**3GPP TSG-RAN WG2 Meeting #116bis-e R2-2201735**

**Online, 17th-25th January 2022**

**Agenda item: 8.12.3.2**

**Source: Samsung**

**Title: Report of [AT116bis-e][104][RedCap] RRM relaxations (Samsung)**

**Document for: Discussion and decision**

1. Introduction

This document is to report the outcome of the following email discussion at RAN2#116bis-e meeting:

* [AT116bis-e][104][RedCap] RRM relaxations (Samsung)

Initial scope: Discuss RRM relaxation aspects based on submitted contributions

Initial intended outcome: Summary of the offline discussion with e.g.:

* + - List of proposals for agreement (if any)
    - List of proposals that require online discussions
    - List of proposals that should not be pursued (if any)

Initial deadline (for companies' feedback): Wednesday 2022-01-19 1300 UTC

Initial deadline (for rapporteur's summary in R2-2201735): Wednesday 2022-01-19 1500 UTC

Proposals marked "for agreement" in R2-2201735 not challenged until Thursday 2022-01-20 0300 UTC will be declared as agreed via email by the session chair (for the rest the discussion will continue in the GTW session).

2. Contact Information

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| --- | --- |
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| ZTE | LiuJing (liu.jing30@zte.com.cn) |
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3. Discussion

## 3.1 Relaxation status report in RRC\_CONNCETED

For RRM measurement relaxation in RRC\_CONNECTED, the main issue that RAN2 should address is "FFS: whether UE Assistance Information or legacy measurement reporting framework should be used by UE to report its relaxation status". Based on the agenda of this meeting, RAN2 needs to conclude the discussion in this meeting and not come back to this in February meeting. As stated above, there are two options on the table.

Option 1) UAI is used for UE to report its relaxation status

Option 2) Legacy measurement reporting framework is used for UE to report its relaxation status

According to contributions submitted in this meeting, rapporteur found there are still split views on it. Some companies [4,8,9,11,17,20] prefer Option 1 which introduces a simple RRC signalling and thus has less specification impact. They also state, given limited discussion time of Rel-17, it is hard for RAN2 to adopt Option 2, as it would require RAN2 to discuss a lot of further issues (e.g., contents of configuration and report, design of event). On the other hand, other companies [5,6,7,10,12,16] support Option2, in that *Hysteresis, timeToTrigger, rsType,* measurement reporting entry and exit condition can be reused. Besides, one company [10] also mentioned: *In the RAN2#115-e meeting, it was agreed that Do not introduce nor reuse not-at-cell-edge threshold for R17 RRC\_CONNECTED UEs. The agreement was reached based on the assumption that network can estimate UE’s position(i.e. whether not-at-cell-edge criterion is met or not) based on A1/A2 events. Hence, option2 allows UE to report the fulfillment of not-at-cell-edge and stationarity criterion with the same mechanism, i.e. RRM measurement reporting mechanism.*

**Q1:** Do you support Option 1 or Option 2 for RRM measurement relaxation in RRC\_CONNECTED?

Option 1) UAI is used for UE to report its relaxation status

Option 2) Legacy measurement reporting framework is used for UE to report its relaxation status

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| Company | Option 1 or 2 | Comments |
| Ericsson | 1 | As discussed earlier, we should not mix functionality. The RRM measurement framework is a core functionality of the RRC specification. We should not mix in reports about fulfillment of e.g. UE stationarity, etc. |
| ZTE | 1 | The stationary status can be regarded as UE assistance information, similar to UE preference indication in power saving, so using UAI is more suitable. |
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**Summary**: <TBD by rapporteur>

Besides, there was the proposal [8] that 1-bit indication (i.e., whether UE meets stationary criterion or not) is sufficient for UE to report its relaxation status. Rapporteur would like to discuss what UE should report.

**Q2**: Do you agree that 1-bit indication (i.e., whether UE meets stationary criterion or not) is sufficient for UE to report its relaxation status? If you consider another information in UE's report, please feel free to elaborate it.

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| Company | Yes/No | Comments |
| Ericsson | Yes |  |
| ZTE | Yes | Right now, we haven’t identified other information that needs to be reported to network. |
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In addition to "what" UE should report, RAN2 also needs to discuss "when" UE should report its relaxation status. There are a few of contributions [8,11,20] discussing this issue. They commonly insist UE does not need to report the same relaxation status repeatedly to reduce redundant signalling, but UE's reports are triggered only if relaxation status (i.e., whether relaxation criterion is met or not) toggles.

**Q3**: Do you agree UE reports are triggered only if relaxation status (i.e., whether relaxation criterion is met or not) toggles?

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| Company | Yes/No | Comments |
| Ericsson | Yes | If this is specified, we may not need a prohibit timer. See our answer on the next question. |
| ZTE | Yes |  |
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**Summary**: <TBD by rapporteur>

In the last meeting (RAN2#116e), RAN2 agreed the following understanding, assuming legacy measurement report framework (i.e., Option 2 in Q1) is used.

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| **Agreement in RAN2#116e**  - RAN2 understands that no prohibit timer is needed, if legacy measurement reporting framework is reused by UE to report its relaxation status |

In this meeting, some companies [4,8,11,20] want to discuss the same issue, assuming UAI framework (i.e., Option 1 in Q1) is used. There are 2 options on this issue, based on contributions submitted.

Option 1) Define its prohibit timer [4,20]

Option 2) No prohibit timer is needed [8,11]

Option 1 may be useful for NW to prevent UE from sending UAI reports too often. Proponents for option 2 argue prohibit timer will delay UE’s reporting when relaxation status changes. Furthermore, NW may have wrong understanding for UE's stationarity due to prohibit timer, and thus provide inappropriate configuration to UE. As compromise, one company [4] proposed value ‘0’ can be configured with Option 1, which means NW may disable prohibit timer, if needed.

**Q4: "**Assuming" UAI is used to report relaxation status, which option do you support?

Option 1) Define its prohibit timer. (Please state whether you support configuration of value ‘0’ or optional configuration of the prohibit timer)

Option 2) No prohibit timer is needed.

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| Company | Option 1/2 | Comments |
| Ericsson | 1 | But this relates to Question 3: another approach to avoid that a misbehaving UE sends the report repeatedly, would be that we specify that the UE cannot repeat the same status again, i.e. that the UE is only allowed to send the report when the UE has toggled the status. |
| ZTE | 2 | As long as we specify that the UE is not allowed to report the same status repeatedly, prohibit timer is not needed. From network perspective, the network will store the reported UE stationary status, multiple reporting with the same value does not bring any help and increases signaling burden. |
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**Summary**: <TBD by rapporteur>

## 3.2 The scope of UEs to which Rel-17 RRM relaxation is applicable

A number of companies [6,10,11,9,4,17] would like to discuss the scope of UEs to which Rel-17 RRM measurement relaxation is applicable. Their proposals can be summarized into 3 options as shown below.

Option 1) Rel-17 RRM relaxation can apply to any Rel-17 UE [6,10,11]

Option 2) Rel-17 RRM relaxation applies to only RedCap UE [9]

Option 3) Network can configure an indicator on whether Rel-17 RRM relaxation applies to all Rel-17 UEs or only RedCap UEs. [4,17]

With Option 1, NW can have flexibility of configuration, and power efficiency is an obvious requirement not only for RedCap UEs but also for non-RedCap UEs. On the other hand, the proponent of Option 2 states the existing Rel-16 RRM relaxation is enough for non-RedCap UEs. Meanwhile, Option 3 can be considered as compromise of both options (i.e., Option 1/2).

**Q5:** Which option do you support?

Option 1) Rel-17 RRM relaxation can apply to any Rel-17 UE.

Option 2) Rel-17 RRM relaxation applies to only RedCap UE.

Option 3) Network can configure an indicator on whether Rel-17 RRM relaxation applies to all Rel-17 UEs or only RedCap UEs.

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| Company | Option 1/2/3 | Comments |
| Ericsson | Not 3 | Either 1 and 2 are fine for us. But option 3 is not OK since it adds more complexity. |
| ZTE | 1 | We see no harm to apply Rel-17 RRM relaxation to non-RedCap UEs. Non-RedCap UE can also be benefit from Rel-17 RRM relaxation when Rel-17 criteria are fulfilled.  We understand some company may argue that RedCap devices are different from normal NR devices, but please note that one use case of RedCap is wearable device (e.g. smart watch), and its movement is basically the same as smart phone. |
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**Summary**: <TBD by rapporteur>

## 3.3 combineRelaxedMeasCondition for Rel-17

In the last offline discussion [1], RAN2 discussed an indication similar to combineRelaxedMeasCondition-r16. This new indication is used to differentiate two cases 1) only stationary criterion is met and 2) both criteria (stationary and not-at-cell-edge) are met, when both criteria are configured.

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| Among 19 companies replied, 11 companies agree that an indication similar to the one used in R16 RRM relaxation can be introduced for R17 and it offers more flexibility in the configuration of relaxation criteria. 5 companies disagree, arguing that R17 relaxation criteria is different because NACE criterion cannot be used independently from R17 stationary criteria. 3 companies think such an indication is useful only if RAN4 agree that RRM relaxation level is different for the two cases.  With the majority support for introducing the indication, the rapporteur suggests that we can consider supporting it. However, the rapporteur agrees with those 3 companies that this issue does depend on RAN4 input. Therefore, we may make it a working assumption, conditional upon confirmation from RAN4.  **Proposal 2. (11/19) (working assumption) RAN2 consider introducing an indication similar to *combineRelaxedMeasCondition-r16*, if RAN4 confirm that RRM relaxation level can be different depend on whether only stationary criterion or both criteria are met.** |

However, the proposal has been postponed since companies would like to wait for RAN4 on whether RRM relaxation level can be different.

Meanwhile, in this meeting, one company [6] captured the following RAN4's tentative agreements [2]:

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| **Issue 2-2-2: Scaling factor value when Rel-17 single criteria (stationary) is satisfied**   * + Option 1: 3 (**Apple** **CMCC**)   + Option 2: >3 (**xiaomi** **Huawei** **MTK** **Ericsson Apple QC Nokia**)     - Option 2a: 6 or 8 (vivo Ericsson CMCC)     - Option 2b: 4 (**Ericsson**)     - Option 2c: [5, 10, 30, 100] (**QC** **Nokia**)     - Option 2d: between [3 8] (MTK)     - Option 2e: FFS (Apple xiaomi Huawei)   + Option 3: FFS   *Tentative agreements: option 2 scaling factor >3* Note: Continue discuss sub-options of option 2  **Issue 2-2-3: Relaxation when both Rel-17 stationary and Rel-17 not-at-cell-edge criteria are satisfied**   * + Option 1: use a fixed long measurement period like Rel-16 for requirement relaxation (**Apple** **CMCC** **vivo** **xiaomi** **Huawei** **Ericsson** **Nokia** **MTK QC**)   *Tentative agreements: Option 1* |

As RRM relaxation level for the two cases are different, they proposed to the new Rel-17 indicator similar to combineRelaxedMeasCondition. There are other proponents [4,5,9,10] for this proposal. Some companies [11,20] proposed to wait RAN4's LS or confirmation, but rapporteur assumes now they can share the same view with the proponents for this new indicator. On the other hand, one company [7] proposed not to have this indicator, since they do not see the benefit of this indicator.

**Q6**: Do you agree to support a Rel-17 indicator similar to combineRelaxedMeasCondition? This indication is used to differentiate two cases 1) only stationary criterion is met and 2) both criteria (stationary and not-at-cell-edge) are met, when both criteria are configured.

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| Company | Yes/No | Comments |
| Ericsson | Yes | We can have this as a working assumption for now pending ACK from RAN4. In the unlikely case that RAN4 changes their mind, we can revisit this. |
| ZTE | Yes |  |
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**Summary**: <TBD by rapporteur>

## 3.4 Further issues

One company [9] pointed out the issue with RRM measurement resources in RRC\_CONNECTED. In RRC\_IDLE/INACTIVE, UE can only detect SSB resources, so it performs RRM measurement and evaluates the stationary criterion only based on SSB. However, in RRC\_CONNECTED, UE may be configured dedicated CSI-RS resource, so UE can derive the cell measurement results based on CSI-RS in addition to SSB. Based on this observation, the company proposed: NW should explicitly configure whether UE to use SSB-based or CSI-RS-based measurement for stationary criterion in connected state.

**Q7**: Do you agree NW should explicitly configure whether UE to use SSB-based or CSI-RS-based measurement for stationary criterion in RRC\_CONNECTED?

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| Company | Yes/No | Comments |
| Ericsson | No | We do not see the benefit of this added complexity. |
| ZTE | No | It is sufficient to use SSB-RSRP, we see no need to use CSI-RS for evaluating stationary criterion in RRC\_CONNECTED, and CSI-RS resource may change upon BWP switching. |
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**Summary**: <TBD by rapporteur>

In the contribution [18], WID [3] is captured:

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| Specify support for the following RRM measurement relaxations for neighbouring cells for RedCap devices: for RRC\_Idle/Inactive/Connected [RAN2, RAN4]:   * Specify measurement (RSRP/RSRQ) based stationarity criterion and not-at-cell-edge criterion [RAN2] * Enabling/disabling of RRM measurement relaxation should be under the network’s control. Specify both broadcast and dedicated signalling for enabling/disabling of RRM measurement relaxation. |

Based on this WID, the author states:

*Network dedicated control for enabling RRM relaxations should be supported for all the RRC states as clearly indicated in the work item objectives. When releasing UE’s RRC connection, RAN can then enable RRM relaxation for the UE in the RRC Release message.*

Consequently, it is proposed network can enable/disable RRM relaxation for IDLE/INACTIVE UE with RRC Release message

**Q8**: Do you agree network can enable/disable RRM relaxation for IDLE/INACTIVE UE with RRC Release message?

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| Company | Yes/No | Comments |
| Ericsson | No | Unnecessary complexity. |
| ZTE | No | There is no need to configure different thresholds for IDLE/INACTIVE UEs, so using system information is sufficient. |
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**Summary**: <TBD by rapporteur>

In the contribution [20], the issue related to CGI reading requirement was raised as captured below:

*In the latest meeting RAN4 agreed that CGI reading requirements will be supported for RedCap in Rel-17. The network requests the UE to read CGI. To acquire the CGI of a cell, the UE needs to acquire both MIB and SIB of that cell and the UE is allowed to autonomously create gaps for this purpose. In a case when the UE is configured to read CGI of a neighbor cell, relaxation of any kind shall be avoided. In practice, this can be achieved by the UE not evaluating the configured relaxation criteria or that the UE may evaluate but does not report fulfillment of the criteria to the network.*

**Q9**:Do you agree RAN2 to handle this issue related to CGI reading requirement? If yes, please elaborate how to address it (e.g., UE does not evaluate the configured relaxation criteria or UE evaluates but does not report fulfilment of the criteria to the network).

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| Company | Yes/No | Comments |
| Ericsson | Yes | I think RAN2 should just specify the observable UE behaviour, so whether the UE does not monitor or whether the UE monitors but does not report, does not make a difference from the specification point of view. We should implement this in the simplest possible way, which can be found when looking at the CR. |
| ZTE | No? | We may not fully understand the consequence if UE contrinues evaluate the stationary criterion. In our understanding, CGI measurement has no impact on the evaluation of serving cell RSRP.  If the intention is to avoid CGI reporting failure, seems it is not necessary. If the network instructs the UE to perform CGI reporting after receiving “stationary status” from the UE, it means the UE should read CGI of target cell, and the UE should fulfill the corresponding requirements defined in RAN4. |
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**Summary**: <TBD by rapporteur>

Meanwhile, one company brought crosstalk issue in SrxlevRef [14]. When both R16 low mobility and R17 stationary criteria are configured for a UE, UE evaluates each criterion using separate Tsearch periods (i.e., TSearchDeltaPand TSearchDeltaP-Stationary). Therefore, the reference Srxlev value should be updated independently. However, based on the current CR, a single SrxlevRef is used and shared as the reference Srxlev value for evaluating both criteria. Thus, crosstalk in updating the SrxlevRef value may occur, causing wrong SrxlevRefvalue being possibly used. As a result, it is proposed to introduce a separate reference Srxlev value (i.e., SrxlevRef-Stationary), for evaluating the R17 stationary criterion. The corresponding TP in 38.304 CR is shown as below:

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| <Beginning of the changes>  5.2.4.9.X Relaxed measurement criterion for a stationary UE  The relaxed measurement criterion for a stationary UE is fulfilled when:  - (SrxlevRef-Stationary – Srxlev) < SSearchDeltaP-Stationary,  Where:  - Srxlev = current Srxlev value of the serving cell (dB).  - SrxlevRef-Stationary = stationary reference Srxlev value of the serving cell (dB), set as follows:  - After selecting or reselecting a new cell, or  - If (Srxlev - SrxlevRef-Stationary) > 0, or  - If the relaxed measurement criterion has not been met for TSearchDeltaP-Stationary:  - The UE shall set the value of SrxlevRef-Stationary to the current Srxlev value of the serving cell.  <End of the changes> |

**Q10**:Do you agree to introduce a separate reference Srxlev value, SrxlevRef-Stationary, for evaluating the R17 stationary criterion?

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| Company | Yes/No | Comments |
| Ericsson | OK | The RAN2 intention of the current CR is that these values are separate. This is what everybody had in mind all along, from what we understand. I.e. it would be a misunderstanding of the reader to believe that there is one reference value shared by the two.  It would be OK to stick to current CR, but if companies see a risk of such misunderstanding, we are OK to clarify this somehow. |
| ZTE | Yes | We are fine with the proposed change. |
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**Summary**: <TBD by rapporteur>

Another contribution [16] raised a new discussion point for RRM relaxation in RRC\_CONNECTED:

*Currently for a UE in RRC\_CONNECTED, the threshold for NR SpCell RSRP measurement in s-MeasureConfig controls when the UE is required to perform measurements on non-serving cells. If s-MeasureConfig is configured and fulfilled (i.e. SpCell RSRP is not lower than the threshold), the UE doesn’t need to measure non-serving cells. It can be seen a kind of RRM relaxation in RRC\_CONNECTED and then the UE doesn’t need to evaluate stationary criterion and potential report whether the criterion is met in this case.*

Based on this, the author proposed: The UE doesn’t need to evaluate stationary criterion and potentially report whether the criterion is met when *s-MeasureConfig* is configured and met.

**Q11**:Do you agree UE to neither evaluate stationary criterion nor report relaxation status, when SpCell RSRP is not lower than *s-MeasureConfig*?

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| Company | Yes/No | Comments |
| Ericsson | - | This can be handled by UE implementation. Either way is fine as UE anyway will not measure neighbouring cells. |
| ZTE | No | s-Measure only impacts neighbor cell measurements, it does not impact the serving cell measurements. If the UE only starts stationary evaluation after S-measure is not met, it will cause extra delay to stationary status reporting. |
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**Summary**: <TBD by rapporteur>

3.5 Any other issues to discuss

If you think there is an issue that is important but is not included in this document, please describe it in the table below.

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| Company | Issue |
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**Summary**: <TBD by rapporteur>

1. Conclusion

Based on the outcome of the discussion, the rapporteur would like to suggest the following set of proposals:

**For agreements**:

<TBD by rapporteur>

**For more discussion:**

<TBD by rapporteur>

1. References
2. R2-2111345, Report of [AT116-e][111][RedCap] RRM Relaxations, Qualcomm
3. R4-2120325, WF on eDRX and RRM measurement relaxations requirements for Redcap UE, Vivo
4. RP-211574, Revised WID on support of reduced capability NR devices, Ericsson
5. R2-2200191, Remaining issues on RRM relaxation, Qualcomm Incorporated
6. R2-2200250, Discussion on RRM relax, OPPO
7. R2-2200288, Open issues on RRM measurement relaxation, Intel Corporation
8. R2-2200467, Discussion on RRM measurement relaxation for redcap, Beijing Xiaomi Mobile Softwar
9. R2-2200549, RRM measurement relaxation in RedCap, Samsung
10. R2-2200555, RRM measurement relaxation for RedCap UE, Huawei, HiSilicon
11. R2-2200598, RRM relaxation for neighboring cell, vivo, Guangdong Genius
12. R2-2200610, Further discussion on RRM relaxation for RedCap UE ZTE Corporation, Sanechips
13. R2-2200667, Remaining issues in RRM relaxation LG Electronics Inc.
14. R2-2200687, Further Discussion on RRM Relaxations, CATT
15. R2-2201088, On the need for a separate reference Srxlev value for evaluating R17 stationary criterion for RRM relaxation, Futurewei Technologies
16. R2-2201101, On a timing issue when both R16 low mobility and R17 stationary criteria are configured for a UE, Futurewei Technologies
17. R2-2201239, RRM relaxation in RRC\_CONNECTED for RedCap UEs, Sharp
18. R2-2201337, Open issues on RRM relaxations, DENSO CORPORATION
19. R2-2201493, On RRM relaxations for REDCAP, Nokia, Nokia Shanghai Bell
20. R2-2201494, On RRM relaxations in CONNECTED, Nokia, Nokia Shanghai Bell
21. R2-2201558, Details on RRM relaxation, Ericsson