**3GPP TSG-RAN WG4 Meeting # 97-e R4-2017006**

**Electronic Meeting, 2 – 13 Nov., 2020**

**Agenda item:** 7.2.1, 7.2.2

**Source:** Apple

**Title:** Email discussion summary for [97e][207] NR\_Mob\_enh\_RRM

**Document for:** Information

# Introduction

The scope of this email discussion includes core requirement maintenance and performance development. The latest RRM progress of NR mobility enhancement in RAN4#96e can be found in the approved WF R4-2012270, according to which the remaining issues include:

1. How to capture the demodulation performance degradation for async intra-frequency DAPS handover and async intra-band inter-frequency DAPS handover.
2. It is FFS whether the test applicability agreed in RAN4#96e needs to be split to cover intra-frequency, intra-band inter-frequency and inter-band inter-frequency respectively.
3. Test cases development for DAPS handover and conditional handover.

Since this is the last meeting for this work item, all remaining issues are expected to be resolved in this meeting.

# Topic #1: Core requirements maintenance

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2014357**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014357.zip) | MediaTek inc. | Discussion on dual active protocol stack handover**Proposal 1: For asynchronous intra-frequency DAPS handover and asynchronous intra-band inter-frequency DAPS handover, demodulation performance degradation might happen on any single symbol of the first 3 symbols of a slot. There is no UE requirement expected if MRTD is larger than 3 OFDM symbol length.** |
| [**R4-2014358**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014358.zip) | MediaTek inc. | CR on TS38.133 for dual active protocol stack handoverSummary of change: Clarify that “For asynchronous intra-frequency DAPS handover and asynchronous intra-band inter-frequency DAPS handover, if the receive time difference exceeds the cyclic prefix length of that SCS, demodulation performance degradation is expected. FFS the exact location(s) of OFDM symbol(s) where the interruption may occur” |
| [**R4-2015167**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015167.zip) | Ericsson | AGC operation in async intra-frequency DAPS HO**Observation 1 : UE implementations can take steps to mitigate and reduce the performance degradation caused by AGC in asynchronous DAPS operation****Observation 2 : Specifying an unbounded performance degradation in 38.133 does not help secure the interoperability between UE and basestation during DAPS handover.****Proposal 1 : During async intra-frequency DAPS handover and async intra-band inter-frequency DAPS handover, interruptions may occur depending on UE implementation. The duration and frequency of occurrence of such interruptions is not specified** |
| [**R4-2015168**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015168.zip) | Ericsson | Corrections to DAPS requirementsSummary of change:Replace editor’s note with normative note saying “During async intra-frequency DAPS handover and async intra-band inter-frequency DAPS handover, interruptions may occur depending on UE implementation. The duration and frequency of occurrence of such interruptions is not specified”Change existing note 1, which says that demodulation impact “is expected” to “may occur”. There are implementations possible which would not have demodulation impact (e.g. 2RX architecture for intraband interfrequency DAPS HO), so the wording “may occur” is more accurate than “is expected”.NRX-TX and NTX-RX changed to 25600 Tc in notes 2 and 3 |
| [**R4-2015464**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015464.zip) | Huawei, HiSilicon | CR on maintaining DAPS handover requirementsSummary of change:1. To correct Notes 2/3 in Table 6.1.3.2-1.
2. To correct some editorial changes.
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| [**R4-2016016**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016016.zip) | Ericsson | CR 38.133 Corrections to Conditional PSCell Change delay requirementSummary of change:Introducing the following correction:Specifying Tprocessing as follows: Tprocessing = 20 ms when source and target cells are in the same FR, and Tprocessing = 40 ms when source and target cells are in different FRs. |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Open issues in the 1st round

**Issue 1-1: demodulation performance degradation for async intra-frequency DAPS handover and async intra-band inter-frequency DAPS handover**

* Proposals
	+ Option 1: For asynchronous intra-frequency DAPS handover and asynchronous intra-band inter-frequency DAPS handover, demodulation performance degradation might happen on any single symbol of the first 3 symbols of a slot. There is no UE requirement expected if MRTD is larger than 3 OFDM symbol length.. (MTK)
	+ Option 2: During async intra-frequency DAPS handover and async intra-band inter-frequency DAPS handover, interruptions may occur depending on UE implementation. The duration and frequency of occurrence of such interruptions is not specified. (Ericsson)
* Recommended WF
	+ Need more discussion.

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| **Company** | **Comments** |
| XXX |  |
| Huawei | We support option 2.Option 1 seems to restrict the MRTD of async intra-freq/intra-band DAPS HO within 3 symbols. However, the MRTD of async intra-freq/intra-band DAPS HO could be up to 0.5 slot. |
| Ericsson | Support option 2. In an async DAPS deployment we don’t know the MRTD that the UE is experiencing, so we don’t know if it will take out a PDCCH or a PDSCH symbol for a given UE. Then option 1 just seems to lead to more complicated requirements yet we can’t really exploit them to handle the UE differently anyway. |
| Intel | Both options are fine for us. But slightly prefer Option 2. For Option 2, no requirements for the interruption is quite simple way to resolve this problem from RAN4 requirements perspective. For option 1, the restriction on the 3 symbols need to be FFS.  |
| Apple | We prefer option 2, since it accommodates option when MRTD is larger than 3 OFDM symbol length, which we believe is the typical case for async scenario. |
| Qualcomm | We propose option3 as “During async intra-frequency DAPS handover and async intra-band inter-frequency DAPS handover, demodulation performance degradation may be expected, and no requirements are defined.” This option3 doesnot presume mitigating the impact via UE and/or network. |
| NEC | We support option 2. |
| MTK | Our proposal in Tdoc is wrong. It should be “For asynchronous intra-frequency DAPS handover and asynchronous intra-band inter-frequency DAPS handover, if the receive time difference exceeds the cyclic prefix length of that SCS, demodulation performance degradation is expected. FFS the exact location(s) of OFDM symbol(s) where the interruption may occur.”It is very close to QC’s proposal and option 2.We can also support option 2 and option 3. |

**Issue 1-2: NRX-TX and NTX-RX values in Note 2 and 3 in table of sync condition**

* Proposals
	+ Option 1: change NRX-TX and NTX-RX to 25600 Tc in notes 2 and 3 (Ericsson)
* Recommended WF
	+ Agreed on option 1.

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| **Company** | **Comments** |
| XXX |  |
| Huawei | Agree option 1, since 25600Tc is the correct value. |
| Intel | Recommended WF is fine for us. |
| Apple | Support option 1. |
| Qualcomm | Recommended WF can be agreed. |
| NEC | Agree on option 1. |
| MTK | Agree on option 1. |

**Issue 1-3: further clarification on DL-to-UL and UL-to-DL switching time**

* Proposals
	+ Option 1: clarify that switching time is allowed between source cell and target cell (Huawei)

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| * 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=26500Tc.
* 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=26500Tc.
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* Recommended WF
	+ Need more discussion.

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| **Company** | **Comments** |
| XXX |  |
| Huawei | Support option 1 |
| Ericsson | This needs significant further discussion. The issue is that if we agree the CR it means that DAPS can only work for TDD with perfect sync (cell phase sync) between the source and target cells. Taking the case of a very small cell we can only set Nta=0 so Nta+Nta,offset is at earliest 25600 Tc before the downlink. Since UL2DL switching time can’t be configured with any margin in this case, we are always done unless the 2 cells are perfectly syncronised. For example, if we thought about time between source cell UL slot and target cell DL slot, and the UE is operating with source cell UL Nta=0, and that the target cell is coming 3us early due to cell phase sync there is nothing we can do.The same problem exists for the DL2UL switching since the guard period allows up to a cetain cell size to be used in the existing TDD deployment without any propagation delay causing a DL-UL switching problem. If we now say that switching time applies jointly to both cells, and we were on the limit of the cell size before, we can only achive that if we have perfect sync between the cells.The problem Huawei has raised here is indeed completely valid, but as the proposed solution could only work with absolutely perfect sync between the cells in the network we cannot agree it and we need to discuss how to move forward. There doesn’t seem to be an obvious simple answer. |
| Apple | We agree with Huawei’s observation. We also understand the concern from network vendor on the negative impact on deployment. We are fine with further study to see if there is better solution. |
| Qualcomm | Our view is that the proposed clarifications are consistent with the original intent of the text and therefore are not adding or modifying requirements. From that point of view, we can support the changes. To Ericsson’s concern: if Ericsson can show that these changes are creating a *new* issue then we are open for more discussions |
| Huawei | To Ericsson:Note 2 refers the UE performing DL-to-UL switching, which can be shown as follow:For single cell, the allowed switching period equals to ‘GP - NTA - NTA-offset’, where ‘NTA + NTA-offset’ is the timing advance for uplink. In considering the MRTD between source and target cell, the allowed switching period equals to ‘GP - NTA - NTA-offset - MRTD’. The network need to configure a proper guard period (GP, configured as symbol level) to make ‘GP - NTA - NTA-offset - MRTD’ longer than 25600Tc.Note 3 refers the UE performing UL-to-DL switching, which can be shown as follow:The above figure shows the worst with NTA=0 for one cell. According to Note 3, the UE will not receive signals before T2, and will miss the reception of source cell between T1 and T2. However, as clarified in Note 1, the demodulation performance degradation for the first symbol of the slot is allowed. |
| MTK | Agree on option 1. |

**Issue 1-4: Tprocessing in conditional PSCell change**

* Proposals
	+ Option 1: Specifying Tprocessing as follows: Tprocessing = 20 ms when source and target cells are in the same FR, and Tprocessing = 40 ms when source and target cells are in different FRs. (Ericsson)
* Recommended WF
	+ Agree on option 1.

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| **Company** | **Comments** |
| XXX |  |
| Huawei | Agree on option 1. |
| Intel | This WF can be agreed. |
| Apple | Support option 1. |
| Qualcomm | Recommended WF can be agreed. |
| NEC | Agree on option 1. |
| MTK | Agree on option 1. |

### 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** |
| [**R4-2014358**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014358.zip)MTK | Intel: up to the discussion on Issue 1-1 |
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| [**R4-2015168**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015168.zip)Ericsson | Intel: up to the discussion on Issue1-1 and 1-2 |
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| [**R4-2015464**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015464.zip)Huawei |  |
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| [**R4-2016016**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016016.zip)Ericsson |  |
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## 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** | **Issue 1-1: demodulation performance degradation for async intra-frequency DAPS handover and async intra-band inter-frequency DAPS handover***Tentative agreements:* N/A*Candidate options:** + Option 1: For asynchronous intra-frequency DAPS handover and asynchronous intra-band inter-frequency DAPS handover, if the receive time difference exceeds the cyclic prefix length of that SCS, demodulation performance degradation is expected. FFS the exact location(s) of OFDM symbol(s) where the interruption may occur.
	+ Option 2: During async intra-frequency DAPS handover and async intra-band inter-frequency DAPS handover, interruptions may occur depending on UE implementation. The duration and frequency of occurrence of such interruptions is not specified. (Ericsson)
	+ Option 3: During async intra-frequency DAPS handover and async intra-band inter-frequency DAPS handover, demodulation performance degradation may be expected, and no requirements are defined. (QC)

*Recommendations for 2nd round:* According to 1st round comments, most companies support option 2. However, QC proposed a new option 3 and got support from MTK. Further discussion is needed in 2nd round. Please QC check if option 2 is acceptable. Please other companies provide views on option 3. |
| **Issue 1-2** | **Issue 1-2: NRX-TX and NTX-RX values in Note 2 and 3 in table of sync condition***Tentative agreements:* RAN4 is to change NRX-TX and NTX-RX to 25600 Tc in notes 2 and 3 in table of sync condition. |
| **Issue 1-3** | **Issue 1-3: further clarification on DL-to-UL and UL-to-DL switching time***Tentative agreements:* N/A*Candidate options:** + Option 1: clarify that switching time is allowed between source cell and target cell (Huawei)

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| * 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=26500Tc.
* 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=26500Tc.
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* + Option 2: further study on other possible option

*Recommendations for 2nd round:* According to 1st round comments, all companies agree that the problem raised in R4-2015464 is valid. However, one company has concern on the solution proposed in R4-2015464. Companies are encouraged to further discuss this issue in 2nd round. |
| **Issue 1-4** | **Issue 1-4: Tprocessing in conditional PSCell change***Tentative agreements:*RAN4 is to specify Tprocessing as follows: Tprocessing = 20 ms when source and target cells are in the same FR, and Tprocessing = 40 ms when source and target cells are in different FRs. |

*Recommendations on WF/LS assignment*

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|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 | Way forward on NR mobility enhancement | Apple |

### 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**  | **Comments** |
| [**R4-2014358**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014358.zip)MTK | *to be revised* | *Cover Note 1 in Table 6.1.3.2-1.* |
| [**R4-2015168**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015168.zip)Ericsson | *to be revised* | *Cover* *NRX-TX and NTX-RX in Note 2 and 3 in Table 6.1.3.2-1.* |
| [**R4-2015464**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015464.zip)Huawei | *Return to* |  |
| [**R4-2016016**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016016.zip)Ericsson | *To be agreed* |  |

## Discussion on 2nd round

**Issue 1-1: demodulation performance degradation for async intra-frequency DAPS handover and async intra-band inter-frequency DAPS handover**

* Proposals
	+ Option 1: For asynchronous intra-frequency DAPS handover and asynchronous intra-band inter-frequency DAPS handover, if the receive time difference exceeds the cyclic prefix length of that SCS, demodulation performance degradation is expected. FFS the exact location(s) of OFDM symbol(s) where the interruption may occur.
	+ Option 2: During async intra-frequency DAPS handover and async intra-band inter-frequency DAPS handover, interruptions may occur depending on UE implementation. The duration and frequency of occurrence of such interruptions is not specified. (Ericsson)
	+ Option 3: During async intra-frequency DAPS handover and async intra-band inter-frequency DAPS handover, demodulation performance degradation may be expected, and no requirements are defined. (QC)
* Recommended WF
	+ Since most companies support option 2, please QC check if option 2 is acceptable. Please other companies provide view on option 3.

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| **Company** | **Comments** |
| XXX |  |

**Issue 1-3: further clarification on DL-to-UL and UL-to-DL switching time**

* Proposals
	+ Option 1: clarify that switching time is allowed between source cell and target cell (Huawei)

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| * 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=26500Tc.
* 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=26500Tc.
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* Recommended WF
	+ Further discussion is needed.

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| **Company** | **Comments** |
| Ericsson | Ericsson cannot agree with option 1 after first round comments. For large TA, the solution proposed by the proponents would reduce available TDD GP by the synchronization accuracy between source and target which according to cell phase sync requirements is up to 3us.  Since the GP determines feasible cell size, in an already deployed TDD network with given GP for which the operator then wants to upgrade to support DAPS there would be areas within the network (especially at cell edge where it is needed) where DAPS cannot be supported unless the assumption has been that GP had a margin (such as 3uS) prior to DAPS deployment. Reconfiguring (increasing) GP to roll out DAPS is unattractive as it increases TDD switching overhead and may need to be coordinated and agreed between operators on adjacent channels.For the small TA case we also still have concerns. One is that earlier we had understood note 1 to be about an AGC issue because that was the explanation of companies in RAN4 where it came from. So we expected it would only occur when the UE performs AGC update. Although this is up to UE implementation, our understanding has been that AGC updating would typically relatively infrequently such as every SMTC (20ms+) or even much less frequently especially if the UE is not moving, the pathloss/channel is rather static and the new AGC value is often the same as the old AGC value. We acknowledge that note 1, as it is written, *allows*the UE to drop every first symbol of every slot if MRTD>CP, on the other hand it could be expected considering real AGC and a desire to make good implementations that this is a very pessimistic view of what would actually happen. However, the reinterpretation of note 1 to include T2R switching adds something we expect that this is going to happen on each T2R switch. So it becomes a much more frequent degradation that the former explanation would have predicted. For Qualcomm, this is a *new* issue, because we were fine with the spec before whereas the update creates implicit new requirements that if DAPS is to be supported, we need to have perfect sync in NW between geographically separate sites (not feasible), or provide a margin in GP and accept loss of first symbol in cases where it would not have been specified before. We understand that the spec as it was captured before created a similar implementation impossibility for the UE (T2R and R2T switching time requirement is effectively tightened by up to 3uS due to cell phase sync) but if this solution is agreed it provides a very major disincentive for any TDD network to implement DAPS at all. It becomes about as attractive as it would be to tighten the UE switching. Finally, we would like to emphasize that the NW is blind to the actual cell phase sync difference/ MRTD at the UE or even Nta used by the UE for either link (network may track accumulated Nta commands but does not know which the UE received). So it means that, in principle, if this condition cannot be ensured by deployment consideration for the entire NW coverage, we should increase GP.So we think RAN4 needs to discuss other solutions.  |
| Huawei | The current definition of Notes 2/3 is just duplicated clarification as specified in TS38.211.In TS38.211A UE not capable of full-duplex communication is not expected to transmit in the uplink earlier than $N\_{Rx-Tx}T\_{c}$ after the end of the last received downlink symbol in the same cell where $N\_{Rx-Tx}$ 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 $N\_{Tx-Rx}T\_{c}$ after the end of the last transmitted uplink symbol in the same cell where $N\_{Tx-Rx}$ is given by Table 4.3.2-3.In TS38133Note 2: For DAPS handover on a TDD band, a UE is not expected to transmit in the uplink earlier than NRX-TX after the end of the last received downlink symbol in the same cell where NRX-TX=26500Tc. 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=26500Tc.In TS38.101-1, the UE transient period for D2U/U2D switching is defined as 10us. For intra-band DAPS handover, the UE is allowed to use same RF chain for source cell and target cell and needs to perform simultaneous D2U/U2D switching on both source cell and target cell. However, a duration of 13us from single cell perspective is not sufficient to cover 10us transient period and 6us timing misalignment between source cell and target cell. So, RAN4 need to introduce Notes 2/3 to solve this issue.So, we suggest to define Notes 2/3 as follows: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.Where, 19712Tc=10us. |

## 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”* |

# Topic #2: performance part

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2014222**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014222.zip) | Apple | Discussion on DAPS HO test applicabilityProposal 1: RAN4 to further split test applicability for DAPS handover to cover intra-frequency, intra-band inter-frequency and inter-band inter-frequency respectively.Proposal 2: update the test applicability for DAPS handover to:* **To verify intra-frequency DAPS handover requirements**
	+ **The UE capable of intra-frequency asynchronous DAPS handover on any band needs to be tested only in asynchronous scenario.**
	+ **The UE not capable of intra-frequency asynchronous DAPS handover on any band but capable of synchronous DAPS handover on some band needs to be tested only in synchronous scenario.**
* **To verify intra-band inter-frequency DAPS handover requirements**
	+ **The UE capable of intra-band inter-frequency asynchronous DAPS handover on any band needs to be tested only in asynchronous scenario.**
	+ **The UE not capable of intra-band inter-frequency asynchronous DAPS handover on any band but capable of intra-band inter-frequency synchronous DAPS handover on some band needs to be tested only in synchronous scenario.**
* **To verify inter-band inter-frequency DAPS handover requirements**
	+ **The UE capable of inter-band inter-frequency asynchronous DAPS handover on any band combination needs to be tested only in asynchronous scenario.**
	+ **The UE not capable of inter-band inter-frequency asynchronous DAPS handover on any band combination but capable of inter-band inter-frequency synchronous DAPS handover on some band combination needs to be tested only in synchronous scenario.**
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| [**R4-2014223**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014223.zip) | Apple | CR for DAPS HO test applicability |
| [**R4-2014580**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014580.zip) | Intel Corporation | CR to TS 38.133: Intra-band Inter-frequency sync DAPS handover test in SA for FR1 |
| [**R4-2015169**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015169.zip) | Ericsson | Conditional handover test cases for NR |
| [**R4-2015465**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015465.zip) | Huawei, HiSilicon | Discussion on DAPS handover test cases**Proposal 1: It is suggested that the DAPS handover tests consist of five successive time periods.*** **Before the start of T1, the UE is connected to the source cell and not aware of the target cell. During T1, the UE does not have any timing information of the target cell.**
* **Starting T2, the target cell becomes detectable. Gap pattern shall be configured for inter-frequency target cell. During T2, the UE performs cell detection and measurements on the target cell and shall send event report to the network. After receiving the event report, the network send a RRC message implying DAPS handover to the UE.**
* **The start of T3 is the instant when the last TTI containing DAPS handover command is sent to the UE. During T3, the handover delay Dhandover1 and the interruption time Tinterrupt1 for target cell addition need to be verified. After successful RACH procedure of the target cell, the network send a RRC message implying source cell release to the UE.**
* **The start of T4 is the instant when the last TTI containing source cell release command is sent to the UE. During T4, the handover delay Dhandover2 and the interruption time Tinterrupt2 for source cell release need to be verified.**
* **Starting T5, the UE stops to send CSI report to the source cell.**

**Proposal 2: The values of handover delay Dhandover1 in Table 1 is suggested to be used for verifying DAPS handover requirements.****Proposal 3: The test applicability rules for DAPS HO could be defined as:*** **The UE capable of intra-frequency asynchronous DAPS handover on any band needs to be tested only in asynchronous scenario.**
* **The UE not capable of intra-frequency asynchronous DAPS handover on any band but capable of synchronous DAPS handover on some band needs to be tested only in synchronous scenario.**
* **The UE capable of intra-band inter-frequency asynchronous DAPS handover on any band needs to be tested only in asynchronous scenario.**
* **The UE not capable of intra-band inter-frequency asynchronous DAPS handover on any band but capable of intra-band inter-frequency synchronous DAPS handover on some band needs to be tested only in synchronous scenario.**
* **The UE capable of inter-band inter-frequency asynchronous DAPS handover on any band combination needs to be tested only in asynchronous scenario.**
* **The UE not capable of inter-band inter-frequency asynchronous DAPS handover on any band combination but capable of inter-band inter-frequency synchronous DAPS handover on some band combinations needs to be tested only in synchronous scenario.**
 |
| [**R4-2015466**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015466.zip) | Huawei, HiSilicon | DraftCR on inter-band DAPS handover tests |
| [**R4-2016555**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016555.zip) | Qualcomm Incorporated | Introduction of intra-frequency sync and async DAPS HO test cases in FR1 |

## Open issues summary

### Open issues in the 1st round

**Issue 2-1: Test applicability for DAPS handover**

* Proposals
	+ Option 1 (Apple, Huawei): RAN4 to further split test applicability for DAPS handover to cover intra-frequency, intra-band inter-frequency and inter-band inter-frequency respectively
	+ To verify intra-frequency DAPS handover requirements
		- The UE capable of intra-frequency asynchronous DAPS handover on any band needs to be tested only in asynchronous scenario.
		- The UE not capable of intra-frequency asynchronous DAPS handover on any band but capable of synchronous DAPS handover on some band needs to be tested only in synchronous scenario.
	+ To verify intra-band inter-frequency DAPS handover requirements
		- The UE capable of intra-band inter-frequency asynchronous DAPS handover on any band needs to be tested only in asynchronous scenario.
		- The UE not capable of intra-band inter-frequency asynchronous DAPS handover on any band but capable of intra-band inter-frequency synchronous DAPS handover on some band needs to be tested only in synchronous scenario.
	+ To verify inter-band inter-frequency DAPS handover requirements
		- The UE capable of inter-band inter-frequency asynchronous DAPS handover on any band combination needs to be tested only in asynchronous scenario.
		- The UE not capable of inter-band inter-frequency asynchronous DAPS handover on any band combination but capable of inter-band inter-frequency synchronous DAPS handover on some band combination needs to be tested only in synchronous scenario.
* Recommended WF
	+ More discussion is needed

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |
| Huawei | Support option 1To define separate applicability rules for intra-freq, intra-band inter-freq and inter-band inter-freq DAPS HO. |
| Ericsson | Option 1 seems OK. Our only comment is that typically RAN5 has assumed that all tests except accuracy can be run on any single band the UE supports (non CA) or any CA band for CA tests. For CA they have even considered for RRM purposes a pass on an intraband (either contiguous or non contiguous) combo or an interband combo to be equivalent. Now for DAPS separating out intra-band inter-frequency DAPS and interband DAPS makes sense to me and also prioritizing async tests if the UE supports both but I just wanted to say that it is different from CA. Ericsson is not against that but we may need to be careful that it is implemented correctly by RAN5. |
| Qualcomm | Option1 is supported to distinguish sync v.s. async for various scenarios. |
| NEC | option 1 is ok for us. |

**Issue 2-2: DAPS handover test procedure**

* Proposals from R4-2015465
* Before the start of T1, the UE is connected to the source cell and not aware of the target cell. During T1, the UE does not have any timing information of the target cell.
* Starting T2, the target cell becomes detectable. Gap pattern shall be configured for inter-frequency target cell. During T2, the UE performs cell detection and measurements on the target cell and shall send event report to the network. After receiving the event report, the network send a RRC message implying DAPS handover to the UE.
* The start of T3 is the instant when the last TTI containing DAPS handover command is sent to the UE. During T3, the handover delay Dhandover1 and the interruption time Tinterrupt1 for target cell addition need to be verified. After successful RACH procedure of the target cell, the network send a RRC message implying source cell release to the UE.
* The start of T4 is the instant when the last TTI containing source cell release command is sent to the UE. During T4, the handover delay Dhandover2 and the interruption time Tinterrupt2 for source cell release need to be verified.
* Starting T5, the UE stops to send CSI report to the source cell.
* Recommended WF
	+ All DAPS HO CRs use 5 time periods. It is recommended to provide comments on each time period above (content in CR from companies are similar. Here discussion paper R4-2015465 is used as baseline, since it is the only one discussion paper in this meeting).

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| **Company** | **Comments** |
| Apple | It is better to clarify that UE is not expected to receive/transmit from/to the two cells on the same slot, as reflected in CRs from Intel and Qualcomm. E.g. “during T3, DL schedule and UL feedback to cell 1 shall be avoided when UE is required to perform DL reception or UL transmission in PRACH procedure in cell 2, except preamble transmission.” |
| Qualcomm | We prefer to directly comment on individual CRs for expectation on the 5 time periods.  |

**Issue 2-3: CHO test case**

* Recommended WF
	+ Since there is only one CR to introduce all CHO test cases, companies are encouraged to provide comments directly on the CR

### 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.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| **[R4-2014223](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014223.zip)**Apple | Intel: for the testing applicability, it is better to include in the same clause as that of DAPS TC. A3.x is usually for the testing configuration itself.Apple: to Intel, we are fine to move it to DAPS TC clause if it is preferred by majority. However, we would like to mention that test applicability is usually captured in A.3.X. In Intel CR (R4-2014580) test applicability is also introduced in A.3.X |
|  |  |
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| **[R4-2014580](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014580.zip)**Intel | Huawei:The testing applicability part is overlapped with CR [R4-2014223].The test procedure need to be updated based on the discussion on issue 2-2.For test parameters, gap pattern need to be configured for UE identifying inter-frequency cells. |
|  | Apple: test applicability part can be merged into R4-2014223 if agreeable. Agree with Huawei that gap is needed for inter-frequency case. |
|  |  |
| **[R4-2015169](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015169.zip)**Ericsson | MediaTek:Our values for CHO test case are provided as follows. However, some values are different from Ericsson’s CR. Thus, we kindly want to know how to get those value in the CR and we suggest that the detailed calculations could also provide in CR.

|  |  |  |
| --- | --- | --- |
|   | calculation | Tinterrupt = Tprocessing + TIU + T∆ + Tmargin ms |
| Intra-frequency CHO FR1-FR1 | 800 (Tmeasure)+62 (Tinterrupt)+10 (TCHO\_execution) = 872 | 62 ms |
| Inter-frequency CHO FR1-FR1 | 920 (Tmeasure)+62 (Tinterrupt)+10 (TCHO\_execution) = 992 | 62 ms |
| Intra-frequency CHO FR2-FR2 | 800 (TPSS/SSS\_sync\_intra)+800 (T SSB\_measurement\_period\_intra)+62 (Tinterrupt)+10 (TCHO\_execution) = 1672 (PC1)600 (TPSS/SSS\_sync\_intra)+480 (T SSB\_measurement\_period\_intra)+62 (Tinterrupt)+10 (TCHO\_execution)=1152 (PC2/3/4) | 62 ms |
| Inter-frequency CHO FR2-FR2 | 2560 (TPSS/SSS\_sync\_inter) +1600 (TSSB\_time\_index\_inter) +2560 (T SSB\_measurement\_period\_inter) + 62(Tinterrupt)+10 (TCHO\_execution)=6792(PC1)1600(TPSS/SSS\_sync\_inter) +960(TSSB\_time\_index\_inter) +1600(T SSB\_measurement\_period\_inter) +62(Tinterrupt)+10 (TCHO\_execution)=4232(PC2/3/4)  | 62 ms |

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| **[R4-2015466](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015466.zip)**Huawei | Apple: It is better to clarify that UE is not expected to receive/transmit from/to the two cells on the same slot, as reflected in CRs from Intel and Qualcomm. E.g. “during T3, DL schedule and UL feedback to cell 1 shall be avoided when UE is required to perform DL reception or UL transmission in PRACH procedure in cell 2, except preamble transmission.”Qualcomm: Agree with Apple. |
|  |  |
|  |  |
| **[R4-2016555](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016555.zip)**Qualcomm | Huawei: The test procedure need to be updated based on the discussion on issue 2-2.The value of time period T4 shall be configured as Dhandover2 (= 10ms + Tinterrupt2).The value of Dhandover1 shall be 72ms for intra-frequency DAPS HO with known target cell.Qualcomm: We can update the time of Dhandover2 accordingly. |
|  |  |
|  |  |

## 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.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Issue 2-1** | **Issue 2-1: Test applicability for DAPS handover***Tentative agreements:** RAN4 to further split test applicability for DAPS handover to cover intra-frequency, intra-band inter-frequency and inter-band inter-frequency respectively
	+ To verify intra-frequency DAPS handover requirements
		- The UE capable of intra-frequency asynchronous DAPS handover on any band needs to be tested only in asynchronous scenario.
		- The UE not capable of intra-frequency asynchronous DAPS handover on any band but capable of synchronous DAPS handover on some band needs to be tested only in synchronous scenario.
	+ To verify intra-band inter-frequency DAPS handover requirements
		- The UE capable of intra-band inter-frequency asynchronous DAPS handover on any band needs to be tested only in asynchronous scenario.
		- The UE not capable of intra-band inter-frequency asynchronous DAPS handover on any band but capable of intra-band inter-frequency synchronous DAPS handover on some band needs to be tested only in synchronous scenario.
	+ To verify inter-band inter-frequency DAPS handover requirements
		- The UE capable of inter-band inter-frequency asynchronous DAPS handover on any band combination needs to be tested only in asynchronous scenario.
		- The UE not capable of inter-band inter-frequency asynchronous DAPS handover on any band combination but capable of inter-band inter-frequency synchronous DAPS handover on some band combination needs to be tested only in synchronous scenario.

*Candidate options:**Recommendations for 2nd round:* |
| **Issue 2-2** | **Issue 2-2: DAPS handover test procedure***Tentative agreements: N/A**Recommendations for 2nd round: companies are encouraged to provide comments directly on the CRs.* |

*Suggestion on WF/LS assignment*

|  |  |  |  |
| --- | --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** | **Comment** |
| #1 | N/A | N/A | Agreements in topic #1 and #2 can be captured in one single WF. |

### CRs/TPs

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

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| [**R4-2014223**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014223.zip)Apple | *To be agreed* |
| [**R4-2014580**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014580.zip)Intel | *To be revised* |
| [**R4-2015169**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015169.zip)Ericsson | *To be revised* |
| [**R4-2015466**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015466.zip)Huawei | *To be revised* |
| [**R4-2016555**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016555.zip)Qualcomm | *To be revised* |

## Discussion on 2nd round

Since remaining issues in performance part are all about detailed test case design and RAN4 is close to consensus, companies are encouraged to focus on discussion on individual CR.

## 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*

|  |  |
| --- | --- |
| **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”* |