**3GPP TSG-RAN WG2 Meeting #129bisR2-250xxxx**

**, , 7th - 11th April 2025**

**Agenda item: 8.4.1**

**Source: CATT**

**Title:  [Post129][212][LPWUS] Running CR for TS 38.304 (CATT)**

**Document for: Discussion and Decision**

# Introduction

This document is the report of the following discussion:

* [Post129][212][LPWUS] Running CR for TS 38.304 (CATT)

Intended outcome: Running CR for submission to the next meeting

Deadline: Long (Mar. 21st 10:00 UTC)

Please provide your comments by Thursday March 20th 10:00 UTC to allow 24h for the rapporteur to update the CR before the deadline.

Companies providing input to this email discussion are requested to leave contact information below.

|  |  |  |
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# Discussion

## How to capture RRM relaxation and offloading in TS 38.304

According to RAN2 agreements, RAN2 focus on specifying the offloading and relaxation criteria.

Rel-16 relaxed RRM measurements mechanism in idle/inactive, i.e. the possible configuration options and the possible combinations of fulfilment of low mobility and/or not-at-cell-edge, were captured in both TS 38.304 and TS38.133. In [1] it mentioned this duplication had led to many LS exchanges between RAN2 and RAN4. Furthermore the way captured was different in TS 38.304 and 38.133 which made it difficult to compare them, as shown below.



In [1], to avoid overlap between RAN2 and RAN4 specification, it is proposed that RAN2 captures the relaxation and offloading criteria while RAN4 captures different use cases that can be identified based on the configuration and which criteria are fulfilled.

Rapporteur shares the same view. In addition, in Rel-16 relaxed RRM measurements mechanism in idle/inactive in TS38.304, it also distinguishes intra-frequency case and NR inter-frequency/ inter-RAT frequency cases, as shown below [2]:

|  |
| --- |
| - if *cellEdgeEvaluation* is configured and *lowMobilityEvaluation* is not configured; and  - if the relaxed measurement criterion in clause 5.2.4.9.2 is fulfilled:  - the UE may choose to perform relaxed measurements for intra-frequency cells according to relaxation methods in clauses 4.2.2.9 and 4.2C.2.7 in TS 38.133 [8];  - if the serving cell fulfils Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ:  - the UE may choose to perform relaxed measurements for NR inter-frequency cells or inter-RAT frequency cells according to relaxation methods in clauses 4.2.2.10, 4.2.2.11 and 4.2C.2.8 in TS 38.133 [8]; |

Rapporteur proposes to discuss how to capture RRM relaxation and offloading in TS 38.304 and TS 38.133 in advance. RAN2 can capture the general description on RRM relaxation and offloading for LP-WUS (e.g. not to capture intra-frequency, inter-frequency or inter-frequency cases) and criteria of RRM relaxation and offloading for LP-WUS. Other details are captured in RAN4.

**Proposal 1: The general description on RRM relaxation and offloading for LP-WUS (e.g. not to capture intra-frequency, inter-frequency or inter-frequency cases) and criteria of RRM relaxation and offloading for LP-WUS are captured in TS 38.304. Other details of RRM relaxation and offloading for LP-WUS are captured in RAN4.**

Companies are invited to give comments on proposal 1.

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| --- | --- | --- |
| **Company** | **Yes/No on proposal 1** | **Comments** |
| Xiaomi | Yes | RAN2 captures the criteria of RRM relaxation and RAN4 captures how UE performs the RRM relaxation. |
| Ericsson | “Yes”, see comments | **It would be good to agree that as a general principle the RRM requirements will not be duplicated in 38.304 and 38.133.**  We suspect that RAN4 will proceed to capture the LP-WUS RRM requirements in a similar way in 38.133 as has been done for PEI. We support to have a “**general description**” in 38.304, i.e. this could avoid overlap and potential conflicts between 38.304 and 38.133. |
| NEC | Yes | Indeed in previous Rel-16 measurement relaxation discussion, overlapping issue between RAN2 and RAN4 was discussed for a long time. For now by only specifying criterion in RAN2 and requirement in RAN4, this can make things very simple. But should we inform RAN4 of this decision? |
| Samsung | Yes | Agree to capture general description and criteria of RRM relaxation and offloading for LP-WUS in TS 38.304. |
| Huawei, HiSilicon | Yes |  |
| Sharp | Yes |  |
| Lenovo | Yes | RAN2 to capture the general description and criteria of RRM measurement relaxation and offloading, while RAN4 to capture the other details of RRM measurement relaxation and offloading. Can coordinate with RAN4 on the split to avoid duplicate responses. |
| InterDigital | Yes |  |
| Nokia | Yes |  |
| Qualcomm | Yes, see the comment | RAN2 should capture UE behavior for RRC relaxation |
| Vivo | Object. See comment | We are fine to avoid the duplication between 38.304 and 38.133.  During the discussion in Rel-16, it was agreed in RAN2 that RAN2 specification will capture the RRM relaxation behaviour, while RAN4 specification will capture the corresponding requirements.  The reason the behaviour should be captured in RAN2 is that some essential information is missing in RAN4 specification, e.g. the below information cannot be reflected in RAN4 specification. Similarly, there are a lot of other information.  - if the UE has performed normal intra-frequency, NR inter-frequency, or inter-RAT frequency measurements for at least TSearchDeltaP after (re-)selecting a new cell; and  - if the relaxed measurement criterion in clause 5.2.4.9.1 is fulfilled for a period of TSearchDeltaP; and  We are very happy to discuss if all these essential information is captured in RAN4 specification.  We could in general agree that we should try to minimum the duplication between RAN2 and RAN4 specification. |

## Comments on TS 38.304 running CR

Companies can provide comments and suggestions to the uploaded running CR in this table. Please do not add changes, suggestions, or comments directly to the draft CR document.

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| --- | --- | --- |
| Company + Issue Number (e.g., C001) | Detailed comments | Rapporteur response |
| X001 | 5.2.4.9.x Relaxed measurement criterion for LP-WUS Comment1:  FFS different UE types, OOK and OFDM need to be considered.  Comment2:  The entry condition for serving cell RRM relaxation is fulfilled when:  - Srxlev > SLP\_WUS\_RelaxEntryThresholdP\_MR, and,  - Srxlev\_lr > SLP\_WUS\_RelaxEntryThresholdP\_LR, if SLP\_WUS\_RelaxEntryThresholdP\_LR is configured,  and,  - Squal > SLP\_WUS\_RelaxEntryThresholdQ\_MR, if SLP\_WUS\_RelaxEntryThresholdQ\_MR is configured, and  - Squal\_lr > SLP\_WUS\_RelaxEntryThresholdQ\_LR, if SLP\_WUS\_RelaxEntryThresholdQ\_LR is configured,  RSRQ is optionally configured for MR or LR. We can further consider the wording.  Comment3:  FFS whether to consider fully offloading and partial offloading. |  |
| X002 | 5.2.4.9.z Offloading measurement criterion for LP-WUS Do not understanding of the intention of this part. Is this the same thing as 5.2.4.9.x Relaxed measurement? |  |
| X003 | 7.x.1 Condition for LP-WUS monitoring  Comment1:  “The exit condition for LP-WUS monitoring is fulfilled when:  - Srxlev\_lr < SLP\_WUS\_ExitThresholdP\_LR, if SLP\_WUS\_ExitThresholdP\_LR is configured, or,  - Squal\_lr < SLP\_WUS\_ExitThresholdQ\_LP, if SLP\_WUS\_ExitThresholdQ\_LR is configured,  ”  Comment2:  We can further discuss whether the Entry/exit conditions for LP-WUS monitoring is the same as the entry/exit conditions for RRM relaxation. If it is, then this part is not needed. |  |
| X004 | 7.x.0 General Comment1:  FFS whether “*lastUsedCellOnly*” is introduced for LP-WUS as in PEI. |  |
|  | The UE monitors the legacy PO (and may monitor PEI)  Comment2:  “When the UE starts LP-WUS monitoring, if the UE detects LP-WUS and the LP-WUS indicates the subgroup the UE belongs to monitor its associated PO (and may PEI), as specified in clause 10.xx in TS 38.213 [4], the UE monitors the associated PO (and may PEI) as specified in clause 7.1.” If UE does not detect a LP-WUS on the monitored LO or the LP-WUS does not indicate the subgroup the UE belongs to monitor its associated PO (and may PEI), as specified in clause 10.xx in TS 38.213 [4], the UE is not required to monitor the associated PO (and may PEI) as specified in clause 7.1.  Comment3:  If single value is configured for *lo-Offset*, and if the gap between the LO and the corresponding PO is no less than the wake-up delay that the UEsupports, the UE monitors the PO associated with the offset after receiving a wake-up indication in a LP-WUS, otherwise UE follows the paging monitoring procedure as described in clause 7.1 and/or 7.2. |  |
| E001 | LR Low power wake-up Receiver |  |  |
| E002 | LP-WUS UE may further perform RRM neighbour measurement relaxation as specified in clause 5.2.4.9.0 or RRM serving cell measurement offloading and relaxation as specified in clause 5.2.4.9.x.  If the UE supports LP-WUS and LP-WUS is configured in SIB [details FFS]…  In 38.304 “RRM measurements” typically only refer to neighbour cell measurements, i.e. serving cell relaxation and offloading is new. From that perspective I think it is better to have serving cell relaxation/offloading in a separate section and clearly make this as “**serving** cell measurement relaxation/offloading”.  In 38.300 also the wording “**further**” RRM relaxation is used for the new Rel-19 scaling factors for neighbour cell measurements, i.e. propose to keep it. |  |
| E003 | LP-WUS UE may choose to perform relaxed measurement according to requirements specified in TS 38.133 [8] if the entry condition for RRM measurement relaxation in clause 5.2.4.9.x is fulfilled.  Agree, but an LP-WUS UE should also be allowed to perform relaxed Rel-16 neighbour cell measurements using the LR serving cell measurements, e.g. when “low mobility” is fulfilled the LP-WUS UE is not required to measure intra-frequency at all. This is even stronger than the Rel-19 “further” relaxation. Maybe you can add an FFS for that case. |  |
| NEC001 | 5.2.4.9.x Relaxed measurement criterion for LP-WUS UE5.2.4.9.z Offloading measurement criterion for LP-WUS UE **Comment: it should be LP-WUS UE.** |  |
| NEC002 | 5.2.4.9.x Relaxed measurement criterion for LP-WUS The entry condition for serving cell RRM measurement relaxation is fulfilled when: **Comment: it should be RRM measurement relaxation, to align with others** |  |
| NEC003 | 5.2.4.9.x Relaxed measurement criterion for LP-WUS The entry condition for serving cell RRM relaxation is fulfilled when:  - Srxlev > SLP\_WUS\_RelaxEntryThresholdP\_MR, and,  - Srxlev\_lr > SLP\_WUS\_RelaxEntryThresholdP\_LR, if SLP\_WUS\_RelaxEntryThresholdP\_LR is configured, and,  - Squal > SLP\_WUS\_RelaxEntryThresholdQ\_MR, if SLP\_WUS\_RelaxEntryThresholdQ\_MR is configured, and  - Squal\_lr > SLP\_WUS\_RelaxEntryThresholdQ\_LR, if SLP\_WUS\_RelaxEntryThresholdQ\_LR is configured,  Where:  - Srxlev = current Srxlev value of the serving cell based on MR (dB).  - Squal = current Squal value of the serving cell based on MR (dB).  - Srxlev\_lr= current measured cell RX level value of the serving cell based on LR (dB).  - Squal\_lr = current measured cell quality value of the serving cell based on LR (dB).  **Comment: no strong view, but think it is worth to highlight “based on MR” since now we have two separate radio. Also apply to 7.x.1.** |  |
| NEC004 | If single value is configured for *lo-Offset*, and if the gap between the LO and the corresponding PO is no less than the wake-up delay that the UE reports, the UE monitors the PO associated with the offset after receiving a wake-up indication in a LP-WUS, otherwise the UE follows the paging monitoring procedure as described in clause 7.1 and/or 7.2.  If more than one values are configured for *lo-Offset*, and if the gap between the LO associated with the largest offset and the corresponding PO is no less than the wake-up delay the UE reports, the UE monitors the LO associated with the smallest offset value that has a gap between the LO and the PO associated with the offset no less than the wake-up delay, otherwise the UE follows the paging monitoring procedure as described in clause 7.1 and/or 7.2.  **Comment: it should be “the UE”, and we need to align the term (either support or report), since this is a UE capability with parameter, slightly prefer “reports”.** |  |
| NEC005 | SubgroupID = (floor(UE\_ID/(N\*Ns\*Np)) mod subgroupsNumForUEID\_LP) + (subgroupsNumPerPO\_LP – subgroupsNumForUEID\_LP),  where:  N: number of total paging frames in T, which is the DRX cycle of RRC\_IDLE state as specified in clause 7.1  Ns: number of paging occasions for a PF  Np is the number of subgroupNumsForUEID for PEI, if configured; otherwise, Np is 1  **Comment-1: subgroupNumForUEID should be subgroupNumsForUEID.**  **Comment-2: in our understanding, no matter the UE supports PEI or not, there is no harm to use a unified LP-WUS formula which already can further reduce false alarm. And on top of further reduce false alarm, if different UE use different parameter Np, it can make the formula computation a little bit messed. However since this is our agreement, we can further discuss this issue based on contribution.** |  |
| NEC006 | The UE monitors one LP-WUS occasion per DRX cycle.  **Comment: even though multiple offsets corresponding to the same PO is introduced by RAN1, this is from NW perspective, we think that the UE only need to select ONE LP-WUS for monitoring. Also this is to refer to PEI description.** |  |
| SS001 | The terminology ‘LP-WUS UE’ must be defined. |  |
| HW001 | As Samsung commented, the terminology “LP-WUS UE” needs to be defined. In 38.300 running CR, “UE configured with LP-WUS” is used. If it’s common understanding that “UE configured with LP-WUS” refers to “a UE capable of LP-WUS functionality is configured with LP-WUS configuration by the NW, and the LP-WUS functionality is enabled”, then “UE configured with LP-WUS” can be used across all specs. |  |
| HW002 | Section 5.2.4.9.x:  Comment: It’s not agreed that “relaxed measurement criteria is different from LP-WUS monitoring entry criteria”. So this should be FFS. (We mean the parameters “SLP\_WUS\_RelaxEntryThresholdP\_MR, and SLP\_WUS\_RelaxEntryThresholdP\_LR”) |  |
| HW003 | Section 7.x.0 General:  As the UE may monitor PEI first, and PO later, suggest: “The UE monitors PO (or may monitor PEI, and PO ~~and may monitor PEI~~) and may stop LP-WUS monitoring if the exit condition in clause 7.x.1 is fulfilled” |  |
| HW004 | Section 7.x.0 General:  “If more than one values are configured for *lo-Offset*”  Comment: According to RAN1 agreement, “it’s FFS whether gNB can configure 3 offset values”. This is not captured in the editor’s NOTE. |  |
| HW004 | Section 7.y.0, 7.y.1, 7.y.2:  Comment: it’s better to align the description with PEI’s description in Section 7.3.0, 7.3.1, 7.3.2 |  |
| HW005 | Section 7.y.2:  Comment: UE\_ID based subgrouping ID formula is used when the following condition is fulfilled, (i.e., the same condition as in 7.3.2), it’s better to clarify it.  “If the UE is not configured with a CN assigned subgroup ID, or if the UE configured with a CN assigned subgroup ID is in a cell supporting only UE\_ID based subgrouping, the subgroup ID of the UE is determined by the formula below:”  This will be address if the description is aligned as commented in HW004. |  |
| Sharp 001 | **A general Comment**: It is unclear what “LP-WUS UE” is, clarification/definition in the spec is needed. However not sure whether “LP-WUS UE” is supporting LP-WUS or configured with LP-WUS, maybe FFS can be added. |  |
| Sharp 002 | Section 5.2.4.2: LP-WUS UE may further perform RRM measurement relaxation as specified in clause 5.2.4.9.0 or RRM measurement offloading as specified in clause 5.2.4.9.x.  **Comment**: The reference causes seem incorrect. A possible change: LP-WUS UE may further perform serving cell RRM measurement relaxation as specified in clause 5.2.4.9.x or serving cell RRM measurement offloading as specified in clause 5.2.4.9.y and 5.2.4.9.z. |  |
| Sharp 003 | Section 7.x.0.  **Comment:** The agreement “If UE starts LP-WUS monitoring, it may stop the legacy PO monitoring before UE receives LP-WUS indicating wake-up” seems not be captured. |  |
| Len001 | 5.2.4.9.0 Relaxed Measurement and Offloading Measurement  LP-WUS UE may choose to perform relaxed RRM serving cell measurement according to requirements specified in TS 38.133 [8]…. |  |
| Len002 | 5.2.4.9.x Relaxed measurement criterion for LP-WUS The entry condition for serving cell RRM measurement relaxation is fulfilled when:  ……  5.2.4.9.z Offloading measurement criterion for LP-WUS  The entry condition for serving cell RRM ~~mearement~~ measurement offloading is fulfilled when:  ……  The exit condition for serving cell RRM ~~mearement~~ measurement offloading is fulfilled when:  …..  [Comment]: to align with the description of relaxation and offloading cases, and the offloading case also only limited on the serving cell. |  |
| Len003 | 7.x.0 General  The UE may monitor LP-WUS in RRC\_IDLE and RRC\_INACTIVE states in order to reduce power consumption. If LP-WUS configuration is provided in system information, the UE in RRC\_IDLE or RRC\_INACTIVE state supporting LP-WUS may start LP-WUS monitoring using LP-WUS ~~parameters~~ configuration in system information according to the procedure described below if the entry condition in clause 7.x.1 is fulfilled. The UE monitors PO (and may monitor PEI) and may stop LP-WUS monitoring if the exit condition in clause 7.x.1 is fulfilled.  When the UE starts LP-WUS monitoring, if the UE detects LP-WUS and the LP-WUS indicates the subgroup the UE belongs to ~~monitor its associated PO~~, as specified in clause 10.xx in TS 38.213 [4], the UE monitors the associated PEI and/or PO as specified in clause 7.1  [Comment]: the wording is a bit misleading because the UE may either monitor PEI after receiving LP-WUS or it may directly monitor PO (provided the LPWUS indicates the UE’s subgroup ID). |  |
| Len004 | Since neighbouring cell measurement relaxation impacts have also been discussed in previous meetings. It is suggested to capture related agreement as below (FFS point) in 5.2.4.9:  ‘FFS (if needed) on enhancements based on R16 criteria (e.g., based on the LR measurements) for the case when MR serving cell measurement results are not available.’ |  |
| IDC001 | If we use the term “MR” in the specification, it would be better to add definition of MR in the 3.2 Abbreviations section such as “Main Radio”. |  |
| IDC002 | *According to RAN2#126 agreement “For serving cell measurement offloading (i.e., serving cell measurement fully offloaded to LR and no serving cell measurement via MR is required.*  When the offloading condition satisfied, then the serving cell measurement via MR is not required based on the RAN2 agreements.  Do we need to add this details in the general description (e.g., difference relaxed and offloading measurement, whether serving cell measurement via MR is required or not) or left to all detail descriptions up to RAN4 specification? |  |
| Nokia 001 | Clause 7.x.0:  It would be better to specify what the UE shall instead of what the UE may do, otherwise UE behaviour would not be clear. Our proposal would be to remove all the sentences with “UE may” until further progress is made. |  |
| Nokia 002 | Many RAN1 agreements are now captured in RAN2 spec. How can we ensure that the same things are not specified in both RAN1 and RAN2 specifications? |  |
| Qualcomm 001 | The following highlight part should be changed to is not required or may not. UE based on implementation can perform MR measurement. 5.2.4.9.y Offloading measurement rules LP-WUS UE may choose to perform RRM measurement offloading according to requirements specified in TS 38.133 [8] if the entry condition for RRM measurement offloading in clause 5.2.4.9.z is fulfilled. LP-WUS UE is not allowed to perform RRM measurement offloading according to requirements specified in TS 38.133 [8] if the exit condition for RRM measurement offloading in clause 5.2.4.9.z is fulfilled. |  |
| Qualcomm 002 | In 5.2.4.9.z Offloading measurement criterion for LP-WUS, RSRQ should be considered if configured. |  |
| SS002 | We propose to replace ‘LP-WUS UE’ with ‘UE supporting LP-WUS’ or ‘UE configured with LP-WUS’, as Sharp and Huawei mentioned. |  |
| V001 | LP-WUS UE may further perform RRM measurement relaxation as specified in clause 5.2.4.9.0 or RRM measurement offloading as specified in clause 5.2.4.9.y |  |
| V002 | “LP-WUS UE may choose to perform relaxed measurement according to requirements specified in TS 38.133 [8] if the entry condition for RRM measurement relaxation in clause 5.2.4.9.x is fulfilled.”  This is stage-3 specification, but not stage-2 specification. This general description didn’t reflect the UE behaviour. |  |
| V003 | “FFS on exit condition for serving cell RRM relaxation, e.g., whether a separate exit condition other than ‘not fulfilling the entry condition’ is needed, or whether exit condition include MR and/or LR-based measurement”  This EN is not needed, as it is already captured in 5.2.4.9.x. |  |
| V004 | 7.y Subgrouping for LP-WUS This part is almost the same as PEI. Suggest to merge them. |  |
| V005 | “The reference point is the start of the PF, or the first PF of the PF(s) (if mapping of POs from multiple PFs to one LO is supported), associated with the LO.”  Suggests to change it as the description of PEI in section 7.2.1, since the reference point is for LP-WUS frame not for the PF of the LP-WUS corresponding to. |  |
| V006 | “the UE monitors the PO associated with the offset after receiving a wake-up indication in a LP-WUS,”  Suggests to changes it as “the UE could monitor the LO and monitors the PO associated with the offset after receiving a wake-up indication in a LP-WUS” , since we focus on the UE could monitor LP-WUS in this case. |  |
| V007 | “, the UE monitors the LO associated with the smallest offset value that has a gap between the LO and the PO associated with the offset no less than the wake-up delay”  Suggest to change it “UE could monitor…” |  |
| V008 | Suggest to add an EN as below:  Editor’s NOTE: FFS whether to change the term in PEI section, for example CN assigned subgrouping to change it as CN assigned subgrouping for PEI. |  |

# Conclusion

TBD

# References

1. R2-2501094, LP-WUS and RRM measurements, Ericsson , discussion, RAN2#129
2. 3GPP TS 38.304: "NR; User Equipment (UE) procedures in Idle mode and RRC Inactive state", v18.4.0