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

**St Julian, Malta, 19th – 23rd May 2025**

**Source: vivo**

**Title: Remaining RRC open issue for LP-WUS/WUR**

**Agenda Item: 8.4.1**

**Document for: Discussion and Decision**

1. Introduction

The following document includes a list of RRC open issues for LP-WUS/WUR according to the following email discussion:

* [Post129bis][209][LPWUS] Running CR for 38.331 (vivo)

Intended outcome:

1. Updated running CR based on new agreements for endorsement
2. open issue list

Deadline: Long

Companies are invited to provide comments/additional issues in the below table by 2nd May, 2025

# Discussion

* 1. Easily addressed open issues

**Open issue RRC-1 (essential): whether whether RRM relaxation configuration is provided in SIB2**

In the current RRC running CR, there is an EN as below:

Editor’s NOTE: FFS on whether RRM relaxation configuration is provided in SIB2.

In legacy Rel-16/17 neighboring cell measurement relaxation, the corresponding conditions and parameters are configured in SIB2. Rapporetur understands it is straightforward to follow the same design for Rel-19 RRM offloading/relaxation conditions and parameters.

**Companies are invited to provide comments on whether RRM relaxation configuration is provided in SIB2.**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments, if any** |
| OPPO | Yes | Fine to follow the the same design as legacy RRM relaxation |
| Lenovo | Yes |  |
| Samsung | Yes | To be aligned with the legacy parameters. |
| Huawei | Yes | To be aligned with the legacy parameters. |
| Sharp | Yes |  |
| CATT | Yes |  |
| LGE | Yes |  |
| Xiaomi | Yes |  |
| Ericsson | Yes |  |
| Apple | Yes | Let’s follow the legacy rule. |
| Vivo | Yes |  |

**Summary:**

**11 companies provided the comments. All companies agree that RRM relaxation configuration is provided in SIB2.**

With this, Rapporteur suggests that:

**Proposal 1: (11/11) RRM relaxation / offloading configuration is provided in SIB2.**

**Open issue RRC-2 (essential): whether entry/exit condition is mandatory or optional**

In the current RRC running CR, there is an EN as below:

Editor’s NOTE: FFS on whether entry/exit condition is mandatory or optional.

During the discussion, some companies think Some companies think if the MR and LR have the same coverage, the entry/exit condition for LP-WUS monitoring seems not always need to be configured. If entry/exit condition for PDCCH monitoring is absent in LP-WUS configuration, UE assumes that entry condition is always met and whether to monitor LP-WUS is up to UE implementation. While some companies think the entry/exit condition should be mandatorily configured to make UE correctly check whether the entry/exit condition for LP-WUS monitoring is met or not.

**Companies are invited to provide comments on whether the entry/exit condition for LP-WUS monitoring is mandatorily configured if the network is intended to support the LP-WUS feature.**

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| **Company** | **Yes/No** | **Comments, if any** |
| OPPO | Yes | When entry/exit condition is not configured, how does the UE know whether the NW does not support LP-WUS or it supports but not configuring the condtion? Especially for the OOK-based receiver, when LP-SS is not configured, does the UE assume NW does not support OOK based LR or assume the UE always met the condition when entry/exit condition is absent?  If the UE is able to differentiate the case, we’re ok to let the UE assume entry condition is always met when entry/exit condition is absent. Otherwise, the mandatory configuration for entry/exit is the easy way. |
| Lenovo | Yes | For coverage aspects, it has been agreed that LR covarege shall match MR’ s PUSCH coverage for MSG3, but it is still has a smaller coverage than MR’s DL coverage; Furthermore, since the LP-WUR architecture may vary from one UE to another (OOK-based or OFDM-based LR).  We think it is necessary to provide an entry/ exit condition for LP-WUS monitoring mandatorily in SIB information if the NW is intended to support the LP-WUS feature. |
| Samsung | Yes | We believe the UE needs to be configured at least a threshold to compare. |
| Huawei | Yes | A specific threshold configured is clear and reliable. We understand in most cases, the coverage of LP-WUS is smaller than that of MR, the signaling overhead saved by making the field optional is marginal. |
| Sharp | Yes |  |
| CATT | No | If the MR and LR have the same coverage, the entry/exit condition for LP-WUS monitoring seems not always need to be configured. In this case, the UE can be aware the NW supports LP-WUS via other paramters in SIB1, e.g. LO related configurations, subgrouping related configurations for LP-WUS and so on. |
| LGE | Yes | Even though the MR and LR have the same coverage, having consistent UE behavior seems more desirable. |
| Xiaomi | Yes | This has been discussed on the online meeting many times. That is the reason we introduced the entry/exit conditions. We do not need to repete the discussions. |
| Ericsson | No | If the NW knows that LP-WUS coverage is provided in the complete cell, then entry/exit conditions are not needed, similar as with PEI. We do not understand the motivation from companies to insist on entry/exit conditions when they are not needed.  @oppo: we assume that there is always an “OFDM support”, “OOK supper” flag in lpwus-config-r19, or other means for the UE to determine whether WUR operation is allowed.  @lenovo: the WID specifies a minimum requirement but the coverage may be larger dependent on WUR type and configuration. Of course an entry/exit threshold will be provided when needed. But the question is: in case full cell coverage is provided, do you still want the UE to measure and check entry/exit, i.e. this may delay the use, and cause unnecessary measurements in the UE. |
| Apple | See comments | Following the existing configuration structure in RRC running CR, I understand the  For the entry/exit condition provision, it provides two informations:  <Info1> whether LPSS based LR or/and SSB based LR are enabled in current cell;  <Info2> the detailed threshold for the two separate LR types.  <Info1> should be mandatorily provided in order to help UE know which LR type is supported in the serving cell.  <Info2> could be optional for the entry condition (i.e. the MR RSRP threshold can be absent), and when the threshold is absent, we can assume the entry condition is always met and it’s up to UE implementation to monitor LPWUS. |
| vivo | Yes | Some companies thought if the MR and LR have the same coverage, the entry/exit condition for LP-WUS monitoring seems not always need to be configured in RAN2#125bis meeting.  According to the WID, the target coverage of LP-WUS and LP-SS shall be the coverage of PUSCH for Msg3. However, it depends on the real deployment on whether the coverage of LP-WUS and LP-SS is full coverage or partial coverage. For example, if the size of a cell is small, the coverage of LP-WUS and LP-SS can be full coverage. On the contrary, if the size of a cell is large, the coverage of LP-WUS and LP-SS can be partial coverage. In our understanding, the entry/exit condition should be mandatorily configured to make UE correctly check whether the entry/exit condition for LP-WUS monitoring is met or not.  Some companies may argue it should be optional to leave the flexibility to network configuration. But our understanding is network could either provide a very small value in case the network always allows UE to perform LP-WUS monitoring or provide the same value as the threshold of condition for RRM relaxation/offloading, which provides enough flexibility for network configuration.  But we are also fine to leave it as optional: when it is absent, the UE always assume the entry condition is met. |

**Summary:**

**11 companies provided the comments:**

8 companies think the entry/exit condition for LP-WUS monitoring is mandatorily configured if the network is intended to support the LP-WUS feature

3 companies think the entry/exit condition for LP-WUS monitoring is optional configured. When it is absent while there is other configuration for LP-WUS monitoring, UE assumes the entry condition is always met and it’s up to UE implementation to monitor LPWUS.

With this, Rapporteur suggests to follow the majority:

**Proposal 2: (8/11) The entry/exit condition for LP-WUS monitoring is mandatorily configured if the network is intended to support the LP-WUS feature**

**Open issue RRC-11 (essential): how to report the UAI for preferred time offset**

In RAN2#129bis meeting, it was agreed that:

* If configured, the UE can signal a preferred time offset via UAI signalling.
* Ask RAN1 for further information regarding their conclusions.

But how to report the UAI has not been decided. Rapporteur understands that the detailed design is the same as legacy, including the configuration, procedure, as well as prohibit timer, etc.

**Companies are invited to provide comments on whether the design of UAI reporting for preferred time offset is same as the legacy, e.g. including the configuration, procedure, as well as prohibit timer, etc.**

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| **Company** | **Yes/No** | **Comments, if any** |
| Lenovo | See Comments | We are okay to follow legacy design, but we may need to wait to hear back from RAN1 since there is an ongoing LS. |
| Huawei | Yes | The design of configuration and procedure can follow the legacy UAI mechanism. |
| Sharp | See comments | Generally, agree to follow legacy UAI reporting procedure, but whether prohibit timer is needed depends on whether the preferred time will be changed frequently which needs RAN1 input. |
| CATT | Yes | Prefer to follow the legacy UAI mechanism |
| LGE | Yes | Agree with Rapporteur’s view |
| Xiaomi | Yes | The legacy way can be reused. The details can be discussed. |
| Ericsson | Yes | The same principles should be used, and it should be motivated when something else is needed.  PS: RAN2 should have provided input to RAN1 about the preferred time offset signalled via UAI, i.e. this value should of course be later or equal to the minimum offset in UE capability. The UE capability should not be change via UAI signalling. |
| Apple | Yes | We should follow the legacy UAI mechanism. |
| vivo | Yes | We prefer to follow the legacy UAI mechanism. |

**Summary:**

**9 companies provided the comments:**

All companies agree to follow the legacy UAI mechanism.

2 companies think we need wait for RAN1 inputs, and one of them think whether prohibit timer is needed depends on RAN1 response on how frequent for the UAI change.

With this, Rapporteur suggests to follow the clear majority, i.e. reuse the legacy UAI mechanism. We could make the assumption from RAN2 point of view, and revisit it after RAN1 provides response.

**Proposal 3: (8/9) RAN2 assumes the design of UAI reporting for preferred time offset is same as the legacy, e.g. including the configuration, procedure, as well as prohibit timer, etc.**

* 1. Other open issue list

**Rapporteur provides the list of open issues as below, and the corresponding suggestions on how to address them. Some of them could be further discussed based on contributions or resoved based on further progress. Companies are invited to provide comments on whether it is open issue and whether the suggestions from reapporteur is accuracy enough.**

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| **Company** | **Comments** |
| OPPO | RRC-3: regarding dual DRX group, we see no blocking issues from UE perspective to support LP-WUS and dual DRX group together.  [Rapp]: Let’s discuss it.  RRC-5: no need to support empty UAI on offset, we see no motivation.  [Rapp]: Let’s discuss it.  For the RRM relaxation related issues, we think the summaries from RAPP is good, we can submit contributions to discussion for the coming meeting. |
| Ericsson | RRC-5: question for clarification, what does “report an empty UAI” mean? The UE omits a preferred offset value in the UAI signalling? This means that the UE does not have a preference, but can support any offset value?  [Rapp]: It is similar as legacy UAI, i.e. when reporting an empty UAI for time offset, it means that there is no preference on the time offset.  RRC-9: this is also discussed in RAN4  [Rapp]: Yes, and RAN4 has achieved some progress on it. |
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### LP-WUS in idle/inactive mode

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| **Index** | **Issue description** | **Rapporteur suggestion** |
| RRC-12 | **whether/how to enable/disable LP-WUS, e.g. by RRC/NAS**  As raised by Ericsson below. | **Issue Type:** not essential  **How to address it:** can be discussed based on companies’ contribution |

### LP-WUS in connected mode

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| **Index** | **Issue description** | **Rapporteur suggestion** |
| RRC-3 | **whether/how to support LP-WUS (including Option 1-1 and 1-2) and dual DRX group**  Editor’s NOTE: FFS on whether/how to support LP-WUS (including Option 1-1 and 1-2) and dual DRX group. | **Issue Type:** not essential but important  **How to address it:** can be discussed based on companies’ contribution |
| RRC-4 | **value range for offset UAI for LP-WUS monitoring for option 1-1 and option 1-2**  Editor’s NOTE: FFS on the value range for offset UAI for LP-WUS monitoring for option 1-1 and option 1-2. | **Issue Type:** essential  **How to address it:** can be easily addressed based on RAN1 inputs |
| RRC-5 | **whether it is allowed to report an empty UAI on offset for LP-WUS monitoring for both option 1-1 and option 1-2**  Editor’s NOTE: There is no conclusion on whether it is allowed to report an empty UAI on offset for LP-WUS monitoring for both option 1-1 and option 1-2. | **Issue Type:** not essential  **How to address it:** can be discussed based on companies’ contribution |

### RRM relaxation/offloading

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| **Index** | **Issue description** | **Rapporteur suggestion** |
| RRC-6 | **the value range of ThresholdPLP and ThresholdQLP for LR measurement based threshold for serving cell relaxation/offloading and neighboring cell relaxation**  Editor’s NOTE: FFS on the value range of *ThresholdPLP* and *ThresholdQLP* for LR measurement based threshold for serving cell relaxation/offloading and neighboring cell relaxation. | **Issue Type:** essential  **How to address it:** can be addressed based on RAN1/RAN4 inputs or companies’ contribution |
| RRC-7 | **FFS on exit condition for serving cell RRM relaxation**  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. | **Issue Type:** not essential but important  **How to address it:** can be discussed based on companies’ contribution |
| RRC-8 | **FFS on whether/how to reduce the threshold number for LP-WUS/WUR**  Editor’s NOTE: FFS on the relationship between the thresholds for serving cell relaxation and offloading. FFS on the relationship between the thresholds for serving cell relaxation/offloading, neighboring cell relaxation and *s-IntraSearchP/s-NonIntraSearchP*.  Editor’s NOTE: FFS on the relationship between the thresholds for serving cell relaxation/offloading, neighboring cell relaxation and entry/exit condition of using LP-WUS, [and potential pre-condition between RRM relaxation/offloading criteria and entry/exit condition of using LP-WUS]. | **Issue Type:** not essential but important  **How to address it:** can be discussed based on companies’ contribution |
| RRC-9 | **FFS on whether/how RRM relaxation is applicable for high priority frequency**  Editor’s NOTE: FFS on whether/how RRM relaxation is applicable for high priority frequency. | **Issue Type:** not essential but important  **How to address it:** can be discussed based on companies’ contribution |
| RRC-10 | **FFS on low mobility criteria**  Editor’s NOTE: FFS on “low mobility” criteria. | **Issue Type:** not essential not important  **How to address it:** can be discussed based on companies’ contribution |

**Proposal 4: RAN2 to consider the above open issues related to RRC for LP-WUS/WUR: RRC-3 to RRC-12.**

* 1. Others, please specify

Companies are invited to describe any other identified open issues not currently included within this document.

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| **Company** | **Other identified open issues? (please describe) or other comments** |
| Ericsson | * RAN2 discussed **LP-WUS enabling/disabling** (e.g. via NAS or RRC) but did not reach agreement.   [Rapp]: Thanks. A new open issue (RRC-12) is added as above.   * How to use **Rel-16 neighbour cell relaxation and LP-WUS** (perhaps that is covered with RRC-10?)   [Rapp]: if there is no further conclusion, I assume it is up to network configuration whether to use them together. But we could also discuss the low mobility in RRC-10.   * **LP-WUS and emergency PDU session** (impact on RAN3)   [Rapp]: Thanks. I think it could be discussed based on companies’ contribution. But it is not RRC related issue?   * **LP-WUS in *lastUsedCellOnly***(impact on RAN3)   [Rapp]: Thanks. I think it could be discussed based on companies’ contribution. But it is not RRC related issue?   * The need for intra-frequency neighbour cell measurements in urban environment aka need for **intra-frequency measurements on LR** (impact on RAN4)   [Rapp]: Thanks. I assume neighboring cell measurement based on LR is not in the WID scope?   * LP**-WUS for paging PDCCH reception in RRC\_CONNECTED** (e.g. ETWS/CMAS indication)   [Rapp]: Thanks. I assume it is similar as PEI, i.e. it is up to UE either to use idle/inactive LP-WUS for paging PDCCH reception. Any specification impact?   * **LP-WUS and dual DRX** (RRC3) |
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# Conclusion

In this contribution, we discuss some open issues related to RRC running CR for LP-WUS and collect the open issues for LP-WUS in RRC. Based on the discussion, the following proposals have been achieved:

**Open issue RRC-1 (essential): whether whether RRM relaxation configuration is provided in SIB2**

**Proposal 1: (11/11) RRM relaxation / offloading configuration is provided in SIB2.**

**Open issue RRC-2 (essential): whether entry/exit condition is mandatory or optional**

**Proposal 2: (8/11) The entry/exit condition for LP-WUS monitoring is mandatorily configured if the network is intended to support the LP-WUS feature**

**Open issue RRC-11 (essential): how to report the UAI for preferred time offset**

**Proposal 3: (8/9) RAN2 assumes the design of UAI reporting for preferred time offset is same as the legacy, e.g. including the configuration, procedure, as well as prohibit timer, etc.**

**Other open issues:**

**Proposal 4: RAN2 to consider the above open issues related to RRC for LP-WUS/WUR: RRC-3 to RRC-12.**

# References

1. R2-25xxx, RRC running CR for LP-WUS/WUR, vivo.