcome for feedbacks. Different from other UL dynamic transmissions, the msg3 grant is conveyed in the physical downlink shared channel (PDSCH) carrying random access channel (RACH) response (RAR) message. In Rel-15 the gap between PDSCH carrying RAR message and msg3 as *T*proc,1 + *T*proc,2 +0.5ms, which roughly separated with msg2 process time (decoding time and higher layer processing: *T*proc,1 +0.5ms) and msg3 preparation time (*T*proc,2). The time instant UE (PHY layer) aware of such transmission is roughly *T*proc,1 +0.5ms. Adding additional time for source cell cancellation, this is how we get the *T*proc,1 + *T*proc,2 +0.5ms timeline.  Regarding ZTE’s comments in first round discussion, we think “0.5ms” is not additional time, it is preserved for higher layer process time for interpreting the RAR information and may not be so flexible. This is why we think a timeline specific to msg3 is needed. |
| Huawei, HiSilicon | Firstly, we observed an error in the summary. TP#1-2 is approach B) and our views should be updated to support of approach B).  [Moderator Note: summary above has been updated]  For moderator’s suggestions:   * + - 1. Group 1: From UE perspective, if partial uplink transmission is un-decodable anyway, UE should not waste the power to transmit it. From this sense, we tend to not support partial uplink transmission. Secondly, TP#1-1 is not acceptable also due to the timeline.       2. Group 2: It really depends on the timeline. As SS argued, if takes the timeline in TP#1-1, MSG3 needs special handling. However, if the timeline takes the one suggested from Apple, then no need to handle MSG3 additionally.       3. Group 3: ok.       4. Group 4: before agreeing on TP#2-1, could anyone tell me what the difference is? If no difference, then TP is not needed.       5. Group 5: If people have concern to define additional Gap, we could be ok with moderator’s suggestion.       6. Group 6: we can be ok with the modified TP#2-5 from Qualcomm. However, for the changing part same as TP#2-1, we still would like to know the reason. |
| Apple | For Group 1, We can’t agree the partial cancellation, TP1-1 has exact cancellation time which is stringent requirement for UE implementation, i.e., cancels the transmission to source cell after the PUSCH preparation time *T*proc,2 … , basically the latest time for UE cancellation is the first overlapping symbol, before that it’s up to UE to perform cancellation or not. In Rel.15, Tproc,2 is used for DG cancelling CG. Now DPSA requires the CG to cancelling CG, and replace with new transmission. The similar case is in the eURLLC, the new processing timeline is defined, i.e., Tproc,2+**d1**. In addition, NR-DC power control defines another timeline, with that timeline, the UL transmission collision is totally avoided. And this timeline already supported by DAPS UE with dynamic power sharing capability. Thus we has the proposal on TP#1-7.  For Group 6, we support TP2-6. |
| ZTE | For group 1~group 5, we support the moderator suggestions.  For group 6, we support TP2-6 below. |
| Nokia | For Group 1, as noted earlier, we are relatively flexible on the timeline of the UL cancellation. Hence if precluding symbol level cancellation and aligning the behavior with NR-DC helps us to move forward and avoid discussion on the support of UL cancellation, we can consider further.  On Group#4: After rechecking, we are fine to take TP#2-1 as proposed.  For Group 6: We agree that the text should be aligned for both cases, thus from that perspective the changes proposed by Qualcomm are acceptable (i.e. TP#2-6).  On the Group#2, #3 and #5 we are fine with the FL proposal. |
| MTK | We **cannot** agree on Group 1 issue that partial uplink transmission (in unit of symbols) is supported. Also HW and Apple have quite solid arguments.  Partial uplink transmission (in unit of symbols) simply does not match previous RAN1 agreements:   * In RAN1 #99 agreement, the collision is defined when there is **partially or fully overlap for time resources**. To our understanding, we can only define partially overlap for “UL transmission based” cancellation, not for “symbol based” cancellation.   Also, a symbol-based cancellation would also need to handle the issue shown by the figure below: |
| Ericsson | We agree with Nokia that we can be flexible on the timeline of the partial cancellation. If we ensure support for UL cancellation for all UEs, we can consider relaxing the symbol level cancellation.  We are fine with the FL proposals for group 2-5.  For group 6, we support TP#2-6. |
| Samsung2 | For group 1, we would like to clarify some of the comments from other companies. We are ok to discuss the different options, but we hope the information on the table is correct and not misleading.  Regarding MTK’s comments on retransmitting the remaining source symbols after the end of target cell transmission:  We don’t think this is the behavior for the symbol based cancellation. There is not much reason why source transmission needs to be resumed. Based on the current spec and agreed TP last meeting, this does not happens. In fact, we don’t recall any cancellation behavior in the spec requiring to resume the transmission after being cancelled earlier.  For apple’s above comments, we don’t agree in some areas:   1. Rel-15 Tproc,2 is not only for DG cancelling CG, the SFI cancellation rule we refer to is to cancel any uplink transmissions. 2. DAPS HO is now a PCell to PCell procedure based on RAN2’s agreement, we don’t think CG to CG argument is valid. 3. URLLC’s timeline is also a symbol based cancellation. 4. For NR-DC case we have discussed several time in past few meetings, cancellation and power control look-ahead behavior are different mechanisms. We can bring back all the arguments again if needed. And we learned from NW vendors that the “totally avoided collision” conditions in NR-DC timeline is impossible in DAPS-HO. (This is the reason the cancellation behavior was defined in DAPS HO)   In general, different WIs have different assumptions and considerations. We don’t think directly referring to other WI’s results is a good idea.  After all, we are not completely against whole transmission cancellation from beginning. We think it is easier for UE if we only consider UE implementation. We just prefer a better solution to be pursued. We also don’t understand that many UE NR behaviors are symbol based operations including the existing cancellation mechanisms, why it becomes so difficult for many UE for this Rel-16 advance feature?  Even the whole transmission is agreed at the end, we are strongly against completely throwing out previous meeting’s discussion and agreement. A rephrasing version similar to TP1-2 is preferred other than the one based on NR-DC look-ahead power control. |
| MTK2 | For Samsung’s comment, we understand that “There is not much reason why source transmission needs to be resumed”. However, according to current spec of DAPS-HO in 38.213 Clause 15, UE only cancels the source UL transmission when UL on the target cell and the source cell overlap and the figure we provide below can happen:    Besides, if a transmission-based cancellation instead of symbol-based cancellation is applied, we can consider to support cancellation for all UEs indicating DAPS-HO (without capability). |
| Samsung3 | For MTK’s comments:  If companies have concerns about the UE behavior that the source cell transmissions need to be resumed after target cell transmission, this part is easy to address by further improving TP.  As we commented before, we don’t support “partial cancelation and resume” either.  Considering the current deadlock situation in [101-eNR-Mob-Enh-01] and [101-e-NR-Mob0enh-UEFeatures-01], although it is not our preference, we can also accept transmission based cancellation and continue discussion based on the agreed TP in R1-2003137 to incorporate this. We believe this is also easy to address with minor modification. |
| Apple | For Samsung’s comments  1. only DG cancelling CG is defined in Rel.15 in section 11.1.1 of 38.213, the cancelled SRS/PUCCH/PUSCH/PRACH is higher layer configured, not scheduled by dynamic grant.  *- if the UE is configured by higher layers to transmit SRS, or PUCCH, or PUSCH, or PRACH in the set of symbols of the slot, the UE*  *- does not transmit the PUCCH, or the PUSCH, or the PRACH in the slot and does not transmit the SRS in symbols from the set of symbols in the slot, if any, starting from a symbol that is after PUSCH preparation time for the corresponding PUSCH timing capability [6, TS 38.214] assuming after a last symbol of a CORESET where the UE is configured to monitor PDCCH for DCI format 2\_0 and corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH carrying the DCI format 2\_0 and the SCS configuration of the SRS, PUCCH, PUSCH or μr, where μr corresponds to the SCS configuration of the PRACH if it is 15kHz or higher; otherwise μr=0*  2. Sorry, we want to say DAPS is DG cancelling DG, which is different from Rel.15 DG cancelling CG, in Rel.15 the cancelling can happen in MAC layer. But DG cancelling DG is on physical layer.  3. Yes, URLLC higher priority PUSCH cancelling low priority PUSCH is on symbol level, but with relaxed timeline.  4. we have different understanding. If the Toffset is larger enough, the overlapping can be fully avoided. any transmission to source cell on T0 will check the target cell PDCCH before T0-T\_offset whether there is collision with PUSCH to target cell, if possible collision, the transmission to source is fully cancelled. The limitation is the gNB scheduling on target cell PUSCH, i.e., k2> T\_offset +1 slot. |

### TP#2-6

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

## **Summary of all comments & discussion received by June 02, 11pm PDT (June 03, 6am UTC):**

The following are comments and discussions on each issue (Group 1 ~ 6):

* **For Group 1 issue:**
  + Moderator original suggestion:
    - Agree in principle to support partial uplink transmission (in unit of symbols) cancellation for DAPS.
    - Agree to TP#1-1 of R1-2004747
  + Moderator original suggestion supported by: ZTE, Nokia, Ericsson
  + MediaTek, Huawei, Apple has mentioned TP#1-1 is not agreeable.
  + Apple has suggested TP#1-7 as an alternative.
  + Mediatek has mentioned only supporting whole transmission dropping could be a comprise for not introducing UL cancellation capability.
  + Moderator suggest discussing this issue together with the UL cancellation capability. Options for agreement are
    - TP#1-1, or
    - Merged TP between TP#1-2 and TP#1-3, or
    - TP#1-7
* **For Group 2 issue:**
  + Moderator original suggestion:
    - Conclude to not introduce UE behavior description related to special handling of Msg 3 transmission in DAPS.
    - Supported by: Ericsson, Nokia, ZTE
  + Samsung has provided further information about additional processing time needed for Msg 3 due to grant being potentially embedded in RAR.
  + Huawei mentioned if TP#1-7 from Apple is agreed, then no need to perform special handling.
  + Moderator suggests have a quick discussion and hear from Samsung during the GTW conference and if companies still have strong concerns, agree to moderator original suggestion, if companies are convinced by the discussion, agree to TP#1-4.
* **For Group 3 issue:**
  + No companies have expressed concerns of the moderator’s suggestion.
  + Moderator suggestion:
    - Once all issues are concluded and TP for each issue are endorsed, review the merged TP from all issues related to uplink cancellation and overlap, and (if needed) clean up the final TP.
* **For Group 4 issue:**
  + Moderator original suggestion:
    - Agree to TP#2-1 of R1-2004747 for Clause 15 of TS38.213
  + No companies have expressed strong concerns. Huawei did want to get clarification of what the TP is intending to change.
  + Moderator suggests getting quick explanation from ZTE during the GTW conference and if explanation is satisfactory, agree on TP #2-1.
* **For Group 5 issue:**
  + Based on feedback the moderator’s original suggestion seems to be agreeable.
  + Moderator suggestion:
    - Conclude to not introduce UE behavior description related to gap between source and target cell PUSCH/PUCCH/SRS transmission.
* **For Group 6 issue:**
  + Moderator original suggestion:
    - Agree to TP#2-5 of R1-2004747 for Clause 15 of TS38.213
  + Qualcomm suggest editorial update of TP#2-5. The revised TP is in TP#2-6. Companies seems to be ok with TP#2-6.
  + Suggestion for agreement
    - Agree on TP#2-6 of R1-2004747 for Clause 15 of TS38.213

## **Discussion (after June 03, 6am PDT/June 03, 1pm UTC):**

Vice-chairman suggested to continue the discussion left off from the GTW teleconference. The following are proposals that were suggested as an comprised. Companies are encouraged to provide comments on the following proposals.

Proposal:

* Introduce the following new FG for inter-frequency DAPS-HO and adopt [UL transmission][symbol] based cancellation

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| [21-2d] | [UL transmission cancellation] | [Indicates support of cancelling UL transmission to the source cell for inter-frequency DAPS-HO] | DAPS  (Note: RAN2 feature) |

* Note: Details to be discussed during RAN1 #101-e

Proposal:

* UL cancellation is only mandatory for UEs capable of dynamic power sharing and DAPS-HO

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| Company Name | Comments/Views |
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# Reference

1. R1-2003330, “Remaining issues on NR mobility enhancements in physical layer,” ZTE
2. R1-2003506, “Remaining issues on DAPS-HO,” Huawei, HiSilicon
3. R1-2003676, “Remaining issues on Physical Layer Aspects for DAPS-HO,” MediaTek Inc.
4. R1-2003748, “Corrections to Physical layer aspects of NR mobility enhancement,” Intel Corporation
5. R1-2003890, “Remaining issues for NR Mobility Enhancement,” Samsung
6. R1-2004202, “Remaining issues on mobility enhancements,” Ericsson
7. R1-2004235, “On remaining issues on NR mobility enhancements,” Apple
8. R1-2004580, “Remaining physical layer aspects of dual active protocol stack based HO,” Nokia, Nokia Shanghai Bell
9. R1-2003331, “Discussion on FR2 mobility interruption enhancements,” ZTE
10. R1-2004148, “Remaining PHY aspects for CHO,” Huawei, HiSilicon
11. R1-2003747, “Issue Summary for NR Mobility Enhancements,” Moderator (Intel Corporation)