**3GPP T****SG-RAN WG2 Meeting #114e R2-2106531**

**Online, April 12 – 20, 2021**

**Agenda item: 8.12.3.2**

**Source: Samsung**

**Title: Summary of [AT114-e][111][RedCap] RRM relaxation criteria in idle/inactive**

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

**Document for: Discussion and Decision**

# Introduction

This document aims at gathering and summarizing company's views for the following offline discussion:

* [AT114-e][111][RedCap] RRM relaxation criteria in idle/inactive (Samsung)

Initial scope: Discuss RSRP/RSRQ based stationarity criterion + not-at-cell-edge criterion + coexistence with R16 configuration, e.g. based on proposals in R2-2106403 and R2-2105637

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

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

Initial deadline (for companies' feedback): Tuesday 2021-05-25 08:00 UTC

Initial deadline (for rapporteur's summary in R2-2106531): Tuesday 2021-05-25 12:00 UTC

Proposals marked "for agreement" in R2-2106531 not challenged until Tuesday 2021-05-25 22:00 UTC will be declared as agreed via email by the session chair.

For the rest the discussion will continue online in the Wednesday CB session.

Note this discussion is limited to RRM relaxation criteria in idle/inactive. We will focus on the following three topics for RRM relaxation criteria in idle/inactive:

1.     RSRP/RSRQ based stationarity criterion,

2.     Not-at-cell-edge criterion,

3.     Coexistence with R16 configuration.

As stated in the scope from VC, the discussion would be mainly based on the proposals in the two contributions (i.e., R2-2106403 [1] and R2-2105637 [2]) and other contributions related to three topics above are also considered as much as possible.

# Contact information

|  |  |
| --- | --- |
| Company | Contact Info (name and email address) |
| Samsung | Seungbeom Jeong (s90.jeong@samsung.com) |
| Apple | naveen.palle@apple.com |
| Qualcomm | Linhai He (linhaihe@qti.qualcomm.com) |
| Futurewei | Yunsong Yang (yyang1@futurewei.com) |
| Huawei, HiSilicon | Yiru Kuang (kuangyiru@huawei.com) |
| MediaTek | pradeep[dot]jose[at]mediatek[dot]com |
| NEC | Zhe Chen (Chen\_zhe@nec.cn) |
| Xiaomi | Rao (shirao@xiaomi.com) |
| Lenovo | Jie Shi(shijie4@lenovo.com) |
| Nokia | Jussi-Pekka Koskinen (jussi-pekka.koskinen@nokia.com ) |
| OPPO | Haitao Li (lihaitao@oppo.com) |
| Vivo | Chenli (chenli5g@vivo.com) |
| Ericsson | Mattias Bergström (mattias.a.bergstrom@ericsson.com) |
| CATT | Pierre Bertrand (pierrebertrand@catt.cn) |
| Thales | Volker Breuer (volker.breuer@thalesgroup.com) |
| ZTE | LiuJing (liu.jing30@zte.com.cn) |
| LG | Oanyong Lee (aidoy.lee@lge.com) |
| Sony | Vivek.Sharma@sony.com |

# Discussion

## RSRP/RSRQ based stationarity criterion

In RAN2#113bis-e, RAN2 made the following agreements for RRM relaxation criteria in RRC\_IDLE/INACTVE:

Agreements:

1. Assuming there will be a stationary property based on subscription (which is FFS), we will not restrict to this and will continue to assume that a UE can use some RSRP/RSRQ based criteria (FFS whether reuse R16 thresholds or new ones. FFS also on the use of a beam based criteria)

Considering RAN2 has agreed the following in 1st week online in RAN2#114e, we can only focus on RSRP/RSRQ based criteria for Rel-17 stationary criterion.

Agreements:

1. Subscription based relaxation criteria will not be considered in Rel-17 RRM relaxation

Different methods as R17 stationary criterion have been proposed in the contributions ([1]~[21]). Among them, many companies [1,3,4,8,15,16,18] proposed to reuse Rel-16 low mobility criterion (as captured below) for Rel-17 stationary criterion.

|  |
| --- |
| 5.2.4.9.1 Relaxed measurement criterion for UE with low mobilityThe relaxed measurement criterion for UE with low mobility is fulfilled when:- (SrxlevRef – Srxlev) < SSearchDeltaP,Where:- Srxlev = current Srxlev value of the serving cell (dB).- SrxlevRef = reference Srxlev value of the serving cell (dB), set as follows:- After selecting or reselecting a new cell, or- If (Srxlev - SrxlevRef) > 0, or- If the relaxed measurement criterion has not been met for TSearchDeltaP:- The UE shall set the value of SrxlevRef to the current Srxlev value of the serving cell. |

Their solutions can be categorized into the following three options:

- Option 1) Reuse R16 low mobility criterion with the same thresholds (i.e., SSearchDeltaP/ TSearchDeltaP)

- Option 2) Reuse R16 low mobility criterion with different thresholds (e.g., SSearchDeltaP\_stationary/ TSearchDeltaP\_stationary)

- Option 3) Do not reuse R16 low mobility criterion and introduce a new mechanism (e.g. beam-level RSRP/RSRQ measurement)

Companies are invited to comment in the question below on which of the above options they prefer to use as a part or entire of R17 RRM relaxation criterion in RRC\_IDLE/INACTIVE. Note beam-level criterion will be discussed separately in the rest of this paper.

**Q1. Among the three options described above, which one do you prefer as a part or entire Rel-17 stationary criterion in RRC\_IDLE/INACTIVE? If your preferred option is not listed, please describe your option in the following table with Option 3 below.**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comments (if any) |
| Apple | Op2 (op3 is also ok) | We think atleast new thresholds are needed. |
| Qualcomm | Option 2 or 3 | We support reuse R16 low mobility criterion with different thresholds (e.g. smaller SSearchDeltaP and longer TSearchDeltaP\_stationary), to enable further relaxations for stationary UEs than R16 low-mobility UEs. Here we assume that NW needs to use different thresholds only when it configures both R17 stationary criterion and R16 low-mobility criterion at the same time. Otherwise, NW should be able to configure any thresholds for the R17 stationary criterion.If companies can’t converge on Option 2 and prefer using beam-level measurements, we can support Option 3 too. But we don’t support using beam change count as a criterion. We prefer using Doppler shift as a relaxation trigger, as it offers a more reliable way of determining UE’s stationarity. |
| Futurewei | Option 2 or modified option 3 | Modified option 3 is to introduce a new beam-level based criterion, which can be combined with option 2 (i.e., a UE needs to fulfill both).  |
| Huawei, HiSilicon | Option 3 | For the “stationarity criterion”, as we focus on the stationary case, it is important to precisely define the “stationary”, so beam-level RSRP/RSRQ measurement is preferred. But we find that it is difficult to identify whether UE is moving or not by evaluating the number of switched beams, no suitable threshold can be defined for all UE located in different distance to the gNB. We think the quality change of beam(s) is more useful. |
| MediaTek | Option 2 | Reusing R16 with different thresholds to detect stationary property of the UE is appropriate here. |
| NEC | Option 2/3 | For option 2, we think the stationary UE and Rel\_16 low mobility UE should have different thresholds. For option 3, we think for stationary, the beam level RSRP/RSRQ measurement makes sense and it is more accurate than cell level RSRP/ RSRQ measurement. |
| Xiaomi | Option 2(Option 3?) | First, different thresholds can be supported to differentiate stationary and low mobility.For option 3, if the new mechanism means that stationary criterion is based on low mobility as a baseline and beam-related can be considered, then our answer is yes. |
| Lenovo | Option.2 | A new threshold for R17 stationary UE is sufficient. If option.3 is introduced, it needs to confirm to introduce it by RAN1 or RAN4. |
| Nokia, Nokia Shanghai Bell | Option 3 & 1 | We preferer option 3, because beam quality measurement is more accurate than cell quality measurement for determining “stationary” of the UE. Furthermore, it is not clear to us why option 3 excludes R16 low mobility criterion. We think they would work nicely also together. |
| OPPO | Option 2 | If RAN4 agrees to define more relaxed measurement for R17 stationary UEs compared to R16 low mobility UEs, we should support separate thresholds configuration for R17 stationary UEs and R16 low mobility UEs, e.g. NW configures more stringent criterion for R17 stationary UEs. |
| vivo | Option2 (and option 3?) | New thresholds are needed to distinguish stationary UEs from low mobility UEs. Besides, considering the reduced capabilities for RedCap devices, the threshold used to determine the relaxation could be different from normal UE.For option 3, we think we could consider it after the use case is identified.  |
| Ericsson | Not 1, not 3 | Our understanding of option 1: a Rel-17 UE may use the existing Rel-16 thresholds (if configured) but instead of applying the relaxation method defined in Rel-16, this Rel-17 UE would apply some new Rel-17 way of relaxing. If this is the correct understanding of the proposal we think Option 1 should be avoided. The reason is that a network implementing the Rel-16 relaxation feature may assume that UEs behave in a certain way (namely the Rel-16 way) but suddenly with this approach some Rel-17 UE may behave completely differently (namely as per the Rel-17 way). We shouldn’t mix features in this way.For Option 3 we would need to figure out many details first, it seems too complicated.  |
| CATT | Option 3 | For the stationary criterion, the new mechanism (e.g. beam-level measurements) can include the R16 low mobility criterion. |
| Thales | Option 2 | We support to reuse R16 low mobility criterion with different thresholds to allow for different treatment of low mobility and stationary devices. |
| ZTE | Option 2 | Reusing R16 low mobility criterion with new thresholds is sufficient.  |
| LG | Option 2 | We think RSRP change-based RRM relaxation criterion is enough, but the network may want different RSRP change thresholds for the stationary RedCap UEs. For example, the network may want only truly stationary RedCap UEs (i.e. smaller SSearchDelta) to trigger extreme RRM relaxation.For option 3, we think beam-level RRM relaxation criterion is not needed, because of the frequent fluctuation of beam quality, the stationary UEs may accidentally leave the stationarity state if someone passes by. |
| Sony | Option 2 or Option 3 | Agree with Huawei. We think enhanced beam-level RSRP/RSRQ measurements are preferred that is not related to beam change criterion, but rather on beam quality.We can reuse R16 criteria but by allowing more dynamic setting of parameters.  |

### Details on Option 1 in Q1

If Option 1 in Q1 is chosen, no further discussion would be needed.

### Details on Option 2 in Q1

If Option 2 in Q1 is chosen, RAN2 could further discuss details on the different thresholds. For instance, some companies [1,3,4,18] proposed to define more stringent stationary criterion (as shown below) for Rel-17 than Rel-16 low mobility criterion.

1) SSearchDeltaP\_stationary ≤ SSearchDeltaP (and/or)
2) TSearchDeltaP\_stationary ≥ TSearchDeltaP.

They assume RAN4 will define more powerful RRM relaxation method for Rel-17 (i.e. stationary) compared to the one for Rel-16 (i.e. low mobility), as RedCap devices require much more energy saving than normal UEs. However, excessive RRM relaxation of neighbouring cells may lead to performance degradation related to cell reselection. To avoid this side-effect, RAN2 should define more careful (i.e., stringent) criterion for Rel-17, rather than reusing Rel-16 thresholds.

Companies are invited to comment in the question below on whether they support more stringent stationary criterion for Rel-17 than Rel-16 low mobility criterion, "If" option 2 in Q1 is adopted.

**Q2. "If" option 2 in Q1 is adopted,** **do you support more stringent stationary criterion for Rel-17 than Rel-16 low mobility criterion:
1) SSearchDeltaP\_stationary ≤ SSearchDeltaP (and/or)
2) TSearchDeltaP\_stationary ≥ TSearchDeltaP.**

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments (if any) |
| Apple | No for stringent | We think the other way. The goal is to allow UE to ‘relax’ more for power-saving, esp for stationary UEs, where the changes in signal strength do not necessarily translate into mobility like the Rel-16. It is up for discussion on how the thresholds should be, but atleast the logic and the config of thresholds should not be limited by rel-16. |
| Qualcomm | Yes | That should be the principle for how those two parameters are configured, when R16 low-mobility is also configured by network at the same time. Otherwise (i.e. only R17 stationary criterion is configured), network can configure whatever values it likes to.  |
| Futurewei | Yes | When the NW configures both R16 low mobility criterion and R17 stationary criterion. |
| MediaTek | In principle yes, but left to NW implementation | This should be the principle for how these parameters should be configured. Ultimately, it is up to NW implementation to determine what values to choose. Only the expected UE outcome on meeting the configured threshold(s) needs to be defined. |
| NEC | No  | We think it can be up to network implementation.  |
| Xiaomi | Yes, but | At least SsearchdeltaP\_stationary can be supported.But we think using the two of parameters is redundant as they are synergistic. What’s more, TSearchDeltaP\_stationary is not reliable, because longer duration may allow opportunity for RSRP to be adjusted. The case is that RSRP may goes through a big change then it comes back to its original value during this longer period. Then it turns out the criterion is still fulfilled.Therefore, we think only SsearchdeltaP\_stationary being used is OK. |
| Lenovo | Yes | We think it is network implementation to configure a stringent stationary criterion. |
| Nokia, Nokia Shanghai Bell |  | If option 2 is selected dedicated control for the configuration would be beneficial. In this way network is able to configure different configurations for different UEs |
| OPPO | Yes | This should be the principle for how these parameters should be configured. |
| Vivo | Yes with comments | Firstly, we share the same view with rapporteur (if “more powerful relaxation” means “more relaxed measurement”). To avoid the performance degradation of cell reselection, more stringent criterion to identify real (temporary) stationary UE should be introduce with separate thresholds: **SSearchDeltaP\_stationary** and/or**TSearchDeltaP\_stationary**If network only configure the relaxation for Rel-17 criteria (without configuration for Rel-16 criteria), it could be up to network how to select the values. But it is better to have separate thresholds.  |
| Ericsson | Not applicable | Should be left to gNB implementation. |
| CATT | Yes | When the NW configures both R16 low mobility criterion and R17 stationary criterion. |
| Thales | In principle yes | But values are configured by the network, the Rel.-16 and Rel.-17 values can be configured separately by the network and should not have any strict dependence even it goes into the right direction. |
| ZTE | Yes | But we think there is no need to capture this restriction in specification. It can be left to network implementation.  |
| LG | Don’t need to be stringent. | It is up to network implementation whether to configure the R17 criterion stringently or not. The network may want only truly stationary UEs to perform extreme RRM relaxation, or also allow less stationary(may be very low mobility) UEs to perform RRM relaxation. |
| Sony | Yes | A stringent stationary criterion should be introduced and it can be configured by the network. |

### Details on Option 3 in Q1

If Option 3 in Q1 is chosen, for the new mechanism, some companies [2,3,6,9,11,14,17] understand beam-level RSRP/RSRQ measurement is beneficial to determine UE's stationariness. Among them, companies [2,6,11] propose to use beam level criterion with reusing Rel-16 low mobility criterion. Assuming the details of beam level criterion/measurement is FFS, we can discuss the following options:

- Option 1) Rel-16 low mobility criterion is enhanced with beam-level measurement.

- Option 2) Beam level criterion is configured separately with Rel-16 low mobility criterion.

Companies are invited to comment in the question below on which of the above options they prefer to use for Rel-17 stationary criterion. Companies are also allowed to add other options, if any.

**Q3. Among the two options described above, which one do you prefer as Rel-17 stationary criterion in RRC\_IDLE/INACTIVE?**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comments (if any) |
| Apple | Op2 | With FR1, beam-level variations are not much. And UE operating with 1Rx does not work in exactly the same way as a legacy NR device would (in terms of capability). So beam-based relaxation is not an option, but does not necessarily be tied to other RRM relaxations.  |
| Qualcomm | Option 2 | In our paper [3], we propose to use Doppler shift based methods (e.g. a UE is considered stationary if Doppler shift of the N best beams from its serving cell are below a threshold for the last K rounds of measurement) as a criterion to determine UE’s stationarity.  |
| Futurewei | Option 2 | Beam-level based criterion can be configured separately or be combined with SSearchDeltaP\_stationary based criterion (i.e., a UE needs to fulfill both). |
| Huawei, HiSilicon | Option 2 | The quality change of beam(s) for a period of time can be considered, i.e. the quality variation of the beam(s) is larger than a certain threshold. The quality of beam will change during UE moves, the quality variation of the beam(s) is a relative value, it will be more accurate to evaluate “stationary” criterion. |
| NEC | Option 2 | The legacy cell level RRM measurement is based on the measurement of multiple SSBs. With a single beam level measurement, we need separate Beam level criterion |
| Xiaomi | Option 2 | Our understanding is that RSRP-based criterion (i.e. low mobility criterion with different thresholds) is mandatory, and beam-related can be optionally configured to precisely define what stationary is. |
| Lenovo | Option.2 | It could be separate with Rel-16 low mobility criterion. |
| Nokia, Nokia Shanghai Bell | Option 1 & 2 | Both options are ok |
| OPPO | none | We think cell level criterion is sufficient. We understand the motivation to use beam level criterion is that using beam level measurement results can assess UE's movement more accurately than cell measurement. However, in our view, even if UE moves in some cases, e.g., when the UE moves among beams (like a circle around the gNB), as long as the UE’s cell level measurement results do not change, the UE would not reselect to another cell, therefore there would be no problem to relax neighbour cell measurement. So we think there is no need to introduce beam-change based criterion. |
| vivo | Option 2 | We think the beam-level criteria could be configured separately from RSRP/RSRQ based criteria. There is no reason to bundle with other criteria. The beam-level signaling quality may change very frequently, due to not only the UE mobility but also the blockage. Hence, it should be totally new criterion for beam-level based measurement.  |
| Ericsson | - |  |
| CATT | Option 1 | The beam level criterion can be combined with the R-16 low mobility criterion. The R16 low mobility criterion can be used to determine the changes of the distance between the UE and the gNB. The beam level criterion e.g. the number of the best beam changes helps the UE to determine the mobility state between beams. |
| Thales | Option 1/2 | Both options would be Ok for us. |
| ZTE | - | We think cell level results evaluation is sufficient. Beam level RSRP change without changing cell level RSRP is really a rare case. |
| LG | None | We do not support beam-level evaluation. |
| Sony | Option 2 | Beam level quality measurements can be measured over time, and can be configured separately from Rel-16 mobility low mobility criterion. We think the same framework as R16 can be used but with more dynamic parameter setting. |

## Not-at-cell-edge criterion

In RAN2#113bis-e, RAN2 agreed not-at-cell-edge criterion can be configured with R17 stationary criterion.

Agreements - via email (from offline [102]):

1. Network can configure R17 stationarity criterion/criteria together with a not-at-cell-edge criterion, to trigger RRM relaxations in RRC Idle/Inactive for R17 UEs supporting the feature. FFS whether the R16 not-at-cell-edge thresholds can be reused or separate R17 not-at-cell-edge thresholds are needed.

In RAN2#114e, many companies [1,2,3,4,8,11,15,18,20] suggested reusing Rel-16 not-at-cell-edge criterion (as shown below) for Rel-17 not-at-cell-edge criterion.

|  |
| --- |
| 5.2.4.9.2 Relaxed measurement criterion for UE not at cell edgeThe relaxed measurement criterion for UE not at cell edge is fulfilled when:- Srxlev > SSearchThresholdP, and,- Squal > SSearchThresholdQ, if SSearchThresholdQ is configured,Where:- Srxlev = current Srxlev value of the serving cell (dB).- Squal = current Squal value of the serving cell (dB). |

The proposals are split into two options:

- Option 1) Reuse Rel-16 not-at-cell-edge criterion with the same thresholds (i.e., SSearchThresholdP / SSearchThresholdQ­) [1,2,11]

- Option 2) Reuse Rel-16 not-at-cell-edge criterion with the different thresholds [3,4,8,15,18,20]

- Option 3) Reuse Rel-16 not-at-cell-edge criterion, no new relaxation method without dependency to the possible Rel-17 stationary criterion.

Companies are invited to comment in the question below on which of the above options they prefer to use for Rel-17 not-at-cell-edge criterion. Companies are also allowed to add other options, if any.

**Q4. Among the two options described above, which one do you prefer as Rel-17 not-at-cell-edge criterion in RRC\_IDLE/INACTIVE?**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comments (if any) |
| Apple | Op2 |  |
| Qualcomm | Option 2 | Because stationary UEs have less uncertainties in their mobility than low-mobility UEs, we think it makes sense to allow stationary UEs to have a more relaxed not-at-cell-edge criterion than the R16 one (e.g. smaller SSearchThresholdP and SSearchThresholdQ) for not-at-cell-edge criterion. In other words, stationary UEs closer to cell edge than R16 low-mobility UEs can also relax their RRM measurements, because they are less likely to reselect their cells. |
| Futurewei | Option 2 | In [18], we discuss that many sensors may be installed at awkward locations such as basements or close to the ground. Due to poor RF reception at these locations, they may be deemed as at cell edge if current thresholds are used. However, because they are stationary, once they select a cell, they will likely stay with the cell for a long time (e.g., until cell planning changes). So, they should be allowed to benefit from RRM relaxation.Therefore, when a UE fulfills R17 stationary criterion, either the UE doesn’t need to fulfill any not-at-cell-edge criterion at all, or if the UE also needs to fulfill not-at-cell-edge criterion, the UE should be allowed to apply lower thresholds in the evaluation.On the other hand, if the UE doesn’t fulfill R17 stationary criterion, the UE should evaluate not-at-cell-edge criterion with higher thresholds, if the UE is also configured to fulfill such criterion (either as a standalone criterion or in combination with R16 low mobility criterion, as specified today), in order to perform RRM relaxation. |
| Huawei, HiSilicon | Option 1 | The measurement result is not an accurate and fixed value, and may vary within a certain range, we do not see much gain to define a new not-at-cell-edge threshold. Beside, the “stationary UE” considered in Rel-17 includes the “temporary stationary UE”, the UE can move in some case that’s why we need to additionally introduce not-at-cell-edge criterion. If it is the case, the case of UE moving is similar as Rel-16 UE, so we think the same threshold is enough.This should be clarified as “Rel-17 not-at-cell-edge criterion only used together with R17 stationary criterion” |
| MediaTek | Option 1 | We do not see significant gains associated with a new cell-edge definition |
| NEC | Option 2 |  |
| Xiaomi | - | We do not have a strong view on this issue and open for both. But it is noted that not-at-cell-edge only can be used when UE is stationary. Which means R17 RRM relaxation has two level relaxation methods. I.e. 1. Satisfying stationary and not-at-cell-edge, 2.only satisfying stationary. |
| Lenovo | Option.2 | A new value is introduced for RedCap UE. |
| Nokia, Nokia Shanghai Bell |  | Option 2 is ok to us if network can configure not-at-cell-edge criterion with dedicated signaling. Otherwise option 1 seems sufficient.  |
| OPPO | Option 2 | In our understanding, since stationarity criterion is stricter than low-mobility criterion, it seems reasonable to combine the stationarity criterion with a looser not-at-cell-edge criterion compared to Rel-16 not-at-cell-edge criterion. But meanwhile this depends on how RAN4 will define the RRM relaxation method for stationary UEs. |
| vivo | Option2 | We think R17 not-at-cell-edge criterion can be less stringent than R16 not-at-cell-edge criterion, as we would define stationary criterion, which is more relaxed than R16 not-at-cell-edge. In other words, a UE which is considered at cell edge but may not fulfil the R16 not-at-cell-edge criterion could perform relaxed measurement, given the UE is stationary. |
| Ericsson | 3 | We think we should not add a new not-at-cell-edge criterion. A Rel-17 UE can of course support the Rel-16 not-at-cell-edge criterion and apply it. But we haven't seen any gains of adding yet another not-at-cell-edge criteria. Hence, we don’t think there should be any new not-at-cell-edge relaxation method either.We are not sure if what we prefer is covered by Option 1. Option 1 could also mean that there will be a new relaxation method which Rel-17 UEs can use and will be triggered based on the Rel-16 criterion. But that would be a poor design in our view.The simplest way to add a potential Rel-17 low mobility criteria is as follows (details in R2-2105246):If Rel-16 low mobility criteria is configured and fulfilled: UE may do Rel-16 "low mobility" relaxationIf Rel-17 low mobility criteria is configured and fulfilled: UE may do Rel-17 "low mobility" relaxationIf Rel-16 cell edge criteria is configured and fulfilled: UE may do Rel-16 "not at cell edge" relaxationIf Rel-16 low mobility criteria is configured and fulfilled, andIf Rel-16 cell edge criteria is configured and fulfilled: UE may do Rel-16 "low-mobility and not at cell edge" relaxation |
| CATT | Option 2 | Redcap UE has less RX chains so it should be discussed whether the threshold could be impacted by the different number of RX chains, and we agree with Qualcomm that R17 stationary UEs closer to cell edge than R16 low-mobility UEs can also relax their RRM measurements, because they are less likely to reselect to other cells. Different threshold should be set. |
| Thales | Option 2 | With possibility to define different thresholds. |
| ZTE | Option 2 | Separate not-at-cell-edge thresholds provide more flexibility. If same threshold is preferred in particular scenario, network can configure them to the same value.  |
| LG | If needed, option 2 | Basically we do not think not-at-cell edge criterion is needed for R17 RRM relaxation because just suitable serving cell would be enough for the stationary RedCap UEs. However, if the not-at-cell edge criterion should be introduced, less stringent not-at-cell edge condition is allowable for the RedCap stationary UEs, because they will not move at most of time. |
| Sony | Option 2 |  |

According to the statement (i.e., "The study includes an objective on RRM relaxation for stationary RedCap UEs") from TR 38.875, some companies [1,3,18] assume, when NW configures Rel-17 RRM relaxation, Rel-17 stationary criterion is mandatory, but Rel-17 not-at-cell-edge criterion is optional configuration.

Companies are invited to comment in the question below on whether they support the following proposal: When NW configures Rel-17 RRM relaxation,1) Rel-17 stationary criterion is mandatory, and 2) Rel-17 not-at-cell-edge criterion is optional configuration.

**Q5. Do you support the proposal (i.e., When NW configures Rel-17 RRM relaxation, Rel-17 stationary criterion is mandatory, and Rel-17 not-at-cell-edge criterion is optional configuration**)**?**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comments (if any) |
| Apple | We support. |  |
| Qualcomm | Agree | We support the proposal |
| Futurewei | Yes | The optionality of not-at-cell-edge criterion is in-line with P4 in our paper [18]. |
| Huawei, HiSilicon | Agree | If Rel-16 not-at-cell-edge criterion with the same thresholds will be agreed, the above Rel-17 not-at-cell-edge criterion means Rel-16 not-at-cell-edge criterion, right? |
| MediaTek | Agree |  |
| NEC | Yes  |  |
| Xiaomi | Support | It means that R17 RRM relaxation has two level relaxation method. I.e. 1.Satisfying both stationary and not-at-cell-edge, 2.Only satisfying stationary. |
| Lenovo | Yes |  |
| Nokia, Nokia Shanghai Bell | No  | It can be left up to network implementation which conditions are configured.  |
| OPPO | Agree |  |
| vivo | No | We are not sure whether such restriction should be introduced for network configuration. It could be up to network implementation.  |
| Ericsson | No | We don’t think there should be a Rel-17 not-at-cell-edge criterion since no one has been able to show any gains worth pursuing. |
| CATT | Agree |  |
| Thales | Agree |  |
| ZTE | Agree |  |
| LG | Yes | If low-mobility criterion is not configured but not-at-cell edge condition is configured, then not low-mobility UE may perform RRM relaxation. |
| Sony | Support |  |

## Coexistence with R16 configuration

In this discussion, the following scenario is considered: NW configures R17 RRM relaxation configuration with R16 RRM relaxation configuration together, and a UE fulfills both R16 relaxation criterion and R17 relaxation criterion. For a such case, there were some proposals [1,2,4776], which showed different understanding on how UE performs RRM relaxation, as follows:

- Option 1) UE performs Rel-17 RRM relaxation method [1,4776]

- Option 2) It is up to UE implementation to select either Rel-16 or Rel-17 relaxation operation [2]

- Option 3) It is up to RAN4's decision

Companies are invited to comment in the question below on which of the above options they prefer to use when NW configures both R16 and R17 RRM relaxation configuration and UE fulfills both R16 and R17criterion.

**Q6. Among the three options described above, which one do you prefer, when NW configures both R16 and R17 RRM relaxation configuration and UE fulfills both R16 and R17criterion?**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comments (if any) |
| Apple | Op1 | We think the NW can just configure rel-17 method or the RedCap UEs applies rel17 method (as these are geared towards redcap UEs). |
| Qualcomm | Option 1 or 2 | Either Option 1 or Option 2 is fine with us. |
| Futurewei |  | It may depend on what Rel-17 RRM relaxation method will be specified by RAN4. We can wait for or work with RAN4 in deciding on this. |
| Huawei, HiSilicon | Option 2 | We are not sure about the relaxed operation for R17 yet. It is difficult to say whether R17 or R16 relaxation is better in the case. UE implementation should be also flexible and sufficient. |
| MediaTek | Option 2 at the moment | Until we know what the Rel-17 RRM relaxation method is, it is difficult to say which option may be better for a given scenario.  |
| NEC | Option 1 | Agree apple’s view. Later release configuration should take precedence.  |
| Xiaomi | See comment | In our understanding, R17 RRM relaxation is a higher level relaxation than R16’s (however it is up to RAN4). In this way, when both criterions are configured, UE could first check R17 criterion (assuming 1.Both stationary and not-at-cell-edge; 2. Only stationary). If UE doesn’t satisfy these criterions, then it can check a lower level relaxation (i.e. R16 combination of low mobility and not-at-edge-cell). |
| Lenovo | Option 1 | Same view as Apple, this Rel-17 RRM relaxation is for RedCap UE. |
| Nokia, Nokia Shanghai Bell |  | Too early to answer, it is not clear yet whether any Rel-17 RRM relaxation method will be defined or not, in case not, Rel-16 RRM relaxation method should be applied by the UE. |
| OPPO |  | Agree with Futurewei. |
| vivo | Option 1 | It would be common understanding that the Rel-17 RRM relaxation mechanism should provide more RRM relaxation gain than Rel-16 RRM relaxation mechanism to target UEs(e.g stationary UE).Hence, Rel-17 UE should of course apply the Rel 17 RRM relaxation method when UE fulfills both R16 and R17criterion.  |
| Ericsson | 2 | Already today the RRM relaxation procedure described in 304 is written with "UE may do relaxation X" and "UE may do relaxation Y". If RAN2 continues writing the procedure in the same style, we would automatically end up with option 2, which is the simplest. |
| CATT | Option 1 | We could wait for RAN4 to finalize the R17 RRM relaxation (Option 3) but we expect that the R17 RRM relaxation will provide more power saving because it addresses stationary UEs, thus with even less mobility than the “low-mobility” R16 UEs, and so we expect RAN4 to specify higher relaxation for the R17 UEs meeting the R17 relaxation requirements than for the R16 UEs meeting the R16 requirements. |
| Thales | Option 2 | RRM relaxation is a means a device may apply to save power. Hence it should apply the method which is best suited in the scenario. However, unless Rel.-17 is really finalized difficult to decide which should be adapted in a certain scenario. |
| ZTE | Option 1 | As long as RAN4 defines R17 RRM relaxation method.  |
| LG |  1  | The UE should trigger R17 RRM relaxation. |
| Sony | Option 2 | But not clear if any issues with mixing two mechanisms.  |

# Conclusion

TBD

# References

1. R2-2106403, RRM relaxation criteria in RRC\_Idle/Inactive, Samsung
2. R2-2105637, RRM measurement relaxation for RedCap UE, Huawei, HiSilicon
3. R2-2104776, RRM measurement relaxations for stationary UEs, Qualcomm Incorporated
4. R2-2104811, Discussion on RRM relax for RedCap UEs, OPPO
5. R2-2104913, RRM relaxation for neighboring cell for RedCap UEs, vivo, Guangdong Genius
6. R2-2104926, RRM measurement relaxation criteria for RedCap devices, Intel Corporation
7. R2-2105138, Confined Mobility impact on RRM Relaxation, Apple Inc
8. R2-2105159, RRM relaxation for RedCap UEs, ZTE Corporation, Sanechips
9. R2-2105229, RRM Relaxation for RedCap UE, NTT DOCOMO INC.
10. R2-2105246, RRM Relaxation, Ericsson
11. R2-2105296, Discussion on RRM relaxations for RedCap UE, Xiaomi Communications
12. R2-2105521, RRM relaxation in RRC\_CONNECTED for RedCap UEs, SHARP Corporation
13. R2-2105705, Redcap relaxed measurements and number of beams, Sony
14. R2-2105706, RedCap Relaxed measurements, stationary definition, Sony
15. R2-2105788, RRM relaxation for stationary RedCap Ues, LG Electronics Inc.
16. R2-2105812, RRM relaxation for stationary UE with reduced capability, Lenovo, Motorola Mobility
17. R2-2105909, On RRM relaxations for REDCAP, Nokia, Nokia Shanghai Bell
18. R2-2105959, Discussion on R17 stationarity criterion and not-at-cell-edge criterion for RedCap UEs, Futurewei Technologies
19. R2-2106229, Discussion on the RRM relaxation for RedCap Ues, CMCC
20. R2-2106272, RRM relaxation of RedCap UE, China Telecommunications
21. R2-2106404, RRM relaxation criteria in RRC\_Connected, Samsung