**3GPP T****SG-RAN WG2 Meeting #113bis-e R2-2104368**

**Online, April 12 – 20, 2021**

**Agenda item: 8.12.3.2**

**Source: Qualcomm Incorporated**

**Title: Summary of [AT113-e][102][RedCap] RRM relaxations – Phase 2**

**WID/SID: FS\_NR\_redcap**

**Document for: Discussion and Decision**

# Introduction

This document is for the **second** round of offline discussion on RRM relaxations for R17 stationary UEs. Per suggestion from the session chair, we will focus the discussion on the following five topics:

1. Whether - besides an RSRP/RSRQ based criterion - we can have a WA on having a Stationary property based on subscription and the need for a related LS to SA2;
2. For the RSRP/RSRQ based criterion, continue the discussion on whether reuse R16 thresholds or new ones;
3. Whether we can have a beam based criterion;
4. Continue the discussion on p4 and p7 from R2-2104361.

Please consider the comments made in the online session as well as those in the first round of offline discussion (in Appendix) when you select your options. Hopefully, companies will converge a bit more in this round of offline so that we can make some agreements/WAs in the CB session.

Deadlines:

* Initial deadline for companies' feedback: **Friday 2021-04-16 00:00 UTC**
* Initial deadline for rapporteur's summary: **Friday 2021-04-16 04:00 UTC**

# Contact information

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# Discussion

## Definition of stationary UEs based on subscription information

One of the motivations for using subscription information to define UE’s stationarity is that UEs may have fixed locations in a number of RedCap use cases, e.g. video surveillance cameras, industrial wireless sensors, robots in a warehouse etc. Since radio links for those fixed-location UEs are relatively stable, it is more efficient for them to trigger RRM relaxations based on their stationarity property, which can be provisioned in their subscription information, instead of based on periodic evaluation of RSRP/RSRQ or beam-change criteria. As for all relaxation criteria, subscription based relaxation is subject to network control too, i.e. if network does not enable it, fixed-location UEs may not use it to trigger relaxation.

**Question 1a: Do you support including subscription information as a relaxation trigger for fixed-location UEs?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments (if any) |
| Apple | Yes, but it doesn’t have to be with subscription, can be with AS UE capability as well | Subscription based involves NAS (CT1) when this can be done within RAN2 with a UE capability that anyway gets transferred across the RAN nodes. Otherwise, this info needs to be shuttled from CN to RAN along with DRX interaction (if that gets agreed). |
| Ericsson | No | Since we haven't seen any meaningful gains of considering subscription information on top of the already defined Rel-16 rules, we do not support this.  However, for a constructive discussion: if (if) this would be considered, we assume that since the subscription information is already available in the CN, if subscription information should be considered for RedCap UEs, it should be information sent from CN to gNB. |
| OPPO | No | Considering RSRP/RSRQ based criterion is more reliable than subscription information, we think for stationary RedCap UEs, the RRM relaxation should be triggered by RSRP/RSRQ based criterion.  Note that in NB-IoT, there are also fixed-location UEs, for which the neighboring cell RRM relaxation is always based on RSRP/RSRQ based criterion. |
| Huawei, HiSilicon | No | We understand the “stationary UE” includes “fixed UE” and “temporary stationary UE”, subscription information is only useful for “fixed” scenario which is limited, so we think R16 style low-mobility criterion is more suitable. If R16 style low-mobility criterion needs to be introduced, a unified criterion for “fixed” and “temporary stationary” is enough. |
| Xiaomi | - | We think RSRP-based is necessary and stationary property can be further considered. Because we still have a concern that how to define UE stationary property, for example, a video surveillance camera carried in a car. |
| CATT | Yes | We think there are obvious and many cases, such as industrial sensors, surveillance cameras, etc where the device, once installed, is guaranteed to remain at a fixed location and not moving. So we believe such information is worth leveraging for RRM relaxation. |
| vivo | Yes | For fixed UE, using the subscription information is an efficient way to trigger RRM relaxation. It allows RedCap UE, which is assumed to be more power sensitive, to apply RRM relaxation method faster than measurement based approach. |
| Samsung | No | This can be used only for fixed location UEs. We prefer a unified solution to apply all types of RedCap UEs (i.e., fixed or moving or temporary fixed). |
| Intel | Yes | For IDLE/Inactive, the subscription should be based on UE’s USIM.  For CONNECTED, the RAN can get it from CN along with DRX interaction. |
| ZTE | Yes | We don’t agree with the comments that RSRP based solution is more reliable. For RSRP based solution, whether the “stationary” UEs identified are reliable purely rely on the thresholds set by network. However, it is unclear which SSearchDeltaP\_stationary RSRP value companies think is suitable to distinguish precisely “stationary” from “low-mobility” UEs? Please note that too stricter RSRP threshold may cause rare UEs met the condition.  We suggest companies to think about the “potential RRM relaxation method” that will be studied in RAN4. For industrial sensors and surveillance cameras, using subscription based information can allow RAN4 to define more aggressive (power saving) RRM relaxation methods for the UEs, because those UEs have no mobility requirement. But if only RSRP based solutions are taken into consideration, we double there is not much RAN4 can do for further RRM relaxation. |
| LG | Yes | For such surveillance device cases, we can use subscription information which is the simplest way. |
| MediaTek | Yes | Agree with CATT that there are obvious cases stated in the RedCap SID (industrial sensors, surveillance cameras) that are guaranteed to remain at a fixed location. This information is worth leveraging to achieve further RRM relaxations. |
| Qualcomm | Yes | We have similar comments as CATT and ZTE |
| Futurewei | No | Even if subscription information is used as relaxation trigger for fixed UE, RAN may need to check it with RSRP measurements. Therefore, we think a unified approach based on RSRP should be sufficient. |
| Sharp | No | Similar view with Oppo and Huawei |
| Sequans | No | Agree with OPPO and HW |

**Summary for Question 1a:**

Among 16 companies that have replied,

* 8 companies support the proposal, based on the observations that leveraging subscription is a more efficient way to trigger relaxation for UEs with fixed locations in a number of target use cases of RedCap;
* 1 company indicates that they can consider studying the proposal further (e.g. to better understand how it works);
* 7 companies do not support using subscription information, out of the concerns about its reliability or gain over R16 low-mobility criterion.

Since a subscription-based relaxation trigger involves core network, we may need to confirm its feasibility with SA2.

**Question 1b: If subscription-based solution is agreed, do you think RAN2 should include it in the LS to SA2 to confirm its feasibility?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments (if any) |
| Apple | Not necessarily | Pls see comment above. While determining the “stationariness” or other RedCap specific mobility ( for eg., confined mobility) can be characterized by subscription, it can also be just a access stratum capability which can be transferred using UE capability.  The key thing is that this is a (RAN) characteristic of the RedCap UE throughout it’s registration with the NW. |
| Ericsson | Yes | The subscription information is already available in the CN, we should not add new ways of signaling this, e.g. in UE capabilities, like Apple suggests. Instead CN should just provide it to the RAN. |
| Xiaomi | Yes | If subscription-based solution is agreed, then we can send a LS to SA2 to confirm that how to use stationary property. |
| CATT | Yes |  |
| vivo | Yes | For connected state, the AMF may need to inform gNB that the UE is stationary according to UE’s subscription. |
| Intel | Positive on the LS. | For constraining of reduction capability, one candidate solution is subscription based validation. RAN2 has agreed that SA2/CT1 confirmation is needed.  And therefore for this subscription based stationary determination, RAN2 can do the same, i.e. ask CT1/SA2 to do the further work if they are ok with the candidate solution. |
| ZTE | Not really | Determine stationary property based on subscription-information is already supported in LTE and NR, e.g. the indication transmitted from CN to gNB. So why we need to confirm the feasibility with SA2 again? |
| LG | Yes | We agree to inform it to SA2. |
| MediaTek | Yes |  |
| Qualcomm | Yes |  |
| Futurewei | Yes |  |
| Sharp | Yes |  |
| Sequans | Yes |  |

**Summary for Question 1b:**

Among 16 companies that replied, only 2 companies thought it is not necessary to confirm it with SA2, because stationary property based on subscription-information is already supported in LTE and NR or UE capability can be used instead. The rapporteur hence suggests that RAN2 include it in the LS to SA2, if it is agreed.

**Proposal for subscription-based trigger:**

There is a slight majority (9/16) supporting using subscription information for relaxations. Given that the main concerns of its opponents are about its benefits (e.g. power saving gains, reliability), the rapporteur thus would like to suggest having further discussions on those concerns and the proposal for further discussion in the CB session:

**Proposal 1. (9/16) Stationarity in subscription information can be used to trigger relaxations for UE with fixed locations, if its benefits (e.g. power saving gains, reliability) can be further justified. (14/16) If agreed, include it in the LS to SA2.**

## Other definitions for stationary UEs

In the first-round offline discussions, companies expressed different views on whether R17 should have other definitions of stationary UEs, especially those that do not have fixed locations but are temporarily immobile or have very low speed (as compared to low-mobility UEs according to the R16 low-mobility criterion). The various options (not in any particular order) are described below:

* Option 1. R16 low-mobility criterion is sufficient for R17 RedCap UEs too, i.e. network configures a single R16 low-mobility criterion for all R16 and R17 UEs (including R17 RedCap UEs);
* Option 2. R17 stationary UEs can have its own RSRP/RSP-based stationarity criterion. This stationarity criterion can use similar algorithm as the one used in R16 low-mobility criterion, but it has its own specific set of thresholds (e.g. SSearchDeltaP\_stationary and/or TSearchDeltaP\_stationary). As a result, network may configure two sets of mobility related relaxation criteria: 1. R16 low-mobility criterion used by all UEs (both R16 and R17 UEs); 2. R17 stationary criterion for R17 stationary UEs.
* Option 3. R17 stationary UEs can trigger relaxation if they meet both of the following two criteria: 1. R16 low-mobility criterion; 2. Beam-based criterion (the exact definition of this criterion is FFS. Some examples can be found in [3][5][7][8][17][18][16]).
* Option 4. For completeness, this option is essentially Option 2 + Option 3, i.e. R17 stationary UEs can trigger relaxation if they meet both of the following two criteria: 1. R17 stationarity criterion as described in Option 2; 2. Beam-based criterion as described in Option 3.

**Question 2: Among the four options described above, which one do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preference  (1, 2, 3 or 4) | Comments (if any) |
| Apple | 2 or 3, not 1. | We are of the view that R16 low-mobility criterion alone does not fully cover RedCap UE mobility requirements. With the knowledge of the mobility characteristic of the RedCap UE ( whether it is (temprorarily) stationary or mobility confined or the “possible” RRM measurement requirement differentiation that can from 1Rx aspect of RedCap from RAN4) it is better for the NW to be able to configure the RedCap UE with different means of relaxations instead of just re-using R16. It can be that the thresholds for triggering mobility can be lowered for RedCap UEs in SIB, that are meant for RedCap UEs alone, while the R16 could be applicable for other R16 and R17 UEs. Or due to “possibly” relaxed measurement requirements, or just the fact that the RedCap UE is stationary, the NW can configure separate (shorter) durations before the relaxation can be triggered.  We think R16 alone cannot cover all aspects.  In addition, we think beam based measurements might not weight much for RedCap esp for 1Rx devices, where Rx beam-forming is not a very active aspect. |
| Ericsson | 1 |  |
| OPPO | 1/2 | We understand the motivation of option 2 is to introduce more stringent thresholds for Rel-17 stationary RedCap UEs compared to Rel-16 low mobility UEs, and so as to further relax RRM measurement to save UE power.  But we think we may need some evaluation before making the conclusion. If the benefit is significant based on evaluation, we are ok to option 2. |
| Huawei, HiSilicon | 3 but | Agree with Apple that R16 low-mobility criterion alone does not fully cover RedCap UE mobility requirements. As in R17 it focuses on “stationary UE”, the criterion should be more accurate to define “stationary”, so we think beam dimension should be taken into account.  Option 3, the relation between 1. R16 low-mobility criterion and 2. Beam-based criterion is not clear. In our understanding, to provide an accurate criterion for “stationary UE”, we think beam dimension should be considered to for determining the mobility (stationary), so we don’t think low-mobility criterion and beam criterion are two independent criterion, beam information should be included in the low-mobility criterion. |
| Xiaomi | 3 | We understand why we define RedCap UE RRM relaxation as stationary is that the mobility of such devices is more certain than eMBB UE. So we think the stationary criterion can be configured separately.  On the other hand, a UE satisfying stationary criterion still can move quickly in the cell. So beam-based criterion can precisely define stationary. We think it is useful as a supplement and can be optionally configured. |
| CATT | 3 | We are not convinced how sensitive new R17 thresholds can be, in addition to those already existing for R16. However, beam information has not been considered in R16, which can be complementary to R16 criterion for checking a stricter mobility. |
| vivo | 2 or 3, not 1 | We prefer to distinguish (temporarily) stationary from low-mobility to enable more efficient power saving method for RedCap UEs. Hence, R16 low-mobility criterion is not sufficient.  For option 2 and 3, we are open to both of them. Option 2 is preferred as it is simple. Option 3 could be also considered as a supplementary approach. |
| Samsung | 2 | We assume R17 RedCap devices also perform R16 RRM relaxation, if configured. Therefore, for R17 stationary criteria, more stringent condition is needed than R16 low-mobility criteria. Then, RAN4 will define more powerful RRM relaxation method accordingly. |
| Intel | 4, 3, 2, not 1 | We agree with Apple on the need of R17 threshold for RedCap UE. In addition, the beam switching should be considered since the cell level measurement may be same when the UE moves among beams. |
| ZTE | 2? | Option 1 is unclear to us, does this "single criterion" approach also implies that we will also have a "single (legacy) relaxation method" for all UEs (meaning there is no new behaviour for RedCap UEs)? Or is the assumption that it will still be possible to have a specific relaxation method for RedCap UEs fulfilling the R16 low mobility criterion (i.e. just based on the fact that they are RedCap UEs)?  If RSRP based solution is agreed, then our understanding about how it works is aligned with option 2. However, as we response to Q1a, using stricter RSRP thresholds looks reasonable, but it may not be so useful in real deployment, because it is hard to set accurate thresholds.  If subscription info based solution is supported and network indicates this solution is enabled, then UE can perform Rel-17 RRM relaxation when its subscription fulfills the requirement. |
| LG | 2, not 3 | We think RedCap UE-specific threshold for RSRP change is needed to identify truly stationary UEs.  For option 3, we do not think beam-level evaluation is needed because of fluctuation. |
| MediaTek | 1 | RRM relaxation in Rel-16 was specifically introduced to address UEs with limited mobility. So this scenario is already covered in the specifications. The only additional functionality needed for RedCap is to address the usecase of truly stationary devices. The subscription based solution can be used to trigger the UE to perform further RRM relaxation, when compared to Rel-16. |
| Qualcomm | 2 | We think stationary UEs, due to their more predictable channel conditions, can benefit from further relaxations than those for R16 low-mobility UEs. For example, stationary UEs can use shorter TsearchDeltaP than low-mobility UEs to trigger relaxation sooner. Since relaxation criterion has to be evaluated periodically, having shorter evaluation period can help UE obtain more power savings.  We are not convinced that beam change is critically needed in the evaluation of UE’s stationarity, for the following reasons.   1. In RRC Idle/Inactive, UEs use only SSBs for their RRM measurements. Since SSBs are wide beams, a UE with fixed location or low speed may not experience frequent changes in the set of beams it monitors between its RRM measurement instances. 2. One counter example can be a UE located near cell center but experiences periodic signal blockage on its neighbor cell beams. Although this UE may have frequent beam changes, it is still safe for it to relax its RRM measurements on neighbor cells. |
| Futurewei | 2 or 3, not 1 | We agree with Apple on the need of R17 threshold for RedCap UE. And beam change should be considered. |
| Sharp | 2 |  |
| Sequans | 2 maybe 4 | Agree with QC, but OK to consider 4 |

**Summary for Question 2:**

Among the four options provides, companies’ views were split as follows:

* 3 out of 16 support Option 1, based on the argument that R16 low-mobility criterion is good enough for stationary UEs too;
* 11 out of 16 support Option 2, based on the observation that stationary UEs can leverage their more predictable mobility for more power savings;
* 7 out of 16 support Option 3, based on the argument that stationarity of a UE can be reliably determined only if both RSRP/RSRQ and beam-change based criteria are applied.
* 1 of 16 companies are interested in Option 4, which is the union of Option 2 and 3.

Based on the above outcome, the rapporteur would like to suggest the following proposals for agreement:

**Proposal 2. (13/16) A measurement-based R17 stationarity criterion can be configured separately from R16 low-mobility criterion for stationary UEs. FFS whether this stationarity criterion is based on**

* **the same algorithm used in R16 low-mobility criterion but with its own specific set of thresholds (11/16); and/or**
* **a combination of R16 low-mobility criterion and some type of beam-change based criterion (7/16).**

## Relaxation criteria in RRC Idle/Inactive

In the R16 relaxation framework, a UE may trigger RRM relaxations if it meets low-mobility criterion, not-at-cell-edge criterion, or both. The exact relaxation method depends on which relaxation criterion/criteria the UE fulfils.

In the first round of discussion, all except one company (20 out 21) agree to reuse the R16 RRM relaxation framework for R17 stationary UEs in RRC Idle/Inactive, with the R16 low-mobility criterion replaced by the R17 stationarity criterion/criteria (which is the one to be agreed based on Question 1a/1b/2). More specifically, what this proposal means is that

* If a R17 UE determines that it is stationary based on R17 stationarity criterion/criteria, it can apply relaxation methods associated with the R17 stationarity criterion/criteria;
* If not-at-cell-edge criterion is also configured by network and this UE meets that criterion, it can apply relaxation methods associated with both stationarity and not-at-cell-edge criteria. Whether this not-at-cell-edge criterion is the R16 one or similar to the R16 one but uses its own specific set of thresholds can be discussed later.

This is also captured as Proposal 4 in R2-2104361.

**Question 3: Do you support reusing the R16 RRM relaxation triggering framework for R17 stationary UEs in RRC Idle/Inactive, with the enhancement described above?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments (if any) |
| Apple | Support (assume the question is to support or not support ☺..) |  |
| Ericsson | Support |  |
| OPPO | Support |  |
| Huawei, HiSilicon | Support, but | It depends on whether the relaxation method for stationarity criterion and for both stationarity and not-at-cell-edge criteria are different. If a separate relaxation method is defined for both stationarity and not-at-cell-edge criteria, the above is fine. |
| Xiaomi | Support | Reusing R16 RRM relaxation “framework” can be considered, because a stationary UE still can combine not-at-cell-edge to determine RRM relaxation. |
| CATT | FFS | We prefer RAN2 only discuss criteria for RRM relaxation and leave relaxation methods to RAN4. As for combination of stationary and not-at-cell-edge criteria for R17 RRM relaxation, RAN2 can wait for RAN4’s further conclusion on the R17 RRM relaxation methods. |
| vivo | Support | Reusing the R16 RRM relaxation triggering framework is a straightforward direction to go, which could be a high level conclusion. More details could be FFS. |
| Samsung | Support |  |
| Intel | Support |  |
| ZTE | Support, but | We should try to limit the number of criterion combinations, it will add more burden to RAN4. |
| LG | See comments | We wonder why not at cell-edge condition is needed. The reason why we introduced not at cell-edge condition in R16 measurement relaxation was to avoid UEs in cell coverage boundary relaxing its measurements, because it may reselect to neighbor cell soon. However, for truly stationary RedCap devices, its serving cell quality may be constant under the threshold forever. In this case, the not at cell-edge condition may block the UE to perform RRM relaxation. |
| MediaTek | See comments | We have a similar question as LG – for truly stationary RedCap devices, the not at cell-edge criteria may not be relevant any longer. We agree with CATT that permutations of stationary/cell-edge criteria need not be discussed now and can be clarified once the R17 relaxation triggers and methods are better understood. |
| Qualcomm | Support | We think it is useful to have not-at-cell-edge criterion for stationary UEs too, because the relaxation methods for stationary UEs at cell center and at cell edge can be different (as in R16). |
| Futurewei | Support |  |
| Sharp | Support |  |
| Sequans | Support |  |

**Summary for Question 3:**

The views of the companies are split as follows:

* 13 out of 16 companies supported reusing the R16 RRM relaxation triggering framework for R17 stationary UEs;
* 2 out of 16 companies did not think not-at-cell-edge criteria is needed for stationary UEs;
* 1 out of 16 companies stated that RAN2 should wait for RAN4’s conclusion on whether combination of stationary and not-at-cell-edge criteria is needed for R17 stationary UEs.

Based on this outcome, the rapporteur would like to suggest the following proposal for agreement:

**Proposal 3. (13/16) Network can configure R17 stationarity criterion/criteria, as well as a not-at-cell-edge criterion, for stationary UEs to trigger RRM relaxations in RRC Idle/Inactive.**

## Relaxation criteria in RRC Connected

In the first round of discussion, there was strong support for reusing the R17 relaxation criteria in RRC Idle/Inactive for relaxations in RRC connected. On the other hand, there were also a few companies that did not support any relaxation in RRC connected.

Companies are invited to indicate their preference for the following two options:

* Option 1. R17 RRM relaxation criteria in RRC Connected should reuse the R17 RRM relaxation criteria in RRC Idle/Inactive. No additional relaxation triggers will be studied for relaxations in RRC connected (i.e. Proposal 7 in R2-2104361).
* Option 2. No relaxation in RRC connected in supported in R17.

**Question 4: Between the two options above, which one do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preference  (1 or 2) | Comments (if any) |
| Apple | 1 | In addition, we think the UE can report the triggering if NW desires. |
| Ericsson | 2 | Note that the NW can already deconfigure unnecessary measurements in CONNECTED. There is no need for anything more (at least no one has shown benefits of anything else). |
| OPPO | 1 | We prefer to use RRM relaxation criteria for RRC Idle/Inactive as a baseline, but with some change to adapt RRC Connected, e.g. different parameters for RRM relaxation criteria are configured for UEs in RRC Idle/Inactive and UEs in RRC Connected. |
| Huawei, HiSilicon | 2 | There is still concerns on the performance in RRC\_connected state, and the NW can control the measurement. |
| Xiaomi | 1 | BTW, we still consider RRM relaxation in connected as a low priority. If we want to do this, UE can determine RRM relaxation by itself, because network can decide to provide relaxed parameters to UE if network allow the UE to perform RRM relaxation. It is noted that the UE is still in network control but the signal overhead is reduced. And UE can perform RRM relaxation more fastly. |
| CATT | 2 | We prefer leaving R17 RRM relaxation in Connected to gNB implementation. |
| vivo | 1 | Whether to configure RRM relaxation is fully controlled by the network, hence the impact on mobility performance is controllable. Therefore, we prefer to keep the flexibility for the network to apply the RRM relaxation for UE in connected, i.e. to achieve power saving gain with controllable potential impact.  Besides, reusing criteria from RRC Idle/Inactive to RRC Connected leads limited workload. |
| Samsung | 1, but | We would like to clarify Option 1 does not mean that network signalling (i.e., broadcast or dedicated signaling) for triggering parameters should be also re-used. We understand network signalling for triggering parameters will be discussed in next meeting. Assuming RAN2 agrees 1) broadcast signalling for Inactive/Idle and 2) dedicated signalling for connected, RAN2 cannot reuse same network signalling methods. |
| Intel | 1 | In addition, the RAN may get the subscription from CN instead of UE. |
| ZTE | 2, but | We are open to option 1 as long as RAN4 confirms there is power saving gain “without or with limited” performance impact.  If UE can be identified based on subscription information, we think it is sufficient to leave it to network implementation (e.g. deconfigure unnecessary measurements). |
| LG | 2 | RRM relaxation criteria based UE-autonomous RRM relaxation may degrade mobility performance. Thus, when the UE accesses to the network, we prefer to just indicating UE’s RRM relaxation status or stationarity status in RRC\_IDLE/INACTIVE to the network. Based on that, the network may provide relaxed measurement configuration (e.g. less frequencies to measure) to the UE. |
| MediaTek | Reuse R16 | We should stick to what’s been agreed in the RedCap WID (RP-210918), i.e. to reuse the Rel-16 RRM relaxation criteria for Connected mode. We foresee some power saving gains for connected mode, especially when RRM relaxations are coupled with C-DRX operation. |
| Qualcomm | 1 | We see benefits in having neighbor-cell RRM relaxation in RRC Connected. One particular use case is temporarily stationary UEs in RRC connected, in which it is not efficient to solely rely on network to trigger relaxation.  We do not see any fundamental difference in the neighbor cell measurement relaxation criteria between RRC Idle/Inactive and RRC Connected. Hence whatever R17 relaxation criteria we agree in one RRC state can be applied to the other. |
| Futurewei | 2 | We prefer to leave RRM relaxation in RRC Connected to gNB implementation. |
| Sharp | 1 | In addition, the gNB can control the relaxation if it would like to. |
| Sequans | 2 | Agree with Ericsson and HW |

**Summary for Question 4:**

Between the two preferences, the views are equally split:

* 8 out 16 companies can support reusing the R17 RRM relaxation criteria in RRC Idle/Inactive for relaxation in RRC Connected (one company indicated that they support option 2 but are open to Option 1 too);
* 8 out 16 companies do not support relaxations in RRC Connected or believe it can be left to network implementation;
* 1 out 16 company preferred reusing the R16 low-mobility criterion for R17 stationary UEs in RRC Connected.

Based on this outcome, the rapporteur would like to suggest the following proposal for further discussion in the CB session:

**Proposal 4. (8/16) Reuse the R17 RRM relaxation criteria in RRC Idle/Inactive for relaxations in RRC Connected, if its benefits over network implementation can be further justified.**

# Conclusion

Based on the outcome of the discussion, the rapporteur would like to suggest the following proposals for agreements, based on the majority support for them:

**Proposal 2. (13/16) A measurement-based R17 stationarity criterion can be configured separately from R16 low-mobility criterion for stationary UEs. FFS whether this stationarity criterion is based on**

* **the same algorithm used in R16 low-mobility criterion but with its own specific set of thresholds (11/16); and/or**
* **a combination of R16 low-mobility criterion and some type of beam-change based criterion (7/16).**

**Proposal 3. (13/16) Network can configure R17 stationarity criterion/criteria, as well as a not-at-cell-edge criterion, for stationary UEs to trigger RRM relaxations in RRC Idle/Inactive.**

And the following proposals for further discussion in the CB session:

**Proposal 1. (9/16) Stationarity in subscription information can be used to trigger relaxations for UE with fixed locations, if its benefits (e.g. power saving gains, reliability) can be further justified. (14/16) If agreed, include it in the LS to SA2.**

**Proposal 4. (8/16) Reuse the R17 RRM relaxation criteria in RRC Idle/Inactive for relaxations in RRC Connected, if its benefits over network implementation can be further justified.**

# Appendix – first-round offline discussion

## Definition of stationarity

Different definitions of stationary UEs for the purpose of R17 RRM relaxations have been proposed in the contributions ([1]~[19]). They can be broadly categorized in the following three options:

Option 1: UE determines its stationarity ***only*** base on an enhanced version of R16 low-mobility criterion ([5], [8], [10], [17], [18], [19]) (*Note: Details of the enhancement to R16 criterion will be discussed in a later question*);

Option 2: UE determines its stationarity ***only*** base on its subscription information ([6], [7], [15]);

Option 3: ***Either*** Option 1 and Option 2 may be used by UE to determine its stationarity, depend on the type of stationarity that UE has. For example, if a UE’s location is fixed, it may determine its stationarity based on information provisioned in its subscription, without evaluating RSRP-based stationarity criterion such as the one described in Option 1 ([1], [3], [4], [16], [11], [14]).

Option 4: R16 low-mobility criterion [12] is sufficient.

Companies are invited to comment in the question below on which of the above options they prefer to use in determining whether a UE is stationary. Since no company discussed the necessity in having different definitions of stationarity in different RRC states, it is assumed that the same definition is used in all RRC states, unless one indicates otherwise in the Comments column.

**Question 1: Among these options described above, which one do you prefer for defining UE’s stationarity?**

|  |  |  |
| --- | --- | --- |
| Company | Preference  (1, 2, 3, or 4) | Comments (if any) |
| Nokia, Nokia Shanghai Bell | 4 | We think that REL16 relaxation triggering condition is sufficient and we assume that RedCap device can implement RRM relaxations specified in REL16 for IDLE/INACTIVE and the same condition for relaxation shall be used also for CONNECTED as per WID objectives:  “for RRC\_Connected the mechanism reuses the Rel-16 RRM relaxation criteria from RRC\_Idle/Inactive” |
| Apple | 3 | RedCap has some unique mobility attributes and these need to be used (either by UE explicitly informing via subscription or capability, and/or by NW configuring enhanced thresholds that reflect the RedCap mobility characteristic) |
| Qualcomm | 3 | We think stationary UEs, due to their more predictable channel conditions, can benefit from further relaxations than those for R16 low-mobility UEs. Hence it is worthwhile to define them separately.  For UEs with fixed locations, we expect they would have much less fluctuation in their S measures than other UEs (even low-mobility ones). Hence it is feasible for them to use some preconfigured/provisioned information to determine their stationarity instead of going through some RSRP based evaluation process. That would enable faster triggering of RRM relaxation and thus more power savings for them. |
| Ericsson | Not 2/3 | From WID:   * RRM relaxations for neighbouring cells for RedCap devices: for RRC\_Idle/Inactive/Connected, considering the alternatives identified in the RedCap SI:   + Study until RAN#92e, and, if agreed, specify RRM measurement relaxation criteria (where, for RRC\_Idle/Inactive the Rel-16 mechanism is the baseline, and for RRC\_Connected the mechanism reuses the Rel-16 RRM relaxation criteria from RRC\_Idle/Inactive so as to maximize the commonality with Idle/Inactive UEs) [RAN2]     - Enabling/disabling of RRM relaxation should be under the network’s control. Specify both broadcast and dedicated signalling for enabling/disabling of RRM relaxation.   + After RAN#92e, if agreed in RAN2, specify RRM measurement relaxation [RAN4]   + No RRM relaxations are specified for the serving cell.   Based on this, we assume the discussion we are having here is which option we should study further? I.e. is there any alternative we can exclude even without have done any evaluation? Assuming this, we say:  Option 2 (subscription info) has been evaluated by RAN2 earlier but was excluded. One of the drawbacks is that it is not reliable, e.g. what happens when the UE starts to move?  *[Vice-Chair]: I don't think option 2 (subscription info) was previously excluded. Furthermore I agree that option 2 might suffer from the issue mentioned above (the UE might misbehave and still move even if it declares itself as stationary), but at the same time it's not obvious this would be blocking point: if for some reason the UE wants to cheat the network, it might do so also by pretending it fulfills the low-mobility and not-at-cell-edge criteria. So in short I guess we can keep this option alive*  Hence, we think that option 1 can be further studied and evaluated. |
| vivo | 3 | According to the previous discussion, it is widely believed that R16 RRM relaxation mechanism can be a starting point for the R17 RRM relaxation. Besides, introducing 2 relaxation levels (i.e. for fixed and moving UEs respectively) for RedCap UEs is considered which could provide enough flexibility to save the UE power for different scenarios. Thus, it is better to apply option1 in Rel-17.  Although one may argue option2 is only applicable to limited scenarios (UE is expected to be stationary or moving slowly in a localized area), it needs to notice a large percentage of RedCap UEs are expected to be used in the target scenarios of option2, e.g. Video Surveillance, industrial wireless sensors in an automated assembly line, Handling robot in a warehouse. From the implementation perspective, the enhancements are expected to be very simple and easy to use. Therefore, the cost to apply this enhancement is expected to be very low. For RedCap UEs in the above scenarios, we assume they are more power sensitive, so it is expected to have more/longer relaxation for RRM measurement. Thus, we prefer to support the solution in option2. |
| Intel | 3 | For fixed UE, subscription based approach is sufficient, and faster than measurement based approach. For temporary stationary UE, enhancements on R16 criteria is needed in order distinguish between them. |
| Futurewei | 1/4 | We are open to enhancements to R16 low-mobility criterion. |
| Sharp | 1 | UE can determine its stationarity base on enhancement of R16 low-mobility criterion. |
| Huawei, HiSilicon | 1 | At first we understand the “stationary UE” includes “fixed UE” and “temporary stationary UE”, subscription information is only useful for “fixed” scenario which is limited, so we think R16 style low-mobility criterion is more suitable. If R16 style low-mobility criterion needs to be introduced, a unified criterion for “fixed” and “temporary stationary” is enough. |
| NEC | 3 | For option1. We have discussed that Rel\_16 or enhanced low mobility evaluation criteria can be used to RRM relaxation for stationary UE. This unified solution can be also used for non-redcap UE.  Further more, regarding option 2, we think the stationary UE can autonomously apply the RRM relaxation in accordance with the subscription information, e.g. Video Surveillance, industrial wireless sensors in an automated assembly line, Handling robot in a warehouse. From the implementation perspective, the subscription information to trigger RRM relaxation are expected to be very simple, effective and easy to use. No additional configuration for low mobility is required. Therefore, the cost to apply this enhancement is expected to be very low. Therefore we think option 2 is also accepted for RRM relaxation for stationary UE. |
| MediaTek | 2/4 | Option 2 is applicable to RedCap scenarios that justify further RRM relaxations (stationary deployments in IIoT, surveillance use-cases). These scenarios are not the same as typical smartphones/ wearables in a network which are subject to mobility. Instead these are tightly controlled scenarios (at deployment) and do not need to consider the case where the UEs move (i.e. these are similar to IoT devices such as smart meters in fixed locations). Therefore, as an enhancement for Rel-17, only such a mechanism is needed.  For other RedCap scenarios (wearables), Rel-16 based mechanisms such as Option 4 are sufficient. We are also open to introduce Option 4 to connected mode. |
| Xiaomi | 1/3 | We think an enhancement of R16 low-mobility criterion can be used for all types of RedCap UE (i.e. including fixed-location UE and temporarily stationary UE). On the other hand, stationary property based on subscription would limit device type to fixed-location UE. So we think option 1 is necessary and we are also OK for using stationary property as a supplementary. |
| CATT | 3 | The subscription information is sufficient for fixed UEs. For slightly moving UEs or UEs not permanently fixed, the number of beam changes can be taken into consideration on top of R16 criterion. |
| CMCC | 3 | UE could determine its stationary based on its subscriptions if configured or based on the low-mobility criterion. |
| Samsung | 1 | The way to determine R16 RRM relaxation is already too complicated according to whether or not 1) cell center, 2) not-cell-edge, 3) low-mobility 4) type of frequencies, 5) *highPriorityMeasRelax*, 6) *combineRelaxedMeasCondition* and so on. Hence, for R17, we don't want to classify more cases by distinguishing according to subscription information. Instead, RAN2 can simply enhance R16 RRM relaxation. |
| Sony | 1 | We understand that option 2 is already ruled out and probably not entirely in RAN2 domain. Between option 1 and 4, Rel-16 baseline wont work well for FR2/beams. |
| ZTE | 2 | The subscription information can be used to identify fixed-location UEs. For these kind of UEs, it is ok to take more aggressive RRM relaxation methods. But whether such UE can perform aggressive methods should be within network’s control.  We understand the benefit of 1 is to also identify temporarily stationary UEs, but our concern is it is hard for network to configure accurate thresholds for differentiate temporarily stationary UEs and low-mobility UEs. The RSRP may still fluctuate even if the UE does not move. |
| OPPO | 1 or 4 | Based on the guidance given in the WID, the Rel-16 RRM relaxation mechanism for RRC Idle/Inactive should be the baseline for Rel-17 RedCap UEs for both RRC Idle/Inactive and RRC Connected. |
| Sequans | 1  Maybe 3 | Since channel conditions are not necessarily constant (even more so in FR2), we are not sure that subscription information can be enough and that there is a real difference between “truly fixed” and “temporarily stationary” UEs.  Therefore, we think R16-style criteria should be enough for all cases. We do think some enhancements could be in order to account for the more specialized RedCap scenarios. |
| LG | 3 | We think subscription information can be used. If the subscription information is not provided, then some enhanced R16 low-mobility criterion can be used. |

**Summary:**

Among the four options, the preferences of companies are split as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Option 1 | Option 2 | Option 3 | Option 4 |
| 8 | 2 | 9 | 2 |

Since Option 3 includes both Option 1 and Option 2, the above result suggests that 17 of 21 companies would support an enhanced version of R16 low-mobility criterion for R17 stationary UEs. The rapporteur hence suggest RAN2 consider it for agreement.

As to subscription-based definition of stationarity, 11 out of 21 companies expressed support (Option 2 and 3 combined). The rapporteur hence suggests discussing it further in the online session.

Within the Option 1 above, there are different views on what the additional enhancements to the R16 low-mobility criterion should be:

Option 1a: Configure a separate set of thresholds (e.g. SSearchDeltaP and/or TSearchDeltaP) in the R16 low-mobility criterion for stationary UEs ([1], [3], [4], [10], [19]);

Option 1b: In addition to Option 1.a, also take in account changes in serving cell beams (e.g. whether number of beam changes within a period is less than a threshold) in the definition of stationarity ([3], [7], [8], [17], [18], [16]).

Option 1c: Without a separate set of thresholds but instead rely on the (single) set of thresholds from Rel-16, also take in account changes in serving cell beams (e.g. whether number of beam changes within a period is less than a threshold) in the definition of stationarity ([5]).

Companies are invited to comment below on which of the above two options is preferred.

**Question 2: If you have selected Option 1 or Option 3 in Question 1, which one do you prefer between the above sub-options to option 1?**

|  |  |  |
| --- | --- | --- |
| Company | Preference  (1a,1b, 1c) | Comments (if any) |
| Apple | 1b | 1b includes 1a as well. |
| Qualcomm | 1a | We think 1a is robust enough for the purpose. Beam change may not add much value to the evaluation of UE’s stationarity, for the following reasons.   1. In RRC Idle/Inactive, UEs use only SSBs for their RRM measurements. Since SSBs are wide beams, a UE with fixed location or low speed may not experience frequent changes in the set of beams it monitors between its RRM measurement instances. 2. Another counter example can be a UE located near cell center but experiences periodic signal blockage on its neighbor cell beams. Although this UE may have frequent beam changes, it is still safe for it to relax its RRM measurements on neighbor cells. |
| Ericsson | Not 1a/1b  Continue to study 1c | So far no one har really shown that the gain exceeds the “cost” of adding a new set of thresholds (1a or 1b). So until that has happened we think we can exclude these options.  We do think that RAN2 could continue to study if changes in beams brings any meaningful gain (which is worth the pain) and if so we could consider specifying that. By the way, since option 1b had option 1a included, we created option 1c. |
| vivo | 1a | We prefer to specify 2-level relaxation criteria and corresponding relaxation methods by configuring a separate set of thresholds (e.g. SSearchDeltaP and/or TSearchDeltaP) on top of the R16 low-mobility criterion for stationary UEs.  The main motivation of option1b/1c is to detect UE moving among beams but without changing the cell level measurement results. As we known, the measurement result of beam is not stable and changes fast. Hence, it may cause misjudgment on UE’s movement state, which may lead to more power consumption or mobility issue.  With this in mind, we think option1b can be considered with low priority. We could also accept it if majority agree its feasibility. |
| Intel | 1b | To consider 2 level mobility as agreed in SI phase, additional threshold is needed. In addition, the beam switching should also be considered since the cell level measurement may be same when the UE moves among beams. |
| Futurewei | 1b | Beam quality change can be used in evaluating “stationarity” |
| Sharp | 1a |  |
| Huawei, HiSilicon | 1c, but | As it focuses on “stationary UE”, the criterion should be more accurate to define “stationary”, so we think beam dimension should be taken into account. But for the details, we prefer to consider beam quality change (e.g. the best beam), it reflects the link quality and also the beam change (e.g. spinning). Besides, the beam quality may change rapidly due to the impact of small-scale fading, to avoid this bad impact on “stationary” evaluation, L3 filter can be used to smooth the beam quality. Thus, we would like to update:  …(e.g. whether number of beam changes within a period is less than a threshold, whether the change of beam measurement within a period is less than a threshold) |
| NEC | 1b | In the UE measurement, UE is configured to measurement the number of ***nrofSS-BlocksToAveragelevel*** SSBs for achieve the cell level measurement result. For stationary UE, it is impossible to evaluate so many beams, so it makes sense to only measurement a small number of beams changes to made decision of a stationary UE to trigger RRM relaxation. |
| Xiaomi | 1b | As we described in our contribution, even a UE satisfying the enhanced R16 criterion is able to move in the cell (i.e. UE spins around cell), which brings two drawbacks: 1.UE moves to a cell with better coverage but can not camp on it; 2. The signal fluctuates more often during movement, which results in entering or leaving criterion frequently.  As some companies worry that beam change mechanism is not stable, we think it doesn’t mean there is no beam change when evaluate stationary criterion. We can give a threshold N to restrict the number of beam change to avoid unstable situation but can limit UE moving (like spin) around cell. |
| CATT | 1c | We don’t think we need new thresholds. The beam information can be used on top of R16 thresholds. |
| CMCC | 1a |  |
| Samsung | 1a | Beam-level measurement is not reliable, since it fluctuates more than cell-level measurement. |
| Sony | 1b | 1b includes 1a. The benefit of 1b over 1c is that Rel-16 evaluation criteria can still be used in our understanding. |
| OPPO | 1a, but | We understand the motivation of option 1a is to introduce more stringent thresholds for Rel-17 stationary RedCap UEs compared to Rel-16 low mobility UEs, and so as to further relax RRM measurement to save UE power.  But we think we may need some evaluation before making the conclusion. If the benefit is significant based on evaluation, we are ok to option 1a. |
| Sequans | 1a,  Maybe 1b | 1a would probably be enough, but we are OK to continue and pursue both for a while more. |
| LG | 1a | Beam-level evaluation is not necessary because it fluctuates frequently. |

**Summary:**

Among the three sub-options for using an enhanced version of R16 low-mobility criteria, the preferences of companies are split as follows:

|  |  |  |
| --- | --- | --- |
| Option 1a | Option 1b | Option 1c |
| 8 | 7 | 3 |

Since Option 1b also includes Option 1a, the above result suggests that 15 of 18 companies would support configuring a separate set of thresholds (e.g. SSearchDeltaP and/or TSearchDeltaP) on top of the R16 low-mobility criterion for R17 stationary UEs. Combined with the results from Question 1, the rapporteur hence suggests that RAN2 consider this option as a baseline for the definition of R17 stationary UEs.

There are 10 out of 18 companies expressed interest in supporting beam-related enhancements to the definition of stationarity (Option 1b and 1c combined). The rapporteur hence suggests discussing them further in the online session.

Based on the outcome of the discussions in this section, the rapporteur would like to suggest the following proposal for agreement:

**Proposal 1. (15/21) The definition of stationary UE in R17 is based on the R16 low-mobility criterion but uses a separate set of thresholds specifically configured for stationary UEs.**

And the following proposals for further discussion during online:

**Proposal 2. (10/21) Discuss whether beam-related enhancements should be included in the definition of stationary UEs specified in Proposal 1.**

**Proposal 3. (11/21) Discuss further whether subscription information can be used as an additional method in determining stationarity of a UE.**

## RRM relaxation in RRC Idle/Inactive

As to triggers for RRM relaxation in RRC Idle/Inactive, most contributions ([1] [8] [16] [18] [19]) except one ([12]) support reusing the R16 RRM relaxation triggering criteria, with the R16 low-mobility criterion replaced by the R17 stationarity criterion discussed in Section 2.1. More specifically,

* If a R17 UE determines that it is stationary (based on the definition(s) to be agreed in Question 1 and 2), then it can apply relaxation methods associated with the stationary criterion (the exact methods are to be discussed later);
* If not-at-cell-edge criterion is also configured and this UE meets that criterion, then it can apply relaxation methods associated with both stationary and not-at-cell-edge criteria (the exact methods are to be discussed later).

Please note that the exact relaxation methods associated with the different criteria specified above are not within the scope of this offline discussion and will be discussed later.

Companies are invited to indicate their preference on the above proposal in the following question:

**Question 3: Do you support reusing the R16 RRM relaxation triggering criteria for R17 stationary UEs in RRC Idle/Inactive, with the R16 low-mobility criterion replaced by the R17 stationarity criterion?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments (if any) |
| Nokia, Nokia Shanghai Bell | No | We think that REL16 relaxation triggering condition is sufficient for IDLE/INACTIVE, |
| Apple | Yes | This would be the direction to go, with details discussed later. |
| Qualcomm | Yes | See our comment to Question 1. |
| Ericsson | See comment | We understand the question to mean that: in case RAN2 enhances the criteria used to determine low/no mobility as per question 2, then that enhanced criteria could be used to apply a potential Rel-17-way of relaxing measurements. I.e. the Rel-16 criteria is replaced by the Rel-17 criteria? If that understanding is correct, our response is "Yes". |
| vivo | Yes | This allows the reuse of existing mechanism and avoids repeating the discussion in R16. |
| Intel | Yes (comments) | I assume question is “low mobility” and “not at cell edge criterion” are applicable for R17 stationary UE with enhancements. Then our answer is yes. |
| Futurewei | Yes | We support this as a general direction to take for now, with details to be discussed later. |
| Sharp | Yes |  |
| Huawei, HiSilicon | Yes |  |
| NEC | Yes, basically | But whether to apply Rel-17 stationary criterion or use Rel-16 low-mobility criterion for RedCap UE (if ReCap UE supports Rel-16 one) can be up to network implementation. |
| MediaTek | See comment | With the same understanding as Ericsson, i.e. in case R2 introduces new criteria for ‘stationary’ UE determination, this would replace the Rel-16 criteria to determine when measurements can be relaxed, then ‘Yes’ |
| Xiaomi | Yes | A stationary UE but located in the edge of cell can also consider its signal quality, so R16 RRM relaxation can be used. |
| CATT | Yes | That’s the generic idea, details FFS. |
| CMCC | Yes |  |
| Samsung | Yes |  |
| Sony | Yes |  |
| ZTE | See comment | Same understanding as Ericsson and MTK about this question. |
| OPPO | Yes with comment | See our reply to Question 2. |
| Sequans | Yes |  |
| LG | Yes |  |

**Summary:**

All except one company (20 out 21) agree to reuse the R16 RRM relaxation triggering criteria for R17 stationary UEs in RRC Idle/Inactive, with the R16 low-mobility criterion replaced by the R17 stationarity criterion.

It is proposed in [1] and [19] that because stationary UEs have less uncertainties in their mobility than low-mobility UEs, separate thresholds (e.g. SSearchThresholdP\_Stationary and/or SSearchThresholdQ\_Stationary) used in the R16 not-at-cell-edge criterion can be introduced for R17 stationary UEs.

Companies are invited to indicate their preference on the above proposal in the following question:

**Question 4: If you answered “Yes” in Question 3, do you support introducing separate thresholds, SSearchThresholdP\_Stationary and/or SSearchThresholdQ\_Stationary, for the not-at-cell-edge criterion for R17 stationary UEs in RRC Idle/Inactive?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments (if any) |
| Apple | Yes |  |
| Qualcomm | Yes | Because stationary UEs have more predictable mobility, the thresholds for not-at-cell-edge criterion can be further relaxed than those used in R16. |
| vivo | Yes | Besides, we have agreed that some reduced capabilities for RedCap UEs, e.g. at least both the number of Rx antennas and maximum bandwidth supported by RedCap UEs are smaller than non-RedCap UEs, which may cause some difference in the measurement results for RedCap UE comparing with non-RedCap UEs. In this way, when reusing the existing criteria in Rel-16 to RedCap UEs, we should consider introducing separate thresholds (e.g. SSearchThresholdP\_Stationary and/or SSearchThresholdQ\_Stationary) for R17 stationary RedCap UEs. |
| Intel | Yes |  |
| Futurewei | Yes |  |
| Sharp | Yes |  |
| Huawei, HiSilicon |  | No strong view. Reusing Rel-16 not-at-cell-edge criterion works. |
| NEC | Yes | Agree the not cell edge criterion can be further relaxed than the cell edge UE. |
| MediaTek | No | We do not need new ‘cell edge’ definitions. We can reuse the Rel-16 thresholds for this purpose. |
| Xiaomi | - | We are not sure if it is a redundant. But it is noted that RedCap UE and non-RedCap UE can be decoupled, and even a same threshold can be configured with different value to RedCap and non-RedCap UE. |
| CATT | No | Only beam information, if available, should be used on top of legacy thresholds. |
| Samsung | Yes |  |
| Sony | Yes |  |
| OPPO |  | It may depend on whether to reuse R16 low-mobility criterion or configure a separate R17 stationarity criterion for R17 stationary UEs.  If RAN2 agree to reuse R16 low-mobility criterion for R17 stationary UEs, we see no need to introduce separate thresholds for the not-at-cell-edge criterion for R17 stationary UEs. |
| Sequans | Yes |  |
| LG | No | We do not understand why cell-edge condition is discussed here. We are discussing RRM relaxation for stationary UEs, so low-mobility criterion is enough. |

**Summary:**

Among 16 companies replied to this question, 11 of them support configuring separate set of not-at-cell-edge thresholds for stationary UEs, while 5 of them think the R16 not-at-cell-edge criterion can be reused as is for R17 stationary UEs. The rapporteur hence suggests discussing this issue further during online.

Based on the outcome of the discussion on Question 3 and 4, the rapporteur would suggest the following proposal for agreement:

It is possible that network may configure both R16 and R17 RRM relaxations at the same time. [1][6][8] discuss what UE behaviors should be in this case. Their proposals are captured in the following options:

* Option 1: If a R17 stationary UE satisfies more than one R16/17 RRM relaxation criteria configured by network, it should be up to UE implementation to choose which criterion(a) to apply relaxation methods [1];
* Option 2: If RedCap UE fulfils the R16 RRM relaxation criteria, then R16 RRM relaxation method is applied without further enhancement. The legacy lowMobilityEvaluation-r16, cellEdgeEvaluation-r16 parameters are applicable to both RedCap and non-RedCap UEs [6];
* Option 3: A R17 UE evaluates the R17 RRM relaxation criterion first; if it is not fulfilled, fall back to R16 RRM relaxation [8].
* Option 4: R16 low-mobility criterion [12] is sufficient
* Option 5: A R17 UE evaluates the R17 RRM relaxation criterion if configured by the network;

Companies are invites to indicate which of the above options they support in the follow question:

**Question 5: Among the three options described above, which one(s) do you support?**

|  |  |  |
| --- | --- | --- |
| Company | Preference  (1, 2, 3 or 4) | Comments (if any) |
| Nokia, Nokia Shanghai Bell | 4 | We think that R16 RRM relaxation criteria is sufficient |
| Apple | 3 | But we also think its up to NW configuration and NW can just use R17 config for R17 RedCap UEs |
| Qualcomm | 1 | Since R17 UEs do not need to take separate measurements for R16 and R17, a single set of S measures can be used by a R17 UE to evaluate both R16 and R17 relaxation criteria. Hence there does not exist any particular order for UE to follow in its evaluation of relaxation criteria.  If network configures both R16 and R17 relaxation criteria and a R17 UE meets both criteria, then the UE should be allowed to decide by itself which release’s criterion it may choose to apply. |
| Ericsson | None | Again, this seems to be something RAN2 can discuss if it is decided that we should specify anything.  Anyway, on the technical question, it seems unnecessary complex that a UE considers two different evaluation criteria and then we need to sort out which criteria is "active" at which point in time, and priorities between the Rel-16 and Rel-17 criteria.  We always assumed and hoped that RAN2 should go for a simple solution where RAN2 may in Rel-17 "enhance" the Rel-16 criteria. A Rel-17 UE would then apply those criteria… without any if:s and but:s. I.e. the UE would not evaluate a Rel-16 set of criteria and a Rel-17 set of criteria and select between these two.  If RAN2 are considering a solution this complex, perhaps it is not worth the effort? |
| vivo | 3 / 1 | In our understanding, R17 would provide more power saving gains than R16, assuming more critical criteria would be defined. In this way, R17 RRM relaxation methods (with more relaxation) should be applied even if both R16 and R17 RRM relaxation criteria are satisfied.  Otherwise (i.e. RRM relaxation in R17 may have less relaxation than R16), it should be up to UE implementation to decide which relaxation approach should be applied. |
| Intel | 5 | The UE shall follow network guidance. If the network indicates R17 criteria, then R17 UE shall only use it. |
| Futurewei | 5 | Agree with Intel. |
| Sharp | 5 and see comments | If the network knows the UE’s mobility characteristic, it is ok to configure either R16 or R17 relaxation criteria to UE. R17 UE checks R17 criteria if configured. R17 UE checks R16 criteria if R17 criteria is not configured and R16 criteria is configured. |
| Huawei, HiSilicon | 1 | We understand if R17 criteria is fulfilled, UE can perform R17 RRM relaxations, if R16 criteria is fulfilled, UE (if supports) can perform R16 RRM relaxations. If both R17 and R16 criteria are fulfilled, it is up to UE implementation. |
| NEC | 3 | Rel 17 RRM relaxation revaluation criterion should be more rigorous than Rel\_16 criterion, so it should perform the Rel\_17 RRM relaxation first, if it applies, then the UE relax the measurement of Rel\_17.  But in addition, we should LS to RAN4 to ask what is the difference between UE behavior of Rel\_16 RRM relaxation and Rel\_17 RRM relaxation, to confirm whether Rel\_17 RRM relaxation can achieve more power gain compared to Rel\_16 RRM relaxation. |
| MediaTek | Too early to decide | We need to first decide what the Rel-17 criteria will be. Once we decide this, the interactions with Rel-16 criteria, when both are configured by the network, will become clearer. For the moment, we agree with Qualcomm that no order needs to be specified. |
| Xiaomi | 1/3 | In our contribution, we analysis option 1 and 3, and we think option 1 is an enhancement on top of R16 RRM relaxation by adding stationary criterion. For option 3, stationary criterion (R17 RRM relaxation) is separated from R16 RRM relaxation, and R17 RRM relaxation is a higher level relaxation than R16 RRM relaxation. We think both can be further considered. |
| CATT | 3 | For example, stationary property based on subscription info does not need any other evaluation. |
| CMCC | 3 | The R17 Redcap UE could check the R17 relaxation criteria if configured and take more relaxation actions. |
| Samsung | 3 | This WID's aim is to reduce more energy consumption by adopting more aggressive relaxation method. Thus we expect RAN4 will define more powerful relaxation method for Rel-17 than Rel-16. Accordingly, RAN2 should define more demanding triggering condition for Rel-17 than Rel-16. Then, as described in option 3, UE checks R17 criterion first. If it is fulfilled, R17 relaxation (more powerful than R16) is performed. Otherwise, UE falls back to R16 RRM relaxation. |
| Sony | 1 or 5 | We should avoid specifying complex rules for interactions between features of different releases unless there is a clear gain. |
| ZTE | 3 | If network configures both Rel-16 and Rel-17 criteria, then a Rel-17 RedCap UE that does not fulfill Rel-17 criteria is allowed to do Rel-16 RRM relaxation.  But we don’t think option 1 makes sense, the aim of this study is to define more power saving RRM relaxation methods for Rel-17. If a UE already fulfills Rel-17 criteria, why does the UE choose to perform Rel-16 RRM relaxation method?  BTW, please see our clarification to option 2. Basically, it is different from this question. |
| OPPO | 3 | Agree with Apple. |
| Sequans | 5 | We understand Rel-17 solution to be based on the Rel-16 one. If there are enhancements, then we do not see how applying Rel-16 criteria makes sense. This could be a way to implement de-facto two levels (one defined by Rel-17, one by Rel-16), but this seems very unelegant. |
| LG | Too early to discuss. | This is very stage-3 level detail, so it should be discussed later when R17 RRM relaxation structure is firm. |

**Summary:**

Among 20 companies replied to this question, the views are split among the following 6 options (a few companies selected multiple options):

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Option 1 | Option 2 | Option 3 | Option 4 | Option 5 | None or too early to decide |
| 5 | 0 | 9 | 1 | 5 | 3 |

Given the divergent views and the dependence of this issue on the exact design of the R17 relaxation criteria, the rapporteur tend to agree with one the comments that it may be too early to decide at the moment and its discussion may be postponed to a later meeting.

Based on the outcome of the discussions in this section, the rapporteur would like to suggest the following proposal for agreement:

**Proposal 4. (20/21) Reuse the R16 RRM relaxation triggering criteria for R17 stationary UEs in RRC Idle/Inactive, with the R16 low-mobility criterion replaced by R17 stationarity criterion.**

And the following proposals for discussion during online:

**Proposal 5. (11/16) Discuss whether network can configure a separate set of thresholds for not-at-cell-edge criterion used by R17 stationary UEs.**

**Proposal 6. (3/20) Postpone the discussion on R17 UE behavior when both R16 and R17 relaxation criteria are configured.**

## RRM relaxation in RRC Connected

Among the submitted proposals, there are two different approaches to design relaxation criteria for stationary UEs in RRC Connected. One approach is “to reuse”, e.g. either use R16 relaxation criteria (e.g. low-mobility, not-at-cell-edge) as baseline or use the same criteria as the R17 relaxation criteria to be developed for stationary UEs in RRC Idle/Inactive. The other approach is to introduce new relaxation criteria.

Among the proposals supporting the “reuse” approach, there are two approaches with subtle differences, which are described in the following:

* Option 1a: A R17 stationary UE in RRC Connected applies the same types of RRM relaxation criteria as those for RRC Idle/Inactive. FFS whether parameters used in the relaxation criteria and relaxation methods can be different [1]. This approach is based on the observation that for stationary UEs, there is no fundamental difference in their neighbor cell measurements in RRC Connected and RRC Idle/Inactive. Hence RAN2 may prioritize the discussion on RRC Idle/Inactive relaxations and then reuse them for RRC Connected.
* Option 1b: R16 mechanism can be taken as baseline for neighbour cell measurement relaxation for R17 stationary UEs in RRC connected [2][12][17]. What this approach suggests is that RAN2 will separately study relaxation criteria that are based on R16 relaxation criteria for RRC Connected. RAN2 may or may not develop different relaxation criteria for RRC Connected and RRC Idle/Inactive for R17 stationary UEs.
* Option 1c: RRC\_Connected reuses the Rel-16 RRM relaxation criteria from RRC\_Idle/Inactive as per WID

Among the contributions supporting new criteria for RRC Connected, there are two proposals:

* Option 2a: Introduce a new parameter, s-MeasureConfig\_Stationary, configured within MeasConfig. A stationary UE decides whether to relax its RRM measurements based on the new stationary criterion and how the RSRP of its SpCell compares against s-MeasureConfig\_Stationary [19];
* Option 2b: Introduce beam based criterion for allowing/disallowing RRM measurement relaxation in RRC Connected [12].

Companies are invited to indicate their preference on the various proposals described above in the following questions:

**Question 6. Do you prefer “reuse” (Option 1a & 1b) or introduce new relaxation criteria (Option 2a & 2b)?**

*[Vice-Chair]: On the criteria for RRM relaxation in RRC Connected and the proposals to "reuse" criteria vs define new ones, I think we should really stick to the "reuse" approach (if it will be agreed to support RRM relaxation in RRC Connected).*

*More specifically, on one hand, as pointed out by Nokia, the WID says "for RRC\_Connected the mechanism reuses the Rel-16 RRM relaxation criteria from RRC\_Idle/Inactive...", then implying "option 1c". On the other hand, the objectives continues as "...so as to maximize the commonality with Idle/Inactive UEs" which is the real motivation behind this restriction and actually speaks in favour of "option 1a" (A R17 stationary UE in RRC Connected applies the same types of RRM relaxation criteria as those for RRC Idle/Inactive).*

*So my intention is to allow the discussion among the different flavors of option1 (and specifically option 1a and 1c), while I fear that for now we shouldn't continue the discussion on proposals to go for anything different (i.e. option 2x)*

|  |  |  |
| --- | --- | --- |
| Company | Reuse or new | Comments (if any) |
| Nokia, Nokia Shanghai Bell | Reuse | It is already very clearly defined in the WID that Rel-16 relaxation criteria shall be used:  “for RRC\_Connected the mechanism reuses the Rel-16 RRM relaxation criteria from RRC\_Idle/Inactive” |
| Apple | reuse |  |
| Qualcomm | Reuse |  |
| Ericsson | None | We do not think we should introduce any relaxation in CONNECTED. Note that the network could, when it has determined that a UE is of low/no mobility simply deconfigure RRC measurements for the UE if the network finds suitable. However, as was noted in some of the contributions: RRM measurements are **not only** performed for mobility. For example, the network may need measurements from the UE for the sake of load balancing and the UE shall of course not relax measurements.  So, in CONNECTED the network is in full control of which measurements the UE performs and can adjust the measurements freely, e.g. also based on observed mobility of the UE. There is no need for any enhancements.  In our paper we suggested that RAN2 can investigate if any UE to network reporting of the mobility of the UE would be beneficial. So far there has not been shown any real gains of this, but we are open to keep evaluating this. |
| vivo | Reuse | We agree with Rapporteur’s observation that that for stationary UEs, there is no fundamental difference in their neighbor cell measurements in RRC Connected and RRC Idle/Inactive. Meanwhile, to save the time for discussion on RRM relaxation, it is more reasonable to reuse criteria from RRC Idle/Inactive to RRC Connected. |
| Intel | See comments | The first question should be whether we consider both fixed UE and temporary stationary UE. If we consider both of them, then IDLE/INACTIVE approach could be “reused” but changes are needed to adapt CONNECTED mode, e.g. subscription based approach, RAN may get this information from CN. |
| Futurewei | Reuse |  |
| Sharp | Reuse |  |
| Huawei, HiSilicon | None | There is still concerns on the performance in RRC\_connected state, if RRM relaxation in RRC Connected will be supported, “Reuse” is preferred. |
| NEC | Reuse | Agree with what is already very clearly defined in the WID that Rel-16 relaxation criteria shall be used:  “for RRC\_Connected the mechanism reuses the Rel-16 RRM relaxation criteria from RRC\_Idle/Inactive” |
| MediaTek | Reuse |  |
| Xiaomi | Reuse | For RRC\_Connected the mechanism reuses the Rel-16 RRM relaxation criteria from RRC\_Idle/Inactive so as to maximize the commonality with Idle/Inactive UEs. But the difference is that in RRC\_Connected, UE can determine relaxation by itself or let network to decide it when UE satisfies the criterion. |
| CATT | Reuse, if any | Relaxation in Connected should take minimum specification effort, if any, on top of Idle/Inactive. We share similar view as Ericsson. |
| CMCC | Reuse |  |
| Samsung | Reuse with 2a | There are two points we want to discuss.  1) We wonder if RAN2 assumes "reuse" also includes broadcast singalling as in R16. In R16, the thresholds for triggering conditions are provided via SIB. But, in RRC\_Conncected, we understand dedicated signalling per UE looks reasonable.  2) If RAN2 agrees to reuse R16 "not-at-cell-edge" in dedicated way, we first note that, for RRM measurement in RRC\_Connected, *s-MeasureConfig* (in *MeasConfig)* is being used as RSRP threshold to determine whether to perform measurements on neighboring cells.  ***s-MeasureConfig***  Threshold for NR SpCell RSRP measurement controlling when the UE is required to perform measurements on non-serving cells. Choice of *ssb-RSRP* corresponds to cell RSRP based on SS/PBCH block and choice of *csi-RSRP* corresponds to cell RSRP of CSI-RS.  Having these in mind, option 2a (i.e., introducing *s-MeasureConfig\_Stationary*) is one way to reuse/enhance R16 not-at-cell-edge with dedicated signalling. |
| Sony |  | We think it is bit early to discuss the exact method for connected mode. RAN2 may start with idle/inactive first and then discuss if these methods are found suitable for connected and if there is a gain for connected mode. |
| ZTE | None | Same view as HW. |
| OPPO | Reuse with 1b | We prefer to use Rel-16 RRM relaxation criteria for RRC Idle/Inactive as a baseline, but with some change to adapt RRC Connected, e.g. different parameters for RRM relaxation criteria are configured for Rel-16 low mobility UEs in RRC Idle/Inactive and Rel-17 stationary UEs in RRC Connected. |
| Sequans | Reuse, if any | Agree with Ericsson. NW control in Connected already gives enough flexibility in configuration, so we do not see the benefit beyond possible new assistance information from UE. |
| LG | None | Mobility performance should be guaranteed to introduce such UE autonomous RRM relaxation in RRC\_CONNECTED. |

**Summary**:

Among the 20 companies replied, the views are split as follows:

|  |  |  |
| --- | --- | --- |
| Reuse | None | Wait for outcome of RRC Idle/Inactive |
| 13 | 5 | 2 |

If you selected “reuse” in Question 6, please indicate your preference between Option 1a and 1b in the following question:

**Question 7: For R17 stationary UEs in RRC Connected, do you prefer applying the relaxation criteria to be developed for R17 stationary UEs in RRC Idle/Inactive (Option 1a), or separately studying the relaxation criteria based on the existing R16 relaxation mechanism (Option 1b)?**

|  |  |  |
| --- | --- | --- |
| Company | Preference  (1a or 1b or 1c) | Comments (if any) |
| Nokia, Nokia Shanghai Bell | 1c | It is already very clearly defined in the WID that Rel-16 relaxation criteria shall be used:  “for RRC\_Connected the mechanism reuses the Rel-16 RRM relaxation criteria from RRC\_Idle/Inactive” |
| Apple | 1a |  |
| Qualcomm | 1a | We do not see any fundamental difference in the neighbor cell measurement relaxation criteria between RRC Idle/Inactive and RRC Connected. Hence whatever relaxation criteria we agree in one RRC state can be applied to the other. |
| Vivo | 1a | We agree with Qualcomm. Besides, we think RedCap UEs may have different measurement performance from non-RedCap UEs due to reduced capabilities. Thus, it is more proper to reuse the criteria to be developed for R17 stationary UEs but not the criteria based on existing R16 relaxation. |
| Futurewei | 1a |  |
| Sharp | 1a |  |
| NEC | 1a | For RRC connected, it is controlled by the gNB. Besides this, the RRM has the same requirement with other RRC states. |
| MediaTek | At least 1b | 1b should be considered as the baseline for Connected mode measurement relaxation study. 1a can be considered if there are significant advantages over 1b. |
| Xiaomi | 1a |  |
| CATT | 1a | The objective of RRM relaxation in RRC Connected is still for stationary RedCap UEs. Hence, the same criteria for stationary Redcap UEs in RRC Idle/inactive can be used. |
| CMCC | 1a |  |
| Samsung |  | We wonder if whether RAN2 assumes broadcast or dedicated signalling for RRC\_Connected. If broadcast, we agree option 1a. Otherwise, we prefer option 1b. |
| OPPO | 1b | We prefer to use Rel-16 RRM relaxation criteria for RRC Idle/Inactive with some change to adapt RRC Connected, e.g. different parameters for RRM relaxation criteria are configured for Rel-16 low mobility UEs in RRC Idle/Inactive and Rel-17 stationary UEs in RRC Connected. |
| Sequans | 1a | We do not see fundamental difference between Idle/Inactive and Connected for this case. |

If you selected “new” in Question 6, please indicate whether you support Option 2a and 2b described above in the following question. If you do not support either Option 2a or 2b but have other proposals for new relaxation criteria, you may indicate “other” as your preference and your motivation in the Comments column.

**Question 8: Do you support introducing a new threshold against RSRP of UE’s SpCell as described in Option 2a, or beam based criterion as described in Option 2b, or other enhancements?**

|  |  |  |
| --- | --- | --- |
| Company | Option 2a, 2b or other | Comments (if any) |
| Samsung | Reuse with 2a | Please see our responses for Q7 and Q8. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Summary:**

Among the 15 companies replied to Question 5, 11 companies support reusing the same R17 relaxation criteria in RRC Idle/Inactive (Option 1a), 2 companies prefer using R16 relaxation criteria as baseline but can study further enhancements for R17 (Option 1b), 1 company indicates that it depends on signaling design of R17 relaxation criteria, and one company support only the same relaxation criteria as R16 (Option 1c).

And no company has indicated to study new enhancements for R17 relaxation criteria in RRC Connected.

Based on the outcome of the discussions on Question 5 and 6, the rapporteur would like to suggest the following proposal for agreement:

**Proposal 7. (11/15) R17 RRM relaxation criteria in RRC Connected should reuse R17 RRM relaxation criteria in RRC Idle/Inactive. No new enhancements will be studied.**

The last issue to discuss is whether it is UE or network that has the power to trigger measurement relaxation when UE meets relaxation criteria. Two types of approaches have been proposed in the contributions, as follows:

* Option 1: If network provides evaluation parameter for relaxation criteria (either in SIB or by dedicated signaling), UE can relax its RRM measurements on neighbor when it meets the relaxation criteria [1] [2] [12] [17];
* Option 2: When UE meets relaxation criteria configured by network, it provides an indication to network and then wait for network’s confirmation to trigger its relaxation. This indication from UE can be in the form of a measurement report [2] or other signaling method [18].
* Option 3: Only UE to network indication is considered, but existing procedures already in spec are used to achieve relaxation, e.g. deconfigure measurements.
* Option 4: On top of Option 1, network can indicate which frequencies (measObjects) can be relaxed when UE meets the relaxation criteria.

Companies are invited to indicate their preference between the above two options:

**Question 9: Do you think UE is allowed to trigger relaxation by itself after meeting the relaxation criteria configured by network (Option 1) or UE always needs a confirmation from network to trigger relaxation even after UE has met the relaxation criteria (Option 2)?**

|  |  |  |
| --- | --- | --- |
| Company | Preference  (Option 1 or 2) | Comments (if any) |
| Nokia, Nokia Shanghai Bell | 2 | We assume that this question is only for CONNECTED |
| Apple | No strong preference, but 2 is feasible as the UE is in CONNECTED mode |  |
| Qualcomm | 1 | If network has configured relaxation criteria, that means network authorizes UEs to evaluate relaxation criteria by themselves. Otherwise, network can evaluate UE’s eligibility by itself based on UE’s measurement reports (this can be done in RRC Connected but no RRC Idle). Hence we do not see any need for an extra signaling step by UE to get a confirmation from network before it can trigger RRM relaxations. |
| Ericsson | 3 | As said, the network is in full control over which measurements a UE in CONNECTED needs to perform. The network can deconfigure measurements if deemed suitable by the network.  Our interpretation of option 2 above seem to be some type of new mechanism should be added? But a simple deconfiguration of measurements will suffice and luckily(!) RAN2 does not need even to change the spec for this. |
| vivo | 1 and 2 | We think the network is in full control even in option1, as the network can decide how and even whether to configure the parameters for RRM relaxation.  In our understanding, it is too early to make the decision on this issue. We could agree to list the options here from RAN2 point of view. After RAN4 defining the relaxation method based on the criteria developed above, we could further discuss which approach should be adopted in both RAN2 and RAN4. |
| Intel | 1 | The relaxation criteria is configured by the network, and therefore the network already have full control on this , i.e. the network can decide whether the UE is allowed to do this, and based on what. Therefore the UE can follow network guidance and relax RRM measurement directly when the criteria (configured by network ) is met. |
| Futurewei | 2 |  |
| Sharp | 1 and 2 | The gNB can control relaxation by sending relaxation parameters or not, which is a kind of rough control. In that case, UE is allowed to trigger relaxation by itself according to gNB’s control.  The gNB also can control relaxation exactly, i.e. to indicate when to start or stop relaxation to UE. The indication mentioned in Option2 is unnecessary. |
| Huawei, HiSilicon | 2 | If RRM relaxation in RRC Connected will be supported, it should be strictly under network control, the network should be aware of RRM relaxation performed by the UE. |
| NEC | Option 1 or 2 | Similar view to vivo. Probably it’s good to wait for further RAN4 progress regarding defining how the RRM relaxation is done for stationary UE and then RAN2 can decide later. |
| MediaTek | 1 | We agree with QC that if the NW has configured relaxation criteria, it is an implicit authorization to relax measurements when that criteria is met. The extra signaling does not add value, and has the disadvantage of increasing the signaling load in the system. |
| Xiaomi | 1 | We understand that option 2 is to ensure that UE can perform relaxed measurement more carefully, but we think once network can provide a UE with evaluation parameter for relaxation criteria, it means network can let UE decide whether to relax, so we think option 1 is a better way which can perform relaxation more fast and reduce signal overhead. |
| CATT | 2 or 3 | How to relax RRM measurement in RRC Connected is decided in RAN4. We can decide whether RRM configurations need to be updated based on RAN4’s conclusion for RRM relaxation in RRC Connected. |
| CMCC | 2 | The network should pre-configured trigger condition and sends indications with dedicated signaling to control the desired RedCap UEs to perform the RRM relaxation in connected mode. |
| Samsung | 1 | We share the view from Qualcomm. |
| Sony | 1 |  |
| ZTE | 4 | As we indicated in our paper [6], only mobility based RRM measurements can be relaxed, considering the UE is not moving.  But there are other measurements that network will expect UE to report as soon as possible (usually these RRM measurement won’t last for a long time, but early reporting is needed). If only Option 1 is adopted, and network wants to configure such kind of RRM measurements (e.g. load balance) to UE, the network can only disable entire RRM relaxation function. By doing this, the UE cannot be benefit from RRM relaxation on other frequencies, and it will take additional time for speed evaluation when network enable the RRM relaxation function again. |
| OPPO | 2 | For option 1, whether to perform relaxed neighbour cell measurement is determined by UE based on the configured creteria, but network does not know whether UE has triggered relaxed neighbour cell measurement or not.  For option 2, network is fully in control of RRM relaxation of the UE.  Considering that RRM measurement in Connected state should be relaxed with more carefulness since any mobility impacts is quite unacceptable, we prefer option 2. |
| Sequans | 2 or 3 | Option 3 looks like a special case of option 2. In any case it doesn’t look RRM relaxation would be used in Connected if option 1 is selected and NW is not in full control. |
| LG | 2 | As it was proposed in [10], if a UE which has been performing measurement relaxation in RRC\_IDLE/INACTIVE accesses to the network, then the UE can indicate its stationarity status/RRM relaxation status to the network. Based on that, the network may configure relaxed measurement configuration (e.g. less frequencies to measure). |

**Summary**:

Among the 20 companies replied, the views are split as follows (some companies selected more than one options):

|  |  |  |  |
| --- | --- | --- | --- |
| Option 1 | Option 2 | Option 3 | Option 4 |
| 9 | 12 | 3 | 1 |

With Option 2 having a slight majority, the rapporteur would like to discuss the following proposal during online:

**Proposal 8. (12/20) In RRC Connected, UE needs a confirmation from network to trigger its RRM relaxations even after UE has met the relaxation criteria configured by network.**

# References

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2. R2-2102737, Discussion on RRM relaxation for RedCap UEs, OPPO.
3. R2-2102853, RRM measurement relaxation criteria for RedCap devices, Intel Corporation.
4. R2-2102860, Discussion on RRM relaxation criteria for neighboring cells, vivo, Guangdong Genius.
5. R2-2102966, Mechanisms for RRM relaxation for RedCap, Ericsson.
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7. R2-2103113, Discussion on RRM Relaxations, CATT.
8. R2-2103150, Discussion on RRM relaxation for RedCap UE, Xiaomi Communications.
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16. R2-2103888, RRM relaxation down selection of options for RedCap, Apple.
17. R2-2103974, RRM relaxation for RedCap UE, InterDigital.
18. R2-2104060, RRM measurement relaxation for RedCap UE, Huawei, HiSilicon.
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