**3GPP TSG-RAN WG2 Meeting #130R2-250xxxx**

**St. Julian’s, Malta, 19th - 23th May 2025**

**Agenda item: 8.4.1**

**Source: CATT**

**Title: Collection of comments and open issues on Running CR for 38.304 (CATT)**

**Document for: Discussion and Decision**

# Introduction

This document is the report of the following discussion:

* [Post129bis][208][LPWUS] Running CR for 38.304 (CATT)

Intended outcome: Updated running CR based on new agreements for endorsement, open issue list (if needed)

Deadline: Long (May. 2nd 10:00 UTC)

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

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| --- | --- | --- |
| **Company** | **Delegate name** | **Email address** |
| ZTE | Gao Yuan | gao.yuan66@zte.com.cn |
| NEC | Rao | shi\_rao@nec.cn |
| OPPO | Haocheng Wang | Wanghaocheng1@oppo.com |
| Ericsson | Martin van der Zee | martin.van.der.zee@ericsson.com |
| Apple | Fangli XU | fangli\_xu@apple.com |
| Huawei/HiSilicon | Rama Kumar Mopidevi | rama.kumar@huawei.com |
| Lenovo | Shwetha Sreejith | ssreejith1@lenovo.com |
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# Discussion

## X in UE\_ID based subgrouping

In RAN2#129bis meeting, the following agreements were achieved:

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| * LP-WUS is supported with eDRX, FFS on exact impact if any * Use 5G-S-TMSI to determine the UE\_ID in the formula of UE\_ID based subgrouping for LP-WUS, i.e., UE\_ID=5G-S-TMSI mod X. * X is based on 32 subgrouping number. Details can be discussed in the running CR. |

Then the formula of subgroup ID of UE\_ID based subgrouping for LP-WUS is:

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| SubgroupID = (floor(UE\_ID/(N\*Ns\*Np)) mod lp-SubgroupsNumForUEID) + (lp-SubgroupsNumPerPO – lp-SubgroupsNumForUEID),  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 subgroupsNumForUEID for PEI, if configured and UE supports PEI; otherwise, Np is 1  UE\_ID: 5G-S-TMSI mod X, X is FFS  lp-SubgroupsNumForUEID and lp-SubgroupsNumPerPO are the subgroup number for UE\_ID based subgrouping for LP-WUS and the total subgroup number for LP-WUS, respectively. |

The UE-ID value range for UE-ID based subgrouping for LP-WUS depends on the maximum number of POs, the maximum number of UE-ID based PEI sub-groups and the maximum number of UE-ID based subgroups for LP-WUS. And we have already agreed to support LP-WUS with eDRX and consider 32 as the maximum number of UE-ID based subgroups for LP-WUS for X. Therefore, the possible options for X include:

* **Option 1: X is depended on if eDRX is applied and different cases of Np.**

If eDRX is not applied and Np is the number of subgroupsNumForUEID for PEI, X=262144 (256\*4\*8\*32);

If eDRX is not applied and Np is 1, X=32768 (256\*4\*32);

If eDRX is applied and Np is the number of subgroupsNumForUEID for PEI, X=1048576(1024\*4\*8\*32);

If eDRX is applied and Np is 1, X=131072(1024\*4\*32).

* **Option 2: X is depended on if eDRX is applied without considering different cases of Np**

If eDRX is not applied, X=262144 (256\*4\*8\*32);

If eDRX is applied, X= 1048576 (1024\*4\*8\*32).

* **Option 3: X is 1048576, i.e., the largest UE ID range in all LP\_WUS cases is be used for all LP-WUS monitoring cases.**

Companies are invited to provide their preference on above options.

**Q: Which option is preferred for X in the formula of subgroup ID of UE\_ID based subgrouping for LP-WUS?**

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| **Company** | **Preferred option** | **Comments** |
| ZTE | Option 1 or Option 3 | Because in the 4 cases listed in option 1, the maximal number of UE subgroupings is different, and the X should be the maximal number of UE subgrouping. So, We prefer to option 1.  But considering that only the largest UE-ID range may be provided in RAN3 specification (similar as for PEI case), we are also ok for option 3. |
| NEC | Opt 2 and Opt 3 | One question is that do we really need to differentiate value of X for different cases? In our understanding, there is no problem if UE just considers using the max X for UE-ID calculation, i.e., only specifying [UE\_ID: 5G-S-TMSI mod X, where X is 1048576 (20 bits)] in the spec, UE-ID can still work well. The reason is that as long as there is no PF/PO/subgroup remaining unused, same/similar allocation mechanism can still be assumed based on the mechanism of formula and modulo operation.  For example, for non-eDRX case, no matter whether the UE is applying PEI or not, all UEs could just calculate UE-ID based on X = 262144 (18 bits) instead of X = 32768 (15 bits) if UE is not applying PEI, actually same effects will be assumed.  Noted that the same principle is also applied for eDRX case. But since we have already differentiated eDRX for PEI, taking PEI mechanism is also a way forward.  As for opt-1, if all solutions can work, we prefer a simple solution. |
| OPPO | Opt2 and Opt3 | We have the same understanding with NEC. The max X can be used for UE-ID calculation without differentiating DRX or eDRX and whether supporting PEI or not. Option 3 is the simplest way.  We can also accept to reuse the principle for PEI, i.e., use different X values for eDRX and non-eDRX case. |
| Ericsson |  | In legacy X depends on whether eDRX and/or PEI are configured, i.e. we wonder why we discuss to deviate from that rule, i.e. what is the benefit? With option 3 the same bits are used for LP-WUS subgrouping, independent whether eDRX/PEI is configured or supported. Given that the AMF is required to randomize the 5G-TMSI we are not sure whether it matters that UEs use different bits of the 5G-S-TMSI for LP-WUS subgrouping.  This discussion also impacts RAN3, i.e. when both eDRX and PEI are not used, then the legacy UE\_ID of 20 bits could be used.  In our understanding the signalled UE\_ID depends on the gNB configuration and UE capability e.g. when UE-ID based subgrouping is configured in the gNB and supported by the UE then UE-ID based subgrouping is assumed to be used (unless UE has CN-assigned subgroup ID and CN-assigned subgrouping is configured in the gNB). The same applies to eDRX, i.e. eDRX is assumed to be used when gNB allows eDRX and UE has eDRX cycle configured. A UE implementation could decide to use normal DRX, but it is not assumed to do so, i.e. the same applies to PEI, i.e. the UE can always monitor PEI directly.  NOTE: PEI can be configured with 1 subgroup, i.e. Np = 1 is not an indication that PEI is not configured. When Np = 1, the UE can monitor PEI (and not be prepared to receive paging PDSCH and save power) but there is no benefit of subgrouping.  About “eDRX is applied”: for eDRX both “UE operates in eDRX” and “eDRX is applied” is used in 38.304 (unfortunately). The term “UE operates in eDRX” is defined in section 7.4 and therefore is perhaps preferred. |
| Apple | Option 2 or Option 3 | For the X value, we can consider the design in PEI style that only distinguishes the edrx case (i.e. option 2) or the design in simplest way (i.e. option 3). |
| Huawei/HiSilicon | Option 2 | As RAN3 most likely will extend the UE Identity index value to 20 bits, and following the PEI’s specification for DRX and eDRX, option 2 is preferred. |
| Lenovo | Opt 2 or Opt 3 | We think all three options would work but we do not see the need to differentiate on the basis of Np since this value is already included in the formula and that implicitly addresses the different cases of Np. So, we think Opt 1 can be precluded. Additionally, since we have previously agreed to take PEI as a baseline, we have a slight preference for option 2 but we are also okay with opt 3 for its simplicity. |
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**Summary:**

## 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 |
| Z001 | 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 in system information according to the procedure described below if the entry condition in clause 7.x.1 is fulfilled. The UE monitors PO (or may monitor PEI) and may stop LP-WUS monitoring if the exit condition in clause 7.x.1 is fulfilled.  *Suggest to change to:*  The UE in RRC\_IDLE state or RRC\_INACTIVE state may monitor LP-WUS 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 in system information according to the procedure described below if the entry condition in clause 7.x.1 is fulfilled. The UE may stop LP-WUS monitoring if the exit condition in clause 7.x.1 is fulfilled. |  |
|  | 7.x.0 General ...  When the UE starts LP-WUS monitoring, if the UE supports PEI and PEI is configured by the gNB, after the UE receives LP-WUS indicating the subgroup the UE belongs to monitor its associated PO, it is up to UE implementation whether to monitor PEI or not. 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 PO as specified in clause 7.1 or monitor PEI as specified in clause 7.2. 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, as specified in clause 10.xx in TS 38.213 [4], the UE is not required to monitor the associated PO as specified in clause 7.1.  *Suggest to change to:*  When the UE starts LP-WUS monitoring, if the UE supports PEI and PEI is configured by the gNB, after the UE receives LP-WUS indicating the subgroup the UE belongs to monitor its associated PO, it is up to UE implementation whether to monitor PEI or not. 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 PO as specified in clause 7.1 or monitor PEI as specified in clause 7.2. 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, as specified in clause 10.xx in TS 38.213 [4], the UE is neither required to monitor the associated PO, nor required to monitor the associated PEI. |  |
|  | 7.y.0 General  ...  If a UE has no CN assigned subgroup ID or does not support CN assigned subgrouping, and there is no configuration for *subgroupsNumForUEID*, the UE monitors the associated PO according to clause 7.1.  *Suggest to change to:*  7.y.0 General  ...  If a UE has no CN assigned subgroup ID, and there is no configuration for *subgroupsNumForUEID*, the UE monitors the associated PO according to clause 7.1 and/or monitors PEI as specified in clause 7.2. |  |
| NEC: W001 | 7.x.0 General  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 PO as specified in clause 7.1 or monitor PEI as specified in clause 7.2.  **Comment: monitor should be monitors** |  |
| NEC: W002 | 7.x.0 General  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 a UE supports, 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: to align with the previous paragraph, it should be:**  if the gap between the LO associated with the largest offset and the corresponding PO is no less than the wake-up delay that a UE supports |  |
| NEC: W003 | The exit condition for LP-WUS monitoring is fulfilled when:  - Srxlev\_lr < SLP\_WUS\_ExitThresholdP\_LR or,  - Squal\_lr < SLP\_WUS\_ExitThresholdQ\_LR, if SLP\_WUS\_ExitThresholdQ\_LR is configured.  **Comment: suggest to use [and] instead of [or], normally we say if SLP\_WUS\_ExitThresholdQ\_LR is configured, so no problem to use [and], this is also to align with other part.** |  |
| NEC: W004 | - Srxlev\_lr= current measured cell RX level value of the serving cell based on LR (dBm).  - Squal\_lr = current measured cell quality value of the serving cell based on LR (dB).  **Comment: agree that Squal\_lr should be dB based on definition of RSRQ, but when we say measured cell RX level value, in legacy it is (RSRP) / (RSRQ), shown below:**  Qrxlevmeas: Measured cell RX level value (RSRP)  Qqualmeas: Measured cell quality value (RSRQ)  **No strong view, but think companies can also consider in this way.**  Agreement:  => Use existing Srxlev/Squal for all MR measurement based entry/exit condition evaluation.  => Use measured value for all LR measurement based entry/exit condition evaluation. |  |
| O001 | - LP-WUS UE may further perform MR serving cell and neighbouring cell measurement relaxation as specified in clause 5.2.4.9.0 or serving cell measurement offloading as specified in clause 5.2.4.9.y.  **Comment:** Suggest to change as below:  - LP-WUS UE may further perform relaxed ~~MR~~ serving cell and neighbouring cell measurement on MR ~~relaxation~~ as specified in clause 5.2.4.9.0 or serving cell measurement offloading from MR to LR as specified in clause 5.2.4.9.y. |  |
| O002 | 5.2.4.9 Relaxed measurement and offloading measurement **Comment:** Suggest to change as below: 5.2.4.9 Relaxed measurement and ~~offloading~~ measurement offloading |  |
| O003 | LP-WUS UE may choose to perform relaxed MR serving cell and neighbouring cell measurements according to requirements specified in TS 38.133 [8] if the entry condition for measurement relaxation in clause 5.2.4.9.x is fulfilled.  **Comment:** It is suggested to be modified to “LP-WUS UE may choose to further perform relaxed ~~MR~~ serving cell and neighbouring cell measurements on MR according to…” |  |
| O004 | 5.2.4.9.x Relaxed measurement criterion for LP-WUS UE The entry condition for MR serving cell and neighbouring cell measurement relaxation is fulfilled when:  Comment: Suggest to revise to “serving cell and neighbouring cell measurement relaxation on MR” 5.2.4.9.x Relaxed measurement criterion for LP-WUS UE The entry condition for ~~MR~~ serving cell and neighbouring cell measurement relaxation on MR is fulfilled when: |  |
| O005 | - Srxlev\_lr > SLP\_WUS\_RelaxEntryThresholdP\_LR, if SLP\_WUS\_RelaxEntryThresholdP\_LR is configured, and,  Comment: Since we have agreed that *use measured value for all LR measurement based entry/exit condition evaluation*, it is suggested to rename the parameter to “Qrxlevmeas-lp” to avoid the confusion.  - ~~Srxlev\_lr~~ Qrxlevmeas-lp > ~~S~~QLP\_WUS\_RelaxEntryThresholdP\_LR, if ~~S~~QLP\_WUS\_RelaxEntryThresholdP\_LR is configured, and, |  |
| O006 | 5.2.4.9.y Serving cell offloading measurement rules Comment: It is suggested to be modified to “Serving cell measurement offloading” to align with the following description. 5.2.4.9.y Serving cell ~~offloading~~ measurement offloading rules |  |
| O007 | 5.2.4.9.y Serving cell offloading measurement rules LP-WUS UE may choose to perform serving cell measurement offloading (i.e., serving cell measurement fully offloaded to LR and no serving cell measurement via MR is required) according to requirements specified in TS 38.133 [8] if the entry condition for serving cell measurement offloading in clause 5.2.4.9.z is fulfilled.  **Comment:** In serving cell offloading case, both serving cell measurement and neighbor cell measurement on MR are not performed. So it is better to also include the “no neighbor cell measurement” to make it clearer. 5.2.4.9.y Serving cell offloading measurement rules LP-WUS UE may choose to perform serving cell measurement offloading (i.e., serving cell measurement fully offloaded to LR and no serving cell measurement and no neighbouring cell measurement via MR is required) according to requirements specified in TS 38.133 [8] if the entry condition for serving cell measurement offloading in clause 5.2.4.9.z is fulfilled. |  |
| E001 | - If the UE supports LP-WUS, the UE may perform MR serving cell relaxation and further neighbouring cell measurement relaxation as specified in clause 5.2.4.9.0 or serving cell measurement offloading as specified in clause 5.2.4.9.y. |  |
| E002 | Drafting rules in 21.801 says that titles shall not be changed:    It is better to introduce a new section and leave the legacy section unchanged, i.e. then it is clearer that there are not changes to legacy and what are the Rel-19 changes. |  |
| A001 | Section 5.2.4.2  Similar comments as E001, whether to perform serving measurement relaxation/offloading should be based on UE capability and network configuration.  If the UE supports LP-WUS and LP-WUS is configured in SIB, the UE may perform MR serving cell relaxation and further neighbouring cell measurement relaxation as specified in clause 5.2.4.9.0 or serving cell measurement offloading as specified in clause 5.2.4.9.y. |  |
| A002 | Section 5.2.4.9  Same comment as E002.  It’s better to introduce the new section for LPWUS based serving measurement relaxation/offloading and neigbhor measurement relaxation, with the following reasons:  1) The existing description is not applicable for LP-WUS UE if the LP-WUS based measurement relaxation/offloading is enabled. So it’s better to keep the existing section for the legacy measurement relaxation without LP-WUS, in order to make the good backward compatibility from the spec structure and description perspective.  2) For neighbour measurement relaxation, RAN4 has the different requirement and section to describe the LP-WUS based neighbor measurement relaxation, so the condition would be also different from legacy R16 condition and description. So it’s better to have a new section to describe the LP-WUS specific case. |  |
| HW001 | 3.2 Abbreviations  LP-WUS Low Power-Wake Up Signal  LR Low power wake-up Receiver  **Comment (editorial):** LR can follow the same format as LP-WUS. “LR Low Power-Wake Up Receiver” |  |
| HW002 | 5.2.4.2 Measurement rules for cell re-selection  - If the UE supports relaxed measurement and *relaxedMeasurement* is present in *SIB2*, the UE may further relax the needed measurements, as specified in clause 5.2.4.9.  - LP-WUS UE may further perform MR serving cell and neighbouring cell measurement relaxation as specified in clause 5.2.4.9.0 or serving cell measurement offloading as specified in clause 5.2.4.9.y.  Editor’s NOTE: FFS on the terminology LP-WUS UE.  **Comment:** Even though it says “may further perform”, whether LP-WUS UE supports RRM relaxation and offloading is still under discussion as part of UE capabilities. So we suggest to reflect this. May be an FFS as “FFS whether LP-WUS UE supports relaxed measurement and offloading” |  |
| HW003 | 7.x.0 General When the UE starts LP-WUS monitoring, if the UE supports PEI and PEI is configured by the gNB, after the UE receives LP-WUS indicating the subgroup the UE belongs to monitor its associated PO, it is up to UE implementation whether to monitor PEI or not. 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 PO as specified in clause 7.1 or monitor PEI as specified in clause 7.2. 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, as specified in clause 10.xx in TS 38.213 [4], the UE is not required to monitor the associated PO as specified in clause 7.1.  The UE monitors one LP-WUS occasion per DRX cycle. A LP-WUS occasion (LO) is a set of LP-WUS monitoring occasions (LP-WUS MOs). In multi-beam operations, the UE assumes that the same LP-WUS is repeated in all transmitted beams and thus the selection of the beam(s) for the reception of the LP-WUS is up to UE implementation.  **Comment:** 1) Can the highlighted in yellow be simplified, for example as below for readability?  “When the UE detects LP-WUS and the LP-WUS indicates the subgroup the UE belongs to monitor its associated PO, monitoring PEI is up to UE implementation if PEI is supported and configured.  2) monitored LO to “monitored LP-WUS occasion” |  |
| L001 | 7.x.0 General  The time location of an LO for UE’s PO is determined by a reference point and the configured frame-level offset:  **Comment: “The time location of a LO…”**  …otherwise the UE follows the paging monitoring procedure as described in clause 7.1 and/or 7.2.  **Comment: “…the UE monitors the associated PO according to clause 7.1 or monitor PEI as specified in clause 7.2.” We think this text is clearer and should be captured where necessary to maintain consistency.** |  |
| L002 | 7.y.1 CN assigned subgrouping for LP-WUS  A UE supporting CN assigned subgrouping for LP-WUS in RRC\_IDLE or RRC\_INACTIVE state can be assigned a subgroup ID (between FFS) by AMF through NAS signalling. 7.y.2 UE\_ID based subgrouping for LP-WUS …..  Editor’s NOTE: FFS X for UE\_ID.  **Comment: In our view, this is understood as between 0 to 31 according to the agreement that X is based on 32 subgrouping number.** |  |
| L003 | 5.2.4.9.x Relaxed measurement criterion for LP-WUS UE …….  Editor’s NOTE: FFS relaxed measurement entry/exit criteria is different from LP-WUS monitoring entry/exit criteria.  **Comment: update the text with entry/exit criteria.** |  |
| L004 | Suggest to capture RAN2 129bis meeting agreements on OFDM and OOK based WUR in 5.2.4.9 x and 5.2.4.9 y.  *RAN2 assumes the entry/exit thresholds for RRM relaxation/offloading for OFDM-based WUR measuring LP-SS only are the same as that for OOK-based WUR measuring LP-SS. It can be revisited based on RAN1/RAN4 process, if any. Network is allowed to provide either OOK based threshold or OFDM based WUR measuring SSB threshold or both.* |  |

## Open issue list

Beside FFS X for UE\_ID in sub-clause 2.1, followings are the Editor’s NOTE in the running CR:

Editor’s NOTE: FFS on the terminology LP-WUS UE.

Editor’s NOTE: Will introduce new parameters for RRM measurement relaxation and offloading according to RRC specification.

Editor’s NOTE: 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.

Editor’s NOTE: 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 measurements.

Editor’s NOTE: The detailed parameters for RRM measurement relaxation for LP-WUS will be aligned with RRC specification.

Editor’s NOTE: FFS how to capture separate thresholds for different UE types (to be aligned with RRC specification).

Editor’s NOTE: FFS relaxed measurement criteria is different from LP-WUS monitoring entry criteria.

Editor’s NOTE: The detailed parameters for serving cell measurement offloading will be aligned with RRC specification.

Editor’s NOTE: FFS if entry/exit conditions are always configured.

Editor’s NOTE: FFS whether/how to capture the mapping between LO and PO. Wait for RAN1 further conclusion on the mapping between LO and PO.

Editor’s NOTE: FFS whether/how to capture the MOs of the LO. Wait for RAN1 further conclusion on MO.

Editor’s NOTE: The detailed calculation for LP-WUS monitoring would be further discussed and decided in RAN1.

Editor’s NOTE: The detailed parameters for LP-WUS monitoring will be aligned with RRC specification.

Editor’s NOTE: FFS how to capture separate entry/exit thresholds for OFDM-based and OOK-based WUR (to be aligned with RRC specification).

Editor’s NOTE: The detailed parameters for LP-WUS monitoring conditions will be aligned with RRC specification.

Editor’s NOTE: The detailed parameters for LP-WUS subgrouping will be aligned with RRC specification.

Editor’s NOTE: The value of a subgroup ID will be aligned with RRC specification.

Editor’s NOTE: The detailed parameters for LP-WUS subgrouping will be aligned with RRC specification.

Among these ENs, the following open issues can be discussed in RAN2, including:

1. FFS on the terminology LP-WUS UE.
2. 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.
3. 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 measurements.
4. FFS relaxed measurement criteria is different from LP-WUS monitoring entry criteria.
5. FFS if entry/exit conditions are always configured.

In addition to the above open issues, please provide your comments on any other RAN2 open issues of 38.304 running CR for LP-WUS, and Rapporteur will response.

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| **Company** | **Open issue** | **Rapporteur response** |
| ZTE | Whether UE low mobility criterion or stationary criterion should be considered in “5.2.4.9 Relaxed measurement and offloading measurement”section. |  |
| ZTE | Whether Relaxed measurement and offloading measurement can be performed when there is NR inter-frequency and/or NR inter-RAT frequency with reselection priority higher than that of the camped frequency. |  |
| ZTE | Whether LP-WUS is only used in the last used cell or in any cell |  |
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# Conclusion