**3GPP TSG-RAN WG4 Meeting # 100-e R4-21xxxxx**

**Electronic Meeting, 16th – 27th August 2021**

**Agenda item:** 9.10.2.2

**Source:** Moderator (vivo)

**Title:** Email discussion summary for [100-e][221] NR\_RRM\_enh2\_2

**Document for:** Information

# Introduction

This email discussion summary covers topic HO with PSCell under agenda 9.10.2.2.

# Topic #1: HO with PSCell

*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** |
| [R4-2111928](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2111928.zip) | CATT | **Proposal 1: RAN4 work should following the WID, i.e. only to define RRM requirements of HO with PSCell for following scenarios:**   * **from NR SA to EN-DC** * **from EN-DC to EN-DC** * **from NE-DC to NE-DC** * **from NR-DC to NR-DC**   **Proposal 2: In Rel-17, RAN4 only considers:**   * **FR1+FR2 NR-DC for HO with PSCell from NR-DC to NR-DC** * **FR1+LTE NE-DC for HO with PSCell from NE-DC to NE-DC.**   **Proposal 3: Parallel processing shall always be assumed.**  **Proposal 4: PCell HO and PSCell addition are performed in parallel independently.**  **Proposal 5: The value of processing time of handover and the PSCell addition can be reused separately. Tprocessing for HO with PSCell will be the maximum of the processing time of handover and the processing time of the PSCell addition.**  **Proposal 6: The ending point of the delay requirement for HO with PSCell will be defined when UE to transmit the last PRACH preamble toward target PCell and PSCell.**  **Proposal 7: No optimisation, the UE’s behavior is same when the configured PSCell is same as the original one or not.**  **Proposal 8: The delay requirement will be defined as Delay = TRRC processing + max(Tinterrupt , Tconfig\_PSCell – TRRC\_delay).**  **Proposal 9: No interruption requirement should be defined during HO with PSCell.**  **Proposal 10: No need to discuss 2 step and 4 step RACH for HO with PSCell further.**  **Proposal 11: The NR-U scenario is out of scope of this WID, no need to discuss.** |
| [R4-2112125](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112125.zip) | Apple | **Proposal 1: RAN4 specifies RRM requirement for HO with PSCell for following scenarios:**   * **from NR SA to EN-DC** * **from EN-DC to EN-DC** * **from NE-DC to NE-DC** * **from NR-DC to NR-DC**   **Proposal 2: In R17 FeRRM, NR-DC and NE-DC mode in HO with PSCell are:**   * **FR1+FR2 NR-DC for HO with PSCell from NR-DC to NR-DC,** * **FR1+LTE NE-DC for HO with PSCell from NE-DC to NE-DC.**   **Proposal 3: RAN4 to recommend introducing full set of RRM requirements for FR1+FR1 NR-DC in R18 eFeRRM WI.**  **Proposal 4: In HO with PSCell for NR-DC to NR-DC, if SMTC of target unknown PSCell is configured in targetcellSMTC-SCG-r16, sequential processing shall be assumed; otherwise, parallel processing shall be assumed.**  **Proposal 5: In HO with PSCell for NR-DC to NR-DC, if SMTC of target unknown PSCell is not configured in either targetcellSMTC-SCG-r16 or reconfigurationWithSync,**   * **UE uses the SMTC in the MO having the same SSB frequency and subcarrier spacing as target PSCell if either source PCell or source PSCell configured this MO, or** * **UE uses the SMTC in the MO from source PCell if both source PCell and source PSCell configured MOs having the same SSB frequency and subcarrier spacing as target PSCell, or** * **UE assumes 5ms as SSB periodicity for target PSCell if neither source PCell nor source PSCell configured MOs having the same SSB frequency and subcarrier spacing as the target PSCell.**   **Proposal 6: In HO with PSCell for NR SA to EN-DC, if SMTC of target unknown PSCell is configured in targetcellSMTC-SCG-r16, sequential processing shall be assumed; otherwise, parallel processing shall be assumed.**  **Proposal 7: In HO with PSCell for NR SA to EN-DC, if SMTC of target unknown PSCell is not configured in either targetcellSMTC-SCG-r16 or reconfigurationWithSync,**   * **UE uses the SMTC in the MO having the same SSB frequency and subcarrier spacing as target PSCell, or** * **UE assumes 5ms as SSB periodicity for target PSCell if source PCell didn’t configure MO having the same SSB frequency and subcarrier spacing as the target PSCell.**   **Proposal 8: In HO with PSCell for EN-DC to EN-DC, parallel processing shall be assumed.**  **Proposal 9: In HO with PSCell for EN-DC to EN-DC, if SMTC of target unknown PSCell is not configured in RRCConnectionReconfiguration,**   * **UE uses the SMTC in the MO having the same SSB frequency and subcarrier spacing as target NR PSCell if either source LTE PCell or source NR PSCell configured this MO, or** * **UE uses the SMTC in the MO from source LTE PCell if both source LTE PCell and source NR PSCell configured MOs having the same SSB frequency and subcarrier spacing as target NR PSCell, or** * **UE assumes 5ms as SSB periodicity for target NR PSCell if neither source LTE PCell nor source NR PSCell configured MOs having the same SSB frequency and subcarrier spacing as the target NR PSCell.**   **Proposal 10: In HO with PSCell for NE-DC to NE-DC, parallel processing shall be assumed.**  **Proposal 11: RAN4 to define the requirements for both sequential processing and parallel processing cases.**  **Proposal 12: Regarding the parallel processing, PCell HO and PSCell addition, without considering RA procedures and Tprocessing, are performed in parallel independently.**  **Proposal 13:**  **For sequential processing for HO with PSCell, the total UE processing time for HO with PSCell is the sum of UE processing timing of HO and UE processing timing of PSCell addition.**  **For parallel processing for HO with PSCell, the total UE processing time for HO with PSCell could be the maximum one between UE processing timing of HO and UE processing timing of PSCell addition**  **Proposal 14: the UE processing time for HO with PSCell is:**   |  |  |  | | --- | --- | --- | | **UE processing margin (Tprocessing)** | **Target PCell and PSCell is in the same FR as old serving cell** | **Target PCell and/or target PSCell is in the different FR from old serving cell** | | **Sequential processing** | **40ms** | **60ms** | | **Parallel processing** | **20ms** | **40ms** |   **Proposal 15: the ending point of the delay requirement for HO with PSCell is:**   * **the later timing between “timing when UE shall be capable to transmit PRACH preamble towards target PCell” and “the timing when UE shall be capable to transmit PRACH preamble towards target PSCell” .**   **Proposal 16: For UE which is already configured with DC, the UE’s behaviour is same regardless of whether the configured PSCell is same as the original one or not.**  **Proposal 17: for requirement of HO with PSCell, RAN4 starts the discussion with 4 step RACH first and FFS on 2 step RACH.**  **Proposal 18: When UE is performing HO with PSCell,**   * **for FR1+FR1 EN-DC, an additional uncertainty delay due to PSCell RACH collision with PCell UL channels may be introduced if the PSCell RACH cannot be transmitted based on the criteria in TS38.213 section 7.6.1;** * **for FR1+FR1 NE-DC, an additional uncertainty delay due to PCell RACH collision with PSCell RACH may be introduced if the PCell RACH cannot be transmitted based on the criteria in TS38.213 section 7.6.2;** * **otherwise, if target PCell and target PSCell are on the different FRs for EN-DC or NR-DC, no need to consider RO collision issue.**   **Proposal 19: The NR-U scenario is out of scope of this R17 FeRRM WID, no need to discuss.**  **Proposal 20: Interruption in legacy handover delay requirement can be applied for Pcell. No interruption is defined on PSCell.**   * **If sequential processing is used for HO with PSCell, UE may have an interruption on new PCell due to the PSCell addition.** * **If parallel processing is used for HO with PSCell, no need to define interruption requirement.**   **Proposal 21:**   * If CSI-RS based CFRA is used for RACH on PSCell, the additional CSI-RS measurement and the CSI-RS to RO association period shall be considered. * The baseline requirement of PSCell addition and handover when CSI-RS based CFRA is used could be discussed in TEI16. |
| [R4-2112178](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112178.zip) | vivo | **Proposal 1 No more discussion on the new scenarios for HO with PSCell.**  **Proposal 2 For NR-DC and NE-DC mode in HO with PSCell, in R17 RAN4 considers FR1+FR2 NR-DC for HO with PSCell from NR-DC to NR-DC, and only considers FR1+LTE NE-DC for HO with PSCell from NE-DC to NE-DC.**  **Proposal 3: Take parallel processing for R17 HO with PSCell for all procedure including RACH, and for all configurations including the case that ‘targetcellSMTC-SCG-r16’ is configured.**  **Proposal 4 RF chain activation and retuning time needs to be further discussed in the timeline of HO with PSCell.**  **Proposal 5 RAN4 consider baseline for UE processing time as [30] ms for NRSA to ENDC, and the details can be further discussed. For other cases PSCell change requirement can be re-used.**  **Proposal 6 For the delay requirement, the ending point of handover with PSCell can be considered separately for PCell and PSCells.**  **Proposal 7 RAN4 assumes PCC could be scheduled for UE when PCell HO is completed but PSCell addition is not completed**  **Proposal 8 Even if PSCell is not changed during HO with PSCell, T∆ reduction seems not necessary, considering the multi-TRP deployment.**  **Proposal 9 RAN4 do not need to specify interruptions for handover with PSCell.**  **Proposal 10 RAN4 include both 2-step RA and 4-step RA into the new requirements made for handover with PSCell. No need to mention 2-step or 4-step in HO with PSCell requirements.** |
| [R4-2112419](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112419.zip) | Xiaomi | **Proposal 1: RAN4 does not specifies RRM requirement for the following additional scenarios for HO with PSCell in Rel-17.**   * **from NR SA to NE-DC** * **from NR SA to NR-DC** * **from LTE SA to EN-DC**   **Proposal 2: For NR-DC and NE-DC mode in HO with PSCell, RAN4 only consider to specify the RRM requirements for the following scenarios:**   * **FR1+FR2 NR-DC for HO with PSCell from NR-DC to NR-DC,** * **FR1+LTE NE-DC for HO with PSCell from NE-DC to NE-DC.**   **Proposal 3: The procedure of PCell HO and PSCell addition should be performed in parallel.**  **Proposal 4: The ending point of delay requirement for HO with PSCell is the later time between “the timing when UE shall be capable to transmit PRACH preamble towards target PCell” and “the timing when UE shall be capable to transmit PRACH preamble towards target PSCell”.**  **Proposal 5: the overall delay requirement for HO with PSCell is defined as TRRC\_delay + max(Tinterrupt, TSync\_PSCell), where,**   * **Tinterrupt is the interruption time for HO, which is defined in section 6.1 TS38.133;** * **TSync\_PSCell is the preparation time for synchronizing to target PSCell, which is defined in section 8.8 or 8.9 TS38.133.**   **Proposal 6: When the configured PSCell is the same as the original one or not, the requirements and UE’s behavior are the same.**  **Proposal 7: No interruption requirement should be defined for HO with PSCell.** |
| [R4-2112501](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112501.zip) | CMCC | **Observation 1: for the case of targetCellSMTC-SCG-r16 configured, the synchronization processing need to be performed in sequence, but the RACH processing can be performed in parallel.**  **Proposal 1: for the** **timeline for HO with PSCell, it is proposed that**   * **for the case that targetCellSMTC-SCG-r16 is configured, the timeline for HO with PSCell can be partially sequential**   + **RACH process can be performed in parallel, while other processing except RACH need to be performed in sequence.** * **For other cases except the configuration of targetCellSMTC-SCG-r16, parallel processing is assumed.**   **Observation 2: according to RAN2 reply LS, there is no restriction on the order on which the UE shall perform RACH towards the PCell and PSCell in handover with MR-DC configuration.**  **Proposal 2: we are OK with either of following options on the ending point of the delay requirement for HO with PSCell:**   * **Option 1:** **the ending point is the later timing between “timing when UE shall be capable to transmit PRACH preamble towards target Pcell” and “the timing when UE shall be capable to transmit PRACH preamble towards target PSCell”** * **Option 2: defining delay requirements for HO and PSCell addition/change separately with the ending points defined as Pcell PRACH and PSCell PRACH respectively**   **Proposal 3: delay for HO with PSCell is maximum (PSCell addition delay, HO delay)**   * **PSCell addition delay= TRRC\_delay + Tprocessing + Tsearch + T∆ + TPSCell\_ DU + 2 ms** * **HO delay = TRRC\_delay +Tinterrupt = TRRC\_delay +Tsearch + TIU + Tprocessing + T∆ + Tmargin ms** |
| [R4-2113139](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113139.zip) | Intel Corporation | **Proposal 1: Don’t consider FR1+FR1 NR-DC case for HO with PSCell from NR-DC to NR-DC in Rel-17.**  **Proposal 2: After RRC processing, parallel processing including RACH can be performed for PCell HO and PSCell addition.**  **Proposal 3: No requirement will be applied if targetcellSMTC-SCG-r16 is configured.**  **Proposal 4: Define delay requirements for HO and PSCell addition/change separately with the ending points defined as Pcell PRACH and PSCell PRACH respectively.**  **Proposal 5:** **The delay requirements for HO with PSCell can be described as:**  **THO\_PSCell= maximum (THO\_delay, Tconfig\_PSCell)**  **Proposal 6: Interruption in legacy handover delay requirement can still be applied for the PCell.** |
| [R4-2113202](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113202.zip) | ZTE Corporation | **Proposal 1: It is suggested to support parallel processing as baseline for HO with PSCell addition.**  **Proposal 2: Include both 2-step RA and 4-step RA into the new requirements made for handover with PSCell.** |
| [R4-2113276](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113276.zip) | OPPO | **Observation 1: RAN4 needs to consider whether or where to handle the baseline requirements of FR1+FR1 NR-DC for HO with PSCell from NR-DC to NR-DC.**  **Proposal 1: In R17 RAN4 only considers: FR1+FR2 NR-DC for HO with PSCell from NR-DC to NR-DC, FR1+LTE NE-DC for HO with PSCell from NE-DC to NE-DC.**  **Proposal 2: PCell HO and PSCell addition, without considering RA procedures and Tprocessing, are performed in parallel independently.**  **Proposal 3: Sequential RACH processing should be considered for minimum RRM requirements of HO with PSCell.**  **Proposal 4: For the case NR SA to EN-DC, we agree to extend the UE processing time to [30]ms assuming sequential UE processing timing of HO and PSCell addition.**  **For the case EN-DC to EN-DC, and NR-DC to NR-DC, the UE processing time to be [30]ms within the same FR of target PCell and PSCell; otherwise, otherwise the UE processing time shall be [50]ms as the legacy PSCell change requirement.**  **Proposal 5: The ending point of the delay requirements for HO with PSCell is the timing when UE shall be capable to transmit PRACH preamble towards target PSCell.**  **Proposal 6: For UE which is already configured with DC, the UE’s behaviour is same when the configured PSCell is same as the original one or not.**  **Proposal 7: Additional interruption may be expected on PCell due to PSCell addition.** |
| [R4-2114140](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114140.zip) | Huawei, Hisilicon | **Observation 1: For HO with PSCell in NR-DC case, If *targetCellSMTC-SCG* is configured, UE shall apply the SMTC configuration of target of target PSCell based on target PCell.**  **Proposal 1: For HO with PSCell in NR-DC, cell searching and fine timing tracking shall be performed sequentially when *targetCellSMTC-SCG* is configured.**  **Proposal 2: Tprocessing is the maximum one between UE processing timing of HO and UE processing timing of PSCell addition/change regardless whether *targetCellSMTC-SCG* is configured or not.**  **Observation 2: There is no restrictions on orders of RACH towards PCell and RACH towards PSCell.**  **Proposal 3: Define the delay requirements of HO with PSCell as the delay of HO and delay of PSCell addition/change separately. The ending point is the time when UE is capable to transmit PRACH towards target PCell and towards target PSCell respectively.**  **Proposal 4: No need to define interruption requirements.**  **Proposal 5: Define the delay requirements of HO with PSCell as above for each cases.** |
| [R4-2114152](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114152.zip) | MediaTek inc. | **Proposal 1: RAN4 will not specify the requirement of HO with PSCell for cases from NR-SA to NE-DC, from NR-SA to NR-DC, and from LTE SA to EN-DC**  **Proposal 2: In R17, RAN4 only considers FR1+FR2 NR-DC HO with PSCell for the case from NR-DC to NR-DC, and FR1+LTE NE-DC HO with PSCell for the case from NE-DC to NE-DC**  **Proposal 3: For LTE-SA to EN-DC or EN-DC to EN-DC, parallel processing on cell search and timing sync is always assumed**  **Proposal 4: For NR-DC to NR-DC, sequential processing cell search and timing sync is needed when targetCellSMTC-SCG is configured. Otherwise, parallel processing is assumed**  **Proposal 5: The overall Tprocessing for HO with PSCell should be max(Tprocessing for PCell HO, Tprocessing for PSCell addition/change) +10ms**  **Proposal 6: Define delay requirements for HO and PSCell addition/change separately by the time that UE transmits PCell PRACH and PSCell PRACH respectively. No need to define an overall delay requirement**  **Proposal 7: No new interruption requirement for HO with PSCell is needed. Interruption in legacy handover delay requirement can still be applied for the PCell** |
| [R4-2114175](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114175.zip) | Ericsson | **Proposal 1:** There shall be no extension of applicable scenarios for HO with PSCell scenarios. Original set of scenarios as captured in the WID applies.  **Proposal 2:** For NR-DC, in this WI, only FR1 – FR2 combinations are considered.  **Proposal 3:** Parallel processing shall be the baseline for delay requirements. This includes RA as well as other parts of the HO with PSCell procedure.  **Proposal 4:** For software processing for PSCell, the following values are to be used.   * 20ms, when source and target cells are different NR cells in same FR, * 40ms, when source and target cells are different NR cells in different FRs, * [40ms], when there is no source PSCell i.e. when it is a matter of PSCell addition.   **Proposal 5:** The delay requirement for HO with PSCell shall be specified separately for PCell and PSCell.  **Proposal 6:** Interruption in legacy handover delay requirement can be applied for PCell. No interruption is defined for PSCell.  **Proposal 7:** RAN4 shall define delay requirements for HO with PSCell for both 2-step and 4-step RA. Impact on delay requirements depends on timeline with respect to parallel processing of RA.  **Proposal 8:** RAN4 to further study whether RA for spCell on unlicensed carrier with CCA shall be prioritized over RA for spCell on licensed carrier, once CCA is successful. |
| [R4-2114213](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114213.zip) | Nokia, Nokia Shanghai Bell | 1. No new additional scenarios for HO with PSCell will be introduced. 2. RRM requirements for Rel-16 FR1+FR1 NR-DC will not be defined in Rel-17. 3. RAN4 should define RRM requirements for handover with PSCell only for FR1+FR2 NR-DC when considering “from NR-DC to NR-DC” scenario. 4. Both FR1+LTE NE-DC and FR2+LTE NE-DC should be supported for RRM requirements for handover with PSCell in “from NE-DC to NE-DC” scenario and “from NR SA to NE-DC” scenario. 5. In HO with PSCell, legacy HO and PSCell addition operations can be performed in parallel. 6. HO with PSCell RRM requirements can refer to existing handover requirements and PSCell addition requirements directly. 7. Agree the TP provided. 8. No additional interruption should be defined during HO with PSCell. 9. Both 2-step RA and 4-step RA are applicable for HO with PSCell and no need to mention 2-step or 4-step in HO with PSCell requirements. |
| [R4-2114429](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114429.zip) | Qualcomm CDMA Technologies | **Proposal1: Introduce a common term of search time budgeted for the joint PCell HO with PSCell, which is twice of the legacy search time Tsearch reserved for HO i.e. Tsrch=2xTsearch.**  **Proposal1.1: Also introduce a common margin time Tm which is twice of the time of legacy Tmargin i.e. Tm=2xTmargin.**  **Proposal2: Adopt the same time for loop processing as legacy T∆.**  Obervation1: RAN2 confirms spec doesnot restrict the UE in the oder to perform RACH towards PCell and PSCell.  Obervation2: UE has no motivations to complicate the handling of PSCell RACH by creating the contingency on PCell RACH.  **Proposal3: RAN4 shall discuss whether there is any fundamental advantage to define requirements for sequential RACH.**  **Proposal3.1: RAN4 define the requirements by assuming independent RACH.**  **Propsoal3.2: Define the ending points as Pcell PRACH and PSCell PRACH respectively by assuming 4-step RACH.**  **Proposal4: Stick to the WID scenarios for discussing the requirements unless new scenarios are approved by RP in the future.**  **Proposal5: Considers following schemes for NR-DC and NE-DC mode in HO with PSCell.**   * **FR1+FR2 NR-DC for HO with PSCell from NR-DC to NR-DC,** * **FR1+LTE NE-DC for HO with PSCell from NE-DC to NE-DC.**   **Proposal6: Requirement definition assumes UE run independent loop processings and RACHs towards PCell and PSCell respectively.**  **Proposal7: RAN4 to specify the delay requirement for HO with PSCell based on the assumption that some of procedures should be able to be performed in parallel.**  **Proposal7.1: if any component during the procedure has a dependency bw/ PCell and PSCell, define a common term to capture the most applicable requirement.**  Observation3: RRC processing, UE processing(to prep the RF) are proceudures common to both PCell and PSCell.  **Proposal8: Extending the UE processing time for NRSA to EN-DC joint handover by [FFS]ms and [FFS] can be 10ms as the starting point, i.e. Tprocessing = [30]ms.**  **Proposal8.1: For NRDC to NRDC, the UE processing time Tprocessing to be 20ms without FR mode switch on PSCell; otherwise, Tprocessing shall be 40ms as the legacy PSCell change requirement.** |

## Open issues summary

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

### Sub-topic 2-1 Scenarios for RRM requirement of HO with PSCell

*Sub-topic description:*

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

**Issue 2-1-1:** Scenarios for RRM requirement of HO with PSCell

* Proposals
  + Option 1(CATT, Apple, vivo, Xiaomi, MTK, Ericsson, Nokia, Qualcomm): RAN4 specifies RRM requirement for HO with PSCell for the following scenarios as in the WID RP-202874:
    - from NR SA to EN-DC
    - from EN-DC to EN-DC
    - from NE-DC to NE-DC
    - from NR-DC to NR-DC
* Recommended WF
  + RAN4 specifies RRM requirement for HO with PSCell for the following scenarios as in the WID RP-202874:
    - from NR SA to EN-DC
    - from EN-DC to EN-DC
    - from NE-DC to NE-DC
    - from NR-DC to NR-DC
* 1st round Comment collection:

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| **Company** | **Comments** |
| Apple | Agree with recommended WF |
| Xiaomi | Support the recommended WF |
| Qualcomm | Option1 is supported in accordance with the RP decision. |
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**Issue 2-1-2: NR-DC and NE-DC mode in HO with PSCell**

* Proposals
  + Option 1(CATT, Apple, vivo, Xiaomi, Intel, OPPO, MTK, Qualcomm): In Rel-17 RAN4 define RRM requirements for
    - FR1+FR2 NR-DC
    - FR1+LTE NE-DC
  + Option 2 (Ericsson): In Rel-17 RAN4 define RRM requirements for
    - FR1+FR2 NR-DC
  + Option 3 (Nokia): In Rel-17 RAN4 define RRM requirements for
    - FR1+FR2 NR-DC
    - FR1+LTE NE-DC
    - FR2+LTE NE-DC
* Recommended WF
  + FR1+FR2 NR-DC is supported.
  + FR1+LTE NE-DC is supported.
  + FR2+LTE NE-DC is FFS.
    - Companies are encouraged to provide comments on the FR2+LTE NE-DC scenario.
* 1st round Comment collection:

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| **Company** | **Comments** |
| Apple | Option 1. |
| Xiaomi | Option 1, as the band combination for FR2 + LTE NE-DC case was not supported in this WI. |
| Qualcomm | Option1 is supported and we think FR2 on PCell shall be deprioritized in general. |
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**Issue 2-1-2a: Baseline requirements for FR1+FR1 NR-DC**

* Proposals
  + Option 1 (Apple):
    - RAN4 to recommend introducing full set of RRM requirements for FR1+FR1 NR-DC in R18 eFeRRM WI.
  + Option 2 (OPPO):
    - RAN4 needs to consider whether or where to handle the baseline requirements of FR1+FR1 NR-DC for HO with PSCell from NR-DC to NR-DC
* Recommended WF
  + Further discussion
* 1st round Comment collection:

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| **Company** | **Comments** |
| Apple | Option 1. |
| Xiaomi | The scope of RRM requirements for FR1+FR1 NR-DC should be discussed in RAN plenary meeting. |
| Qualcomm | Suggest we leave this to the plenary level discussion.  From work load pov, it’s preferred not to handle this in the current WI. |
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### Sub-topic 2-2 Delay requirement design of HO with PSCell

*Sub-topic description*

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

**Issue 2-2-1a: Condition of parallel processing without considering RACH**

* Proposals
  + Option 1a (Apple):
    - In HO with PSCell for NR-DC to NR-DC, if SMTC of target unknown PSCell is configured in targetcellSMTC-SCG-r16, sequential processing shall be assumed; otherwise, parallel processing shall be assumed.
    - In HO with PSCell for NR-DC to NR-DC, if SMTC of target unknown PSCell is not configured in either targetcellSMTC-SCG-r16 or reconfigurationWithSync,
      * UE uses the SMTC in the MO having the same SSB frequency and subcarrier spacing as target PSCell if either source PCell or source PSCell configured this MO, or
      * UE uses the SMTC in the MO from source PCell if both source PCell and source PSCell configured MOs having the same SSB frequency and subcarrier spacing as target PSCell, or
      * UE assumes 5ms as SSB periodicity for target PSCell if neither source PCell nor source PSCell configured MOs having the same SSB frequency and subcarrier spacing as the target PSCell.
    - In HO with PSCell for NR SA to EN-DC, if SMTC of target unknown PSCell is configured in targetcellSMTC-SCG-r16, sequential processing shall be assumed; otherwise, parallel processing shall be assumed.
    - In HO with PSCell for NR SA to EN-DC, if SMTC of target unknown PSCell is not configured in either targetcellSMTC-SCG-r16 or reconfigurationWithSync,
      * UE uses the SMTC in the MO having the same SSB frequency and subcarrier spacing as target PSCell, or
      * UE assumes 5ms as SSB periodicity for target PSCell if source PCell didn’t configure MO having the same SSB frequency and subcarrier spacing as the target PSCell.
    - In HO with PSCell for EN-DC to EN-DC, parallel processing shall be assumed.
    - In HO with PSCell for EN-DC to EN-DC, if SMTC of target unknown PSCell is not configured in RRCConnectionReconfiguration,
      * UE uses the SMTC in the MO having the same SSB frequency and subcarrier spacing as target NR PSCell if either source LTE PCell or source NR PSCell configured this MO, or
      * UE uses the SMTC in the MO from source LTE PCell if both source LTE PCell and source NR PSCell configured MOs having the same SSB frequency and subcarrier spacing as target NR PSCell, or
      * UE assumes 5ms as SSB periodicity for target NR PSCell if neither source LTE PCell nor source NR PSCell configured MOs having the same SSB frequency and subcarrier spacing as the target NR PSCell.
    - In HO with PSCell for NE-DC to NE-DC, parallel processing shall be assumed.
  + Option 1b (CMCC):
    - For the case that targetCellSMTC-SCG-r16 is configured, the timeline for HO with PSCell can be partially sequential
    - For other cases except the configuration of targetCellSMTC-SCG-r16, parallel processing is assumed.
  + Option 1c (Huawei):
    - For HO with PSCell in NR-DC, cell searching and fine timing tracking shall be performed sequentially when targetCellSMTC-SCG is configured.
  + Option 1d (MTK):
    - For NR-DC to NR-DC, sequential processing cell search and timing sync is needed when targetCellSMTC-SCG is configured.
    - Otherwise, parallel processing is assumed
  + Option 2a (CATT, Xiaomi, ZTE, Ericsson, Nokia):
    - Parallel processing shall be the baseline for delay requirements
  + Option 2b (vivo):
    - Take parallel processing for R17 HO with PSCell for all procedure including RACH, and for all configurations including the case that ‘targetcellSMTC-SCG-r16’ is configured
  + Option 2c (Intel):
    - After RRC processing, parallel processing including RACH can be performed for PCell HO and PSCell addition.
  + Option 2d (OPPO):
    - PCell HO and PSCell addition, without considering RA procedures and Tprocessing, are performed in parallel independently.
* Recommended WF
  + Further discussion in the 1st round
* 1st round Comment collection:

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| **Company** | **Comments** |
| Apple | We would like to revise option 1a to correct the configuration of NR-SA to EN-DC case.   * + Option 1a (Apple):     - In HO with PSCell for NR-DC to NR-DC, if SMTC of target unknown PSCell is configured in targetcellSMTC-SCG-r16, sequential processing shall be assumed; otherwise, parallel processing shall be assumed.     - In HO with PSCell for NR-DC to NR-DC, if SMTC of target unknown PSCell is not configured in either targetcellSMTC-SCG-r16 or reconfigurationWithSync,       * UE uses the SMTC in the MO having the same SSB frequency and subcarrier spacing as target PSCell if either source PCell or source PSCell configured this MO, or       * UE uses the SMTC in the MO from source PCell if both source PCell and source PSCell configured MOs having the same SSB frequency and subcarrier spacing as target PSCell, or       * UE assumes 5ms as SSB periodicity for target PSCell if neither source PCell nor source PSCell configured MOs having the same SSB frequency and subcarrier spacing as the target PSCell.     - In HO with PSCell for NR SA to EN-DC, if SMTC of target unknown PSCell is configured in RRCConnectionReconfiguration in targetRAT-MessageContainer, sequential processing shall be assumed; otherwise, parallel processing shall be assumed.     - In HO with PSCell for NR SA to EN-DC, if SMTC of target unknown PSCell is not configured ~~in either targetcellSMTC-SCG-r16 or reconfigurationWithSync~~,       * UE uses the SMTC in the MO having the same SSB frequency and subcarrier spacing as target PSCell, or       * UE assumes 5ms as SSB periodicity for target PSCell if source PCell didn’t configure MO having the same SSB frequency and subcarrier spacing as the target PSCell.     - In HO with PSCell for EN-DC to EN-DC, parallel processing shall be assumed.     - In HO with PSCell for EN-DC to EN-DC, if SMTC of target unknown PSCell is not configured in RRCConnectionReconfiguration,       * UE uses the SMTC in the MO having the same SSB frequency and subcarrier spacing as target NR PSCell if either source LTE PCell or source NR PSCell configured this MO, or       * UE uses the SMTC in the MO from source LTE PCell if both source LTE PCell and source NR PSCell configured MOs having the same SSB frequency and subcarrier spacing as target NR PSCell, or       * UE assumes 5ms as SSB periodicity for target NR PSCell if neither source LTE PCell nor source NR PSCell configured MOs having the same SSB frequency and subcarrier spacing as the target NR PSCell.     - In HO with PSCell for NE-DC to NE-DC, parallel processing shall be assumed.   We don’t think parallel processing could be assumed as baseline. The reason is:   1. In NR-DC to NR-DC case, smtc configuration in reconfigurationWithSync is a very common case, and RAN2 also clarified this case in last meeting in CR R2-2106754 2. In NR-SA to EN-DC, the PSCell SMTC can only be configured in RRCConnectionReconfiguration in targetRAT-MessageContainer; and this SMTC can only be based on reference timing from target LTE PCell, so only sequential processing shall be used when SMTC is configured for NR-SA to EN-DC case. |
| Xiaomi | We are fine with the proposal of “For HO with PSCell in NR-DC, cell searching and fine timing tracking shall be performed sequentially when targetCellSMTC-SCG is configured.” And for other cases, the parallel processing is assumed. |
| CMCC | For the case that targetCellSMTC-SCG-r16 is not configured, parallel processing is assumed.  For the case that targetCellSMTC-SCG-r16 is configured, since UE is expected to use target PCell timing as reference for PSCell SMTC, fully parallel processing is not suitable for this case. But we think fully sequential processing is not suitable either, for example, the RACH can be performed in parallel. That is the reason we suggest partially sequential. As for which part need to be performed in sequence, in our understanding, cell search and timing tracking can be considered. Based on above consideration, we are also OK with option 1c/1d. |
| Qualcomm | Option2a can be a starting point.  Beyond that, we would like to hear from infra and operators whether it is common to have targetcellSMTC-SCG-r16 configured by the network in NRDC to NRDC HO.  If yes, we agree to further discuss which portion of processing shall be sequential under this case(targetcellSMTC-SCG-r16 is configured). For which, we think cell search(and the SSB post processing) can be sequential and the following procedures of time sync and RACH are independently running for MN and SN. So option1b is supported. |
| Qualcomm post 0816 GTW session | Per GTW, it seems to us that the baseline is parallel processing and then RAN4 can identify cases that could result in partial parallel or partial sequential processing. Just to summarize R2-2106754 as below.   |  |  |  | | --- | --- | --- | | ***Target PSCell time reference*** | *reconfigurationWithSync present* | *reconfigurationWithSync not present* | | *targetCellSMTC-SCG received* | **Case1: Follow target NR PCell** | **Case2: Follow target NR PCell** | | *targetCellSMTC-SCG not received* | **Case2: source PSCell** | **Case4: SMTC in the measObjectNR** |   It seems case1 and case2 creates the dependency of target PSCell on the target PCell as a time reference.  Further question remains on whether and how to capture the requirements in the baseline requirements based. |
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**Issue 2-2-1b: Whether requirements for sequential processing are needed if parallel processing is only possible under certain condition**

* Proposals
  + Option 1 (Apple):
    - RAN4 to define the requirements for both sequential processing and parallel processing cases.
  + Option 2 (Intel):
    - No requirement will be applied if targetcellSMTC-SCG-r16 is configured.
* Recommended WF
  + Further discussion in the 1st round
* 1st round Comment collection:

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| **Company** | **Comments** |
| Apple | Option 1. Smtc configuration in targetcellSMTC-SCG-r16 is not a corner case based on RAN2 spec (in TS38.331 this case has been clarified explicitly). |
| Xiaomi | RAN4 should define the requirements for the case when targetcellSMTC-SCG-r16 is configured. |
| CMCC | Both the case with targetcellSMTC-SCG-r16 configured and the the case without targetcellSMTC-SCG-r16 configured need to be considered to specify the requirements.  For the case without targetcellSMTC-SCG-r16 configured, parallel processing is used.  For the case with targetcellSMTC-SCG-r16 configured, cell search and timing tracking is performed in sequence, other procedures are performed in parallel. |
| Qualcomm | As we shared in the previous issue, if configuration of targetcellSMTC-SCG-r16 is not common, we are fine with option2. |
| Qualcomm post 0816 GTW session | Our proposal of option2c in issue2-2-2 can be considered as a generic requirement to accommodate both parallel and partial parallel processing. |
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**Issue 2-2-2: Parallel processing timeline without considering Tprocessing and RA procedures**

*The entire delay for HO with PSCell may include RRC processing delay, PCell handover and PSCell addition delay.*

*The PCell handover and PSCell addition may be performed in parallel or sequential depending on outcome of Issue 2-2-1a.*

*Even for sequential processing of PCell handover and PSCell addition, there are views that partially parallel processing is also possible.*

*The Tprocessing during PCell handover and PSCell addition are discussed in Issue 2-2-3 separately.*

*The RA procedures during the entire HO with PSCell are discussed in Issue 2-2-4 separately.*

*RRC processing is not considered in this issue.*

*This issue is focusing on other procedures during PCell handover and PSCell addition that may be performed in parallel independently or at least in partial parallel.*

* Proposals
  + Option 1 (Apple, CATT, Xiaomi, ZTE, Ericsson, Nokia, vivo, Intel, OPPO):
    - PCell HO and PSCell addition are performed in parallel independently
  + Option 2a (CMCC):
    - For the case that targetCellSMTC-SCG-r16 is configured, the timeline for HO with PSCell can be partially sequential
    - For other cases except the configuration of targetCellSMTC-SCG-r16, parallel processing is assumed.
  + Option 2b (MTK, Huawei):
    - For NR-DC to NR-DC, sequential processing cell search and timing sync is needed when targetCellSMTC-SCG is configured.
    - Otherwise, parallel processing is assumed
  + Option 2c (Qualcomm):
    - Only if partial parallel processing is assumed when targetCellSMTC-SCG is configured, Tsearch can be extended for sequential processing cell search, e.g. Tsrch= Tsearch\_MCG+Tsearch\_SCGand the time for SSB post-processing may also be extended e.g. Tm=2xTmargin
      * Adopt the same time for loop processing as legacy T∆ i.e. the fine time tracking and acquiring full timing information of the target cell shall be assumed running independently for each CG
    - Otherwise, parallel processing is assumed
* Recommended WF
  + Further discussion in the 1st round.
* 1st round Comment collection:

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| **Company** | **Comments** |
| Apple | Option 1 |
| Xiaomi | Option 1 |
| CMCC | This issue needs to be discussed case by case.  For the case that targetcellSMTC-SCG-r16 is not configured, parallel processing is used, we are OK with option 1.  For the case that targetcellSMTC-SCG-r16 is configured, cell search and timing tracking is performed in sequence, other procedures are performed in parallel. |
| Qualcomm | Depending on the RAN4 agreement to support the case when targetcellSMTC-SCG-r16 is configured, we support option 2c(if supported) or option1(if not supported).  Please note a correction on option2c shall be Tsrch=Tsearch\_MCG+Tsearch\_SCG |
| Qualcomm post 0816 GTW session | Tsearch\_MCG and Tsearch\_SCG are based on the SMTC periodicities for target PCell and target PSCell respectively.  Question to proponents of Option2b, thanks for any elaborations on the need to perform sequential processing of time sync? In our view, the TRS being the target cell SMTC periodicity which has been derived for both target PCell and target PSCell by extending the search time and SSB post processing time. Thanks |
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**Issue 2-2-3: UE SW processing and RF warm-up(if needed) time for HO with PSCell**

* Proposals
  + Option 1 (CATT):
    - The value of processing time of handover and the PSCell addition can be reused separately. Tprocessing for HO with PSCell will be the maximum of the processing time of handover and the processing time of the PSCell addition.
  + Option 2 (Apple):
    - For sequential processing for HO with PSCell, the total UE processing time for HO with PSCell is the sum of UE processing timing of HO and UE processing timing of PSCell addition.
    - For parallel processing for HO with PSCell, the total UE processing time for HO with PSCell could be the maximum one between UE processing timing of HO and UE processing timing of PSCell addition
    - the UE processing time for HO with PSCell is:

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| UE processing margin (Tprocessing) | Target Pcell and PSCell is in the same FR as old serving cell | Target Pcell and/or target PSCell is in the different FR from old serving cell |
| Sequential processing | 40ms | 60ms |
| Parallel processing | 20ms | 40ms |

* + Option 3 (Huawei):
    - Tprocessing is the maximum one between UE processing timing of HO and UE processing timing of PSCell addition/change regardless whether *targetCellSMTC-SCG* is configured or not.
  + Option 4 (Ericsson):
    - For software processing for PSCell, the following values are to be used.
      * 20ms, when source and target cells are different NR cells in same FR,
      * 40ms, when source and target cells are different NR cells in different FRs,
      * [40ms], when there is no source PSCell i.e. when it is a matter of PSCell addition.
  + Option 5 (Nokia):
    - HO with PSCell RRM requirements can refer to existing handover requirements and PSCell addition requirements directly
  + Option 6 (OPPO):
    - For the case NR SA to EN-DC, we agree to extend the UE processing time to [30]ms assuming sequential UE processing timing of HO and PSCell addition.
    - For the case EN-DC to EN-DC, and NR-DC to NR-DC, the UE processing time to be [30]ms within the same FR of target PCell and PSCell; otherwise, otherwise the UE processing time shall be [50]ms as the legacy PSCell change requirement.
  + Option 7 (MTK):
    - The overall Tprocessing for HO with PSCell should be max(Tprocessing for PCell HO, Tprocessing for PSCell addition/change) +10ms
  + Option 8 (vivo):
    - RAN4 consider baseline for UE processing time as [30] ms for NRSA to ENDC, and the details can be further discussed. For other cases PSCell change requirement can be re-used.
  + Option 9 (Qualcomm):
    - Extending the UE processing time for NRSA to EN-DC joint handover by [FFS]ms and [FFS] can be 10ms as the starting point, i.e. Tprocessing = [30]ms.
    - For NRDC to NRDC, the UE processing time to be 20ms without FR mode switch on PSCell; otherwise, the UE processing time shall be 40ms as the legacy PSCell change requirement.
* Recommended WF
  + Further discussion in the 1st round
* 1st round Comment collection:

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| **Company** | **Comments** |
| Apple | Option 2. The principle shall reply on which processing is used. In order to define a minimum requirement, we think the principle shall be:   * For sequential processing for HO with PSCell, the total UE processing time for HO with PSCell is the sum {legacy UE processing timing of HO, legacy UE processing timing of PSCell addition}. * For parallel processing for HO with PSCell, the total UE processing time for HO with PSCell is the max{legacy UE processing timing of HO, legacy UE processing timing of PSCell addition}. |
| Qualcomm | Option9 is supported |
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**Issue 2-2-4: RACH processing for Pcell and PSCell**

* Proposals
  + Option 1 (vivo, Xiaomi, CMCC, ZTE, Huawei, CATT, MTK, Ericsson, Nokia, Qualcomm, Apple):
    - RACH processing for PCell and PSCell are performed in parallel independently.
  + Option 2 (OPPO):
    - Sequential RACH processing should be considered for minimum RRM requirements of HO with PSCell.
  + Option 2b (Qualcomm):
    - RAN4 shall discuss whether there is any fundamental advantage to define requirements for sequential RACH.
* Recommended WF
  + Further discussion in the 1st round

* 1st round Comment collection:

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| **Company** | **Comments** |
| Apple | Option 1 |
| Xiaomi | Option 1 |
| CMCC | Option 1 |
| Qualcomm | Option1 is supported as it appears clear that majority view is not to consider sequential RACH processing. |
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**Issue 2-2-5: Ending point of the delay requirement for HO with PSCell**

* Proposals:
  + Option 1 (Apple, Xiaomi, CMCC, CATT):
    - the later timing between “timing when UE shall be capable to transmit PRACH preamble towards target PCell” and “the timing when UE shall be capable to transmit PRACH preamble towards target PSCell”.
  + Option 2 (vivo, CMCC, Intel, Huawei, MTK, Ericsson, Qualcomm):
    - Defining delay requirements for HO and PSCell addition/change separately with the ending points defined as PCell PRACH and PSCell PRACH, respectively.
  + Option 3 (OPPO):
    - The timing when UE shall be capable to transmit PRACH preamble towards target PSCell.
* Recommended WF
  + Further discussion in the 1st round.
* 1st round Comment collection:

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| **Company** | **Comments** |
| Apple | Option 1. Question to Option 2: what’s the starting point of PSCell addition delay in sequential processing case? |
| Xiaomi | Option 1, prefer to define the overall delay requirement for HO with PSCell. |
| Qualcomm | Both option1 and option2 can be further discussed depending on the conclusions of previous issues. |
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**Issue 2-2-6: Optimisation for the case when PSCell is not changed during HO with PSCell**

* Proposals
  + Option 1 (CATT, Apple, vivo, Xiaomi, OPPO, Qualcomm):
    - For UE which is already configured with DC, the UE’s behavior is same when the configured PSCell is same as the original one or not.
* Recommended WF
  + For UE which is already configured with DC, the UE’s behavior is same when the configured PSCell is same as the original one or not.
* 1st round Comment collection:

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| **Company** | **Comments** |
| Apple | Option 1. |
| Xiaomi | Option 1 |
| Qualcomm | Option1 is supported. |
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**Issue 2-2-8: Delay requirements design**

* Proposals
  + Option 1 (CATT):
    - The delay requirement will be defined as Delay = TRRC processing + max(Tinterrupt , Tconfig\_PSCell – TRRC\_delay).
      * TRRC processing is RRC processing time defined as in introduction.
      * Tinterrupt is interruption time defined in requirements of handover in every scenarios.
      * Tconfig\_PSCell is delay requirement for PSCell addition.
      * TRRC\_delay is RRC processing time defined for PSCell addition.
  + Option 2 (Xiaomi):
    - the overall delay requirement for HO with PSCell is defined as TRRC\_delay + max(Tinterrupt, TSync\_PSCell), where,
      * Tinterrupt is the interruption time for HO, which is defined in section 6.1 TS38.133;
      * TSync\_PSCell is the preparation time for synchronizing to target PSCell, which is defined in section 8.8 or 8.9 TS38.133.
  + Option 3 (CMCC):
    - Delay for HO with PSCell is maximum (PSCell addition delay, HO delay)
      * PSCell addition delay= TRRC\_delay + Tprocessing + Tsearch + T∆ + TPSCell\_ DU + 2 ms
      * HO delay = TRRC\_delay +Tinterrupt = TRRC\_delay +Tsearch + TIU + Tprocessing + T∆ + Tmargin ms
  + Option 4 (Intel):
    - The delay requirements for HO with PSCell can be described as:
      * THO\_PSCell= maximum (THO\_delay, Tconfig\_PSCell)
      * THO\_delay = TRRC\_delay + Tsearch + Tprocessing +TIU + T∆ + Tmargin ms
      * Tconfig\_PSCell = TRRC\_delay + Tsearch + Tprocessing + TPSCell\_ DU + T∆ + 2 ms
        + TRRC\_delay is the RRC procedure delay as specified in TS 38.331.
        + Tsearch is the time required to search the target cell.
        + Tprocessing is the SW processing time needed by UE, including RF warm up period.
        + T∆ is time for fine time tracking and acquiring full timing information of the target cell.
        + TIU and TPSCell\_ DU are the interruption uncertainty in acquiring the first available PRACH occasion in the PCell and PSCell.
  + Option 5 (Nokia):
    - HO with PSCell RRM requirements can refer to existing handover requirements and PSCell addition requirements directly
    - Agree the TP provided in R4-2114213
  + Option 6 (Qualcomm):
    - Requirement definition assumes UE run independent loop processings and RACHs towards PCell and PSCell respectively.
    - RAN4 to specify the delay requirement for HO with PSCell based on the assumption that some of procedures should be able to be performed in parallel.
    - If any component during the procedure has a dependency bw/ PCell and PSCell, define a common term to capture the most applicable requirement.
    - RRC processing, UE processing(to prep the RF) are proceudures common to both PCell and PSCell
    - Introduce a common term of search time budgeted for the joint PCell HO with PSCell, which is twice of the legacy search time Tsearch reserved for HO i.e. Tsrch= Tsearch\_MCG+Tsearch\_SCG.
    - Also introduce a common margin time Tm which is twice of the time of legacy Tmargin i.e. Tm=2xTmargin.
    - Adopt the same time for loop processing as legacy T∆.
  + Option 7 (Huawei):
    - **For NR SA to EN-DC, the delay of HO and PSCell addition:**
    - THO = TRRC\_delay +Tsearch\_PCell + TIU + TProcessing
    - TPSCell= TRRC\_delay + Tprocessing + Tsearch\_PSCell + T∆ + TPSCell\_ DU + TPCell\_DU+ Tmargin ms
    - Where TRRC\_delay = 50 ms, TPCell\_DU is the delay uncertainty due to PCell RACH preamble transmission defined in TS 38.213.
    - **For EN-DC to EN-DC, the delay of HO and PSCell addition:**
    - THO = TRRC\_delay +Tsearch\_PCell + TIU + TProcessing
    - TPSCell= TRRC\_delay + Tprocessing + Tsearch\_PSCell + T∆ + TPSCell\_ DU + TPCell\_DU+ Tmargin ms
    - Where TRRC\_delay = 20 ms, TPCell\_DU is the delay uncertainty due to PCell RACH preamble transmission defined in TS 38.213.
    - **For NE-DC to NE-DC, the delay of HO and PSCell addition:**
    - THO = TRRC\_delay + Tsearch\_PCell + Tprocessing + TIU + TPSCell\_DU + T∆ + Tmargin
    - TPSCell= TRRC\_delay + Tprocessing + Tactivation\_time + TE-UTRAN-PSCell\_ DU
    - Where TRRC\_delay = 16 ms, TPSCell\_DU is the delay uncertainty due to PSCell RACH preamble transmission defined in TS 38.213.
    - **For NR-DC to NR-DC (FR1+FR2 NR-DC), the delay of HO and PSCell addition:**
    - THO = TRRC\_delay + Tsearch\_PCell + Tprocessing + TIU + T∆ + Tmargin
    - TPSCell= TRRC\_delay + Tprocessing + Tsearch\_DU+ Tsearch\_PSCell + T∆ + TPSCell\_ DU + Tmargin ms
    - Where TRRC\_delay = 16 ms. Tsearch\_DU is delay uncertainty due to time tracking of PCell if targetCellSMTC-SCG is configured; Tsearch\_DU = 0 otherwise.
    - It should be noted Tprocessing depends on the conclusion of related issues.
* Recommended WF
  + Further discussion in the 1st round.
* 1st round Comment collection:

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| **Company** | **Comments** |
| Apple | Can wait for more conclusions from other issues. |
| Xiaomi | Option 1 and 2, as commented in issue 2-2-5, the overall delay requirement for HO with PSCell is proposed, and the T\_RRC\_delay should be counted once, and the T\_interrup (Tsearch + TIU + Tprocessing + T∆ + Tmargin) for HO and T\_sync\_PSCell (Tprocessing + Tsearch + T∆ + TPSCell\_ DU + 2 ms) for PSCell addition delayHO delay is accounted in parallel or partial sequential based on whether the targetCellSMTC-SCG-r16 is configured or not. |
| Qualcomm | Prefer to defer this to the 2nd round discussion till previous issues are agreed.  One outstanding issue we sense is about whether to assume any dependency of PSCell time tracking on the availability of the PCell fine timing. |
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### Sub-topic 2-3 Interruption requirement design of HO with PSCell

*Sub-topic description*

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

**Issue 2-3-2: Interruption requirement for HO with PSCell**

* Proposals
  + Option 1 (CATT, vivo, Xiaomi, Huawei):
    - No interruption requirement should be defined during HO with PSCell
  + Option 2a (Intel, MTK, Ericsson, Nokia):
    - No new interruption requirement for HO with PSCell is needed. Interruption in legacy handover delay requirement can still be applied for the PCell
  + Option 2b (Ericsson):
    - Interruption in legacy handover delay requirement can be applied for PCell. No interruption is defined for PSCell.
  + Option 3 (Apple):
    - Interruption in legacy handover delay requirement can be applied for Pcell. No interruption is defined on PSCell.
      * If sequential processing is used for HO with PSCell, UE may have an interruption on new PCell due to the PSCell addition.
      * If parallel processing is used for HO with PSCell, no need to define interruption requirement.
  + Option 4 (OPPO):
    - Additional interruption may be expected on PCell due to PSCell addition.
* Recommended WF
  + Further discussion in the 1st round.
* 1st round Comment collection:

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| **Company** | **Comments** |
| Apple | Option 3. In sequential processing, the RF tuning for PSCell addition/change may interrupt the PCell scheduling. To define the minimum requirement, we need to consider possible UE implementation, e.g., UE performs the RF tuning for PSCell addition/change later than the RF tuning for PCell HO in the sequential processing case for saving power. |
| Xiaomi | When partial sequential processing is assumed, the interruption due to PSCell addition should be considered. When parallel processing is assumed for HO with PSCell, no interruption requirement should be defined. |
| Qualcomm | Option2a is supported. |
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### Sub-topic 2-4 Generic RACH assumption for HO with PSCell

*Sub-topic description*

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

**Issue 2-4-1: 2 step and 4 step RACH for HO with PSCell**

* Proposals
  + Option 1a (ZTE, Nokia, vivo, CATT):
    - Include both 2-step RA and 4-step RA into the new requirements made for handover with PSCell. No need to mention 2-step or 4-step in HO with PSCell requirements.
  + Option 1b (Ericsson):
    - RAN4 shall define delay requirements for HO with PSCell for both 2-step and 4-step RA. Impact on delay requirements depends on timeline with respect to parallel processing of RA.
  + Option 2 (Apple):
    - For requirement of HO with PSCell, RAN4 starts the discussion with 4 step RACH first and FFS on 2 step RACH.
  + Option 3 (Qualcomm):
    - Define the ending points as Pcell PRACH and PSCell PRACH respectively by assuming 4-step RACH
* Recommended WF
  + Further discussion in the 1st round.
* 1st round Comment collection:

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| --- | --- |
| **Company** | **Comments** |
| Apple | Option 2 |
| Xiaomi | Prefer option 2. |
| Qualcomm | Option3 is supported for discussions and RAN4 may discuss to add applicability to 2-step RACH when requirements are shaped. I.e.  we can compromise to Option2 as well. |
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**Issue 2-4-2: RACH occasion collision between Pcell and PSCell**

* Proposals
  + Option 1 (Apple):
    - for FR1+FR1 EN-DC, an additional uncertainty delay due to PSCell RACH collision with PCell UL channels may be introduced if the PSCell RACH cannot be transmitted based on the criteria in TS38.213 section 7.6.1;
    - for FR1+FR1 NE-DC, an additional uncertainty delay due to PCell RACH collision with PSCell RACH may be introduced if the PCell RACH cannot be transmitted based on the criteria in TS38.213 section 7.6.2;
    - otherwise, if target PCell and target PSCell are on the different FRs for EN-DC or NR-DC, no need to consider RO collision issue.
* Recommended WF
  + Discussion option 1 in the 1st round.
* 1st round Comment collection:

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| **Company** | **Comments** |
| Apple | Option 1. Reason is as described in our discussion paper. |
| Qualcomm | Support this to be FFS. |
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**Issue 2-4-3: RACH occasion on NR-U CC for HO with PSCell**

* Proposals
  + Option 1 (Ericsson):
    - RAN4 to further study whether RA for spCell on unlicensed carrier with CCA shall be prioritized over RA for spCell on licensed carrier, once CCA is successful.
  + Option 2 (CATT, Apple):
    - The NR-U scenario is out of scope of this WID, no need to discuss.
* Recommended WF
  + Further discussion in the 1st round.
* 1st round Comment collection:

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| **Company** | **Comments** |
| Apple | Option 2. The reason is as below,   1. the CCA on target carrier would not only impact the UL RACH but also the DL synchronization procedure, and therefore it would introduce extra big working scope for this topic (not only impact on RACH uncertainty). 2. All the on-going R17 WIs didn’t by default consider NR-U scenario in the requirement design, e.g., power saving enhancement, FeMIMO, MG enhancement and so on. NR-U is optional feature and there are many optional features in R16, we cannot by default consider all the other R16 features in the HO with PSCell, e.g., mobility enhancement in R16 was not by-default considered in this HO with PSCell. 3. In the justification part of this WID, the motivation to design this set of RRM requirement is based on RAN2 consideration in R2-1916600, and NR-U and other R16 new features were not in the scope of that LS. 4. Moreover, regarding the scenario, in R16 NR-U the requirements were only designed for scenario A/B/C, only the scenario B is EN-DC of licensed LTE + NR-U. However, the whole scope of the HO with PSCell covers all EN-DC/NE-DC/NR-DC cases, so we think before considering HO with PSCell with NR-U, we need to make up another important scenario of NR-U in RRM first, i.e., scenario E (NR-DC). |
| Qualcomm | Option1 is supported as we believe the principle is to include NR-U for any new R17 features by default and RAN4 can further discuss if TU shall be extended for addressing the spec effort as needed. |
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**Issue 2-4-4: CSI-RS based CFRA**

* Proposals
  + Option 1 (Apple):
    - If CSI-RS based CFRA is used for RACH on PSCell, the additional CSI-RS measurement and the CSI-RS to RO association period shall be considered.
    - The baseline requirement of PSCell addition and handover when CSI-RS based CFRA is used could be discussed in TEI16.
* Recommended WF
  + Further discussion in the 1st round.
* 1st round Comment collection:

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| **Company** | **Comments** |
| Apple | Option 1 |
| Qualcomm | Prefer to follow the same assumption as legacy HO requirements and donot need to discuss CSI-RS based CFRA since CSI-RS based L3 measurement is an optional feature or if the baseline requirements can be approved in TEI16, this can be further discussed. |
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## Companies’ views collection for 1st round

### Open issues

Comments are collected in section 1.2.

### 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.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## 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.*

**Sub-topic 2-1 Scenarios for RRM requirement of HO with PSCell**

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|  | **Status summary** |
| **Issue 2-1-1: Scenarios for RRM requirement of HO with PSCell** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 2-1-2: NR-DC and NE-DC mode in HO with PSCell** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 2-1-2a: Baseline requirements for FR1+FR1 NR-DC** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

**Sub-topic 2-2 Delay requirement design of HO with PSCell**

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|  | **Status summary** |
| **Issue 2-2-1a: Condition of parallel processing without considering RACH** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 2-2-1b: Whether requirements for sequential processing are needed if parallel processing is only possible under certain condition** |  |
| **Issue 2-2-2: Parallel processing timeline without considering Tprocessing and RA procedures** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 2-2-3: UE SW processing and RF warm-up(if needed) time for HO with PSCell** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 2-2-4: RA processing for PCell and PSCell** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 2-2-5: Ending point of the delay requirement for HO with PSCell** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 2-2-6: Optimisation for the case when PSCell is not changed during HO with PSCell** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 2-2-8: Delay requirement design** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

**Sub-topic 2-3 Interruption requirement design of HO with PSCell**

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|  | **Status summary** |
| **Issue 2-3-2: Interruption requirement for HO with PSCell** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

**Sub-topic 2-4 Generic RACH assumption for HO with PSCell**

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|  | **Status summary** |
| **Issue 2-4-1: 2 step and 4 step RACH for HO with PSCell** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 2-4-2: RACH occasion collision between Pcell and PSCell** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 2-4-3: RACH occasion on NR-U CC for HO with PSCell** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 2-4-4: CSI-RS based CFRA** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### 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)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

## Summary on 2nd round (if applicable)

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on … | YYY |  |
| LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| [R4-2111928](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2111928.zip) | Further discussion on HO with PSCell | CATT |  |  |
| R4-2111929 | The requirements for HO with PSCell | CATT |  |  |
| [R4-2112125](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112125.zip) | Discussion on RRM requirement for handover with PSCell | Apple |  |  |
| [R4-2112178](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112178.zip) | Discussion on RRM requirements for HO with PSCell | vivo |  |  |
| [R4-2112419](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112419.zip) | Further discussion on RRM requirements for handover with PSCell | Xiaomi |  |  |
| [R4-2112501](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112501.zip) | Discussion on HO with PSCell | CMCC |  |  |
| [R4-2113139](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113139.zip) | Discussion about HO with PSCell | Intel Corporation |  |  |
| [R4-2113202](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113202.zip) | Discussion on requirements for HO with PSCell | ZTE Corporation |  |  |
| [R4-2113276](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113276.zip) | RRM requirements for HO with PSCell | OPPO |  |  |
| [R4-2114140](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114140.zip) | Discussion on requirements for HO with PSCell | Huawei, Hisilicon |  |  |
| [R4-2114152](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114152.zip) | Discussion on HO with PSCell | MediaTek inc. |  |  |
| [R4-2114175](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114175.zip) | On RRM requirements for handover with PSCell | Ericsson |  |  |
| [R4-2114213](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114213.zip) | discussion on HO with PSCell | Nokia, Nokia Shanghai Bell |  |  |
| [R4-2114429](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114429.zip) | Views on HO w PSCell | Qualcomm CDMA Technologies |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents

# Annex

Contact information

|  |  |  |
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Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)