**3GPP TSG-RAN WG4 Meeting # 97-e R4-200XXXX**

**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

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| **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 handover  Summary 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 requirements  Summary 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 requirements  Summary of change:   1. To correct Notes 2/3 in Table 6.1.3.2-1. 2. To correct some editorial changes. |
| [**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 requirement  Summary 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 |  |

**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 |  |

**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. |

* Recommended WF
  + Need more discussion.

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

**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 |  |

### 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 |  |
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| [**R4-2015168**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015168.zip)  Ericsson |  |
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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** |
| **Sub-topic#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”* |

# 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 applicability  Proposal 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.** |
| [**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

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

**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** |
| XXX |  |

**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

R4-2015169

### 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** |
| [**R4-2014223**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014223.zip)  Apple |  |
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| [**R4-2014580**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014580.zip)  Intel |  |
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| [**R4-2015169**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015169.zip)  Ericsson |  |
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| [**R4-2015466**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015466.zip)  Huawei |  |
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| [**R4-2016555**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016555.zip)  Qualcomm |  |
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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** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

*Suggestion 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 provided recommendation on CRs/TPs Status update suggestion*

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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”* |