**3GPP TSG-RAN WG2 Meeting #131 R2-25xxxx**

**Bangalore, India, 25th – 29th Aug. 2025**

**Source: vivo**

**Title: Discussion summary and list of 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:

* [Post130][210][LPWUS] Running CR for 38.331 (vivo)

Intended outcome: Updated and reviewed the CR for endorsement, update the open issue list if needed, can also discuss open issues to form proposals to the next meeting

Deadline: Long

Companies are invited to provide comments/additional issues in the below table by 31st July, 2025

# Discussion

* 1. Easily addressed open issues

**Open issue RRC-6 (essential): the value range of ThresholdPLP and ThresholdQLP for LR measurement based threshold**

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

Editor’s NOTE: FFS on the value range of *ThresholdPLP* and *ThresholdQLP* for LR measurement based threshold for conditions for LP-WUS monitoring serving cell relaxation/offloading and neighboring cell relaxation.

Rapporteur understands the receiver sensitivities of LR and MR are roughly the same. Although the receiver hardware is degraded for LR, the number of information bits carried is smaller and the data rate is lower, which results in a similar overall sensitivity compared to MR. Thus, the value range for LR measurement thresholds should reuse the range corresponding to the absolute measured values for MR. With this, Rapporteur proposed the detailed value range is as below (as specified in the current running CR):

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| --- |
| The IE *ThresholdLP* is used to indicate a measured RSRP threshold for LP-WUS. Actual value of threshold = field value \* 2 [dBm].ThresholdP-LP ::= INTEGER (-80..0)The IE *ThresholdQ-LP* is used to indicate a measured RSRQ threshold for LP-WUS. Actual value of threshold = field value [dB].ThresholdQ-LP ::= INTEGER (-34..0) |

Besides, regarding the agreement made in RAN2#130 meeting as below,

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| * Full coverage for LP-WUS is not precluded, e.g., if there needs to be a threshold value so that the condition is always fulfilled for all LPWUS UEs.
 |

Rapporteur thinks the current value range for the MR based threshold or LR based threshold is low enough, i.e. full coverage for LP-WUS is naturally supported by configuring a low enough threshold.

**Companies are invited to provide comments on whether the above proposed value range for LR based threshold is enough. Otherwise, please provide your suggestion.**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments, if any** |
| OPPO | No | Maybe we need to ask RAN4 |
| NEC | Yes | Since it has been agreed to use measured value for all LR measurements based evaluation, we think the above proposed value range is reasonable.If no further input from RAN4/1, we can adopt it. |
| Huawei/HiSilicon | Please see comments | We need to check with RAN4 |
| Samsung | Yes | We can adopt the thresholds for now, and could modify them if there is further input from RAN4. |
| Xiaomi | See comments | Agree with companies that we need to confirm with RAN4 |
| Lenovo | Yes | Can update if there is further inputs from RAN4 |
| CATT | Yes | Slightly prefer to adopt it first and modify if RAN4 has further input in the future. |
| DOCOMO | Please see comments | Basically we are fine with the thresholds but it would be better to ask RAN4. |
| Qualcomm |  | RAN2 can make such assumption, and ask RAN1/RAN4 confirmation. If they have concern, RAN2 can change during ASN.1 review. |
| Ericsson | See comments | RAN2 agreed that full coverage is supported. Full coverage means that the UE can use LP-WUS directly after cell reselection without measurements to check if the entry condition is fulfilled (similar as with PEI). A simple and straightforward way is to make the entry condition optional: entryCondition-r19 EntryCondition-r19 OPTIONAL,Alternatively to a special value can be defined, i.e. when the special value is configured the entry condition is always fulfilled. But a special value is much more complex, impacts RAN4 and also requires more specification changes including serving offloading/relaxation. If companies do not see the benefit to omit entry measurements when there is full coverage, i.e. make the entry condition optional, then we are fine to do nothing. The alternative is way too complex for the problem solved.[Rapp] In RAN2#130 meeting, it was agreed:* The entry/exit condition for LP-WUS monitoring is mandatory in LP-WUS configuration, if the LP-WUS configuration is provided by the NW.

My understanding is the special value could be a lower enough threshold, which could reflect the full coverage. I assume the above proposed value range could cover this case. Otherwise, please feel free to provide any suggested value range.  |
| Apple | See comments | Agree with other companies that we can make it as assumption and check it with RAN4.  |
| ZTE | Yes | But agree with Qualcomm, need be confirmed with AN1/RAN4. |
| vivo | Yes | We can adopt the thresholds for now, and could modify them if there is further input from RAN4. |

**Summary:**

**13 companies provided comments:**

8 companies agree, or are fine to make the assumption in RAN2 and check with RAN1/RAN4.

4 companies think we need to check with RAN4.

1 company proposes to make the entry condition optional.

With this, Rapporteur suggests to follow the majority, i.e. make the assumption in RAN2, and check with RAN1/RAN4 whether they have any concern.

**Proposal 1: [8/13] RAN2 assumes the value range of *ThresholdPLP* and *ThresholdQLP* for LR measurement based threshold for entry/exit condition for LP-WUS monitoring and RRM relaxation/offloading is captured as below in RRC. It could be revised based on inputs from RAN1/RAN4, if any.**

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| The IE *ThresholdLP* is used to indicate a measured RSRP threshold for LP-WUS. Actual value of threshold = field value \* 2 [dBm].ThresholdP-LP ::= INTEGER (-80..0)The IE *ThresholdQ-LP* is used to indicate a measured RSRQ threshold for LP-WUS. Actual value of threshold = field value [dB].ThresholdQ-LP ::= INTEGER (-34..0) |

**Open issue RRC-13 (essential): how to determine the cell quality for LR based measurement.**

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

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| * 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.
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For MR measurement based entry/exit condition, it is obvious that how to derive the measurement quantity of a cell in multi-beam operations should follow the legacy MR measurement based Srelev/Squal, i.e. up to UE implementation, as in TS 38.304.

For LR measurement based entry/exit condition, how to derive the measurement quality of a cell in multi-beam operations should be determined. Rapporteur understands that the below LR measurement based RX level and cell quality value:

- Qrxlevmeas \_lr= current measured cell RX level value of the serving cell based on LR (RSRP).

- Qqualmeas \_lr = current measured cell quality value of the serving cell based on LR (RSRQ).

should be derived by UE implementation in multi-beam operations, i.e. no additional RRC parameters like *nrofSS-BlocksToAverage*, *absThreshSS-BlocksConsolidation* for LR measurement is needed.

**Companies are invited to provide comments on whether LR measurement based RX level and cell quality value should be derived by UE implementation in multi-beam operations.**

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| **Company** | **Yes/No** | **Comments, if any** |
| OPPO | No | The LR based cell quality should be derived in the similar way as MR based cell quality.  |
| Sharp | Comments | For cell selection in multi-beam operations, LR measurement quality of a cell can be up to UE implementation same as legacy.For cell reselection in multi-beam operations, the similar way as legacy also can be used for LR, i.e. based on RRC parameters.[Rapp] In this release, there is no case for LR measurement used for cell reselection. On the serving cell measurement is used for entry/exit condition.  |
| NEC | Yes | Cell selection in multi-beam operations is up to UE implementation while cell reselection should be based on the linear average using nrofSS-BlocksToAverage, absThreshSS-BlocksConsolidation.Here since LR measurements in this release is only used for serving cell, it could be up to UE implementation. |
| Huawei/HiSilicon | Yes | Can be left to UE implementation |
| Samsung | Yes | It could be up to UE implementation and no additional RRC parameters are required. |
| Xiaomi | Commnents | We are wondering whether this need to be confirmed in RAN1/RAN4 on how to derive the RSRP for LR. |
| Lenovo | Yes | It can be left to UE implementation. |
| CATT | Yes | Share the same view with NEC, LR measurements in this release is not used for cell selection or cell reselection and it is up to UE implementation how to obtain LR measurements in multi-beam operation. |
| DOCOMO | Yes | Share the same view as NEC. |
| Qualcomm | Yes | For UE implementataion simplicity, agree it can be left to UE implementation. |
| Ericsson | No, see comments | It is important to have predictable UE behavior, i.e. in case RAN2 decides to not introduce RRC parameters, then the UE shall use the highest beam measurement quantity value for LR, as in legacy for MR. @oppo: Our understanding is that LR is not used for cell reselection, i.e. only for entry/exit.  |
| Apple | Yes | Up to UE implementation. |
| ZTE | Yes |  |
| vivo | Yes |  |

**Summary:**

**14 companies provided comments:**

10(+1 Sharp) companies agree LR measurement based RX level and cell quality value should be derived by UE implementation in multi-beam operations, which is similar as legacy for cell selection, considering LR measurements in this release is not used for cell selection or cell reselection. One company of them (Sharp) thinks we should follow legacy.

1 companies think it should be based on RRC parameters.

1 companies thinks the UE shall use the highest beam measurement quality value for LR as legacy if there is no RRC paramters.

1 company asks whether we need to check with RAN1/RAN4.

With this, Rapporteur suggests to follow the majority, i.e. LR measurement based RX level and cell quality value should be derived by UE implementation in multi-beam operations.

**Proposal 2: [11/14] LR measurement based RX level and cell quality value should be derived by UE implementation in multi-beam operations.**

**Open issue RRC-14 (Not essential but important): on the terminology of LP-WUS/LP-SS/MR/LR.**

Based on the comments from Samsung and response from vivo as below:

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| **Samsung comments:**Now, RAN1 has finalized the LP-WUS CRs in 38.212, 213, 214, and 215 with using the following terminologies: -         LPSS      Low power synchronization signal -         WUS      Wake-Up Signal -         WUR      Wake-Up ReceiverAdditionally, the LS R1-2504888 from RAN1 explicitly states that:*As the reply to RAN2 LS in R1-2503616, RAN1 assumes that UE is not able to operate LR and MR simultaneously in Rel-19. RAN1 understanding is that the terminology of LR and MR operations are for discussion purpose and will not be specified** *LR operation is the UE operation for LP-WUS monitoring*
* *MR operation is the UE operation for all other NR signals/channels transmissions/receptions in connected mode*

**Based on this context, we suggest to update the terminologies as below:*** LP-WUS → WUS
* LP-SS → LPSS
* LO (LP-WUS Occasion) → WUS Occasion
* LR → WUR
* MR → removed

**Besides, the corresponding parameter names should be updated, such as:** * Q\_rxlevmeas\_lr → Q\_rxlevmeas\_wur
* based on LR → based on WUR
* lpxxx → wurxx
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On the other hand,

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| **Vivo response**Our understanding is no matter which term is used in the specification, it doesn’t imply any separate RAT, which is crystal clear enough based on either RAN1 and RAN2 specification. **On LP-WUS/WUR -> WUS/WUR, LR-> WUR:**As far as I know, RAN1 use “WUS/WUR” instead of in stead of “LP-WUS/WUR” to avoid using ”LP-”. Meanwhile, RAN1 also use “LPSS”. Frankly speaking, I don’t quite understand the logic in RAN1. Even within their own specification, there are inconsistencies — in some places they use the term “LP”, e.g. LPSS, while in other places they deliberately avoid it, e.g. WUS. So I don’t think it’s a good idea to align with such inconsistent usage in the RAN1 specification. Anyway, we are open to see other companies’ view in RAN2. **On MR-> remove:**We think there is no need for RAN1 to differentiate MR and LR in their specifications. But RAN2 specifications need to capture the entry/exit condition for LP-WUS monitoring and criteria for RRM relaxation/offloading, which include measurement on several cases:1. Measurement on SSB via LR
2. Measurement on SSB via MR
3. Measurement on LP-SS via LR

Thus, we think we need to use term “MR” to differentiate case 1 and 2 above, i.e. the field *cellEdgeEvaluationOnMR*and *cellEdgeEvaluationOnLR*. Otherwise, there may be ambiguity. Given that the RAN1 spec does not cover this part and this is a RAN2/RAN4-specific objective, as shown in WID below, I believe our first priority should be to ensure the specification is clear enough, and terminology alignment should be done on a best-effort basis.*•    Specify procedure and configuration of LP-WUS indicating paging monitoring triggered by LP-WUS, including at least configuration, sub-grouping and entry/exit condition for LP-WUS monitoring (RAN2, RAN1, RAN3, RAN4)**•    Specify further RRM relaxation of UE MR for both serving and neighbor cell measurements, and UE serving cell RRM measurement offloaded from MR to LP-WUR, including the necessary conditions (RAN4, RAN2)*Alternatively, we could discuss it, in case there are better suggestions that can both distinguish the cases above and align as much as possible with the RAN1 specification. |

Rapporteur suggests to discuss the terminology of LP-WUS/LP-SS/MR/LR in RAN2 specifications.

**Companies are invited to provide comments on whether agree to change the below terminologies (as well as the corresponding field):**

* LP-WUS → WUS
* LP-SS → LPSS
* LO (LP-WUS Occasion) → WUS Occasion
* LR → WUR

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| **Company** | **Yes/No** | **Comments, if any****Rapp: if partially yes, please elaborate them.** |
| OPPO | No | Prefer to keep the current terminologies. There is no harm to differenciate LR and MR. This will also introduce lots of change in RRC spec and maybe also in TS38.304 and TS38.300. Besides, in offloading case, we also need to describe the measurement on MR and measurement on LR.  |
| Sharp | No strong view and slightly prefer “Yes” | Normally it is better to align terminologies between RAN1 and RAN2 specs. It is running CR stage now, we have time to change if needed. |
| NEC | No | Share same view as vivo response.  |
| Huawei/HiSilicon | Please see comments | Prefer to keep current terminology |
| Samsung | Proponent. | We acknowledge that this change was deemed imminent right before the last meeting. However, we believe there is still time for discussion and a final decision.As RAN2, we need to emphasize the importance of maintaining terminology consistency with RAN1 specifications. This alignment is a critical and essential process for ensuring unified standards.Unlike the more complex issue of removing MR (below), the proposed changes above are relatively straightforward and could potentially be implemented as simple replacements.So we kindly ask you to consider the above proposals that would enhance coherence between RAN1 and RAN2 specifications. This alignment would ultimately make our work easier to understand and implement. |
| Xiaomi | No strong view | But prefer the current terminology that RAN2 is using. |
| Lenovo | No | Prefer to keep current terminology |
| CATT | Please see comments | We think it’s a good idea to align terminologies between RAN1 and RAN2 specs. But if we adopt the RAN1 terminologies, it will introduce a lot of changes in RRC spec and also in MAC, 304 and 300 specs. So we prefer to keep the current terminologies which RAN2 is using.To align terminologies between RAN1 and RAN2 specs, maybe we can add some Notes in specs to say those terminologies between RAN1 and RAN2 specs have the same meaning. |
| DOCOMO | No strong view but slightly prefer “Yes” | It would be better to align the terminologies among specs for readability. |
| Qualcomm | No | The term “WUS” is already used in RAN3 spec, e.g.38.413. |
| Ericsson | No | We think that the RAN1 choice of wording is unfortunate, e.g. WUS is used in LTE. We think the RAN2 terminology is better and should be kept. Perhaps we can convince RAN1 to change, or at least inform them about the wording used in RAN2. |
| Apple | See comments | We should keep the terminologies consistency across RAN1/2/3/4 spec. Comparing the term used in RAN1 spec and in RAN2 running CR, we think current RAN2 terminology is clearer.   |
| ZTE | No | Prefer LP-WUS as that in in TR. And we should also align with SA2.  |
| vivo | No | Prefer to keep the current terminology in RAN2.  |

**Summary:**

**14 companies provided comments:**

11 companies prefer to keep the current terminology in RAN2, which is better and clearer.

2 ot them think we should keep the terminology consistence across RAN1/2/3/4

One of them thinks we should convince RAN1 to change or inform them about the terms used in RAN2

One them thinks we could add some notes in the specification about these terminology misalignment.

3 companies prefer to change the current terminology in RAN2

With this, **Rapporteur suggests to follow the majority, i.e. keep the current terminologies in RAN2 specification. We could further address any issue, if any.**

**Companies are invited to provide comments on whether agree to remove the term “MR” in the specification:**

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| **Company** | **Yes/No** | **Comments, if any** |
| Sharp | No | Keep “MR” can make the description of measurement more clear. |
| NEC | No | Share same view as vivo response. |
| Huawei/HiSilicon | No |  |
| Samsung | Proponent | MR could be removed, as the specification readers can clearly distinguish between WUR and NR operations. For example:‘Measurement on SSB via WUR’ explicitly indicates WUR-related operation‘Measurement on SSB’ (without WUR reference) clearly implies this applies to normal NR operations and not meant to WUR.Similar modification could be done for all the parameters.  |
| Xiaomi | No |  |
| Lenovo | No |  |
| CATT | No | We think current RAN2 spec is more clearly. |
| DOCOMO | No | Share the same view as vivo response. |
| Qualcomm | No |  |
| Ericsso | No |  |
| Apple | No |  |
| ZTE | No |  |
| vivo | No |  |

**Summary:**

**13 companies provided comments:**

12 companies prefer to keep the term “MR” in the RAN2 specifications.

1 company prefer to remove the term “MR” from the RAN2 specifications.

With this, **Rapporteur suggests to follow the clear majority, i.e. keep the term “MR” in the RAN2 specifications.**

* 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** |
| Ericsson | RRC-10: The description of “FFS on low mobility criteria” is not very clear. In our understanding this is for the use case when LP-WUS and Rel-16 RRM relaxation are configured, i.e. Rel-19 RRM relaxation is not configured. This is not about introducing low mobility criteria in the entry condition (which I think has been discussed already). It needs to be clarified whether the LR can be used to evaluate the Rel-16 “not-at-cell-edge” and “low mobility” criterion.Proposed wording:**FFS on low mobility criteria (e.g. can LR can be used to evaluate Rel-16 “not-at-cell-edge” and “low mobility” criterion).**PS: This open issue overlaps with open issue 38304-2. In our understanding this open issues is not supposed to cover open issue 38304-2, i.e. low mobility part of RRM relaxation/offloading condition.[Rapp]: OK. Actually, there is no conclusion on whether to introduce “low mobility” criterion for Rel-19 entry/exit condition. This should be an open issue.Regarding what you raised is another issue. I have added it as RRC-15 below.  |
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### Closed open issues

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| **Index** | **Issue description** | **Status** |
| RRC-1 | **whether whether RRM relaxation configuration is provided in SIB2** | **Closed** |
| RRC-2 | **whether entry/exit condition is mandatory or optional** | **Closed** |
| RRC-4 | **value range for offset UAI for LP-WUS monitoring for option 1-1 and option 1-2** | **Closed** |
| RRC-9 | **FFS on whether/how RRM relaxation is applicable for high priority frequency** | **Closed** |
| RRC-11 | **how to report the UAI for preferred time offset**  | **Closed** |
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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** | **Issue Type:** not essential but important**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-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-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/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-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 |
| RRC-15 | **FFS on impact on R16 RRM relaxation criteria (e.g. can LR can be used to evaluate Rel-16 “not-at-cell-edge” and “low mobility” criterion).**As raised by Ericsson above. | **Issue Type:** not essential not important**How to address it:** can be discussed based on companies’ contribution |

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

* 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** |
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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-6 (essential): the value range of ThresholdPLP and ThresholdQLP for LR measurement based threshold**

**Proposal 1: [8/13] RAN2 assumes the value range of *ThresholdPLP* and *ThresholdQLP* for LR measurement based threshold for entry/exit condition for LP-WUS monitoring and RRM relaxation/offloading is captured as below in RRC. It could be revised based on inputs from RAN1/RAN4, if any.**

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| --- |
| The IE *ThresholdLP* is used to indicate a measured RSRP threshold for LP-WUS. Actual value of threshold = field value \* 2 [dBm].ThresholdP-LP ::= INTEGER (-80..0)The IE *ThresholdQ-LP* is used to indicate a measured RSRQ threshold for LP-WUS. Actual value of threshold = field value [dB].ThresholdQ-LP ::= INTEGER (-34..0) |

**Open issue RRC-13 (essential): how to determine the cell quality for LR based measurement.**

**Proposal 2: [11/14] LR measurement based RX level and cell quality value should be derived by UE implementation in multi-beam operations.**

**Other open issues:**

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

# References

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