**3GPP TSG-RAN WG2 Meeting #113e draft R2-2102020**

**Electronic Meeting, 25th Jan – 5th Feb 2021**

**Source: ZTE Corporation**

**Title: Offline [110][REDCAP] – RRM Relaxations**

**Agenda item:**  **8.12.3**

**Document for:** **Discussion and Decision**

# Background

This document is to kick off the following email discussion:

* [AT113-e][110][REDCAP] RRM relaxations (ZTE)

Scope: Continue the discussion on RRM relaxations based on the proposals in [R2-2100569](file:///C%3A%5CData%5C3GPP%5CExtracts%5CR2-2100569%20Report%20of%20Email%20discussion%5B155%5D%5BREDCAP%5D%20RRM%20relaxations.docx) marked as "continue in offline 110". Also discuss possible evaluations to be added in the Annex.

The intention of this offline is to describe options in the TR and, whenever applicable/possible, also provide some recommendations (i.e. p7 and p10 in [R2-2100569](file:///C%3A%5CData%5C3GPP%5CExtracts%5CR2-2100569%20Report%20of%20Email%20discussion%5B155%5D%5BREDCAP%5D%20RRM%20relaxations.docx))

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

* + - List of proposals for agreement
		- List of proposals that require online discussions
		- Corresponding TP for the TR

Initial deadline (for companies' feedback): Monday 2021-02-01 11:00 UTC

Initial deadline (for rapporteur's summary in R2-2102020): Monday 2021-02-01 17:00 UTC

Proposals marked "for agreement" in R2-2102020 not challenged until Tuesday 2020-02-02 10:00 UTC will be declared as agreed by the session chair. For the rest the discussion will continue online.

# Contact information

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# Discussion on remaining proposals

Regarding the proposals in the summary of email disc [1], after first online session, RAN2 has made following agreements.

Agreements:

1. Irrespective of RRC state, whether to enable/disable RRM relaxation function for Redcap UEs is within network’s control.
2. The following enhancements for triggering neighbour RRM relaxation in RRC\_IDLE/RRC\_INACTIVE are endorsed for inclusion in the TR. Among these solutions, -Enhancement #1, #2, #3 and #5 can be considered as higher priority. Exact TP and whether some amendments are needed/ further enhancements need to be added can be further discussed:
* Enhancement 1: Introduce additional SsearchDeltaP\_stationary threshold to support 2 level speed evaluation (i.e. stationary, low mobility);
* Enhancement 2: Take into account of beam switching in low mobility evaluation;
* Enhancement 3: UE determines its stationary property based on subscription information (e.g. USIM);
* Enhancement 4: Introduce an additional SsearchDeltaP\_correction threshold and configure the UE to use it if only it detects that it observes higher received signal power variation that do not violate stationarity i.e., rotating around itself, dynamically changing multipaths;
* Enhancement 5: Introduce additional TSearchDeltaP\_stationary to support 2-level stationarity (i.e. fixed location vs low mobility);
1. The following enhancements for neighbour RRM relaxation methods in RRC\_IDLE/RRC\_INACTIVE are endorsed for inclusion in the TR. Exact TP and whether some amendments are needed/ further enhancements need to be added can be further discussed:
* Enhancement 1: UE can stop measurements on neighbor cells for T (T>>1) hours;
* Enhancement 2: Enabling further relaxation via reducing the number of monitored RS;
* Enhancement 3: UE only perform measurements on a number of dedicated intra-freq, inter-freq cells;
* Enhancement 4: Minimize the number of measured frequencies;
1. For neighbour cell RRM relaxation in RRC\_CONNECTED, “fixed or immobile UEs” are considered with higher priority than “slightly moving UEs”.

Due to limited time, the rest proposals (marked as “continue in offline 110”) will be further discussed in this document.

|  |
| --- |
| General principle:**Proposal 1:** For measurement relaxation methods, RAN2 can discuss preferable solutions, but RAN4 should be consulted before making the final decision. Neighbour cell RRM relaxation in RRC\_CONNECTED:**Proposal 7**: Compared to RRC\_IDLE/INACTIVE, RRM relaxation in RRC\_CONNECTED can be considered with low priority if the time is limited in WI. **Proposal 8:** Capture in TR the following solutions for triggering neighbour RRM relaxation in RRC\_CONNECTED. • Solution 1: UE reports “stationary” property to network in Msg5; • Solution 2: Network provides (e.g. low mobility, not-at-cell-edge) evaluation parameters to UE via dedicated signalling; • Solution 3: AMF sends “stationary” indication to gNB (based on UE subscription); • Solution 4: UE reports “stationary” in UE Assistance Information to network;**Proposal 9:** Capture in TR the potential solutions for neighbour cell RRM relaxation methods in RRC\_CONNECTED. The exact mechanism, if any, should be decided by RAN4. From RAN2’s perspective, other solutions are not precluded (e.g. network does not configure measurements for mobility purpose, UE only performs measurement on single RS type). *Serving cell RRM relaxation in RRC\_IDLE/INACTIVE/CONNECTED***Proposal 10:** Irrespective of RRC state, serving cell RRM relaxation for Redcap UEs is not considered in Rel-17*.* |

Companies are invited to show your comments to above proposals:

**Q1.1: Do companies agree with above Proposal 1 (if no, please provide your comments)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree****(Yes or No)** | **Comments** |
| Apple | Yes |  |
| Huawei, HiSilicon | Yes |  |
| vivo | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| OPPO | Yes |  |
| Sharp | Yes |  |
| LG | Yes |  |
| CATT | Yes |  |
| Ericsson | Yes |  |
| Nokia | Yes |  |
| MediaTek | Yes, and | We need to avoid introducing too much RAN4 impact as they are quite overloaded in Rel-17 |
| Futurewei | Yes |  |
| Qualcomm | Yes |  |
| NEC | Yes  |  |
| Xiaomi | Yes |  |

**Q1.2: Do companies agree with above Proposal 7 (if no, please provide your comments)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree****(Yes or No)** | **Comments** |
| Apple | We are ok but | Pls note that C-DRX operation is part of RRC\_CONNECTED and RedCap UEs can benefit from relaxations here. |
| Huawei, HiSilicon | Yes |  |
| vivo | No | we have strong concern on this proposal. Based on the first round of email discussion, half of companies support this proposal, but half of companies do not support this proposal. I donot know how email rapporteur gets this conclusion based on such situation. [ZTE] We are a bit surprised about this comment. If you have such strong concern on this proposal, why didn’t you provide feedback during the phase II of email discussion [155]? There was a question to collect companies’ views on the proposals. (Meanwhile, thanks to companies who participated in phase II discussion)Please note, the wording of the proposal is a bit different from original question, as explained in the summary part. We’ve added “if the time is limited in WI.” So it means, if time allows, of course both scenarios will be studied/specified. But if, unfortunately, the time is limited, then IDLE/INACTIVE scenarios can be considered with high priority. In our understanding, for recommendation to WI, it is necessary to have a high level plan rather than put everything at the same level. [vivo] Thanks for the explanation. So how to determine whether the time is limited in WI or not? Our understanding is that, this discussion will happen in RANP during WID drafting and TU allocation. It is not fair for one feature to determine whether it is high/low priority independently. We should consider together with other features. As email rapporteur, I assume we should truly reflect the discussion situation. Our understanding is that, in the SI phase, we should focus on the technique issue, list all possible solutions with pros and cons. But which part is high priority/which part is lower priority should be considered together with other features. This discussion could happen in RAN plenary when drafting WID. So we suggest not to waste time to discuss this kind of proposal. |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| OPPO | No | Among the three use cases for RedCap, IWSN is likely to stay in RRC IDLE or RRC INACTIVE for most of the time, but for video surveillance and wearables, the situation may be different. For video surveillance and wearables in RRC CONNECTED with low mobility, RRM relaxation would also play an important role for UE’s power saving. |
| Sharp |  | We think RRM relaxation in RRC\_CONNECTED has benefits for power saving of RedCap UEs. Seems it may be quite difficult to get consensus on the priority at this stage, then it might be possible to be left to RANP or WI phase. |
| LG | Yes |  |
| CATT | Yes |  |
| Ericsson | Yes | If something is agreed to be done for RRC\_CONNECTED, the gains achieved over the mechanisms specified in Rel-16 Power saving should be clearly demonstrated.Note also possible enhancements in Rel-17 PowSav.  |
| Nokia | No | RRM relaxations for IDLE/INACTIVE were introduced in Rel-16 and RedCap UE should be able to implement these. However CONNECTED mode relaxations were not introduced in Rel-16 and therefore these should be considered in Rel-17 for new use cases. In addition, we think that RAN should do prioritization, if any, instead of RAN2. |
| MediaTek | OK to go with the majority | For ‘truly stationary’ UEs, there is an opportunity to reduce connected mode power consumption when the UE is in connected DRX. |
| Futurewei | Yes |  |
| Qualcomm | See comment | We can agree in principle but do not think we need to make a conclusion in this meeting.  |
| NEC | Yes  |  |
| Xiaomi | Yes |  |

**Q1.3: Do companies agree with above Proposal 8 (if no, please provide your comments)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree****(Yes or No)** | **Comments** |
| Apple | Agree, and | We would like to bring up another potential property of atleast certain RedCap UEs in that instead of (or in addition to) the stationary property, there could be UEs whose mobility is localized, and reporting of this characteristic can also follow the same principles proposed in proposal 8. We understand more discussion on this is in questions 3.1/3.2 below. |
| Huawei, HiSilicon | Agree, but | In our understanding, it is up to network to decide whether to enable UE RRM measurement relaxation in RRC\_CONNECTED, the solutions in proposal 8, e.g. UE/AMF provide information to the gNB for triggering RRM measurement relaxation, and the gNB makes the decision. |
| Vivo | Agree, but | We are open with the solutions. I assuming detailed triggering criteria could be discussed in WI phase. The solutions listed here are just for assistance. In this way, we suggest to have a minor change: Capture in TR the following solutions for assistanting triggering neighbour RRM relaxation in RRC\_CONNECTED. |
| ZTE | Agree |  |
| Lenovo | Agree |  |
| OPPO | Agree |  |
| Sharp | Agree |  |
| LG | Agree, and comments | We would like to clarify what “property” in Solution 1 means. Our understanding of the solution is that the UE may indicate its stationary characteristics from birth or temporarily stationary status, but the word “property” seems to close to the former one. So we propose to change the wording slightly, e.g. “UE reports “stationary” status to network in Msg5”. |
| CATT | Agree |  |
| Ericsson | Agree, but | OK to include options in TR. We have similar view as vivo on detailed discussions later, and with Huawei that mechanisms should be under NW control. See also Q2.3. |
| Nokia | Agree | In addition. we agree that any mechanism should be strictly under NW control. |
| MediaTek | Agree | We are OK to list all the solutions in the TR with no recommendation. The solution should be decided in the WI phase. We should aim to align solutions with the connected mode RLM discussions in Rel-17 power savings, to minimize specification and implementation effort. |
| Futurewei | Agree |  |
| Qualcomm | Agree |  |
| NEC | Agree  |  |
| Xiaomi | Yes |  |

**Q1.4: Do companies agree with above Proposal 9 (if no, please provide your comments)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree****(Yes or No)** | **Comments** |
| Agree |  |  |
| Huawei, HiSilicon | Yes |  |
| vivo | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| OPPO | Yes |  |
| Sharp | Yes |  |
| LG | Yes |  |
| CATT | Yes |  |
| Ericsson | Yes |  |
| Nokia | Yes |  |
| MediaTek | Yes |  |
| Futurewei | Yes |  |
| Qualcomm | Yes |  |
| NEC | Yes  |  |
| Xiaomi | Yes |  |

**Q1.5: Do companies agree with above Proposal 10 (if no, please provide your comments)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree****(Yes or No)** | **Comments** |
| Agree |  |  |
| Huawei, HiSilicon | Yes |  |
| vivo | No | Honestly, during the first round of email discussion, we did not see any technique reason for not supporting RRM relaxation in IDLE/INACTIVE mode. Companies’ reasons are mainly about the performance degrading in connected mode, e.g. HO failure or RLF.In our understanding, we should focus on the technique discussion on the feasibility and benefit in the SI phase. Whether to include this feature could be handled during the discussion on recommendation or WID drafting. Regarding the feasibility on RRM relaxation for serving cell for RedCap at least in idle/inactive mode, we think there is no technique issue. [ZTE] As email disc rapporteur, we believe every companies had their technical reason when providing their inputs to the email discussion.On behalf of ZTE, please see our detailed technical justification below:[vivo] During the first round of discussion, we only found that ZTE agreed with MTK, (BTW, one of points is: eDRX automatically introduces serving cell relaxation, which we also agreed and it is what I argued online and here), but unfortunately, did not see any technical justification. As I commented during online discussion, in legacy eDRX in LTE, there is no RRM requirement outside the PTW. It means that, RRM on serving cell is required to be performed only in PTW based on the requirement defined in RAN4. In this way, there is RRM relaxation on serving cell in eDRX case (more specifically, no RRM outside PTW, which is similar as Rel-16 RRM relaxation when both criteria are fulfilled for a period). If eDRX could be supported for NR, RRM relaxation for serving cell could be naturally supported. Thus, at least we should confirm the feasibility on RRM relaxation for serving cell in idle/inactive mode. If some companies really hate this feature, they could provide preference when discussing the recommendation or WID. But we donot accept such proposal without any technique reason.  |
| ZTE | Agree | Response to Vivo about our technical reasons:1. First, so far, we haven’t seen any feasible solution of serving cell RRM relaxation without impacting IDLE/INACTIVE eighbor (e.g. paging monitoring). Right now, idle/inactive UE has to wake up at least every paging cycle, in order to detect the best SSB for paging reception. In addition to this, the UE can sleep for lower power consumption. By introducing eDRX, the paging cycle will be extended, thus power consumption caused by serving cell measurement can be reduced naturally. The simulation result (from R2-2100459) shows there is power saving gain, but it is based on the assumption that UE will perform serving cell measurement every four paging cycle, this definitely impacts the IDLE/INACTIVE eighbor;

[vivo] Companies providing technique comments should be based on evidence. In the context of our discussion, we assume RRM relaxation on serving cell for “stationary” UEs in idle/inactive mode. We would like to check how “definitely” impacts to idle/inactive. Thanks.1. The simulation results from Vivo shows that mobility impact will be “HO failure rate changes from 0%~0.26%”. First, we believe the simulation does not consider the case that eighbor cell measurements are also relaxed based on the evaluation of serving cell quality. (We believe in real deployment, UE will first relax eighbor cell measurement, and then serving cell. The condition for triggering serving cell relaxation should be stricter than eighbor cell). Then once serving cell degrades rapidly, then eighbor cell measurement may still in relaxing mode, therefore the real mobility performance impact might be much higher than what is shown in the simulation results. In addition, 0.5% decrease of HO failure rate is a huge problem in real deployment, so even 0.26% HO failure rate decrease is non negligible performance impact.

[vivo] That is true, we did not consider the neighboring cell relaxation during evaluation. We agree ZTE’s observation for connected mode, and OK with the suggestion on the TP part.1. Regarding Vivo’s comment on eDRX, as we explained during online, we shouldn’t mix up “RRM requirement” with “RRM relaxation”. For eDRX, RAN4 will define corresponding RRM requirements for eDRX case. But “RRM relaxation” means whether to do further relaxation on top of those RRM requirements. There are totally different things.

[vivo] Based on the comments, I suppose we have some gap on the meaning or “RRM relaxation”. I do not mind to explain what “RRM relaxation” means. In Rel-16, RAN4 defined RRM measurement requirement by two approaches to achieve RRM relaxation:1. Using scaling factor, e.g. RAN4 define requirement for 3 or 4 times of measurement interval.
2. Stopping measurement for a period, e.g. 10min or 1hour. That is there is no requirement for a period of stopping measurement.

In general, we agree with you, that RRM relaxation means whether to do further relaxation on top of existing requirements. Thus, any relaxation on top of existing requirements is “RRM relaxation”. In NR, we currently do not have RRM requirement for eDRX. If we defined corresponding RRM requirement for eDRX e.g. like what we have in LTE, there is no RRM requirement outside PTW. It is RRM relaxation for serving cell (comparing with existing RRM requirement in NR), which is exact 2nd approach of RRM relaxation: stopping measurement for a period, the length is (eDRXcycle - PTW). There is only RRM requirement inside PTW.I donot know why you mentioned they are totally different things. |
| Lenovo | Yes |  |
| OPPO | Yes |  |
| Sharp |  | Yes for RRC\_CONNECTED. For RRC\_IDLE, we have sympathy on the comments about the serving cell measurement for LTE eDRX. Maybe we can first check whether LTE serving cell measurement rule can be reused for NR if eDRX is configured, and of course RAN4 should be consulted. |
| LG | Yes |  |
| CATT | Yes |  |
| Ericsson | Agree | Agree with ZTE comments: The technical issues were brought up in previous email/offline discussions already. In case there would be demonstrable and significant gains without unwanted side-effects, such improvements could be considered but until now this kind of analysis has not been presented. We also agree with ZTE explanation w.r.t. RRM requirements during eDRX vs. additional RRM relaxation (i.e. we are talking about the latter here – eDRX requirements are then another matter to be discussed in RAN4). |
| Nokia | Agree |  |
| MediaTek | Yes | Serving cell measurement relaxations are largely pointless as the UE anyways needs to monitor PDCCH on the serving cell every DRX/eDRX cycle. If we follow LTE baseline, RRM requirements for the serving cell are a function of the eDRX cycle. Our understanding is that these are baseline RRM requirements, whereas we understand from vivo’s comments that they view this as RRM relaxation. Regardless, we both agree that serving cell RRM requirements will be a function of eDRX cycle similar to LTE. |
| Futurewei | Yes |  |
| Qualcomm | Yes |  |
| NEC | Yes  |  |
| Xiaomi | Yes | In addition to the degradation of performance, we are concerned about due to serving cell measurement relaxation, the triggering condition may not be indicated accurately. |

# Discussion on draft TP

Based on agreements and the rest proposals of summary of email disc, rapporteur provides a draft TP in FTP folder for further discussion, it is drafted based on the latest endorsed TP [2]. In this section, companies are welcome to check the draft TP, and provide possible evaluations if any.

For easy discussion, we split the draft TP into 3 parts:

* **Part 1: Triggering condition for RRM relaxation in RRC\_IDLE and RRC\_INACTIVE**

|  |
| --- |
| 8.4.1.1 RRM relaxation in RRC\_IDLE and RRC\_INACTIVERel-16 NR RRM relaxation procedures are taken as a baseline to study further enhancements of neighbour cell RRM relaxation for Redcap UEs in RRC\_IDLE and RRC\_INACTIVE. For triggering neighbour cell RRM relaxation for RedCap UEs in RRC\_IDLE and RRC\_INACTIVE, based on Rel-16 triggering criterion, following enhancements can be considered:* **Enhancement 1:** Introduce additional SsearchDeltaP\_stationary threshold to support 2-level speed evaluation (i.e. stationary and low mobility), for example:
	+ Stationary: (SrxlevRef – Srxlev) < SSearchDeltaP\_stationary
	+ Low mobility: SSearchDeltaP\_stationary <= (SrxlevRef – Srxlev) < SSearchDeltaP\_low\_mobility

Pros:* From specification point of view, it is simple and straightforward enhancement based on Rel-16 mechanism;
* It supports 2 levels speed evaluation (i.e. stationary and low mobility), so it provides flexibility of designing different RRM relaxation levels for different mobility scenarios.

Cons:* Unclear whether UE’s mobility level can be accurately determined;
* Channel or link (RSRP/RSRQ) may change even if UE is purely stationary, thus it may not be a reliable way to distinguish between truly stationary and low mobility UE.
* **Enhancement 2:** Introduce additional TSearchDeltaP\_stationary to support 2-level speed evaluation (i.e. fixed location and low mobility).

Pros:* From specification point of view, it is simple and straightforward enhancement based on Rel-16 mechanism;
* It supports 2 levels speed evaluation (i.e. stationary and low mobility), so it provides flexibility of designing different RRM relaxation levels for different mobility scenarios.

Cons:* Unclear whether UE’s mobility level can be accurately determined.

Note: There can be synergies if Enhancement 1 is combined with Enhancement 2.* **Enhancement 3:** Take into account of beam switching in low mobility evaluation, for example:
	+ Stationary:
		- number of beam switch < N1 or
		- no beam switch and (SrxlevRef – Srxlev) < SSearchDeltaP\_stationary
	+ Low mobility:
		- number of beam switch < N2 or
		- SSearchDeltaP\_stationary <= (SrxlevRef – Srxlev) < SSearchDeltaP\_low\_mobility

Pros:* Using beam level measurement results can assess UE’s movement more accurately than cell measurement, because UE may move among beams but without changing the cell level results;
* Potentially good for detecting “circular motion” around base station.

Cons:* Unclear whether UE’s mobility level can be accurately determined;
* Beam level measurement results may fluctuate more than cell-level results, so it might cause misjudgement;
* **Enhancement 4:** UE determines its stationary property based on subscription information (e.g. USIM).

Pros:* It is simpler and faster than evaluating the quality of serving cell.

Cons:* Only applicable to limited scenarios, e.g. fixed-location devices;
* Channel or link (RSRP/RSRQ) may change (e.g. may be low) even if UE is fixed-location, RRM relaxation only depends on fixed-location information may impact the performance.
* **Enhancement 5:** Introduce an additional SsearchDeltaP\_correction threshold and configure the UE to use it if only it detects that it observes higher received signal power variation that do not violate stationarity, i.e. rotating around itself, dynamically changing multipath.

Pros:* Can be used to differentiate different stationary cases. E.g. stationary or stationary with rotating around itself.

Cons:* Covers specific use case where device is rotating around itself.
 |

Above context related to agreement 2, and also including the Pros/Cons analysis summarized in R2-2100569 (the bullets marked as FFS are not listed). Companies are asked to provide feedback on the above suggestion for baseline text and provide further evaluations, if needed.

**Q2.1: Do companies agree with above text proposal added to section 8.4.1?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree****(Yes or No)** | **Comments or TP suggestions** |
| Apple | Agree |  |
| Huawei, HiSilicon | Yes |  |
| vivo | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| OPPO |  | For enhancement 3, we doubt how to evaluate the number of beam switch since there is no serving beam concept for UEs in RRC IDLE. |
| Sharp | Yes |  |
| LG | Agree |  |
| CATT | Yes |  |
| Ericsson | Yes | TP looks OK in general. If the proposal is agreed we think editorial corrections and additional clarifications should be made when implementing the text to TR, if needed. |
| Nokia | Yes, but | See proposed modification above for 5 |
| MediaTek | See comment | For enhancement #4, Con #2 (“Channel or link (RSRP/RSRQ) may change (e.g. may be low) even if UE is fixed-location…”) can be removed. Since the UE is configured to be stationary, it will not have to change the serving cell, therefore changes in the serving link RSRP/RSRQ (e.g. if the device is rotating on a fixed position) can be ignored, the serving cell will never change. |
| Futurewei | Yes |  |
| Qualcomm | Yes | We’d like to suggest adding a note as follows:For triggering neighbour cell RRM relaxation for RedCap UEs in RRC\_IDLE and RRC\_INACTIVE, based on Rel-16 triggering criterion, following enhancements can be considered (other solutions are not precluded):This note also applies to Q2.2 and Q2.3. |
| NEC | Yes  |  |
| Xiaomi | Yes | We suggest to have a minor change for the description of enhancement 3: Take into account of beam switching in speed evaluation, for example…… |

* **Part 2: RRM relaxation methods in RRC\_IDLE and RRC\_INACTIVE**

The draft TP is shown below:

|  |
| --- |
| For neighbour cell RRM relaxation methods for RedCap UEs in RRC\_IDLE and RRC\_INACTIVE, based on Rel-16 NR RRM relaxation methods, following enhancements can be considered:* **Enhancement 1:** UE can stop measurements on neighbour cells for T (T>>1) hours.

Pros:* It is useful to further reduce power consumption for truly stationary UEs.

Cons:* Not applicable to wearable devices;
* Based on evaluation scenario in TR, the gain compared to 1 hour measurement interval is not significant.
* **Enhancement 2:** Enabling further relaxation by reducing the number of monitored RS.

Pros:* Since UE only needs to measure specific beams, the power consumption can be reduced and the time period of measurement can be reduced.

Cons:* **Enhancement 3:** UE only perform measurements on a number of dedicated intra-frequency, inter-frequency cells.

Pros:* For stationary UEs, can avoid UE to measure all frequencies/cells broadcast.

Cons:* **Enhancement 4:** Minimize the number of measured frequencies.

Pros:* For stationary UEs, can avoid UE to measure all frequencies/cells broadcast.

Cons: |

Above context related to agreement 3, and also including the Pros/Cons analysis summarized in R2-2100569. Companies are asked to provide feedback on the above suggestion for baseline text and provide further evaluations, if needed.

**Q2.2: Do companies agree with above text proposal added to section 8.4.1.1?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree****(Yes or No)** | **Comments or TP suggestions** |
| Apple | agree |  |
| Huawei, HiSilicon | Yes, but | In our contribution R2-2101257, we propose another solution for neighboring cell RRM measurement relaxation in RRC\_IDLE/INACTIVE. In the case that measurement interval expanded with scaling factor of 3 times based on Rel-16 NR RRM relaxation method, the truly stationary UEs can further expand the measurement interval to 1 hour to reduce power. We also provided simulation results. Thus, we propose to add the following in the TP:* **Enhancement 5:** Expand the scenario of performing “stop measurement for 1 hour” for stationary UEs.

Pros:* It is useful to further reduce power consumption for truly stationary UEs.

Cons: |
| vivo | Yes |  |
| ZTE | Yes | We are ok with HW’s proposal. |
| Lenovo | Yes |  |
| OPPO | Yes |  |
| Sharp | Yes |  |
| LG | Yes, but see comments | We are fine with listed enhancements, and want to clarify enhancement 3 – What does “dedicated” frequency mean here? Does it mean particular frequencies are provided via dedicated signaling or particular frequencies may be pointed by the network among broadcast neighbor frequencies?Additionally, in our contribution R2-2100581, we propose to add enhancement for the measurement relaxation method of frequency reduction. As UE should fulfil the low mobility criterion for a time period of TSearchDeltaP to check that the UE has entirely, but we believe that once RedCap stationary fulfils the low mobility criterion, it is low possibility that UE’s mobility increases rapidly. Therefore, we propose to trigger the measurement relaxation quickly before TSearchDeltaP expiry so that the UE can maximize the power saving.* **Enhancement 6:** Upon UE fulfils the criterion, UE can trigger the measurement relaxation on part of configured frequencies before TSearchDeltaP expiry.
* UE can maximize its power saving on the measurements.

Cons: |
| CATT | Yes |   |
| Ericsson | Yes, with additions | Enhancement 2, cons: Unclear if useful for FR1, potentially more benefit for FR2 UEs, exact gain is not clear (e.g. due to averingEnhancement 3 cons: Not clear if RedCap will support all legacy measurements, e.g. inter-cells? Such details need to be sorted out first. Relaxation may require additional efforts for network planning.Enhancement 4 cons: If the UE actually does moves or radio conditions change enough, impact on cell-reselections. Also for enhancement 4, what does minimize exactly refer to here? Who controls this, even for stationary device some measurements would be needed?  |
| Nokia | Yes |  |
| MediaTek | Yes |  |
| Futurewei | Yes |  |
| Qualcomm | Yes |  |
| NEC | Yes  |  |
| Xiaomi | Yes | About enhancement 1 Cons：- Not applicable to wearable devices;We wonder why this is not applicable to wearable devices. Once a moving UE whose the serving cell measurement is not fulfilled with the condition, UE will exit the relaxed measurement. Please correct me if I am wrong, thanks. |

* Part 3: RRM relaxation in RRC\_CONNECTED

The draft TP is shown below:

|  |
| --- |
| 8.4.1.2 RRM relaxation in RRC\_CONNECTEDFor neighbour cell RRM relaxation in RRC\_CONNECTED, “fixed or immobile UEs” are considered with higher priority than “slightly moving UEs”. For triggering neighbour cell RRM relaxation for RedCap UEs in RRC\_CONNECTED, following solutions can be considered:* **Solution 1:** UE reports “stationary” property to network in Msg5.

Pros:* Allows UE to report to network if it is temporarily stationary, so network can change its RRM configuration timely.

Cons:* Channel or link (RSRP/RSRQ) may change even if UE is purely stationary, so it may impact handover performance if UE cannot cancel RRM relaxing timely.
* **Solution 2:** Network provides (e.g. low mobility, not-at-cell-edge) evaluation parameters to UE via dedicated signalling.

Pros:* Reusing Rel-16 mechanism in Connected UEs, maximize the commonality with idle/inactive UEs;
* Network can set evaluation parameters to UE, so it is more reliable and impacts on performance can be reduced.

Cons:* Network needs to configure UE with additional parameters for RRC\_CONNECTED;
* Takes away the control from network in RRC\_CONNECTED to some extent.
* **Solution 3:** AMF sends “stationary” indication to gNB (based on UE subscription).

Pros:* The information is derived from UE subscription information, such fixed-location UE will not move, so performance impact can be minimized.
* It is useful in potentially reducing the amount of measurements, and can enable network to configure more power-efficient RRM in RRC\_CONNECTED.

Cons:* Only applicable to limited scenarios, e.g. fixed-location devices.
* Channel or link (RSRP/RSRQ) may change even if UE is purely stationary, so it may impact handover performance if UE cannot cancel RRM relaxing timely.
* **Solution 4:** UE reports “stationary” in UE Assistance Information to network.

Pros:* Allows UE to report to network if it is temporarily stationary, so network can change its RRM configuration timely.

Cons:* Channel or link (RSRP/RSRQ) may change even if UE is purely stationary, so it may impact handover performance if UE cannot cancel RRM relaxing timely.
* **Solution 5:** Network enables measurement relaxation based on UE’s measurement report.

Pros:* It keeps the control fully on network side.

Cons:* It relies on UE measurement reporting.

For neighbour cell RRM relaxation methods for RedCap UEs in RRC\_CONNECTED, the exact mechanism, if any, will be decided by RAN4. But from RAN2’s perspective, other solution are not precluded (e.g. network does not configure measurements for mobility purpose, UE only performs measurement on single RS type). |

Above context related to Proposal 8 and Proposal 9, and also including the Pros/Cons analysis summarized in R2-2100569. Companies are asked to provide feedback on the above suggestion for baseline text and provide further evaluations, if needed.

**Q2.3: Do companies agree with above text proposal added to section 8.4.1.2?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree****(Yes or No)** | **Comments or TP suggestions** |
| Apple | yes |  |
| Huawei, HiSilicon | Yes |  |
| vivo | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| OPPO | Yes |  |
| Sharp | Yes |  |
| LG | Yes | As we commented in Q1.3, for solution one, we suggest to change the solution as “UE reports “stationary” status to network in Msg5”.Additionally, we suggest to update the Pros, because we think it is more important to indicate UE’s operation rather than just stationary state :Pros:Allows UE to report to network if it is temporarily stationary so that it is relaxing the measurements, so network can change its RRM configuration timely. |
| CATT | Yes |   |
| Ericsson | Yes, with additions/clarifications | Solution 1: Based on the description (“Allows UE to report to network if it is temporarily stationary”), this seems to imply the reporting would be based on the measurements/evaluation done during idle/inactive states. This should be clarifiedSolution 2: Perhaps this could be combined with e.g. solution 1 – could be clarified in TP that the methods need not be mutually exclusive.Solution 4: Same as for Opt 1, how does UE determine it is stationary? Our understanding is that the UE could send such information multiple times when it is in RRC\_CONNECTED, thus the UE needs to determine somehow it is stationary. Solution 5: It would be good to add a phrase (in “pro”) stating that UE measurement report would be based on the existing mechanism (at least this was the original intention).Regarding all “stationary” conditions directly announced by UE or read from subscription information: As commented earlier we do not this information can be 100% accurate as physical movement cannot be prevented in practice. Thus we would like to capture this as a “con” e.g. in Opt 1, 3, 4.  |
| Nokia | Yes |  |
| MediaTek | See comment | For solution #4, Con “Channel or link (RSRP/RSRQ) may change even if UE is purely stationary…” can be removed. Given that the UE is stationary at deployment, and the gNB is not moving, there is no case of a handover. |
| Futurewei | Yes |  |
| Qualcomm | Yes |  |
| NEC | Yes  |  |
| Xiaomi | Yes |  |

**Q2.4: Do companies have any other comments to the draft TP (uploaded in FTP folder)?**

|  |  |
| --- | --- |
| **Company** | **Comments or TP suggestions** |
| Huawei, HiSilicon | We provided the TP in our contribution R2-2101257, and suggest it can be discussed in the following clause.[ZTE] Thanks for that, and sorry for my carelessness of missing it.  |
| vivo | We could provide the recommendation on the RRM relaxation part after we conclude the above open issues. |
|  |  |

# Discussion on draft TP from contributions

During this meeting, there are two company contributions containing draft TP:

[R2-2100459](file:///C%3A%5CData%5C3GPP%5CExtracts%5CR2-2100459_TP%20for%20TR%2038875%20on%20evaluation%20for%20RRM%20relaxation.docx) TP for TR 38875 on evaluation for RRM relaxation vivo, Guangdong Genius discussion Rel-17 FS\_NR\_redcap

[R2-2101461](file:///C%3A%5CData%5C3GPP%5CRAN2%5CDocs%5CR2-2101461.zip) Localized mobility of some RedCap devices Apple Inc discussion Rel-17 FS\_NR\_redcap

[R2-2101257](file:///D%3A%5C%5CDocuments%5C%5C3GPP%5C%5Ctsg_ran%5C%5CWG2%5C%5CTSGR2_113-e%5C%5CDocs%5C%5CR2-2101257.zip%22%20%5Co%20%22D%3ADocuments3GPPtsg_ranWG2TSGR2_113-eDocsR2-2101257.zip) RRM measurement relaxation for RedCap UE Huawei, HiSilicon discussion Rel-17

For R2-2100459, it is requested to add simulation results to the TR, including the simulation results for serving cell RRM relaxation in RRC\_IDLE/INACTIVE, and the simulation results for RRM relaxation in RRC\_CONNECTED. Companies are welcome to show their view on the draft TP.

**Q3.1: Do companies agree to add the draft TP (R2-2100459) to TR?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree****(Yes or No)** | **Comments or TP suggestions** |
| Apple | Yes | We are ok with adding the results to the TR. |
| Huawei, HiSilicon | Yes |  |
| vivo | Yes | It was agreed that: Power consumption analysis can be put in an Annex of the TR. We are OK to include all reasonable simulation results in the TR. |
| ZTE | Yes with comments | As response to Q1.5, we think the simulation on serving cell results based on the assumption that NO neighbour cell relaxation is performed. So we suggest to highlight this point to the background part.In addition, The TP says:Ø By increasing measurement period 4 times for RRC\_Connected UEs, 11.1% - 26.6% power saving gains are observed, at the cost of 0.26% raise in handover failure rate for stationary or low mobility (e.g., 3km/h) case.Actually, according to Power Saving TR, in this case the HOF rate for stationary/low mobility scenario would go from 0% to 0.26%, strictly speaking, it is not 0.26% raise. So the wording has to be changed into "at the cost of an increase of HOF rate from 0 to 0.26%...".[vivo] Thanks for pointing it out. We are fine to make it more clear in the assumption that “No neighboring cell relaxation is performed”. |
| Lenovo | Yes | The results could be added. |
| OPPO | Yes |  |
| LG | Yes | We are fine with the TP. |
| CATT | Yes but | We think the simulation results with WUS should be removed as this is more RAN1ish and is not directly related to the RRM performance. |
| Ericsson | Yes with comments | We are fine in principle. 2 of the 3 cases however apply WUS and it is not clear whether this will be applicable, but it should be fine with the Note. The observation should be clarified however so it is clear there are dependencies.It should be clarified what “true stationary” UE refers to: Does it mean the RSRP and (all) channel conditions stay static all the time? Any assumptions that go along with this propert?For the E.x.2 it should be clearly mentioned the results come from Power saving SI TR 38.840.  |
| Nokia | Yes |  |
| MediaTek | Yes with comments | The impact on PDCCH and PDSCH decoding as a result of not monitoring SSBs are not captured in the simulation. This must be clarified in the TP. |
| Futurewei | Yes |  |
| Qualcomm | Yes | We can agree to include the TP in an annex of the TR (as reminded by vivo).  |
| NEC | Yes  |  |
| Xiaomi | Yes |  |

For R2-2101461, it proposes to agree on the use case of certain RedCap UEs whose mobility is localized for the lifetime of the UE. And this paper also suggests to capture below observation into the TR:

|  |
| --- |
| * **If the NW is aware of such mobility nature of the RedCap UE, the NW can use this information in allocating resources to the UE (for e.g. paging).**
* **The NW can configure a set of neighbour cells that are the cells likely to be used by the UE during it’s lifetime and the NW can configure the UE to inform the NW in case the UE moves out of these cells**
	+ **In addition, the NW can provide additional thresholds and control other aspects of the UEs mobility (in IDLE/INACTIVE for reselection and in CONNECTED mode for potential handover) to ensure that the UE does not reselect to cells that outside the configured set of neighbour cells.**
	+ **Alternatively, the NW can also prohibit the UE to reselect to other cells than the ones configured by the NW.**
* **The information about the localized mobility can be from the subscription or from the user configuration, and this information can be provided to the core network or can be limited to the RAN.**
 |

Per rapporteur understanding, these are feasible measures that can be considered, but strictly speaking, some bullets are not related to RRM relaxation (e.g. paging resource allocation). However, companies are welcome to show their views to this proposal.

**Q3.2: Do companies agree to add above text to TR? (may not be completely covered in clause 8.4 )**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree****(Yes or No)** | **Comments or TP suggestions** |
| Apple  | Yes | We thank the rapporteur in including this as part of the discussion. |
| Huawei, HiSilicon | Yes |  |
| vivo | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| OPPO | No | We have similar understanding with rapporteur and some of these are not related to RRM relaxation. RAN2 has not discussed this use case and therefore we are reluctant to capture it in the TP directly. |
| LG | Yes |  |
| CATT | Yes, but | As pointed by Rapporteur, some bullets are not related to RRM relaxation. We wonder whether to include it and where to put the description if agreed. |
| Ericssson | No without further clarification | We think such a solution brings additional complexity for both the UE and the network side, and is a bigger feature than just RRM relaxation as commented by rapporteur. Also, the details are not fully clear:* How is the network made aware of “mobility nature of the RedCap UE”. Is this based on NW understanding or something else?
* Perhaps one option can be for the UE to provide assistance information to NW to configure such a feature.
* Not clear how e.g. paging resource optimization should work and interaction with eDRX
* Likely results in additional overhead in signaling and complexity from UE side to apply new different thresholds, possibly on top of new thresholds for determining whether UE is stationary or not (i.e on top of the other suggested options in this discussion, if this is the intention?) => added complexity for both UE and NW side
* What would the actual gains be and what kind of scenarios would really benefit from such feature?

All in all, we think such feature would require further considerations and is out of scope for the current SID.If the text is agreed to be adopted in TR, further editorial updates should be made and preferably specification impact analyzed as well. |
| Nokia | Yes |  |
| MediaTek | No | We are reluctant to capture this in the TR as we have not discussed this in the SI. |
| Futurewei | Yes |  |
| Qualcomm | Yes | We agree with the observations in principle. But like some other companies have pointed out, we need to discuss how (which part of the text and in which section) to include the TP.  |
| NEC | Yes, but | Further clarifications are needed, as Ericsson pointed out. |

For R2-2101257, it is requested to add simulation results to the TR, including the simulation results for power saving gain achieved by further expanding the measurement interval and reducing measurement time for neighboring cell RRM measurement relaxation in RRC\_IDLE/INACTIVE. Companies are welcome to show their view on the draft TP.

**Q3.3: Do companies agree to add the draft TP (R2-2101257) to TR?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree****(Yes or No)** | **Comments or TP suggestions** |
| Huawei, HiSilicon | Yes | Proponent. |
| vivo | Yes | We are OK to include all reasonable simulation results in the TR. |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| OPPO | Yes |  |
| LG | Yes |  |
| CATT | Yes |  |
| Ericsson | Yes | Fine in principle. Is the intention to add this is Annex and refer from the body text, as has been done for other analyses? |
| Nokia | Yes |  |
| MediaTek | Yes, but | We are open to include the simulation results in the TR. However the associated text in section 8 of the TR is not needed as it has been covered in part 1 and 2 of this email discussion. |
| Futurewei | Yes |  |
| Qualcomm | No | We don’t agree including the 1st and 2nd change in the body text, which preferrably should consist of mostly agreements or issues that have been discussed, not views from a particular company that has not been discussed. We’d like to suggest moving the 1st and 2nd change to the annex to be together with the 3rd change.  |
| NEC | Yes  |  |
| Xiaomi | Yes |  |

# Summary

TBD

# Reference

1. R2-2100569 Report of Email discussion[155][REDCAP] RRM relaxations ZTE Corporation, Sanechips discussion Rel-17 FS\_NR\_redcap

*endorsed TP*

1. R2-2100984 RAN2 update to TR38875 Ericsson discussion FS\_NR\_redcap