**3GPP TSG-RAN WG4 Meeting # 104-e R4-** **22xxxxx**

**Electronic Meeting, 15th – 26th August, 2022**

**Agenda item:** 9.18.6

**Source:** vivo

**Title:** WF on eDRX and RRM measurement relaxations requirements for Redcap UE

**Document for:** Approval

# Introduction

This is the WF to capture all agreements and open issues in [104][224] NR\_redcap\_RRM\_2 email related to eDRX, RRM measurement relaxations and some LS replies for Redcap UE discussion at RAN4#103-e meeting.

# Topic #1: Extended DRX enhancements

### Sub-topic 1-1 Remaining issues for idle state eDRX requirements

**Issue 1-1-1: FR2 serving cell requirements and cell reselection requirements for Redcap UE with eDRX length = 20.48s**

* + Option 1: Define requirements for all eDRX configurations with PTW for FR2 (Ericsson vivo MTK Apple)
  + Option 2: When eDRX=20.48s, and DRX=0.32s, UE is allowed to only perform intra-frequency, inter-frequency, inter-RAT measurement within PTW in every 2 eDRX cycles. (Ericsson MTK)
  + Option 3: RAN4 shall capture the following note in the WF and specification: Note: The number of wake-up occasions for the scenario of eDRX IDLE cycle = 20.48s and DRX cycle = 0.32s are twice that of using eDRX cycle = 2.56s, yet this shall not prevent the NW from configuring this scenario. (MTK Apple vivo)

*Tentative agreements (1st round): No*

*Recommendations for 2nd round: Could option 2 can be used as a compromise? In addition could company double check their 1st round feedback since all options are ok for some companies.*

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| **Company** | **Comments** |
| Ericsson | Support option 1 and 2.  The reason behind the issue is that RAN4 defined a strict requirement other than the configuration is unsuitable. RAN4’s responsibility is to define a reasonable requirement to consider UE’s behaviour.  Thus, RAN4 should add some scaling factors to solve the issue other than saying the configuration makes UE more power consumption. |
| Apple | Can compromise to moderator suggestion option 2. |
| Qualcomm | We are okay with Option 2 |
| MediaTek | We can compromise to support Option 2. |
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**Issue 1-1-2: Update on requirements T when the Redcap UE has not found new suitable cell during T at inactive state**

* + Option 1: If the UE in RRC\_Inactive has not found any new suitable cell based on searches and measurements during the time T’, the UE shall initiate cell selection procedures. (Huawei)
  + - T’= MAX (10 s, one DRX\_inactive cycle or one eDRX\_inactive cycle if configured) in FR1, or
  + - T’= MAX (10 s, N1\* DRX\_inactive cycle or N1\* eDRX\_inactive cycle if configured) in FR2.

*Tentative agreements:*

* 10s if the UE is **not** configured with eDRX\_inactive cycle, or
* MAX (10 s, one eDRX\_inactive cycle) if the UE is configured with eDRX\_inactive cycle for FR1, or
* MAX (10 s, N1\* eDRX\_inactive cycle) if the UE is configured with eDRX\_inactive cycle for FR2.

# Topic #2: RRM measurement relaxations

### Sub-topic 2-1 General aspects for RRM measurment relaxation for Redcap

**Issue 2-1-1: Whether Scenario 8 should be allowed or not**

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| **No** | **Rel-16 relaxation criterion** | **Rel-17 relaxation criterion** | **Applicability** |
| 8 | Rel-16 not-at-cell-edge | Rel-17 stationary |  |

* Proposals
  + Option 1: Case 8 is supported (Apple Xiaomi Huawei vivo MTK)
  + Option 2: Case 8 is not supported (CMCC Ericsson)

GTW Agreement:

* Scenario 8 is supported

**Issue 2-1-1-1: Requirements for scenario 8 if scenario 8 is allowed**

* Proposals
  + Option 1: If UE can meet both Rel-16 not-at-cell-edge and Rel-17 stationary conditions, the UE is allowed to meet the requirements that are the most relaxed out of Rel-16 not-at-cell-edge and Rel-17 stationary RRM relaxation requirements. (Apple Huawei)
  + Option 2: UE could follow the requirements when both Rel-17 not-at-cell-edge criteria and Rel-17 stationary criteria are satisfied. (vivo)

GTW Agreement:

For scenario 8, if UE can meet both Rel-16 not-at-cell-edge and Rel-17 stationary conditions, the UE is allowed to meet the requirements that are the most relaxed out of Rel-16 not-at-cell-edge and Rel-17 stationary RRM relaxation requirements.

The most relaxed requirement is the Rel-17 stationary RRM relaxation requirements.

**Issue 2-1-2 Update the “Srxlev” for stationary criterion to “SS-RSRP” in RRC\_CONNECTED (question from RAN2 LS R2-2206418)**

* Proposals
  + Option 1: the SS-RSRP in stationary condition TP from RAN2 LS shall be revised as: SS-RSRP = current L3 RSRP measurement of the PCell based on an identical SSB (dB) (Apple)
  + Option 2: It is proposed to check with RAN2 whether CSI-RSRP can be used to evaluate the relaxed measurement criterion for stationary UE in addition to SS-RSRP (CMCC)
  + Option 3: From RAN4 perspective, it is reasonable to change the “Srxlev” for stationary criterion to “SS-RSRP” in RRC\_CONNECTED (Huawei Ericsson vivo)

GTW Agreement:

Option 3 is used as the baseline for replying LS

**Issue 2-1-3 Clarification on RRM relaxation applying conditions**

* Proposals
  + Option 1: The RedCap UE shall not relax measurements on any of the neighbour cells when it has failed to meet the S criterion; In detail add the phrase: “In this case the UE shall not relax measurements on any of the neighbour cells even if the UE is configured with any relaxed measurement criterion and has fulfilled that criterion.”, for the cases configured eDRX and non-configured eDRX in clause 4.2B.2.2 in TS 38.133 (Nokia Ericsson CMCC Intel)
  + Option 2: RAN4 not to capture the additional highlighted text from the WF in the RAN4 specifications (Apple Huawei Qualcomm Oppo MTK)

*Tentative agreements (1st round): No*

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| **Company** | **Comments** |
| Ericsson | We support option 1.  We agree that option 2 (not making any changing) is in line with Rel-16 relaxation requirements. Based on the comments so far, we have not seen that any company denying that UE shall exit the relaxed mode when UE has failed to meet the S-criterion, which is reasonable. The reason UE fails to meet the S-criterion is because it experiences problems with the current serving cell which is a critical situation. At this situation, UE should obviously not continue to be in relaxed mode, i.e. shall not be performing neighbour cell measurements following the relaxed mode.  Please also note that this issue was not even discussed Rel-16, we believe it was overlooked. This issue was brought up as part of RedCap relaxation Rel-17 and has valid technical benefits. Therefore, we kindly ask companies to reconsider option 1 from technical point of view. |
| Apple | Slightly prefer Option 2 to align with R16 power saving. If network wants UE to not relax RRM when S criteria is not met, network could configure not-at-cell-edge criteria with SSearchThresholdP >=0 SSearchThresholdQ >=0, then when Srxlev or Squal<0, UE will automatically quit the RRM relaxation. |
| Qualcomm | Option 2. We agree with Apple. Network can configure the thresholds to avoid such scenarios |
| vivo | Prefer option 2. In our understanding the threshold should be higher than that of S criteria hence a UE will exist relaxed mode before failing to meet S criteria. |
| Xiaomi | Prefer option 2. We share the view with Apple, QC and vivo.  In our understanding, the issue mentioned in option 1 has been solved through network configuration. The parameter SSearchThresholdP for both R16 and R17 not-at-cell-edge criteria can only be positive value according to the RAN2’s spec. Then, if UE fail to meet the S criterion, it cannot fulfill the relaxation criterion. |
| MediaTek | Support Option 2. |
| Ericsson | At least for the cases (when UE has fulfilled not-at-cell edge and low mobility criteria) when the UE is allowed to skip neighbour cell measurements for 4hours, the UE shall exit the relaxed mode when S-criterion is not fulfilled. This case is critical meaning that UE won’t be able to even measure on any of the neighbour cells even if the S-criterion is not met. Therefore, as a compromise, we suggest following:   * *“If the UE is configured with and has fulfilled the stationary and not-at-cell-edge criteria in sections 4.2B.2.10.3 and 4.2B.2.11.3 and if UE has failed to meet the S-criterion, then the UE shall not relax measurements on any of the neighbour cells.* |

### Sub-topic 2-2 RRM measurment relaxation for Redcap at Idle/Inactive state

**Issue 2-2-1: On scaling factor based RRM relaxation under eDRX with PTW**

* Proposals
  + Option 1: The scaling factor applies only when the relaxed evaluation/measurement time with such scaling factor on one carrier is not greater than single PTW window length (Apple Nokia xiaomi vivo Huawei oppo)
    - Option 1a: UE applies the scaling factor (6) on each PTW window providing the relaxed RRM measurement/evaluation period for PHY filtering shall not cross different PTW windows.(Apple xiaomi vivo Huawei oppo)
  + Option 2: The condition “provided eDRX cycle is ≤ [163.84]” could be removed. ()
  + Option 3: (MTK)
    - The new eDRX requirements are up to 10485.76 s (i.e. already very relaxed) hence there is no need for further relax the high values of eDRX with RRM relaxation.
    - Support the design of new relaxed eDRX for Rel-16/17 RRM relaxation for low eDRX cycles with PTW.
    - Different scaling factor can be applied for different eDRX with PTW, where the larger the eDRX with PTW the smaller the scaling factor.

*Tentative agreements: Option 1*

*Companies can provide comments on option 2 or option 3*

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| **Company** | **Comments** |
| Ericsson | Given that option 1 is agreed in 1st round, we don’t think any discussions are needed on option 2 and 3 because option 1 is aligned with previous agreements. |
| Apple | Option 1 and 1a. Agree with Huawei’s CR to extend PTW window in this case to avoid PHY filtering crossing different PTW windows. |
| Huawei | Option 1 and option 1a. To address this issue, our CR [R4-2213000] is provided to ensure RedCap UE can perform measurement and evaluate R criterion within one PTW. |
| MediaTek | Option 1 and Option 1 are sufficient. |
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**Issue 2-2-2: Clarification on the “4 hours” applying conditions of RRM relaxation under eDRX**

* Proposals
  + Option 1: When UE fulfils both stationary and not at cell edge criterion, UE is allowed to relaxed measurement per 4 hours regardless of the eDRX cycle length. (Huawei)
* Moderator Note: To moderator’s understanding option 1 is a clarification of previous agreement.

*Tentative agreements: Option 1*

**Issue 2-2-3: Higher priority inter-frequency measurement Relaxation**

* Proposals:
  + - Option 1: When only Rel-17 stationarity criterion is satisfied and Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ or both Rel-17 criteria are satisfied, RRM relaxation for higher priority frequency could be based on the same methodology used by Rel-16 UE power saving, i.e., based on K4\*Thigher\_priority\_search where K4 = 4\*K2 = 240 (Apple Xiaomi vivo oppo)
    - Option 2: (Apple Nokia Xiaomi Ericsson vivo Huawei oppo)
    - When only Rel-17 stationarity criterion is satisfied and Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, UE performs measurement on high priority layer per 4 hour \*Nlayer.
    - When both R17 criteria are satisfied,
      * When Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, UE performs the measurement relaxation for lower, equal and higher priority frequency layers are the same, i.e., 4 hours.
      * When Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, UE performs measurement on high priority layer per 4 hour \*Nlayer.
    - Option 3: When Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE shall search for inter-frequency layers of higher priority at least every K4\*Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2B.2.7 and K4=240
    - Option 4: the value is 4hr\*Nlayer and discuss wording directly at CR

*Tentative agreements: Option 2*

**Issue 2-2-4: RRM measurement relaxation in SDT at inactive state**

* Proposals:
  + - Option 1: RAN4 can define TA validation requirement as a single value = 640ms for SDT in RedCap with RRM relaxation. (Nokia)
    - Option 2: For FR2 640ms is not be sufficient and existing requirements shall be applied (Apple Huawei)
    - Option 3: FFS (Ericsson)
    - Option 4: Reuse the requirements specified for the configuration without eDRX (Huawei)
    - Option 5: Issue needs more clarification. Cannot catch the issues with SDT procedure in conjunction with neighbor cell measurement relaxation in RRC INACTIVE (Intel)
    - Option 6: Option 1 is used for FR1 and existing TA validation period is used for FR2 (MTK)

*Tentative agreements: No*

*Recommendations for 2nd round: For TA validation requirement, follow conclusion from issue 1-1-2 in email thread [223] and no more discussion here..*

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# Topic #3 Others

### Sub-topic 3-1 On offset to transmit CD-SSB and NCD-SSB at different times (Reply LS for R2-2204115)

**Issue 3-1-1: NCD-SSB time offset**

* Proposals
  + Option 1 (Huawei, Ericsson): The MGRP of MG can be a candidate values for NCD-SSB time offset.
    - Option 1a(Ericsson): At least MGRP=40ms should be introduced.
    - Option 1b(Huawei): Additional offset values, i.e., 20ms, 40ms, 60ms
  + Option 2 (Apple): Support the RAN2 proposal with the value {sf5, sf10, sf15, spare5, spare4, spare3, spare2, spare1}.

GTW agreement:

* For NCD-SSB time offset, add the addtional MGRP values of 20ms and 40ms, and further discuss whether and what other values are needed.

*Recommendations for 2nd round: other values are discussed at 2nd round.*

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| **Company** | **Comments** |
| Ericsson | We’re fine with the values agreed in GTW.  Based on GTW’s agreement, we think MGRP=80ms is missing which can be used when CD-SSB and NCD-SSB SMTC=160ms. |
| Apple | Fine with GTW agreement and also fine with 80ms proposed by Ericsson. |
| Qualcomm | Fine with 80ms too. |
| Huawei | Fine with GTW agreement. And we confirm 20ms and 40ms offset are needed. Besides, these two offsets can be used for both with meas gap and without meas gap cases.  We are open to have 80ms offset. |
| MediaTek | Fine with GTW and E/// proposed value. |
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**Issue 3-1-2: NCD-SSB time offset impact**

* Proposals
  + Option 1: When the SSB for intra-frequency measurement is fully-partially overlapping with the MG due to SSB offset, UE is required to perform intra-frequency measurement and drop the configured MG. (Ericsson Nokia)
  + Option 2: Up to NW configuration to address this issue (Apple Qualcomm oppo MTK)
  + Option 3: FFS (Huawei)

*Tentative agreements: No*

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| **Company** | **Comments** |
| Ericsson | Option 1.  First of all, 5ms is a typical NCD-SSB offset value defined in RAN2 signalling. We suggest the group to further consider how to handle the following scenario based on current signalling. |
| Apple | Option 2. For 15kHz and 30kHz, the SSB will not fully occupy 5 slots but only 4 slots in a half frame. We still think network can configure MG offset to avoid such error scenario. We are open to further consider this issue. |
| vivo | Agree with Apple that it can be up to NW configuration to solve this issue especially more offset value are available now. |
| Huawei | Option 3 or option 2. When intra-frequency measurement is fully-partially overlapping with the MG, if we refers R15 measurement rule, the intra-f measurement may be allowed to be measured within gap. But we are open to further discuss this. |
| Xiaomi | Option 3. we can further study. |
| MediaTek | Support option 2. |
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### Sub-topic 3-2 Reply LS for R2- 2201760

**Issue 3-2-1: On draft reply LS to R2- 2201760**

* Proposals
  + Option 1: RAN4 concludes that RAN2’s understanding on “it is up to UE implementation to perform new RSRP measurement in a DL BWP associated with CD-SSB before Msg1/A retransmission” is right and it is up to RAN2 to determine how to progress this work (vivo)

GTW Agreement:

There is no impact on RAN4 RRM specification from LS R1-2112802

# Reference