**3GPP TSG-RAN WG2 Meeting #115-e R2-210xxxx**

**Online, Aug 16th – 27th, 2021**

**Agenda Item: 8.12.3.2**

**Source: Huawei, HiSilicon**

**Title: Summary of [AT115-e][110][RedCap] RRM relaxation**

**Document for: Discussion and decision**

# Introduction

This document summarizes the following offline discussion.

* [AT115-e][110][RedCap] RRM relaxation (Huawei)

Initial scope: Continue the discussion on the proposals from [R2-2107211](file:///C:\Data\3GPP\Extracts\R2-2107211%20RRM%20measurement%20relaxation%20for%20RedCap%20UE.doc) and [R2-2107748](file:///C:\Data\3GPP\Extracts\R2-2107748%20RRM%20relaxation%20for%20RedCap%20UEs.docx)

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): Monday 2021-08-23 10:00 UTC

Initial deadline (for rapporteur's summary in R2-2108894): Monday 2021-08-23 16:00 UTC

Proposals marked "for agreement" in R2-2108894 not challenged until Tuesday 2021-08-24 0800 UTC will be declared as agreed via email by the session chair (for the rest the discussion will further continue online).

# Contact from companies

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| --- | --- |
| Company | Name and email address |
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# Discussion

## Beam level criterion

* Option 1: Proposal in [1]: Beam-level criterion is adopted for Rel-17 stationary criterion.
* Option 2: Proposal in [2]: Do not introduce beam change based criterion in Rel-17.
* Option 3: Compromised solution, to introduce the network configuration for beam-level criterion, and it is up to network implementation to decide whether to use beam-level criterion as Rel-17 stationary criterion (in addition to i.e. SSearchDeltaP\_stationary/TSearchDeltaP\_stationary criterion).

**Q1-1 Which option above do companies support in Rel-17?**

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| **Company** | **Option 1, 2, 3?** | **Comments** |
| Fraunhofer | 1 |  |
| Ericsson | 2 | Let's not talk about optimizations before we have the basics sorted out. |
| ZTE | 2 | We suggest not to consider beam-based criterion in Rel-17 because:   1. Usually, the cell level RSRP will change when UE moves, beam results change without cell level RSRP change is a very rare case as we indicated in [2], so we think using cell-level based criterion is sufficient. 2. Beam level results are more sensitive than cell level results, using beam level results may easily cause misjudgment, so UE will have less chance to trigger RRM relaxation. 3. RAN2 already agreed cell level based low mobility criterion and not-at-cell-edge criterion, so there are already three combinations:  * Only low mobility is configured, and UE fulfills; * Both criteria are configured, and UE only fulfills low-mobility one; * Both criteria are configured, and UE fulfills both.   If beam-based criterion is introduced, then it can also combine with not-at-cell-edge (and/or low-mobility criterion), so it may produce much more cases. Considering the heavy workload in RAN4, most likely, RAN4 cannot finish studying /specifying relaxation methods for all cases. |
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If the beam-level criterion for stationary criterion in Rel-17 is supported, the details of defining beam-level criterion can be:

* Option 1: Proposal in [1]: For beam-change based criterion, it is determined based on whether quality change of beam(s) for a period of time is lower than a threshold.
* Option 2: Proposal in [3]: use Doppler shift of UE’s best beams from its serving cell instead of beam change counts.
* Option 3: Proposal in [4]: beam-change evaluation method which takes Number of serving beams into account.
* Option 4: Other…

**Q1-2 If beam-level criterion is supported in Rel-17, which option above do companies support for defining beam-level criterion?**

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| **Company** | **Option 1, 2, 3 or other?** | **Comments** |
| Fraunhofer | 2 | Doppler shift can be a more robust measure than change count or quality variation |
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## R17 not-at-cell-edge threshold for IDLE/INACTIVE

In RAN2#114-e, RAN2 made the following agreements on Rel-17 not-at-cell-edge criterion in RRC\_IDLE/INACTIVE:

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| Agreement:  1. When NW configures Rel-17 RRM relaxation for RRC\_IDLE/INACTIVE, Rel-17 stationary criterion is mandatory, and Rel-17 not-at-cell-edge criterion is optional configuration.  2. Continue discussion on Rel-17 not-at-cell-edge criterion in RRC\_IDLE/INACTIVE within two options:  - Option 1) Reuse Rel-16 not-at-cell-edge criterion with the same thresholds (i.e., SSearchThresholdP / SSearchThresholdQ)  - Option 2) Reuse Rel-16 not-at-cell-edge criterion with the different thresholds |

The Rel-17 not-at-cell-edge criterion in RRC\_IDLE/INACTIVE can be:

* Option 1: Proposal in [1]: Reuse Rel-16 not-at-cell-edge criterion with the same thresholds, when configured together with the R17 stationary criterion.
* Option 2: Proposal in [2]: Introduce separate Rel-17 not-at-cell-edge threshold, and the new threshold is only associated with Rel-17 stationary criterion (if configured).

**Q2 Which option above do companies support for Rel-17 not-at-cell-edge criterion in RRC\_IDLE/INACTIVE?**

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| **Company** | **Option 1 or 2?** | **Comments** |
| Fraunhofer | 1 | We do not see the benefit on adding a separate threshold |
| Ericsson | 1 | We assume 1 means that we don’t add anything new but rely on existing spec. |
| ZTE | 2 | RAN2 already agreed to reuse low mobility criterion with separate thresholds for Rel-17 UEs, so network can configure stricter low-mobility thresholds in order to determine stationary UEs. If Option 2 is supported, then network can configure a lower not-at-cell-edge threshold for stationary UEs, so they can have more chance to do RRM relaxation.  In addition, we think separate thresholds bring more flexibility to network deployment, if network wants to use single threshold, network can configure them to the same value. |
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## Stationarity criterion for CONNECTED

In RAN2#114-e, RAN2 made the following agreements on Rel-17 not-at-cell-edge criterion in RRC\_IDLE/INACTIVE:

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| Agreement:  1. An RSRP/RSRQ based stationarity criterion (Working Assumption: the same as in idle/inactive) can be configured for UEs in RRC Connected. If the criterion is met, this is reported to the network (FFS how/when). It is FFS whether, based on this, besides possibly reconfiguring RRM measurements (up to network implementation), the network can enable RRM measurement relaxation (FFS whether same method as in Idle/Inactive) |

For the configuration of stationarity criterion in RRC\_CONNECTED, how the network provide the configuration of stationarity criterion to the UE in RRC\_CONNECTED?

* Option 1: Dedicated signaling, e.g. RRCReconfiguration message;
* Option 2: Broadcast signaling, e.g. using configuration broadcast for RRC\_Idle/Inactive;
* Option 3: Combining dedicated signaling and broadcast signaling;
* Option 4: Other…

**Q3-1 Which option above do companies support for configuration of stationarity criterion in RRC\_CONNECTED?**

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| **Company** | **Option 1, 2, 3 or other?** | **Comments** |
| Fraunhofer | 3 | A broadcast signalling should suffice in most situations but for the sake of flexibility it would be good if the network can override the parameters for specific UEs via dedicated signaling |
| Ericsson | 1 | In CONNECTED mode the UE has a dedicated connection with the network, there is no need to add broadcast signalling for CONNECTED UEs. We don’t expect it to be a lot of overhead to signal these thresholds compared to other configurations the NW provides to the UE with dedicated signalling. |
| ZTE | 1 | First, we don’t think the configurations provided for IDLE/INACTIVE UEs can be reused for Connected UEs, because the performance impact in connected mode will be considered more seriously. If network broadcasts two set of thresholds in system information, it takes more public resources (especially because SIB is periodical transmitted).  For RRC\_CONNECTED UEs, we think the signalling overhead of Option 1 is not much, and network is able to configure different parameters for different UEs (e.g. based on service type).  Option 3 is not necessary, because using one method is sufficient. |
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If the configured stationary criterion is met by the UE, UE can report it to the network, so that the network can decide whether to enable the RRM relaxation to the UE, then how the UE reports it to the network in RRC\_CONNECTED?

* Option 1: Reuse UEAssistanceInformation message for the report, e.g. introduce new field to indicate whether stationary criterion is met or not;
* Option 2: Reuse RRM measurement reporting mechanism;
* Option 3: Define a new RRC message for the report;
* Option 4: Other…

**Q3-2 Which option above do companies support to report whether the stationarity criterion is met or not by the UE in RRC\_CONNECTED?**

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| **Company** | **Option 1, 2, 3 or other?** | **Comments** |
| Fraunhofer | 2 | Reusing the RRM measurement report mechanism seems more natural since the object of relaxation are the RRM measurement themselves. Also, this would create the opportunity to associate the relaxation with particular measurement objects. For example, as part of RRM relaxation report the UE could report the headroom on certain measurement objects (how far the UE is from reporting it) to assist the network to decide if that particular measurement object can be relaxed or not. |
| Ericsson | 1 | The RRM measurement framework is used to provide RRM measurements to the network.  What we are discussing here is a report of assisting data that the UE may have for the network in order to configure the UE in a certain way. For that purpose we have the UE assistance information framework.  We therefore assume that the simplest approach is to use the UE assistance information. |
| ZTE | 2 | We think it is simpler to reuse RRM measurement reporting mechanism, as we indicated in [2], we can define a new event, formulate TsearchDeltaP\_stationary as TTT, reuse *ReportOnleave* to trigger UE report when the criterion is not met any more. And network can use *reportAmount* and *reportInterval* to control UE’s reporting behaviour.  The current UAI mechanism is a bit complex and still has several open issues to be solved (see offline 14), so we think using Option 2 is simpler and reduces the specification effort. |
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## LS to RAN4

Based on WID, RAN2 only focus on defining RRM relaxation criteria, and the RAN4 will define RRM relaxation methods. [2] suggests to send RAN2’s conclusions to RAN4.

**Q4-1 Do companies agree to send LS to RAN4 to inform RAN2 conclusions for RRM relaxation in both RRC\_IDLE/INACTIVE and RRC\_CONNECTED?**

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| **Company** | **Yes or No** | **Comments** |
| Fraunhofer | Yes (but) | We agree to send an LS regarding the conclusions on RRC\_IDLE/INACTIVE, but for RRC\_CONNECTED it may be still be a bit premature as there are less agreements and more FFS. |
| Ericsson | Yes | Perhaps RAN4 can start working at least on the IDLE/INACTIVE relaxation. See comment on CONNECTED below. |
| ZTE | Yes | We think it’s time to inform RAN4 about our conclusion, and provide guidance to their discussion on RRM relaxation methods. |
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**Q4-2 If the answer for Q4-1 is yes, which content(s) to be included in the LS?**

1. **Agreed RAN2 conclusions;**
2. **“For RRC\_IDLE/INACTIVE, RAN4 is asked to study and define corresponding R17 RRM relaxation method” proposed in [2];**
3. **“For RRC\_CONNECTED, RAN4 is asked to study whether additional RRM relaxation method is needed. If yes, please specify it.” proposed in [2];**
4. **Other…**

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| **Company** | **Content(s)** | **Comments** |
| Fraunhofer | 1,2,4 | Regarding 3. the RRM relaxation method needs to match the criteria (for an harmonic overall solution). We think that we should discuss other criteria before asking RAN4 to specify the method. As pointed in our contribution (R2-2107145) we think that including a new criterion based on measurements of other cells (non-serving) is needed to prevent certain handover failures and network degradation. We suggest we discuss that before asking RAN 4 to specify the methods.  4 – we should kindly request that RAN 4 whether certain methods should not be used in RRC\_CONNECTED. In particular, we have concerns regarding the existing Rel16 method of stopping measurements for 1 hour. In our view this should not be applicable to RRC\_CONNECTED because it will prevent the UE to know it should leave RRM relaxation timely. |
| Ericsson | 1, 2 | Regarding 3, we have not yet decided how RRM relaxation in CONNECTED should be achieved. We describe in our paper [R2-2108275](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_115-e/Docs//R2-2108275.zip) that there can be done in two different ways:   1. define a new RRC measurement mode that the UE can be put in to, e.g. the network would tell the UE "please enable RRM relaxation". 2. rely on network configuration, e.g. network can deconfigure/reconfigure RRM measurements   This discussion needs to be sorted out before we involve RAN4. |
| ZTE | 1,2,3 | For CONNECTED UEs, RAN2 already agreed the network implementation based approach. But we don’t think RAN2 is able to discuss other relaxation methods, and whether IDLE/INACTIVE methods can be reused for CONNECTED UEs.  So it is better to inform RAN4 what has been agreed in RAN2, and let them to discuss and decide whether additional methods are needed. |
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# Conclusions

*To be added…*

# References

1. R2-2107211, RRM measurement relaxation for RedCap UE, Huawei, HiSilicon.
2. R2-2107748, RRM relaxation for RedCap UEs, ZTE Corporation, Sanechips.
3. R2-2107218 RRM relaxations for RedCap UEs, Qualcomm Incorporated.
4. R2-2107754 RRM Relaxation for RedCap UE, NTT DOCOMO INC.