**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) |
| Qualcomm | Linhai He (linhaihe@qti.qualcomm.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) |
| 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. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

### 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 ≥ SSearchDeltaP.

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 ≥ SSearchDeltaP.**

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments (if any) |
| 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.  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

### 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) |
| 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.  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

## 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 [1,2,3,4,8,11,15,20] 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 [3,4,8,15,20]

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) |
| 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. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

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] 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) |
| Qualcomm | Agree | We support the proposal |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

## 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) |
| Qualcomm | Option 1 or 2 | Either Option 1 or Option 2 is fine with us. |
|  |  |  |
|  |  |  |
|  |  |  |

# 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