**3GPP TSG-RAN WG4 Meeting #94-e R4-2002173**

**Electronic Meeting, Feb.24th – Mar.6th 2020**

**Agenda item:** 8.3

**Source:** Intel Corporation

**Title:** Email discussion summary for RAN4#94e\_#50\_NR\_Mob\_enh\_RRM

**Document for:** Information

# Introduction

This email discussion is to address the open issues in NR mobility enhancement RRM, based on the approved WF in RAN4#93 (R4-1913436) and the status report in RP#86 (RP-192533):

* Interruption in DAPS HO D1 to down select from option 1 and option 2 in slide 2 (R4-1913436).
* Power imbalance between the source and target cells in DAPS intra-frequency HO side condition.
* TRRC\_2 in conditional handover.
* Conditional PSCell change RRM requirement.

# Topic #1: DAPS handover

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000375 | Intel | **Proposal 1: interruption for DAPS handover in Delay (1) is defined as:**

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length X (slotsnote 1) |
| **0** | **1** | **[1]** |
| **1** | **0.5** | **[1]** |
| **2** | **0.25 Note 2** | **[2]** |
| **Note 1: The same SCS of source cell and target cell is assumed.****Note 2: Both source cell and target cell is on FR1.** |

**Observation 1: small A3 offset (e.g. -1dB~1dB) can benefit the intra-frequency DAPS handover.****Proposal 2: add the following side condition in RRM requirement for intra-frequency DAPS handover: power imbalance between the two cells should be within [3] dB.** |
| R4-2000723 | Qualcomm | **Observation 1. In intra-frequency DAPS HO upon adding target cell, UE needs to perform basic tasks that cause interruptions and are not dependent on the SCS. Some of these tasks are as following:*** **Activating another baseband module for the target cell**
* **Adjust UE processing resources and power (e.g., clocks, memory) to reflect the increased processing demand due to target cell addition**
* **Enabling streaming of RF samples (from the same or different RF module depending on UE implementation) to the newly activated baseband module**

**Proposal 1. RAN4 to adopt option 1 for interruption time in D1 for intra-frequency DAPS HO.** **Proposal 2. RAN4 to define requirements for intra-frequency DAPS HO assuming at most 8 dB power imbalance between source and target cells.****Proposal 3. RAN4 to not define requirements for the case when CBW relationship between source and target cells are different from BWP relationship between source and target cells.** |
| R4-2001413 | Ericsson | **Proposal 1 : To support cases where the relationship of CBW of target and source cell is different to different the relationship between BWP of target and source cell, generic interruption requirements are necessary. An interruption is allowed both when the target cell is added, and the source cell is released. This allows the UE always to have its RF configured to receive CBW.****Proposal 2 : RAN4 should discuss if P1 is strictly necessary****Proposal 3 : The interruption for intra-frequency DAPS handover is specified as:**

|  |  |  |
| --- | --- | --- |
|  | **NR Slot length (ms)** | **Interruption length X (slotsnote 1)** |
| **0** | **1** | **[1]** |
| **1** | **0.5** | **[1]** |
| **2** | **0.25 Note 2** | **[2]** |
| **Note 1: The same SCS of source cell and target cell is assumed.****Note 2: Both source cell and target cell are on FR1.** |

**Proposal 4: power imbalance between the two cells should be within [6] dB.** |
| R4-2001571 | Huawei | **Proposal 1: During DAPS HO delay (1), it is suggested to use option 2 to define the interruption time Tinterrupt1.****Proposal 2: For intra-band inter-frequency DAPS HO, it is suggested to clarify that the BWP of target cell is non-overlapped with the BWP of source cell in frequency domain.****Proposal 3: Both FR1-FR2 and FR2-FR1 DAPS handover requirements need to be standardized.** |
| R4-2001797 | MTK | **Observation 1: In Rel-15 it is RAN4 consensus that adjusting RF bandwidth based on CBW or BWP is the UE’s implementation issue.****Observation 2: Key factor that determines the UE RF bandwidth adjustment during Delay (1) is whether the target bandwidth is confined within the source bandwidth. The bandwidth can be either CBW or BWP, depending on UE implementation.****Observation 3: Key factor that determines the UE RF bandwidth adjustment during Delay (2) is whether the source bandwidth is confined within the target bandwidth. The bandwidth can be either CBW or BWP, depending on UE implementation.**And we propose:**Proposal 1: RAN4 to use 1ms as the interruption length of intra-frequency DAPS handover during Delay (1) even if UE does not adjust its RF bandwidth****Proposal 2: RAN4 to decide the power imbalance between source cell and target cell for DAPS handover in the performance part discussion****Proposal 3: RF retuning time during Delay (1) is needed if either one of the following condition is true*** **CBWtarget is NOT confined within CBWsource**
* **BWPtarget is NOT confined within BWPsource.**

**Similarly, the RF retuning time during Delay (2) is needed if either one of the following condition is true*** **CBWsource is NOT confined within CBWtarget**
* **BWPsource is NOT confined within BWPtarget.**
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## Open issues summary

**Issue 1-1: Interruption in intra-frequency DAPS HO D1**

* Proposals
	+ Option 1: (Intel, Ericsson, Huawei)

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| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length X (slotsnote 1) |
| 0 | 1 | [1] |
| 1 | 0.5 | [1] |
| 2 | 0.25 Note 2 | [2] |
| Note 1: The same SCS of source cell and target cell is assumed.Note 2: Both source cell and target cell is on FR1. |

* + Option 2: (Qualcomm, MTK)

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length X (slotsnote 1) |
| 0 | 1 | [1] |
| 1 | 0.5 | [2] |
| 2 | 0.25 Note 2 | [4] |
| Note 1: The same SCS of source cell and target cell is assumed.Note 2: Both source cell and target cell is on FR1. |

* Recommended WF
	+ Need more discussion

**Issue 1-2: Power imbalance in side condition**

* Proposals
	+ Option 1: [3dB] (Intel)
	+ Option 2: [8dB] (Qualcomm)
	+ Option 3: [6dB] (Ericsson)
	+ Option 4: decided only in test case (MTK)
* Recommended WF
	+ Need more discussion

**Issue 1-3: When CBW relationship is different from that of BWP**

* Proposals
	+ Option 1: no requirements (Qualcomm)
	+ Option 2: An interruption is allowed both when the target cell is added, and the source cell is released. (Ericsson)
	+ Option 2A: (MTK)
		- RF retuning time during Delay (1) is needed if either one of the following condition is true
			* CBWtarget is NOT confined within CBWsource
			* BWPtarget is NOT confined within BWPsource.
		- RF retuning time during Delay (2) is needed if either one of the following condition is true
			* CBWsource is NOT confined within CBWtarget
			* BWPsource is NOT confined within BWPtarget.
* Recommended WF
	+ Need more discussion

**Issue 1-4: Restriction on BWP for inter-frequency DAPS HO:**

* Proposals
	+ Option 1: For inter-frequency DAPS HO, it is suggested to clarify that the BWP of target cell is non-overlapped with the BWP of source cell in frequency domain. (Huawei)
* Recommended WF
	+ Need more discussion

**Issue 1-5: Requirement for inter-FR DAPS HO:**

* Proposals
	+ Both FR1-FR2 and FR2-FR1 DAPS handover requirements need to be standardized. (Huawei)
* Recommended WF: agree to introduce both FR1-FR2 and FR2-FR1 DAPS handover requirements

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Issue 1-1: We think that 500uS should be sufficient for intra-frequency DAPS interruption in D1. For 15kHz SCS this needs to be rounded up to one slot (option 1).Issue 1-2: We think it may be beneficial to have further discussion on what the imbalance actually means. The main purpose of DAPS handover is to improve handover robustness, since the UE maintains connection to both source and target cell. In the short-medium term, either source or target may be subject to deep fading and we would expect that the DAPS connection is maintained. From this perspective imbalance may be large, at least temporarily. On the other hand, reading contributions it seems that other companies understand imbalance as a requirement, eg a power window when the UE receives successfully from both cells with a certain MCS.We certainly don’t want to see a limitation that DAPS HO can’t be used when the short term imbalance is relatively large. The tehnically endorsed CR from Reno has this TBD as a side condition of the interruption requirement, from which we have assumed that this means the imbalance needs to be satisfied over the whole interrupt duration, although it is still not clear what sort of average period it applies over. But anyway the point is we did not assume that it means that both links can be used in this condition.At any rate, we think more clarity is needed on what “imbalance” really means in a DAPS HO before discussing the options.Issue 1-3: All 3 options are feasible ways of addressing the issue We agree with Qualcomm that it is an unusual scenario where the target CBW>source CBW but target BWP<=source BWP. That means that option 1 may be preferable to our option 2 where an interrupt would be allowed at each D2 even though it is typically not needed. Option 2A is also complicating the spec quite significantly for a scenario that is not common. So we can support option 1 even though option 2 was our proposal.Issue 1-4: The issue is new, but the proposed solution seems valid.Issue 1-5: We agree DAPS HO between FR1-FR2 and FR2-FR1 should be feasible since only the FR2 link needs beamforming.….Others: |
| Intel | Issue 1-2: during DAPS handover UE needs to perform downlink reception from both source and target cell. Assuming 3dB power imbalance, UE will observe -3dB for one of these two cells. Although cell search and RRM measurement performance can be guaranteed under -6dB, PDSCH demodulation performance is quite different, which can hardly be guaranteed under such low SNR even for low MCS. Note that in real practice there are other neighbor cells which will also cause interference to the UE. Thus the actual SINR is likely to be even lower than -3dB.Issue 1-3: support option 1. Technically interruption should be allowed if there is CBW change, considering all kinds of UE implementation. However, we prefer to focus on the very common case, where CBW is not changed during the procedure. On the other hand, if target cell wants to configure different CBW for the UE, it can be done via RRC reconfiguration alone with source cell release (anyway target cell needs to release source cell via RRC).Issue 1-5: support proposals from Huawei.  |
| Nokia | Issue 1-1: Depends on the assumptions but if it is assumed that BW is the same the we would expect this could be done at least with same delay as BWP switch delay, Type-1.Issue 1-2: As in HO reporting the event reporting is often triggered at 3dB difference and hence it is expected that the UE should be able to handle even larger power imbalance. Hence, we would expect it to be higher than 3dB. We do not believe core requirements are set by test cases.Issue 1-3: We can accept Option 2.Issue 1-4: This is likely an acceptable approach. Is this limitation due to CA?Issue 1-5: Is this supported in RAN2? |
| Qualcomm | Issue 1-1: The actions that cause interruption when target cell is added, as described in our paper, is not dependent on SCS. The interruption time cannot be made smaller with larger SCS. We cannot agree to option 1. There is a distinction between interruption in this case and BWP switch delay; UE has to support simultaneous connectivity and enabled dual baseband processing. Issue 1-2: Our understanding from RAN4#93 meeting was that the power imbalance limit is specified as a side condition for applicability of interruption requirements, i.e., if the power imbalance exceeds the specified limit, UE is allowed more interruption. It should not be interpreted that DAPS HO would not work if power imbalance exceeds X dB. Some of the comments above suggest that limiting power imbalance is to ensure UE can decode PDSCH from both source and target links. If that is the intention, we really don’t see why this would be any different from power imbalance in intra-band CA (i.e., 6 dB). Also, as mentioned above, it is hard to guarantee that short term fading does not violate the X dB limit. In that case, what should the expected UE behavior be?Issue 1-4: we can agree to Huawei’s proposal. Issue 1-5: We don’t see a strong justification for enhanced mobility features in FR2 PCell and prefer to not specify inter-FR in R16. Moreover, the interruption values may have to be revisited. |
| Huawei | Issue 1-1:We propose that 0.5ms is sufficient for UE applying the BB parameter of target cell. Then, the interruption requirements can be defined as option 1.Issue 1-2:The definition of Tsearch for legacy handover is reused for DAPS handover. The value of Tsearch for unknown cell is defined under the condition of target cell Es/Iot≥[-2] dB. The power imbalance between source and target shall not be too large. We are fine to agree on option 1.Issue 1-3:We can agree on option 1.During D1, an interruption to source cell is only allowed for adding target cell. However, UE is still connected with source cell and may receive BWP switching indication. If UE perform BWP switching for source cell, there would cause the interruption.It is assumed that UE performs SSB based cell search and fine time tracking for target cell, hence, SSB shall be within target cell BWP indicated by DAPS HO command. Otherwise, UE need gaps to perform cell search and fine time tracking for target cell, which would also cause interruption to source cell. SSB is within initial BWP. Then initial BWP need to be included in target cell BWP for DAPS HO.We propose to capture the following conditions for the current DAPS handover requirements.- UE does not receive any BWP switching indication during whole DAPS HO procedure.- The target cell BWP indicated by DAPS HO command contains initial BWP.Issue 1-5:In RAN4, the feasibility of inter-FR DAPS handover has been confirmed in RAN4#91 meeting, and an LS was also sent to inform RAN1 and RAN2 the agreements. Currently, DAPS HO for FR1 to FR2 and FR2 to FR1 has not been excluded in both RAN1 and RAN2. We propose to define both FR1 to FR2 and FR2 to FR1 DAPS HO requirement. The inter-FR HO is also a kind of inter-band HO. The existing interruption requirements due to PSCell/SCell addition/release can be reused. |
| MediaTek | **Issue 1-1: Interruption in intra-frequency DAPS HO D1**[MTK]: Support option 2 to allow UE to re-allocate some baseband and RF chain resources. Here, we assume that UE does not need to conduct any RF-retuning in D1. **Issue 1-2: Power imbalance in side condition**[MTK]: Our understanding is that limiting power imbalance is to ensure UE can decode PDSCH from both source and target cells. Considering that power imbalance in intra-band CA (i.e., 6 dB) is determined in performance part, so we suggest to specify it only in test case. If the interpretation is “UE is allowed more interruption when power imbalance exceeds the specified limit,” we wonder what is the expected UE behavior when power imbalance exceeds the specified limit? Will we define a longer interruption time for this case? As mentioned, it is hard to guarantee that short term fading does not violate the X dB limit. From UE perspective, it seems that UE no matter what needs a longer interruption time. We believe that the intention to specify a particular interruption time for UE is to test the UE performance in particular scenario, based on the assumption that some ideal conditions are met. So we believe it will be more appropriate to determine the power imbalance value when we discuss the parameter setting in performance part. We don’t have to discuss whether the short term fading will violate the X dB limit or not, because we can assume that the testing environment is very ideal.**Issue 1-3: When CBW relationship is different from that of BWP**[MTK]: We prefer to clarify the definitions of intra-freq. DAPS handover and inter-freq. DAPS handover. In RRM measurement, the definitions of intra/inter-freq. measurement are:* Intra-freq. measurement: the centre frequency of the SSB of the serving cell indicated for measurement and the centre frequency of the SSB of the neighbour cell are the same, and the subcarrier spacing of the two SSBs are also the same
* Inter-freq. measurement: if it is not intra-freq. measurement.

However, RAN4 has never agreed on definitions of so-called intra-freq. DAPS handover and inter-freq. DAPS handover. **Issue 1-4: Restriction on BWP for inter-frequency DAPS HO:**[MTK]: We prefer to clarify the definitions of intra-freq. DAPS handover first. Then we can assert that as long as it is not intra-freq. DAPS handover, it is inter-freq. DAPS handover. |
| NEC | Issue 1-1: We support option 1Issue 1-2: We support option 4Issue 1-3: We are OK with 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** |
| R4-2000376 | Ericsson : Need to conclude discussion on imbalance and other open issues |
|  Qualcomm: we have brought a CR to LTE DAPS (R4-2001840) where most of the suggested corrections should also apply to NR DAPS. It would be good if those changes, if agreed, are also ported to NR spec. |
| xxx |
| R4-2001414 | Company A |
| Company B |
| xxx |
| R4-2001572 | Ericsson : There are TBDs and editors notes left remaining by this CR which we would prefer to see progress on during this meeting. |
|  Qualcomm: As mentioned above, we prefer not to add inter-FR scenarios. |
| Huawei: The TBDs can be updated based on the agreements in this meeting. |
| xxx |

## 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** | **Interruption in intra-frequency DAPS HO D1:***Tentative agreements:* *No agreement in the 1st round.**Candidate options:**o Option 1: 500us interruption, rounded up to number of slot. (Intel, Ericsson, Huawei, NEC)**o Option 2: 1ms interruption, rounded up to number of slot. (QC, MTK)**Recommendations for 2nd round: continue discussion.* |
| **Issue 1-2** | **Power imbalance in side condition***Tentative agreements:* *No agreement in the 1st round.**Candidate options:**o Option 1: [3dB] (Intel)**o Option 2: [8dB] (Qualcomm)**o Option 3: [6dB] (Ericsson)**o Option 4: decided only in test case (MTK, NEC)**Recommendations for 2nd round: continue discussion* |
| **Issue 1-3** | **When CBW relationship is different from that of BWP***Tentative agreements: no requirements for CBW relationship is different from that of BWP**Candidate options: N/A**Recommendations for 2nd round: N/A* |
| **Issue 1-4** | **Restriction on BWP for inter-frequency DAPS HO***Tentative agreements: For inter-frequency DAPS HO, the BWP of target cell is non-overlapped with the BWP of source cell in frequency domain.**Candidate options: N/A**Recommendations for 2nd round: clarify the definitions of intra-freq. DAPS handover first. Then we can assert that as long as it is not intra-freq. DAPS handover, it is inter-freq. DAPS handover.* |
| **Issue 1-5** | **Requirement for inter-FR DAPS HO***Tentative agreements: Both FR1-FR2 and FR2-FR1 DAPS handover requirements need to be standardized.**Candidate options: N/A**Recommendations for 2nd round: N/A* |

*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**  |
| R4-2001571 | *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: Conditional handover

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000377 | Intel | **Proposal 1: TRRC\_2 is [10ms], as long as TRRC\_1 + TRRC\_2 will not significantly exceed the total RRC processing delay in conventional handover.** |
| R4-2000724 | Qualcomm | **Observation 1. Many steps in TS 38.331 cannot be executed until the first condition specified in the conditional HO command is met since:*** **only in that instance of time the identity of the target cell is known**
* **UE can prematurely declare RLF if some of the steps are executed as it is possible that the conditions configured in CHO command are never met**

**Proposal 1. For both NR and LTE conditional HO, TCHO\_execution = 10ms.** |
| R4-2001337 | Nokia | 1. Remove *TCHO\_execution* from Dhandover for conditional handover.
2. Update the reference to inter-frequency section.
3. Measurement delay would need to be considered in the CHO measurement time.
4. Update sections 6.1.1.7,6.1.1.8 and 6.1.1.9
5. Refer from sections 6.1.1.7, 6.1.1.8 and 6.1.1.9 to the generic NR CHO requirements in section 6.1.1.6.
6. Agree on the text proposal.
 |
| R4-2001415 | Ericsson | **Proposal 1 : Trrc2 is specified as [5]ms****Observation 1: Conditional PSCell addition or release is not within the scope of release 16 mobility enhancements since it involves the MN****Proposal 2 : No additional requirements are needed for PSCell addition, release or change in 36.133** |
| R4-2001573 | Huawei | **Proposal 1: For conditional HO, the time period Tmeasure can be defined as:****Tmeasure= TEvent\_DU + Tmeasure\_delay****Where****TEvent\_DU is the delay uncertainty in waiting an event that will trigger a CHO after UE successfully decoding the RRC message including CHO execution conditions.****Tmeasure\_delay is the measurement delay between the event that will trigger a CHO and the point when the UE starts to execute CHO. Tmeasure\_delay is same as the measurement reporting delay defined in existing event triggered reporting requirements.****Proposal 2: The values of TRRC\_2 used in conditional HO delay requirements can be defined as 13ms.** |
| R4-2001798 | MTK | **Proposal 1: Reuse the existing processing time for RRC reconfiguration message to specify the required time of TRRC\_2.** |

## Open issues summary

**Issue 2-1: TRRC\_2/TCHO\_execution:**

* Proposals
	+ Option 1: [10ms] (Intel, Qualcomm, MTK)
	+ Option 2: [5ms] (Ericsson)
	+ Option 3: [13ms] (Huawei)
	+ Option 4: Remove *TCHO\_execution* from Dhandover for conditional handover (Nokia)
* Recommended WF
	+ Agree on option 1.

**Issue 2-2: Reformulate Tmeasure:**

* Proposals
	+ Option 1: (Huawei)

Tmeasure= TEvent\_DU + Tmeasure\_delay

Where:

* TEvent\_DU is the delay uncertainty in waiting an event that will trigger a CHO after UE successfully decoding the RRC message including CHO execution conditions.
* Tmeasure\_delay is the measurement delay between the event that will trigger a CHO and the point when the UE starts to execute CHO. Tmeasure\_delay is same as the measurement reporting delay defined in existing event triggered reporting requirements.
	+ Option 2: keep previous agreement
* Recommended WF
	+ Need more discussion

## Companies views’ collection for 1st round

### Open issues

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| --- | --- |
| **Company** | **Comments** |
| Ericsson | Issue 2-1: The recommended way forward to agree on option 1 is OK for us as a compromise. 10ms is very significantly shorter than the shortest NR measurement period (200ms) so the exact value is not extremely critical to system performance.Issue 2-2: The motivation to split Tmeasure isn’t really clear after reading R4-2001573. I also didn’t find a CR or TP related to this. It would be easier to agree or otherwise on splitting Tmeasure after seeing how the new definition is proposed to be used in the spec.….Others: |
| Intel | Issue 2-1: prefer option 1. Option 3 seems longer than legacy RRC processing delay, which is 10ms as defined in TS38.133.Issue 2-2: support option 1.  |
| Nokia | Issue 2-1: It seems Nokia’s proposal was missing – now added. The current delay is already very relaxed and hence we see this delay as being redundant or at most very short. For the sake of progress we can support Option 2.Issue 2-2: This is our understanding already captured in the current delay. Hence, we prefer option 2. |
| Qualcomm | Issue 2-1: we support option 1. We’d like to mention that this parameter is not just about the delay but it also specifies the beginning of the interruption window. Issue 2-2: We also don’t understand the motivation behind Huawei’s proposal. In our view, the description of TEvent\_DU hints at TTT but it was previously agreed in RAN4 that this would not be any different than event-triggered measurement reporting. |
| Huawei | Issue 2-1:We are fine to define Trrc2 as the legacy RRC processing delay. We can agree on option 1.Issue 2-2:Based on the endorsed CR in last meeting, Tmeasure only include two parts: TTT and the measurement delay. Tmeasure is defined as the time period between the end of Trrc1 and the start of Trrc2. However, during Tmeasure, there may exist a time period that target cell is neither detectable nor satisfying CHO condition, which is not included in current version.We suggest to use TEvent\_DU instead of TTT. TEvent\_DU includes TTT and the missing part. |
| MediaTek | **Issue 2-1: TRRC\_2/TCHO\_execution:**[MTK]: Support option 1. **Issue 2-2: Reformulate Tmeasure:**[MTK]: I remember that companies agree that TTT will always be set to zero when it goes to test cases.  |
| NEC | Issue 2-1: Support option 2. Issue 2-2: Support Option 2. |

### 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** |
| R4-2000378 | Ericsson : No major concern with CR |
|  Qualcomm: We brought a CR to make some corrections to LTE CHO (R4-2001839) and believe many of those, if agreed, can also be applicable and ported to NR version.  |
| Huawei: The definition of Tmeasure need to be revised. 2ms margin need to be added for fine time tracking. |
| xxx |
| R4-2001338 | Ericsson : Section 6.1.4.3.1 contains some references to 6.1.1.7.x which should I think be 6.1.4.3.x. In section 6.1.4.3.1 Tprocessing should be 40ms (FR2-FR2 HO)  |
|  Qualcomm: We brought a CR to make some corrections to LTE CHO (R4-2001839) and believe many of those, if agreed, can also be applicable and ported to NR version.  |
| xxx |
| R4-2001416 | Qualcomm: We brought a CR to make some corrections to LTE CHO (R4-2001839) and believe some of them, if agreed, can also be applicable and ported to NR version. |
| Company B |
| xxx |

## 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 2-1** | **TRRC\_2/TCHO\_execution***Tentative agreements:**TRRC\_2/TCHO\_execution is defined as [10ms]**Candidate options: TRRC\_2/TCHO\_execution is defined as [5ms], Ericsson and Nokia support this option. But Ericsson can compromise to the tentative agreement.**Recommendations for 2nd round: try to agree on tentative agreement. Otherwise continue discussion.* |
| **Issue 2-2** | **Reformulate Tmeasure*****to Tmeasure= TEvent\_DU + Tmeasure\_delay****Tentative agreements: no agreement in 1st round**Candidate options: keep previous agreed framework.**Recommendations for 2nd round: some companies think TEvent\_DU hints at TTT. However, Huawei clarify that there may exist a time period that target cell is neither detectable nor satisfying CHO condition, which is not included in the endorsed CR in RAN4#93. Companies are suggested to further elaborate their view based on CR R4-2001338. Check if the total handover delay is complete.* *Companies can also propose wording for the CR (e.g. upload to the same folder in FTP). It could be easier to proceed if companies can see the whole picture.*  |

*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**  |
| R4-2001338 | *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 #3: Conditional PSCell addition/change

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000379 | Intel | **Observation 1: RAN4 doesn’t need to define RRM requirement for conditional PSCell addition.****Proposal 1: conditional NR PSCell change RRM requirements are defined in TS38.133, covering both EN-DC and NR-DC.****Proposal 2: conditional PSCell change delay is defined as:****TCPC = TRRC\_1 + Tmeasure + TRRC\_2 + Tprocessing + Tsearch + T∆ + TPSCell\_ DU + 2 ms** |
| R4-2000725 | Qualcomm | **Proposal 1. RAN4 to capture NR PSCell addition/change requirements within EN-DC in TS 36.133 and NR PSCell addition/change requirements within NR-DC in TS 38.133.** **Proposal 2. Conditional PSCell addition delay is formulated as:****Tconfig\_PSCell\_Conditional = TRRC\_processing + Tmeasure + TUE\_preparation + Tprocessing + T∆ + TPSCell\_ DU + 2 ms****Where** **TRRC\_processing : is the RRC processing to process the conditional PSCell addition command which is not larger than currently defined TRRC\_processing in TS 36.133 and TS 38.133 and begins when UE receives the RRC command for conditional PSCell addition.****Tmeasure : is the from the end of RRC processing time to when until UE realizes the condition(s) for at least one of the PSCell candidates is/are met. When PCell is E-UTRA, the measurement period is bounded by Tidentify\_NR\_with\_index as defined in clause 8.17.4 of TS 36.133. When PCell lis NR, the measurement period is bounded by Tidentify\_inter\_with\_index as defined in clause 9.3.4 of TS 38.133.****TUE\_preparation : is the UE preparation time for conditional PSCell addition and starts after UE realizes the condition is met and identity of PSCell is determined. Its value is FFS but not larger than currently defined TRRC\_processing in TS 36.133 and TS 38.133.****T∆ : is the time for fine time tracking and acquiring full timing information of the target PSCell as in existing requirements.** **Tprocessing : is the SW processing time needed by UE as in existing requirements****TPSCell\_ DU : is the delay uncertainty in acquiring first available PRACH occasion in the NR PSCell as in existing requirements.** **Proposal 3. The conditional PSCell change delay requirements can be formulated as below:****Tconfig\_PSCell\_Conditional = TRRC\_processing + Tmeasure + TUE\_preparation + Tprocessing + T∆ + TPSCell\_ DU + 2 ms****Where** **Tmeasure : is the from the end of RRC processing time to when until UE realizes the condition(s) for at least one of the PSCell candidates is/are met. For intra-frequency PSCell change, the measurement period is bounded by Tidentify\_intra\_with\_index as defined in clause 9.2.4 of TS 38.133. For inter-frequency PSCell change, the measurement period is bounded by Tidentify\_inter\_with\_index as defined in clause 9.3.4 of TS 38.133.****TUE\_preparation : is the UE preparation time for conditional PSCell change and starts after UE realizes the condition is met and identity of new PSCell is determined. Its value is FFS and it may include some RRC processing related to release of the existing PSCell.** **All the other terms in the above formula are similar to those in Proposal 2.**  |
| R4-2001574 | Huawei | **Proposal 1: The conditional PSCell addition/change delay can be defined a**s **Tconfig\_CPAC:****Tconfig\_CPAC = TRRC\_1 + Tmeasure + TRRC\_2 + Tprocessing + T∆ + TPSCell\_ DU + 2 ms****Where****TRRC\_1 is the RRC processing time for RRC reconfiguration message containing conditional PSCells addition execution conditions and candidate PSCell configuration.****Tmeasure is the time period from the time when UE successfully decoded CPAC RRC command until UE detects an event for CPAC.****TRRC\_2 is the RRC processing time for applying target PSCell configuration.****Tprocessing, T∆ and TPSCell\_ DU are defined same as legacy PSCell addition/change.****Proposal 2: The interruption at conditional PSCell addition/change shall be allowed only after UE detects an event for CPAC.** |
| R4-2001415 | Ericsson | **Proposal 1 : Trrc2 is specified as [5]ms****Observation 1: Conditional PSCell addition or release is not within the scope of release 16 mobility enhancements since it involves the MN****Proposal 2 : No additional requirements are needed for PSCell addition, release or change in 36.133** |

## Open issues summary

**Issue 3-1: Conditional PSCell addition/release:**

* Proposals
	+ Option 1: no requirement is needed in this work item (Intel, Ericsson)
	+ Option 2: RAN4 to capture NR PSCell addition requirements within EN-DC in TS 36.133 and NR PSCell addition requirements within NR-DC in TS 38.133 (Qualcomm)
* Recommended WF
	+ Requirements for conditional PSCell addition/release are not needed in this work item.

**Issue 3-2: Where to capture conditional PSCell change**

* Proposals
	+ Option 1: capture in TS38.133 only (Intel, Ericsson)
	+ Option 2: capture in both TS 36.133 and TS 38.133 (Qualcomm)
* Recommended WF
	+ Capture in TS38.133 only

**Issue 3-3: Conditional PSCell change delay:**

* Proposals
	+ Option 1: (Qualcomm, Intel, Huawei)

Tconfig\_PSCell\_Conditional = TRRC\_processing + Tmeasure + TUE\_preparation + Tprocessing + T∆ + TPSCell\_ DU + 2 ms

Where

**TRRC\_processing**: is the RRC processing to process the conditional PSCell addition command which is not larger than currently defined TRRC\_processing in TS 36.133 and TS 38.133 and begins when UE receives the RRC command for conditional PSCell change.

**Tmeasure**: is the from the end of RRC processing time to when until UE realizes the condition(s) for at least one of the PSCell candidates is/are met. For intra-frequency PSCell change, the measurement period is bounded by Tidentify\_intra\_with\_index as defined in clause 9.2.4 of TS 38.133. For inter-frequency PSCell change, the measurement period is bounded by Tidentify\_inter\_with\_index as defined in clause 9.3.4 of TS 38.133.

**TUE\_preparation**: is the UE preparation time for conditional PSCell change and starts after UE realizes the condition is met and identity of new PSCell is determined. Its value is FFS and it may include some RRC processing related to release of the existing PSCell.

**T∆:** is the time for fine time tracking and acquiring full timing information of the target PSCell as in existing requirements.

**Tprocessing:** is the SW processing time needed by UE as in existing requirements

**TPSCell\_ DU:** is the delay uncertainty in acquiring first available PRACH occasion in the NR PSCell as in existing requirements.

* Recommended WF
	+ Agree on option 1.

**Issue 3-4: Interruption during conditional PSCell change:**

* Proposals
	+ Option 1: The interruption at conditional PSCell addition/change shall be allowed only after UE detects an event for CPAC. (Huawei)
* Recommended WF
	+ Agree on option 1.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Issue 3-1: We support the recommended WF since conditional PS addition/removal would involve MN. Issue 3-2: This is linked to issue 3-1. As there are no PSCell change requirements in 36.133, there is also no need for conditional PSCell change requirements in 36.133 so we agree with the recommended way forward.Issue 3-3 : Formula seems OK.Issue 3-4 : Agree, UE should not start executing conditional HO, nor interrupt….Others: |
| Intel | Issue 3-1: conditional PSCell addition is not likely to be supported in this work item.Issue 3-2: there is even no PSCell change requirement is TS36.133. thus to align with existing spec, we propose to only define conditional PSCell change requirement in TS38.133. |
| Nokia | Issue 3-1: Support WF as this is according to RAN2 agreement.Issue 3-2: This would depend on what RAN2 has agreed. We support covering UE requirements for the cases supported by RAN2Issue 3-3: Would need more discussion. We do not see why Tmeasure is bounded as described. And ‘All the other terms in the above formula are similar to those in Proposal 2’ is unclear.Issue 3-4: We understand the intention of the option1, but it would still need to be discussed more detailed where the interruption would be. |
| Qualcomm | Issue 3-1: We agree to the WF.Issue 3-2: We agree to the WF.Issue 3-3: We’d like to note that as agreed in CHO, Tsearch = 0 Issue 3-4: Agreed. |
| Huawei | Issue 3-1:We can agree on option 1Issue 3-2:We can agree on option 1Issue 3-3:We can agree on option 1.The definition of Tmeasure need to be align with CHO. |
| MediaTek | **Issue 3-1: Conditional PSCell addition/release:**[MTK]: Agree on recommended WF**Issue 3-2: Where to capture conditional PSCell change**[MTK]: Agree on recommended WF**Issue 3-3: Conditional PSCell change delay:**[MTK]: Agree on recommended WF |

### 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** |
| R4-2000380 | Company A |
| Company B |
| xxx |

## 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 3-1** | **Conditional PSCell addition/release***Tentative agreements:* *Requirements for conditional PSCell addition/release are not needed in this work item.**Candidate options: N/A**Recommendations for 2nd round: N/A* |
| **Issue 3-2** | **Where to capture conditional PSCell change***Tentative agreements: conditional NR PSCell change requirement will only be introduced in TS38.133**Candidate options: N/A**Recommendations for 2nd round: N/A* |
| **Issue 3-3** | **Conditional PSCell change delay***Tentative agreements:**Tconfig\_PSCell\_Conditional = TRRC\_processing + Tmeasure + TUE\_preparation + Tprocessing + T∆ + TPSCell\_ DU + 2 ms**Where* ***TRRC\_processing****: is the RRC processing to process the conditional PSCell addition command which is not larger than currently defined TRRC\_processing in TS 36.133 and TS 38.133 and begins when UE receives the RRC command for conditional PSCell change.****Tmeasure****: [is the from the end of RRC processing time to when until UE realizes the condition(s) for at least one of the PSCell candidates is/are met. For intra-frequency PSCell change, the measurement period is bounded by Tidentify\_intra\_with\_index as defined in clause 9.2.4 of TS 38.133. For inter-frequency PSCell change, the measurement period is bounded by Tidentify\_inter\_with\_index as defined in clause 9.3.4 of TS 38.133.]****TUE\_preparation****: is the UE preparation time for conditional PSCell change and starts after UE realizes the condition is met and identity of new PSCell is determined. Its value is FFS and it may include some RRC processing related to release of the existing PSCell.* ***T∆:*** *is the time for fine time tracking and acquiring full timing information of the target PSCell as in existing requirements.****Tprocessing:*** *is the SW processing time needed by UE as in existing requirements****TPSCell\_ DU:*** *is the delay uncertainty in acquiring first available PRACH occasion in the NR PSCell as in existing requirements.**Candidate options: N/A**Recommendations for 2nd round: one company has concern on the bounded Tmeasure. Corresponding definition is put in square brackets. Companies are encouraged to continue discussion.* |
| **Issue 3-4** | **Interruption during conditional PSCell change***Tentative agreements: no agreement in 1st round**Candidate options: N/A**Recommendations for 2nd round:* *Most companies agree that:* ***The interruption at conditional PSCell addition/change shall be allowed only after UE detects an event for CPAC.*** *Nokia understands the intention but would like to have more discussion. It is appreciated if Nokia can elaborate more on where the interruption would be.* |

*Suggestion on WF/LS assignment*

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

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| R4-2000380 | *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*

|  |  |
| --- | --- |
| **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 #4: performance part

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2001417 | Ericsson | In this contribution we discuss and analyse necessary test coverage for NR and LTE mobility enhancements (DAPS handover and conditional handover). While it would be possible to specify a large number of tests for both procedures, we propose for DAPS testing to develop fairly generic tests which can cover most different UE capabilities. For `conditional handover, we propose to verify the measurement/handover procedure and to rely on existing event triggered reporting and PSCell addition/change tests under the assumption that conditional PSCell change will behave as expected. |

## Open issues summary

**Issue 4-1: test case list for DAPS handover:**

* Proposals
	+ Option 1: (Ericsson)

|  |  |  |
| --- | --- | --- |
| Test case number | Test purpose | Description |
| 1 | Intrafrequency DAPS handover test in SA for FR1 | See R4-201417 |
| 2 | Interfrequency DAPS handover test in SA for FR1 |
| 3 | Conditional intrafrequency handover test in SA for FR1 |
| 4 | Conditional interfrequency handover test in SA for FR1 |
| 5 | Intrafrequency DAPS handover test in SA for FR2 |
| 6 | Interfrequency DAPS handover test in SA for FR2 |
| 7 | Conditional intrafrequency handover test in SA for FR2 |
| 8 | Conditional interfrequency handover test in SA for FR2 |

* Recommended WF
	+ Postpone to RAN4#94bis.

**Issue 4-2: test case list for conditional handover:**

* Proposals
	+ Option 1: capture in TS38.133 only (Intel, Ericsson)

|  |  |  |
| --- | --- | --- |
| Test case number | Test purpose | Description |
| 1 | Intrafrequency DAPS handover test | See R4-201417 |
| 2 | Interfrequency DAPS handover test |
| 3 | Conditional intrafrequency handover test |
| 4 | Conditional interfrequency handover test |

* Recommended WF
	+ Postpone to RAN4#94bis.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | Issue 4-1: Baseline for further discussion in 94bisIssue 4-2: Baseline for further discussion in 94bis….Others: |

### 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** |
| xxxx | Company A |
| Company B |
| xxx |

## 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 4-1** | **Test case list for DAPS handover***Tentative agreements: belongs to performance part. Can be used as baseline for further discussion in RAN4#94bis**Candidate options: N/A**Recommendations for 2nd round: N/A* |
| **Issue 4-2** | **Test case list for conditional handover***Tentative agreements: belongs to performance part. Can be used as baseline for further discussion in RAN4#94bis**Candidate options: N/A**Recommendations for 2nd round: N/A* |

*Suggestion on WF/LS assignment*

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

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

|  |  |
| --- | --- |
| **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”* |