**3GPP TSG-RAN4 Meeting #98-eR4-210xxxx**

**Online, 25 Jan. - 5 Feb., 2021**

**Agenda item:** 7.2.1

**Source:** Apple

**Title:** Email discussion summary for [98e][207] NR\_Mob\_enh\_RRM

**Document for:** Information

# Introduction

The scope of this email discussion covers the following issues:

1. Further clarification on DL-to-UL and UL-to-DL switching time
2. Maintenannce on interruption time Tinterrupt2 of FR1 intra-freq DAPS hadover
3. RRC procedure delay for conditional PSCell change

# Topic #1: Maintenance

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2101009**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101009.zip) | Apple | Note 2 and 3 in Table 6.1.3.2-1 was introduced to make sure that UE can have enough time for UL2DL and DL2UL switch. For intra-band TDD case, UE is allowed to support DAPS handover with single RF chain. Therefore, the UL2DL switch time shall apply to UL/DL switch between the two cells. So is DL2UL.  26500Tc in Note 2 and 3 is incorrect. It should be 25600Tc. |
| [**R4-2101204**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101204.zip) | Ericsson | Proposal 1 : Prior to random access procedure autonomous interruption is done in communication towards the target cell as necessary to enable the UE to have sufficient switching time, and after the random access procedure autonomous interruption is done in communication towards source cell as necessary to allow the UE to have sufficient switching time. |
| [**R4-2101205**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101205.zip) | Ericsson | Add conditions for not expected to transmit / not expected to receive covering both source and target cell.  Add autonomous interruption allowance if these conditions are unspecified.  Correct Ntx-rx and Nrx-tx to 25600 Tc |
| [**R4-2101210**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101210.zip) | MediaTek inc. | The RRC procedure delay for conditional PSCell change should be aligned with that for conditional handover。  Clarify that “TRRC\_delay is the maximum RRC procedure delay to be defined in clause 12 in TS 38.331 [2] for processing the conditional PSCell change commandas defined in TS 38.331 [2].” |
| [**R4-2101667**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101667.zip) | Huawei | Observation 1: Option 2 could not provide sufficient time for UE completing UL-to-DL switching on both source cell and target cell for intra-band DAPS handover.  Proposal 1: option 3 is suggested to clarify the switching time allowed between source cell and target cell |
| [**R4-2101668**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101668.zip) | Huawei | For FR1 DAPS hadover, the synchronous conditions are defined with adding 3 notes. In current specification, Notes 2/3 clairfies to leave enough time for UE performing DL-to-UL and UL-to-DL switching only from single cell perspective. However, the UE shall be allowed to switching time between both source cell and target cell.  For FR1 intra-freq DAPS hadover, the interruption time Tinterrupt2 are not separately defined for sync and async cases when the BWP of target cell is smaller than the BWP of source cell. For async case, 1 additional slot interruption time is needed.   1. To correct Notes 2/3 in Table 6.1.3.2-1. 2. To correct some editorial changes. 3. To separately define interruption time Tinterrupt2 of FR1 intra-freq DAPS hadover for sync and async cases, when the BWP of target cell is smaller than the BWP of source cell. |

## Open issues summary

### Topic 1 maintenance on DAPS handover

*Sub-topic description:*

*The issue was discussed in RAN4#97e.Ccorresponding agreements were captured in R4-2017093:*

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| * *Issue 1-3: further clarification on DL-to-UL and UL-to-DL switching time*   + *Option 1: clarify that 13us switching time is allowed between source cell and target cell:*     - *Note 2: For DAPS handover on a TDD band, a UE is not expected to transmit in the uplink to source or target cell earlier than NRX-TX after the end of the last received downlink symbol from source or target cell in the same TDD band where NRX-TX=25600Tc.*     - *Note 3: For DAPS handover on a TDD band, a UE is not expected to receive in the downlink from source or target cell earlier than NTX-RX after the end of the last transmitted uplink symbol toward source or target cell in the same TDD band where NTX-RX=25600Tc.*   + *Option 2: Retain the existing specification that DL-to-UL and UL-to-DL switching time applies within the same cell*     - *Note 2:      For DAPS handover on a TDD band, a UE is not expected to transmit in the uplink earlier than NRX-TXafter the end of the last received downlink symbol in the same cell where NRX-TX=25600Tc.*     - *Note 3:  For DAPS handover on a TDD band, a UE is not expected to receive in the downlink earlier than NTX-RX after the end of the last transmitted uplink symbol in the same cell where NTX-RX=25600Tc.*   + *Option 3: clarify that 10us switching time is allowed between source cell and target cell*     - *Note 2: For DAPS handover on a TDD band, a UE is not expected to transmit in the uplink to source or target cell earlier than NRX-TX after the end of the last received downlink symbol from source or target cell in the same TDD band where NRX-TX=19712Tc.*     - *Note 3: For DAPS handover on a TDD band, a UE is not expected to receive in the downlink from source or target cell earlier than NTX-RX after the end of the last transmitted uplink symbol toward source or target cell in the same TDD band where NTX-RX=19712Tc.*   + *Other options* |

*Open issues and candidate options before e-meeting:*

**Issue 1-1: Further clarification on DL-to-UL and UL-to-DL switching time**

* Proposals
  + Option 1: same as option 1 in R4-2017093: clarify that 13us switching time is allowed between source cell and target cell: (Apple)
    - *Note 2: For DAPS handover on a TDD band, a UE is not expected to transmit in the uplink to source or target cell earlier than NRX-TX after the end of the last received downlink symbol from source or target cell in the same TDD band where NRX-TX=25600Tc.*
    - *Note 3: For DAPS handover on a TDD band, a UE is not expected to receive in the downlink from source or target cell earlier than NTX-RX after the end of the last transmitted uplink symbol toward source or target cell in the same TDD band where NTX-RX=25600Tc.*
  + Option 2: Add conditions for not expected to transmit / not expected to receive covering both source and target cell. Autonomous interruption is allowed if these conditions are not met: (Ericsson)
    - *Note 2: For DAPS handover on a TDD band, a UE shall be capable to transmit in the uplink to source or target cell after NRX-TX  from the end of the last received downlink symbol from source or target cell in the same TDD-band where NRX-TX=25600Tc. When this condition is not met, the UE may perfrom autonomous interruption as shown in Table 6.1.3.2-2.*
    - *Note 3: For DAPS handover on a TDD band, a UE is shall be capable to receive in the downlink from source or target cell after NTX-RX after the end of the last transmitted uplink symbol towards sorce or target cell in the same TDD-band where NTX-RX=25600Tc. When this condition is not met, the UE mau perfrom autonomous interruption as shown in table 6.1.3.2-3.*
* Table 6.1.3.2-2: Autonomous interruptions related to DL to UL switching for syncrounous TDD DAPS handover in the same band

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| **Scenario** | **Allowed interruption** |
| Target cell earlier than source cellNote 1, prior to start of random access | Not applicable |
| Target cell later than source cell Note 1, prior to start of random access | The UE may stop receiving the target DL up to 25600 Tc prior to the start of the source UL |
| Target cell earlier than source cell Note 1, after start of random access | The UE may stop receiving the source DL up to 25600 Tc prior to the start of the target UL |
| Target cell later than source cell Note 1, after start of random access | The UE may start transmitting the source UL up to 25600 Tc after the start of the source DL |
| Note 1: As observed by UE at antenna connector | |

* Table 6.1.3.2-3: Autonomous interruptions related to UL to DL switching for syncrounous TDD DAPS handover in the same band

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| **Scenario** | **Allowed interruption** |
| Target cell earlier than source cell Note 1, prior to start of random access | The UE may start receiving the target DL up to 25600 Tc after the end of the source UL |
| Target cell later than source cell Note 1 prior to start of random access | Not applicable |
| Target cell earlier than source cell Note 1, after start of random access | The UE may stop transmissions of the source UL up to 25600 Tc prior to the start of target DL reception. |
| Target cell later than source cell Note 1, after start of random access | The UE may start receiving the source DL up to 25600 Tc after the end of the target UL |
| Note 1: As observed by UE at antenna connector | |

* + Option 3: same as option 3 in R4-2017093: Add conditions for not expected to transmit / not expected to receive covering both source and target cell. Autonomous interruption is allowed if these conditions are not met: (Huawei)
    - *Note 2: For DAPS handover on a TDD band, a UE is not expected to transmit in the uplink to source or target cell earlier than NRX-TX after the end of the last received downlink symbol from source or target cell in the same TDD band where NRX-TX=19712Tc.*
    - *Note 3: For DAPS handover on a TDD band, a UE is not expected to receive in the downlink from source or target cell earlier than NTX-RX after the end of the last transmitted uplink symbol toward source or target cell in the same TDD band where NTX-RX=19712Tc.*
* Recommended WF
  + More discussion is needed

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| **Company** | **Comments** |
| Huawei | We prefer option 3, but option 1 is acceptable for us.  As we analyzed in our paper, an up to 3us interruption may occur on DL receiving after U2D switching with PRACH transmission on target cell. However, it has already been captured in current spec that the performance degradation on the first symbol of slot is allowed.  From single carrier point of view, the principles defined in TS38.211 are that the receiving/transmission before D2U/U2D switching is prioritized. However, the principles of Option 2 will be conflicted with the current principles with single carrier perspective. We suggest to use the same principles for UE to perform simultaneous D2U/U2D switching on both source and target cells, i.e. the receiving/transmission before D2U/U2D switching is prioritized. |
| Apple | Support option 1.  With Note 2/3 in option 1 and Note 1, we think the conditions are complete. With existing Note 1, UE can finish the previous symbol and may still be able to switch to the next symbol on the other cell (with some degradation allowed). While in option 2 new UE behavior is introduced. However, no benefit can be observed from system throughput perspective. |
| MTK | We support 1.  For option 2, we have concern on the description of Autonomous interruptions.UE might not be able to receive PDSCH data if PDCCH is missing.  For option 3, it seems to violate the agreed value *NRX-TX=25600Tc* specified in RAN1 spec |
| Qualcomm | Option 1 is supported.  Option2 provides further analysis and recommendation for this issue, but as UE vendor, we share similar concerns as other companies that new requirements would be imposed on UE with complexity. |
| Ericsson | We support option 2.  Option 3 is a non-backwards compatible change onto existing specification. |
| Nokia | We support option 2. |

**Issue 1-2: Tinterrupt2 of FR1 intra-freq DAPS hadover**

Huawei pointed out in [R4-2101668](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101668.zip) that for FR1 intra-freq DAPS hadover, the interruption time Tinterrupt2 are not separately defined for sync and async cases when the BWP of target cell is smaller than the BWP of source cell. For async case, 1 additional slot interruption time is needed.

* Proposals
  + Option 1: To separately define interruption time Tinterrupt2 of FR1 intra-freq DAPS hadover for sync and async cases, when the BWP of target cell is smaller than the BWP of source cell. (Huawei)
* Recommended WF
  + Need more discussion.

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| **Company** | **Comments** |
| Huawei | Support Option 1, since it is Huawei’s proposal. |
| Apple | Agree option 1. |
| MTK | Support option 1. |
| Qualcomm | Option1 is supported. |
| Ericsson | Option 1, |
| Nokia | Agee with Option 1. |

### Topic 2 conditional PSCell change

**Issue 2-1: RRC procedure delay for conditional PSCell change**

MTK pointed out in [R4-2101210](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101210.zip) that the RRC procedure delay for conditional PSCell change is not aligned with that for conditional handover

* Proposals
  + Option 1: Clarify that “TRRC\_delay is the maximum RRC procedure delay to be defined in clause 12 in TS 38.331 [2] for processing the conditional PSCell change commandas defined in TS 38.331 [2].” (MTK)
* Recommended WF
  + Need more discussion.

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| **Company** | **Comments** |
| Apple | As RAN2 is not discussing different RRC procedure delay for conditional PSCell change and handover, could we update the statement in conditional handover to align with that in conditional PSCell change, which is more precise in our view. |
| MTK | Our understanding is that previous RAN4 agreement is TRRC\_delay =16ms for conditional handover. We will further check the RAN2 agreement. |
| Ericsson | We will also further check agreements. |

## Companies views’ collection for 1st round

### CRs/TPs comments collection

*Major close-to-finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

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| **CR/TP number** | **Comments collection** |
| [**R4-2101009**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101009.zip) | MTK: Ok for us |
| Ericsson: This corrects typo in N\_RX\_TX, like our R4-2101205, but we prefer our R4-2101205, sine this a more complete proposal. |
| Nokia: CR can be come back after issue 1-1 has conclusion |
| [**R4-2101205**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101205.zip) | MTK: we have concern on the description of Autonomous interruptions.UE might not be able to receive PDSCH data if PDCCH is missing. |
| Ericsson:  First as described and explained in our R4-2101204 discussion paper there are unfortunate circumstances that combined has to occur for UE switching time in the UL2DL, not to be fulfilled, e.g. actual cell phase sync at its worst performance and worst relative relation (between source and target) , UE at a certain relative position within the cells, unfortunate scheduled DL and UL transmissions  etc i.e. so in many cases the switching time could be fulfilled and then no issue at all based on Table 6.1.3.2-3  i.e. below has no impact at all, since there are margins for it and can do the switching and receive in due time.  The UE may start receiving the target DL up to 25600 Tc after the end of the source UL The UE may start receiving the source DL up to 25600 Tc after the end of the target UL  Secondly  Even if starting it DL reception somewhat late as the autonomous interruptions above allows (if unfortunate and UE switching conditions could not be fully met) it might e.g. miss some part of the CP (4.7us at 15kHz) still many times this would still be OK.  Thirdly  The idea with DAPS is DL duplication i.e. as mentioned in our discussion paper “. *In the case of DL, PDCP data is duplicated so in principle, receiving DPCP DL streams from both source and target fully should not be needed, further motivating a  prioritization.“* a prioritization and toolbox that the Table allows and still it is about likelihood and still DL is duplicated so consequence might not be that big if unfortunately happens to be an issue and the toolbox allows mitigations, prioritization. Also missing PDCCH have no impact if not scheduled in this DL.  So the CR is needed to allow different flexible methods, to mitigate potential issues and minimize consequences in a flexible way, when a switching constraint is determined to actually (even if can be rare and related to some likelihood) occur, rather than having an unspecified UE behavior “not expected to receive” and “ not expected to transmit”. |
| Nokia: the change is fine. But we can wait until issue 1-1 has conclusion. |
| [**R4-2101210**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101210.zip) | Ericsson: We will also further check agreements. |
| [**R4-2101668**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101668.zip) | MTK: it seems to violate the agreed value *NRX-TX=25600Tc* specified in RAN1 spec. Modification on Tinterrupt2 is fine.  Ericsson: This is a non-backwards compatible change onto existing specification. |
| Nokia: for the change 1, need to be come back after issue 1-1 has conclusion. OK with change 2&3. |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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|  | **Status summary** |
| Issue 1-1 | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| Issue 1-2 | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| Issue 2-1 | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

*Recommendations on WF/LS assignment*

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |