3GPP TSG-RAN WG2 Meeting #109-e R2-200xxxx

Online, 24 February – 6 March 2020

**Agenda item: 6.11.6**

**Source: Huawei (summary rapporteur)**

**Title: Summary of RRM measurement relaxation open issues**

**WID: NR\_UE\_pow\_sav-Core**

**Document for: Discussion and Decision**

# 1 Introduction

This document contains the summary of documents from agenda item 6.11.6 (“RRM measurement relaxation”) as referenced in Section 4.

# 2 RRM Measurement relaxation issues summary

## 2.0 Proposals covered in the email discussion

The following table contains all of the proposals and indicates where a proposal is already covered by the email discussion in [15]. The green highlighted proposals are not covered by the email discussion conclusion, either partly or entirely, and are covered in the following sections.

|  |  |  |
| --- | --- | --- |
| [1] | CATT | Proposal 1: Ask RAN4: Q1: Would RAN4 have a concern if it is allowed to relax measurement on higher priority frequencies beyond the legacy limit, Thigher\_priority\_search, if the UE is in good coverage (i.e. Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ) and meets the low-mobility criterion for RRM measurement relaxation?  Proposal 2: Ask RAN4: Q2: In case the UE is not in good coverage conditions (Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ), legacy behavior is to perform measurements at least every Tmeasure,NR\_Inter (< Thigher\_priority\_search ). In case RAN4 decides that when RAN2-defined RRM relaxation criterion(s) is/are met, UE is allowed to relax its neighbor cells measurements to, say Tmeasure,NR\_Inter\_relax where one would expect that Tmeasure,NR\_Inter < Tmeasure,NR\_Inter\_relax < Thigher\_priority\_search, does it make sense from load balancing performance perspective, to not relax higher priority frequencies, but only relax lower priority frequencies? |
| [2] | MediaTek Inc. | Proposal 1: Network should be able to configure UE to perform RRM measurement in the following conditions: (1) UE is with low mobility, (2) UE is not at cell edge, (3) UE is with low mobility or not at cell edge, and (4) UE is with low mobility and not at cell edge.   * Proposal is covered in the email discussion [15] (Proposals 8 and 9).   Proposal 2: RAN2 should define RRM measurement relaxation methods corresponding to the three scenarios: (1) UE with at low mobility, (2) UE is not at cell edge, and (3) UE is with low mobility and not at cell edge.   * Proposal is covered in the email discussion [15] (Proposals 8 and 9).   Proposal 3: UE takes the following RRM measurement relaxation actions: - When UE experiences low-mobility scenario, it is allowed to skip neighbour cell measurements.  - When UE experiences not-at-cell-edge scenario, it is allowed to perform measurements with longer intervals.  - When UE experiences low-mobility and not-at-cell-edge scenario, it is allowed to skip neighbour cell measurements.   * Proposal is covered in the email discussion [15] (Proposals 8 and 9 and 23).   Proposal 4: The ASN.1 structure shown in this paper is considered as baseline for further discussions on RRC configurations for RRM measurement relaxation in NR.   * Proposal is covered in the email discussion [15] which provides a baseline running CR. |
| [3] | Ericsson | Proposal 1: UE shall not un-conditionally, i.e. when relaxed criterion is not fulfilled, relax needed measurements, as specified in section 5.2.4.2 in 38.304: • Intra-frequency measurements when below intra-frequency measurement threshold • Inter-frequency measurements on all priority layers when below inter-frequency measurement threshold • Higher priority inter-frequency measurements every Thigher\_priority\_search when above inter-frequency measurement threshold   * Proposal is implicitly covered in the email discussion [15] (Proposal 12).   Proposal 2: UE is required to perform measurements on higher priority frequencies at least Thigher\_priority\_search independent of relaxed monitoring criterion.  Proposal 3: For “low mobility” trigger the serving cell reference value (SrxlevRef) shall be set to the serving cell value (Srxlev) after a configurable time period (TSearchDeltaP).   * Proposal is covered in the email discussion [15] (Proposal 12).   Proposal 4: The UE shall perform intra-frequency and inter-frequency neighbour cell measurement during TSearchDeltaP after cell selection/re-selection.    Proposal 5: The UE shall perform intra-frequency and inter-frequency neighbour cell measurement at least every TMinSearchPeriod (range {x min .. y hours}).   * Proposal is covered in the email discussion [15] (Proposal 18).   Proposal 6: The network can configure “low mobility” or “not-at-cell-edge” trigger or both triggers, and configure whether either or both triggers (AND/OR) shall be satisfied to enable relaxed RRM measurements.   * Proposal is covered in the email discussion [15] (Proposals 8 and 9).   Proposal 7: RAN4 to discuss and agree on the relaxed RRM measurement requirements.   * Proposal is covered in the email discussion [15] (Proposal 23). |
| [4] | vivo | Proposal 1: Detailed solution and requirements for RRM measurement relaxation in time domain should be decided in RAN4.   * Proposal is covered in the email discussion [15] (Proposal 23).   Proposal 2: When the network configured criteria is satisfied, the UE can perform the reduced RRM measurement with less neighboring cell numbers.  Proposal 3: Network can configure “anchor” carrier(s), whose measurement results can represent the measurement of this co-site band deployment, e.g. in system information.  Proposal 4: UE performs inter-frequency RRM measurement on the configured “anchor” carrier(s), and performs cell reselection in this band according to the measurement results.  Proposal 5: An LS should be sent to RAN4 for any discussion on further requirements for relaxed RRM measurement in time domain, with less neighboring cell / carrier numbers, if any.   * Proposal is covered in the email discussion [15] (Proposal 25). |
| [5] | Apple | Proposal 1: It would be appropriate to use the term “relaxed measurement” in the current context and to avoid confusion with the RLM of “relaxed monitoring”.   * Proposal is covered in the email discussion [15] (Proposal 1).   Proposal 2: Per frequency indication for measurement relaxation is better as it offers finer granularity and helps to distinguish between FR1 and FR2 deployments.   * Proposal is covered in the email discussion [15] (Proposal 6).   Proposal 3: NW should mandatorily indicate to the UE which measurement relaxation criteria to use (either cell-edge or low mobility or both criteria).   * Proposal is covered in the email discussion [15] (Proposals 8 and 9).   Proposal 4: UE can perform measurement relaxation when either RSRP or RSRQ criteria (if configured) is met.   * Proposal is covered in the email discussion [15] (Proposal 19). |
| [6] | Sony | Proposal: Network configures additional criteria for measuring a particular frequency. These criteria could include the detection of a particular cell or frequency (higher priority) or a timer (e.g. if UE does not find this frequency whilst the timer is running then it skips measuring this frequency). |
| [7] | CMCC | Proposal: Support inter-frequency measurement relaxation in idle mode: - SIB4 is added with carrier association, which means the associated carriers are in the same band and co-site deployed.  - While UE performs inter-frequency measurement, UE randomly pick 1 carrier from associated carriers. - UE perform inter-frequency measurement and cell re-selection only considering the picked carrier instead of other associated carriers. |
| [8] | Nokia, Nokia Shanghai Bell | Proposal 1: Network can allow/disallow RRM measurement relaxation e.g. for the UE configured with early measurements   * Proposal is covered in the email discussion [15] (Proposal 24).   Proposal 2: Frequency specific RRM measurement relaxation is supported   * Proposal is covered in the email discussion [15] (Proposal 3). |
| [9] | Huawei, HiSilicon | Proposal 1: Improve the LTE behaviour for NR by setting SrxlevRef = Highest measured Srxlev value of the serving cell (dB) within TSearchDeltaP.   * Proposal is covered in the email discussion [15] (Proposal 12). |
| [10] | Huawei, HiSilicon | Proposal 1: Allow UE to only monitor N best neighbour cells on a carrier, until one of the N cells falls below a certain threshold.  Proposal 2: Introduce signalling of the association between serving SSB index and neighbour cells/frequencies/SSBs to allow UE to limit measurements. |
| [11] | LG Electronics, Ericsson, MediaTek | Proposal: UE shall not perform measurement relaxation on a given frequency when the UE is configured to perform early measurement for fast CA/DC setup on that frequency and T331 is running. After T331 expiry, the UE may perform measurement relaxation on the frequency if the UE still continues to perform early measurements based on implementation.   * Proposal is covered in the email discussion [15] (Proposal 24). |
| [12] | LG Electronics | Proposal 1: Consider per-frequency measurement relaxation based on the neighbour cell measurement results of a UE.  Proposal 2: If the highest ranked cell of a frequency is below a configured threshold, the UE is allowed to perform measurement relaxation on that frequency. How to perform measurement relaxation on the frequency may be decided by RAN4.  Proposal 3: Introduce an indication that UE has performed measurement relaxation, upon access to the network. |
| [13] | Samsung | Proposal 1: When network configures both not-cell-edge criteria and low-mobility criteria together for RRM measurement relaxation, the UE should perform relaxed RRM measurement when both criteria are fulfilled simultaneously.   * Proposal is covered in the email discussion [15] (Proposals 8 and 9).   Proposal 2: The not-cell-edge criteria for RRM measurement relaxation should consider both RSRP and RSRQ.   * Proposal is covered in the email discussion [15] (Proposal 19).   Proposal 3. For the not-cell-edge criteria for RRM measurement relaxation, cell selection level (Srxlev and Squal) should be used instead of measured cell level (Qrxlevmeas and Qqualmeas).   * Proposal is covered in the email discussion [15] (Proposal 20).   Proposal 4. highPriorityMeasRelax should not be per-frequency indication, but one indication for all higher priority frequencies.   * Proposal is covered in the email discussion [15] (Proposal 20).   Proposal 5. When highPriorityMeasRelax is configured with true (or present), different RRM measurement relaxation should be used for each of following two cases: 1) When the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, and 2) When the serving cell fulfils Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, and low-mobility and/or not-cell-edge criteria is fulfilled. How to relax these two cases differently is up to RAN4.  Proposal 6: UE should perform relaxed RRM measurement irrespective of whether the priorities are provided by dedicated signalling or broadcast signalling.  Proposal 7. If timer T330 is running, the UE should not perform relaxed RRM measurement. Instead, existing measurement rules in Rel-15 are applied |
| [14] | Samsung R&D Institute UK | Proposal 1. RAN2 don’t introduce reduced number of cells to be measured in the relaxed measurement operation.  Proposal 2. RAN2 discuss whether other characteristics on frequency to be measured also affects to the selection of frequency to be measured in RRM relaxation |

## 2.1 Summary of open issues related to absolute priorities

The following proposals related to absolute priorities are covered in this section

|  |  |  |
| --- | --- | --- |
| [1] | CATT | Proposal 1: Ask RAN4: Q1: Would RAN4 have a concern if it is allowed to relax measurement on higher priority frequencies beyond the legacy limit, Thigher\_priority\_search, if the UE is in good coverage (i.e. Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ) and meets the low-mobility criterion for RRM measurement relaxation?  Proposal 2: Ask RAN4: Q2: In case the UE is not in good coverage conditions (Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ), legacy behavior is to perform measurements at least every Tmeasure,NR\_Inter (< Thigher\_priority\_search ). In case RAN4 decides that when RAN2-defined RRM relaxation criterion(s) is/are met, UE is allowed to relax its neighbor cells measurements to, say Tmeasure,NR\_Inter\_relax where one would expect that Tmeasure,NR\_Inter < Tmeasure,NR\_Inter\_relax < Thigher\_priority\_search, does it make sense from load balancing performance perspective, to not relax higher priority frequencies, but only relax lower priority frequencies? |
| [3] | Ericsson | Proposal 2: UE is required to perform measurements on higher priority frequencies at least Thigher\_priority\_search independent of relaxed monitoring criterion. |
| [13] | Samsung | Proposal 5. When highPriorityMeasRelax is configured with true (or present), different RRM measurement relaxation should be used for each of following two cases: 1) When the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, and 2) When the serving cell fulfils Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, and low-mobility and/or not-cell-edge criteria is fulfilled. How to relax these two cases differently is up to RAN4.  Proposal 6: UE should perform relaxed RRM measurement irrespective of whether the priorities are provided by dedicated signalling or broadcast signalling. |

### 2.1.1 Proposals with potential easy agreement

Proposal 6 of [13] has not been explicitly agreed, however it should also be noted that no different handling depending on whether broadcast or dedicated priorities are used has been proposed either (i.e. there is no opposing view, and the proposal is in line with agreeing nothing new), which is why this proposal is put forward as a potential easy agreement.

**Proposal S1-1: Relaxed RRM measurement is applied in the same way irrespective of whether the priorities are provided by dedicated signalling or broadcast signalling.**

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments** |
| MediaTek | Yes |  |
| ZTE | Yes |  |
| LG | Yes |  |
| Huawei, HiSilicon | Yes |  |
| vivo | Yes |  |
| CATT | Yes |  |
| Ericsson | Yes |  |
| Panasonic | Yes |  |
| Samsung | Yes |  |
| Sony | Yes |  |
| OPPO | Yes |  |
| CMCC | Yes |  |
| Apple | Yes |  |

### 2.1.2 Proposals needing further discussion in this meeting

Proposals 1 and 2 of [1] and proposal 5 of [13] highlight the possibility that different handling could be needed for high priority frequencies, depending on the coverage level, as is also the case for legacy measurements. All of the proposals also indicate that RAN4 should be asked. The email discussion in [15] proposal 25 suggests sending an LS to RAN4, so the question is whether to include this issue in the LS if sent.

In addition the email discussion in [15] contains the proposal 5, which is related to whether the handling of the *highPriorityMeasRelax* indication is associated with the trigger criteria for measurement relaxation and how RAN4 will make use of it. The more important question to answer before solving that is how the high priority carrier measurements are relaxed in each of the existing cases, before deciding if and how the different values of an indication impact that.

Proposal 2 of [3] relates to RAN4 performance requirements, and therefore could be discussed in RAN4. However since it has been raised in RAN2 the question should be whether an explicit indication to RAN4 in an LS is needed. The email discussion in [15] proposal 25 suggests sending an LS to RAN4, so the question is whether to include this issue in the LS if sent.

**Proposal S1-2: [FFS]** **Ask RAN4 about the behaviour of relaxation of higher priority carriers, e.g.**

* **whether different relaxation should be used for higher priority carriers depending on whether Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ**
* **whether it makes sense to (further) relax high priority carrier measurements at all in each of the 2 cases**
* **whether the same or different relaxation is used for high priority carriers compared to equal/lower priority carriers.**
* **whether UE should be required to perform measurements on higher priority frequencies at least Thigher\_priority\_search independent of relaxed monitoring criterion**

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments**  **(including comments on the specific question(s))** |
| MediaTek | Yes | Yes, we can ask RAN4 about the about the behaviour of relaxation of higher priority carriers. But before that, RAN2 should be aware that relaxation of higher priority carriers is related to “how to relax”.  1. If LTE relaxed monitoring is adopted (i.e., UE may stop neighbour cell measurements), the RAN4 requirement (UE should perform measurements on higher priority frequencies at least Thigher\_priority\_search) is violated, so we need to ask RAN4 whether the requirement can be changed.  2. If the “time-domain relaxation” is adopted, since the relaxed measurement interval (e.g., several DRX cycle) is still shorter than Thigher\_priority\_search, there is no RAN4 impact. |
| ZTE | YES | We support MTK’s view.  We prefer to figure out ‘how to relax’ before we ask RAN4 this question. |
| LG | Yes | 1. TS 38.133 : If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ then the UE shall search for inter-frequency layers of higher priority at least every Thigher\_priority\_search  * RAN4 can discuss whether to perform measurement relaxation in this case. If performed, Thigher\_priority\_search may be extended.  1. If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ then the UE shall search for and measure inter-frequency layers of higher, equal or lower priority  * RAN4 can discuss how to perform measurement relaxation (RAN4 is discussing how much the measurement period is scaled) |
| Huawei, HiSilicon | Yes | In our understanding RAN4 is already discussing the questions above, but if we are sending an LS with agreements we may add the above questions to ensure we get clear guidance in RAN2 on this matter.  In addition it could be worth asking whether the *highPriorityMeasRelax* is useful (i.e. if and how can it be used ?) |
| vivo | Yes | We agree to ask RAN4 above questions.  Furthermore, I think our RAN2 can further discuss how to use this indication after RAN4 making the conclusion on how to perform measurement relaxation. |
| CATT | Yes but | We think it should be simplified to make it clearer, along similar lines as e.g. LG. Essentially, the two questions in our view are:   1. For the case where Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, does RAN4 envision to relax higher priority carriers measurements further than Thigher\_priority\_search if RAN2-defined relaxation criterion(s) is/are met? 2. For the case where Srxlev < SnonIntraSearchP or Squal < SnonIntraSearchQ, does it make sense / is there a performance benefit to only relax equal/lower priority carriers but not higher priority carriers measurements if RAN2-defined relaxation criterion(s) is/are met?   If any of the 2 answers is Yes, then we keep on defining *highPriorityMeasRelax* otherwise we just abandon it. |
| Ericsson | - | RAN2 agreed that “higher priority frequency measurement relaxation” is under NW control, and we want to keep this agreement. In general we are reluctant to relax the higher priority frequency measurements that the UE does every Thigherprioritysearch, because in our view they are already relaxed, and we think they are important for load balancing. So from our perspective we only want to keep the option to configure the UE not to relax Thigherprioritysearch, even when the relaxation criterion is met. When the NW allows the UE to relax higher priority measurement, this relaxation should also depend on whether the relaxation criterion is met.  In our understanding we already indicated this RAN2 agreement to RAN4, and RAN4 may already discuss higher priority frequency relaxation today. We do not have a strong view whether an LS needs to be sent to RAN4 to further clarify what RAN2 meant with “higher priority frequency measurement relaxation”. |
| Panasonic | Yes | We think it is okay to ask RAN4 the questions above, but it seems 4th question is redundant as it is covered by the 2nd question in our view. |
| Samsung | Yes |  |
| Sony | Yes |  |
| OPPO | Ok but | **We are ok on sending the LS, however, before we sending the LS, we think several questions needs to be confirmed firstly in RAN2:**   1. **Do we have aligned understanding that (Nlayers\*60) seconds should not be relaxed. The relaxation we are talking about is only related to the case when UE is required to perform intra-frequency and lower/equal priority inter-frequency.** 2. **Then, we may need to ask whether RAN4 will define different relaxation requirements for higher priority inter-frequency measurement and others.** |
| CMCC | Yes |  |
| Apple | Yes | **We agree to ask RAN4 for guidance. Also agreed with CATT to simplify the questions.** |

**Note:** It is assumed that proposal S1-2, if agreed, can be included in the same LS to RAN4 resulting from the email discussion in [15], if that is also agreed to be sent**.**

## Summary of reducing the number of cells/carriers to measure

The following proposals related to reducing the number of cells/carriers to measure are covered in this section

|  |  |  |
| --- | --- | --- |
| [4] | vivo | Proposal 2: When the network configured criteria is satisfied, the UE can perform the reduced RRM measurement with less neighboring cell numbers.  Proposal 3: Network can configure “anchor” carrier(s), whose measurement results can represent the measurement of this co-site band deployment, e.g. in system information.  Proposal 4: UE performs inter-frequency RRM measurement on the configured “anchor” carrier(s), and performs cell reselection in this band according to the measurement results. |
| [6] | Sony | Proposal: Network configures additional criteria for measuring a particular frequency. These criteria could include the detection of a particular cell or frequency (higher priority) or a timer (e.g. if UE does not find this frequency whilst the timer is running then it skips measuring this frequency). |
| [7] | CMCC | Proposal: Support inter-frequency measurement relaxation in idle mode: - SIB4 is added with carrier association, which means the associated carriers are in the same band and co-site deployed.  - While UE performs inter-frequency measurement, UE randomly pick 1 carrier from associated carriers. - UE perform inter-frequency measurement and cell re-selection only considering the picked carrier instead of other associated carriers. |
| [10] | Huawei, HiSilicon | Proposal 1: Allow UE to only monitor N best neighbour cells on a carrier, until one of the N cells falls below a certain threshold.  Proposal 2: Introduce signalling of the association between serving SSB index and neighbour cells/frequencies/SSBs to allow UE to limit measurements. |
| [12] | LG Electronics | Proposal 1: Consider per-frequency measurement relaxation based on the neighbour cell measurement results of a UE.  Proposal 2: If the highest ranked cell of a frequency is below a configured threshold, the UE is allowed to perform measurement relaxation on that frequency. How to perform measurement relaxation on the frequency may be decided by RAN4. |
| [14] | Samsung R&D Institute UK | Proposal 1. RAN2 don’t introduce reduced number of cells to be measured in the relaxed measurement operation.  Proposal 2. RAN2 discuss whether other characteristics on frequency to be measured also affects to the selection of frequency to be measured in RRM relaxation |

### Proposals needing further discussion in this meeting

Most of the above proposals provide different ways in which the UE could reduce the number of cells or carriers to measure, although there is also a proposal (proposal 1 in [14]) not to reduce the number of cells to measure. It is proposed in this meeting to conclude whether or not to do that.

**Proposal S2-1: [FFS] A method for reducing the carriers to measure is introduced in Rel-16**

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments**  **(including potential RAN2/RAN4 impact)** |
| MediaTek | No | We don’t think it helps much to reduce the number of cells or carriers to measure. |
| LG | Yes | Measurement relaxation criteria is only based on serving cell quality, so it is not a good way that all the UEs camping on a cell relaxes the measurement on all the neighbour frequencies. Our understanding is that the measurement relaxation will not affect the mobility performance only if measurement relaxation is performed on the frequencies whose cell quality is low.  Suppose UE1 have good measured cell quality results on F1 but poor results on F2. UE2 locating at opposite side from the UE1 may have opposite measurement results (poor quality on F1 but good quality on F2). In this case, the UE1 may be allowed to relax the measurements on F2 where UE2 may be allowed to relax the measurements on F1, because each UE has low possibility to perform cell reselection to a frequency if cell quality of a frequency is bad.  Therefore, we think that only the neighbour frequencies whose measured cell quality is bad should be relaxed. Then we can guarantee the mobility performance of the UE. |
| Huawei, HiSilicon | No | This issue is actually being discussed in RAN4 and the majority of companies see no benefit to power saving, due to the way in which the RAN4 requirements are scaled according to the number of carriers.  Therefore we think this can be dropped. |
| vivo | Yes | In some real deployment scenarios, multiple intra-band frequencies are co-site deployed. For the intra-band carriers co-site deployed, similar propagation condition can be assumed. Accordingly, similar path loss for all carriers in the same band can be achieved. Thus, the UE will have similar measurement results for all intra-band carriers, e.g. RSRP. From network point of view, it can be assumed that the measurement on some carrier can represent the measurement of corresponding band.  In this case, network can configure the RRM relaxation by reducing number of carriers to save some unnecessary measurement for some of carriers in the same band. More specific, some indication can be provided by the network to indication an anchor carrier. The measurement results of this anchor carrier can be used as the measurement of this band. For this indication, it can be configured based on the operator’s deployment.  Moreover, RAN4 is also the leading WG for this objective. Thus, RAN4 input is also required on the mechanism details enabled to reduce the measured carrier for intra-band deployment, if any. |
| CATT | No | Considering it is hard to converge, we prefer to discuss it in later release |
| Ericsson | No | We think that the UE should measure on the inter-frequencies indicated in system information, i.e. the NW had a reason to signal those frequencies to the UE. The NW should try to configure this properly, i.e. dependent on individual cell planning. In our understanding the main power saving will come from the relaxed monitoring trigger (i.e. low mobility and not at cell edge). When the UE is required to perform measurements, the UE should measure on the frequencies indicated in SI. |
| Samsung | No |  |
| Sony | Yes | This means the UE is skipping a frequency from measurements when this frequency is not ubiquitously present. Therefore, it is not meaningful to measure this carrier. This can be achieved by introducing a network-controlled condition for this frequency. |
| OPPO | No |  |
| CMCC | Yes | We fully agree with vivo. In real network, there are intra-band carriers deployed on the same site. Since the measurement result for these carriers are almost the same, it’s waste of power to require UE to measure all these carrers.  In addition, there is a UE capability limitation on the maximum number inter-frequency measurements, if UE can reduce the number of measured frequency layers in the same band in this case, UE will have more chance to measure other frequencies in other bands.  Therefore, we think it’s beneficial to reduce measured carriers for intra-band co-site deployment scenario. |
| Apple | Yes | Especially in cases of low mobility, there is a genuine case to reduce the number of carriers to measure (e.g. monitor only the top N carriers, until one of the carriers falls below a threshold) |

**Proposal S2-2: [FFS] A method for reducing the cells to measure on a carrier is introduced in Rel-16**

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments**  **(including potential RAN2/RAN4 impact)** |
| MediaTek | No |  |
| ZTE | No |  |
| LG | No | If number of cells to measure is reduced, the UE may lose chance to detect highest ranked cell of a frequency. This may occur cell reselection ping-pong. Furthermore, once it starts to perform measurement on a frequency, it already consumes power. So detecting less cell on the frequency seems not beneficial in power consumption perspective. |
| Huawei, HiSilicon | No | Although we propose it in our paper, and given there are already 3 “no” above, then we think it is becoming too late in the WI and we can reconsider in Rel-17. |
| vivo | Yes | The RRM measurement relaxation by reducing neighboring cell number has been investigated in the Study item phase, and shows significant power saving gain.  Current mechanism to reduce the measured neighboring cell number in LTE and NR is S-measure mechanism as above. For some UE with low mobility or stationary state, current S-measure is not enough, since the UE anyway needs to measure all neighboring cells to check whether S-measure condition is satisfied. Considering the receiver sensitivity, not all UEs can observe 8 cells. All the detected cells may have quite different quality. Then, it is not so necessary to always measure all the detectable cells.  Thus, we think reducing RRM measurement with less neighboring cell numbers can be considered as a possible solution for power saving.  Similarly, RAN4 is the leading WG for this objective. Thus, we can leave this issue to RAN4. |
| CATT | No | Considering it is hard to converge, we prefer to discuss it in later release |
| Ericsson | No | We think there is little gain in power saving when number of cells to measure is reduced. We are also not sure if there is a RAN4 requirement for this in Idle/Inactive, or if companies assume the connected mode requirements apply. |
| Panasonic | No | As we are not clear how this would impact the mobility performance, we prefer to not proceed with it in Rel-16. |
| Samsung | No |  |
| Sony | No | We have some sympathy for the proposal but ok to postpone it |
| OPPO | No |  |
| CMCC | Yes | We think it’s beneficial to reduce the number of cells to measure, especially for low mobility UEs. |
| Apple | Yes | If the concern is lack of time to address it in this release, we are fine with considering it in the next release. |

### Proposals to postpone

If the S2-1 and S2-2 are not agreed then there is no need to postpone the following issue. We propose just to determine whether methods for reducing cells/carriers to measure is introduced. We think it is very unlikely to converge on a specific method or methods and therefore this should be postponed.

**Proposal S2-3: The specific method(s) for reducing cells/carrier to measure is FFS.**

**Note:** Whether this issue is needed depends on the discussion on S2-1 and S2-2. Whether this is handled by an email discussion to the next meeting or postponed entirely can be decided after discussion.

## Summary of other miscellaneous issues

The following miscellaneous proposals are covered in this section

|  |  |  |
| --- | --- | --- |
| [3] | Ericsson | Proposal 4: The UE shall perform intra-frequency and inter-frequency neighbour cell measurement during TSearchDeltaP after cell selection/re-selection. |
| [13] | Samsung | Proposal 7. If timer T330 is running, the UE should not perform relaxed RRM measurement. Instead, existing measurement rules in Rel-15 are applied |
| [12] | LG Electronics | Proposal 3: Introduce an indication that UE has performed measurement relaxation, upon access to the network. |

### 2.3.1 Proposals with potential easy agreement

Proposal 4 of [3] is the current behaviour in LTE, but has not been explicitly agreed for NR. Assuming that the email discussion [15] proposal 12 is agreed (i.e. The parameter SrxlevRef is set according to the LTE mechanism as captured in current running 38.304 CR for power saving. ) then we expect this is an easy agreement to make. Given that this condition in LTE is there to ensure a UE which has just change cell does not relax too quickly, because by definition the UE is mobile, then even if an alternative approach to proposal 12 of [15] is agreed, we expect the behaviour shall ensure the following behaviour.

**Proposal S3-1: The UE shall perform intra-frequency and inter-frequency neighbour cell measurement during** **TsearchDeltaP after cell selection/re-selection.**

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments** |
| MediaTek | Yes |  |
| ZTE | yes |  |
| LG | Yes | It is needed to get enough time to observe the new serving cell’s quality. |
| Huawei, HiSilicon | Yes | This is also used in LTE. A UE just entering the cell is by definition mobile and therefore should perform measurements for sufficient time before relaxing. |
| vivo | Yes |  |
| CATT | Yes |  |
| Ericsson | Yes |  |
| Panasonic | Yes |  |
| Sony | Yes |  |
| OPPO | Yes |  |
| CMCC | Yes |  |
| Apple | Yes |  |

### 2.3.2 Proposals needing further discussion in this meeting

Proposal 7 of [13] raises the issue of whether measurement relaxation should be allowed while T330 is running. As this has not been discussed so far it is proposed to collect company views.

**Proposal S3-2: If timer T330 is running, the UE should not perform relaxed RRM measurement. Instead, existing measurement rules in Rel-15 are applied**

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments** |
| MediaTek | - | Need further check. |
| LG | No | The network evaluates the logged MDT based on reporting from number of UEs, so even if the MDT measurement is relaxed, it won’t bring significant degradation. |
| Huawei, HiSilicon | No | As mentioned by LG the measurement logging is performed by multiple UEs so there is no significant problem from NW usage point of view, and no real benefit from the proposal.  From UE point of view, the general principle of measurement logging is that this should not require extra measurement effort from the UE. In other words power saving is more important than measurement logs and therefore the proposal is not agreeable. |
| vivo | No |  |
| CATT | No | Measurement relaxation shouldn’t reduce the accuracy of measurement results. If the UE is low mobility, the UE location changes slowly. Hence, if RRM relaxation is applied with low mobility criterion, the logging measurement results are not impacted. Even if RRM relaxation is applied with not-at-cell-edge criterion, the logging measurement results can be achieved via a large number of UEs.  In addition, UEs logging measurement results are also willing to reduce UE consumption. |
| Ericsson | Yes | The NW will typically not configure all UEs with logged measurements. If the UE would prioritize relaxation over logged measurements, the NW may not get much result. Furthermore the NW would get biased results from UE that have been relaxing.  We are also not sure if this question should be answered with a yes or no, i.e. the UE may be able to log measurements while the relaxation criterion is met. The details of relaxed RRM measurements are not settled yet, but if the relaxation is in time, the UE may use those measurements for logging.  PS: We wonder if the timer is correct, i.e. T331 does not exist in NR? |
| Samsung | Yes |  |
| Sony | No | Since it is expected that the UE radio conditions won’t change much during the relaxed monitoring, MDT measurement samples will also not change much and overall many UE samples may statistically provide the same level of accuracy. |
| OPPO | No |  |
| Apple | No | Agree with LG |

Proposal 3 of [12].

**Proposal S3-3: Introduce an indication that UE has performed measurement relaxation, upon access to the network.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments** |
| ZTE | No | We don’t think it has enough benefit. |
| LG | Yes | We could consider informing the network that the UE has performed measurement relaxation when the UE access to the network. If the network is aware that the UE has performed measurement relaxation until access, the network may provide the measurement configuration with relaxed parameters. After that, if such as Event A2/A4 is triggered, then the network will provide appropriate measurement configuration.  Based on RAN4’s WF (R4-1915946), especially both two conditions are satisfied, the UE may not perform measurement on the neighbour cells. If the UE accesses to the network, the network does not know about the UE’s previous state, so the network may provide normal measurement configuration. Even though the UE was saving power consumption as much as possible in idle/inactive state, the UE starts to perform normal measurements. (S-Measure could work, but it may not work if the measurement relaxation was triggered by low-mobility). Moreover, the network still may not know the UE’s condition, the UE may continue the unnecessary measurements until measurement reporting is triggered.  We think 1-bit indication is enough be via RRCSetupComplete/RRCResumeComplete. |
| Huawei, HiSilicon | No | We don’t see how the network can make use of this indication. |
| vivo | No | We don’t see the motivation and any benefit for this. |
| CATT | No | No strong motivation. |
| Ericsson | (No) | This might be useful, but would require further discussion, i.e. there will be further discussion about what the UE reports, i.e. just a flag whether relaxed measurements where triggered during last re-selection, how many times, for how low, which triger, etc, etc, |
| Panasonic | No | The mobility performance requirements for RRC\_IDLE and RRC\_CONNETED may be different. Allowing a UE to relax the measurement in RRC\_IDLE doesn’t mean the UE can also relax the measurement in RRC\_CONNECTED. |
| Samsung | No |  |
| Sony | No |  |
| OPPO | No |  |
| CMCC | No |  |
| Apple | No | Not clear on how NW is going to use this indication. |

# 3 Conclusions (may be updated following offline)

**Proposals with potential easy agreement**

**Proposal S1-1: UE should perform relaxed RRM measurement irrespective of whether the priorities are provided by dedicated signalling or broadcast signalling.**

**Proposal S3-1: The UE shall perform intra-frequency and inter-frequency neighbour cell measurement during TSearchDeltaP after cell selection/re-selection.**

**Proposals needing further discussion in this meeting**

**Proposal S1-2: [FFS]** **Ask RAN4 whether different relaxation should be used for higher priority carriers depending on whether Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, including whether it makes sense to relax high priority carrier measurements at all in each of the 2 cases and whether the same or different relaxation is used for high priority carriers compared to equal/lower priority carriers.**

**Proposal S1-3: [FFS]** **Ask RAN4 whether UE should be required to perform measurements on higher priority frequencies at least Thigher\_priority\_search independent of relaxed monitoring criterion**

**Note:** It is assumed that proposals S1-2 and S1-3, if agreed, can be included in the same LS to RAN4 resulting from the email discussion in [15], if that is also agreed to be sent**.**

**Proposal S2-1: [FFS] A method for reducing the carriers to measure is introduced in Rel-16**

**Proposal S2-2: [FFS] A method for reducing the cells to measure on a carrier is introduced in Rel-16**

**Proposals to postpone**

**Proposal S2-3: The specific method(s) for reducing cells/carrier to measure is FFS.**

**Proposal S3-2: If timer T330 is running, the UE should not perform relaxed RRM measurement. Instead, existing measurement rules in Rel-15 are applied**

**Proposal S3-3: Introduce an indication that UE has performed measurement relaxation, upon access to the network.**

# 4 List of referenced documents

1. [R2-2000256](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e\Docs\R2-2000256.zip), “Way forward on measurement relaxation with high priority frequencies”, CATT
2. [R2-2000312](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e\Docs\R2-2000312.zip), “Configurations for RRM Measurement Relaxation in NR”, MediaTek Inc.
3. [R2-2000352](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e\Docs\R2-2000352.zip), “Open issues RRM measurement relaxation”, Ericsson
4. [R2-2000370](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e\Docs\R2-2000370.zip), “UE Power Consumption Reduction in RRM Measurement”, vivo
5. [R2-2000595](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e\Docs\R2-2000595.zip), “Open Issues of RRM Measurement Relaxation”, Apple
6. [R2-2000827](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e\Docs\R2-2000827.zip), “UE power saving for inter frequency measurements”, Sony
7. [R2-2000913](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e\Docs\R2-2000913.zip), “Discussion on power saving for inter-frequency measurements”, CMCC
8. [R2-2001039](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e\Docs\R2-2001039.zip), “On RRM measurement relaxation”, Nokia, Nokia Shanghai Bell
9. [R2-2001063](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e\Docs\R2-2001063.zip), “On SrxlevRef adaptation in relaxed monitoring”, Huawei, HiSilicon
10. [R2-2001064](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e\Docs\R2-2001064.zip), “Reducing the number of neighbour cells/carriers to measure”, Huawei, HiSilicon
11. [R2-2001401](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e\Docs\R2-2001401.zip), “Coexistence issues of measurement relaxation and early measurements”, LG Electronics, Ericsson, MediaTek
12. [R2-2001402](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e\Docs\R2-2001402.zip), “Per-frequency measurement relaxation based on neighbour cell quality”, LG Electronics
13. [R2-2001577](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e\Docs\R2-2001577.zip), “RRM measurement relaxation”, Samsung
14. [R2-2001643](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e\Docs\R2-2001643.zip), “On the frequency selection for RRM relaxation”, Samsung R&D Institute UK
15. [R2-2000365](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000365.zip), “Report of [108#79] [Power Saving] Running 38.304 phase 2 – Open issues”, Vivo