**3GPP TSG-RAN WG2 Meeting #130 Draft R2-2504739**

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

**Agenda Item: 8.4.3**

**Source: vivo**

**Title: Discussion report on [AT130][205][LPWUS]**

**Document for: Discussion and Decision**

# 1 Introduction

This paper aims to capture the discussion report on the below offline discussion:

* [AT130][205][LPWUS] Proposals to address the open issues RRC-7,38304-3, RRC-8, 38304-4 (vivo)

 Intended outcome: Summary with proposals in R2-2504739 to address the listed open issues.

 Deadline: before Thursday CB

# 2. Discussion

## 2.1. RRC-7/38304-3

The open issue list from post meeting email discussion in [1] and [2] is as follows:

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| 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 |

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| **RRM relaxation/offloading:****Open issue 38304-3: 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. (Same as the open issue in RRC, i.e., FFS on exit condition for serving cell RRM relaxation)** |

And the online discussion is as follows:

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| R2-2504403 Discussion on RRM measurement relaxation and offloading in RRC\_IDLE INACTIVE CMCC discussion Rel-19 NR\_LPWUS-Core* Noted

*Proposal 8: No separate exit condition is needed, and the exit condition can be defined as failing to meet the entry condition.*R2-2503660 RRM Relaxation and Offloading in RRC\_IDLE/INACTIVE CATT discussion Rel-19 NR\_LPWUS-Core* Noted

*Proposal 1: (RRC-7/38304-3) The exit condition of MR measurement relaxation is only based on LR serving cell quality.*Discussion- NEC wonders whether CATT P1 means seperate exit condition, CATT think yes. - Lenovo think this issue depends on whether we merge these conditions with other conditions. Samsung share this view. - ZTE support CMCC proposal 8, do not see it critical to optimize exit condition. - Xiaomi think R4 is not adding new requirements for MR based measurements so it can still be used.  |

Discussion on whether define a separate exit condition other than ‘not fulfilling the entry condition’ for serving/neighboring cell RRM relaxation.

* 6 companies want to have separate exit condition.
* 5 companies donot want to have separate exit condition.
* Nokia think we need to have TTT.
* Ericsson it is up to NW to configure offloading and or relaxation. We need to discuss it case by case.

If we have relaxation only, may be no need to define exit. If we have relaxation and offloading, we need to discuss how to work.

* Xiaomi think for case 3, we donot need to exit condition as MR measurement is usable.
* QC think we need exit condition if merging with LP-WUS monitoring. There may be pingpong issue.
* CATT think if UE cannot get the MR measurement, but UE moves out of the cell. Vivo think NW could configure LR threshold for entry.
* LG agree with vivo. Pingpong issue is not a real issue. It can be resolved by NW configuration on LR based threshold. UE will exit the relaxation if MR or LR measurement is not met.
* ZTE agree with Xiaomi and vivo. RRM relaxation is optimization. We donot need to worry about the pingpong issue.
* Lenovo same view as xiaomi vivo LG. don’t see the problem for pingpong.
* Apple prefer separate exit condition, prefer to have LR based exit. HW agree. LR based exit should be mandatory.
* QC suggest to add an offset on entry. Nokia is fine. Ericsson think it is the same.
* Ericsson as any problem to introduce LR based exit condition. LG think there is no separate exit condition in R16, suggest to keep it same as R16. Ericsson think offload have separate exit condition.

**Rapporteur: There is no consensus whether to define a separate exit condition (MR and or LR based) or just rely on ‘not fulfilling the entry condition’ for serving/neighboring cell RRM relaxation**

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| **Offline agreement:** |

## 2.2 RRC-8/38304-4

The open issue list from post meeting email discussion in [1] and [2] is as follows:

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| 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 |

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| **RRM relaxation/offloading:****Open issue 38304-4: FFS relaxed measurement criteria/RRM offloading criteria is different from LP-WUS monitoring criteria. (Same as the open issue in RRC, i.e., FFS on whether/how to reduce the threshold number for LP-WUS/WUR)** |

And the corresponding proposal is as follows:

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| R2-2504678 Discussion on RRM measurement in RRC IDLE and INACTIVE OPPO discussion Rel-19 NR\_LPWUS-Core* Noted

*Proposal 2 Define the separate entry/exit condition for LP-WUS monitoring and serving cell & neighbour cell measurement relaxation.*R2-2503604 RRM measurement relaxation and offloading in RRC Idle Inactive Mode Samsung discussion Rel-19* Noted

*Proposal 4: For Rel19 LP-WUS, no additional merging of thresholds or functions is required.*R2-2503614 Discussion on RRM measurement relaxation and offloading in RRC\_IDLE/INACTIVE vivo discussion Rel-19 NR\_LPWUS-Core* Noted

*Proposal 3-1: (38304-4) Merge LP-WUS monitoring entry/exit condition and serving cell RRM offloading if only serving cell RRM offloading is supported in the camped cell or UE only supports serving cell RRM offloading.**Proposal 3-2: (38304-4) Merge LP-WUS monitoring entry/exit condition and Rel-19 serving/neighboring cell RRM relaxation if only Rel-19 serving/neighboring cell RRM relaxation is supported in the camped cell or UE only supports Rel-19 serving/neighboring cell RRM relaxation.**Proposal 3-3: (38304-4) It is up to network configuration to merge LP-WUS monitoring entry/exit condition with serving cell RRM offloading or Rel-19 serving/neighboring cell RRM relaxation if both are supported in the camped cell and UE supports both.*R2-2504066 Further discussion on the criteria for RRM measurement relaxation and offloading Huawei, HiSilicon discussion Rel-19 NR\_LPWUS-Core* Noted

*Proposal 1: The threshold(s) for RRM measurement fully offloading (CASE#1) should be higher than threshold(s) for RRM measurement relaxation (CASE#3).**Proposal 2: (38304-4/RRC-8) RAN2 to agree on the following cases for merging the thresholds of RRM measurement relaxation (CASE#3) or RRM measurement fully offloading (CASE#1) with LP-WUS monitoring:**• If the network configures the RRM measurement relaxation (CASE#3), the UE can regard the entry/exit condition of RRM measurement relaxation (CASE#3) as the entry/exit condition of LP-WUS monitoring, regardless of whether the RRM measurement fully offloading (CASE#1) is configured.* *• If the network ONLY configures the RRM measurement fully offloading (CASE#1), the UE can regard the entry/exit condition of RRM measurement fully offloading (CASE#1) as the entry/exit condition of LP-WUS monitoring.* |

**Rapporteur proposal 1: Merge LP-WUS monitoring entry/exit condition and serving cell RRM offloading if only serving cell RRM offloading is supported in the camped cell or UE only supports serving cell RRM offloading.**

**Rapporteur proposal 2: Merge LP-WUS monitoring entry/exit condition and Rel-19 serving/neighboring cell RRM relaxation if only Rel-19 serving/neighboring cell RRM relaxation is supported in the camped cell or UE only supports Rel-19 serving/neighboring cell RRM relaxation.**

**Rapporteur proposal 3: if both are supported in the camped cell and UE supports both:**

* **Option 1: It is up to network configuration to merge LP-WUS monitoring entry/exit condition with serving cell RRM offloading or Rel-19 serving/neighboring cell RRM relaxation**
* **Option 2: Merge LP-WUS monitoring entry/exit condition and Rel-19 serving/neighboring cell RRM relaxation**
* **Option 3: Not merge any.**

Discussion on whether to merge LP-WUS monitoring condition and RRM relaxation condition/criteria:

* Rapporteur: IDC, LG, Samsung, Nokia donot want to merge these two.
* IDC think the condition is for different objectives. NW can configure same value for these threhsolds.
* Ericsson if some threshold is not configured, it could also refer to others.
* Rapporteur: 10 companies want to merge these two.
* LG ask the motivation. Rapporteur: make it easy to be deployed.
* LG think we could rely on NW to configure the same value.
* HW think if we donot merge them, there are a lot of cases need to be discussed on the relationship between each other.
* Apple ask if only RRM relaxation threshold is configured, but threshold for LPWUS monitoring is configured.
* Samsung think the UE behaviour is different, so the threshold should be different.

**Rapporteur proposal 4: The corresponding threshold(s) of entry condition for serving cell RRM offloading should be higher than the threshold(s) of entry condition for R19 RRM relaxation (serving cell relaxation and neighboring cell relaxation).**

Discussion on the relationship between the thresholds for serving cell RRM relaxation and RRM offloading:

* QC think this should be ensured by NW configuration.
* SS strongly suggest to capture this in field description, as in R16.
* HW prefer to capture it in spec.
* Nokia prefer not to capture it in the spec.
* Samsung ask what is the motivation not to capture it in the spec.
* Nokia ask whether NW is allowed to configure only LP-WUS monitoring condition.

**Rapporteur proposal 5: The threshold of the entry condition for serving cell RRM offloading should be higher than or equal to the** **threshold to stop neighboring cell RRM measurement, i.e. maximum of {SIntraSearchP, SnonIntraSearchP}.**

Discussion on the relationship between the threshold of serving cell RRM offloading with SIntraSearchP/ SnonIntraSearchP:

**Rapporteur proposal 6: If merging LP-WUS monitoring and Rel-19 RRM relaxation is not agreed, the threshold of the entry condition for R19 RRM relaxation should be lower than or equal to the threshold of the entry condition for LP-WUS monitoring.**

**Rapporteur proposal 7: If merging LPWUS monitoring and serving cell RRM offloading is not agreed, the threshold of the entry condition for serving cell RRM offloading should be higher than or equal to the threshold of the entry condition for LP-WUS monitoring.**

Discussion on the relationship between thresholds of RRM relaxation/offloading and LP-WUS monitoring:

* NEC support this.
* Apple prefer equal to for P7.
* LG want to have NW implementation.
* Lenovo think if we choose not to merge. But it is anyway up to NW.
* Samsung donot think it is the error case, it is related to performance. Donot have strong view.
* HW think we should ensure there is no such case: UE is only monitoring LP-WUS but not have RRM relaxation/offloading. Lenovo support HW. LG think there is no harm, just no power saving gain. NEC think this is power saving WI, we are talking about power saving performance.
* ZTE think there is no need to specify these.
* Nokia think this is not the most important one.
* Ericsson think either to specify threshold restriction or not, it should be unified. Otherwise, it is strange. NEC agrees.

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| **Offline agreement:*** **The corresponding threshold(s) of entry condition for serving cell RRM offloading should be higher than the threshold(s) of entry condition for R19 RRM relaxation (serving cell relaxation and neighboring cell relaxation), if there is such configuration. Capture this in the field description. Details will be discussed in the running CR.**
* **It is up to NW to configure the condition for LP-WUS monitoring and/or [R19 serving/ neighboring cell RRM relaxation /R19 serving cell RRM offloading], as in the current RRC running CR.**
* **The threshold of the MR based entry condition for serving cell RRM offloading should be higher than or equal to the threshold to stop neighboring cell RRM measurement, which is the maximum of {SIntraSearchP, SnonIntraSearchP}. Capture this in the field description. Details will be discussed in the running CR.**
* **The threshold value of the entry condition for R19 RRM relaxation should be lower than or equal to the threshold of the entry condition for LP-WUS monitoring, if there is such configuration. Capture this in the field description. Details will be discussed in the running CR.**
* **The threshold value of the entry condition for serving cell RRM offloading should be higher than or equal to the threshold of the entry condition for LP-WUS monitoring, if there is such configuration. FFS whether/how to capture this in the field description.**
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# 3 Conclusion

Based on the discussion above, we have the following offline agreement:

**Proposal: RAN2 to agree the below offline agreement:**

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| **Offline agreement:*** **The corresponding threshold(s) of entry condition for serving cell RRM offloading should be higher than the threshold(s) of entry condition for R19 RRM relaxation (serving cell relaxation and neighboring cell relaxation), if there is such configuration. Capture this in the field description. Details will be discussed in the running CR.**
* **It is up to NW to configure the condition for LP-WUS monitoring and/or [R19 serving/ neighboring cell RRM relaxation /R19 serving cell RRM offloading], as in the current RRC running CR.**
* **The threshold of the MR based entry condition for serving cell RRM offloading should be higher than or equal to the threshold to stop neighboring cell RRM measurement, which is the maximum of {SIntraSearchP, SnonIntraSearchP}. Capture this in the field description. Details will be discussed in the running CR.**
* **The threshold value of the entry condition for R19 RRM relaxation should be lower than or equal to the threshold of the entry condition for LP-WUS monitoring, if there is such configuration. Capture this in the field description. Details will be discussed in the running CR.**
* **The threshold value of the entry condition for serving cell RRM offloading should be higher than or equal to the threshold of the entry condition for LP-WUS monitoring, if there is such configuration. FFS whether/how to capture this in the field description.**
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4 Reference

1. R2-2503765, Discussion summary and list of RRC open issue for LP-WUS WUR
2. R2-2503658, Summary of [Post129bis][208][LPWUS] Running CR for 38.304 (CATT)

5 RAN2 agreement on RRM measurement

**RAN2#126**

* For serving cell measurement offloading (i.e., serving cell measurement fully offloaded to LR and no serving cell measurement via MR is required), RAN2 should focus on specifying the offloading criterion for serving cell for UEs supporting LP-WUS, and assume that RAN4 will define the measurement offloading requirements for serving cell.
* RAN2 understand that the RRM measurement of the neighboring cell can only be performed by MR. Can discuss again if RAN1 inform us otherwise.
* RAN2 will further discuss the neighbor cell measurement relaxation criteria (if the UE is using LR to measure the serving cell), e.g., considering reuse Rel-16 criteria for ‘not at cell edge’ and ‘low mobility’.

**RAN2#127**

* RAN2 only discuss RRM measurement offloading/relaxation for LP-WUS UEs.
* For serving cell measurement offloading (i.e., there is no serving cell measurement by MR):
	+ - The entry conditions for serving cell measurement offloading can be defined as at least MR greater than a certain RSRP threshold, and LR could also be considered.
		- The exit condition is based on the LR measurement results.

**RAN2#127bis**

Working assumption

* For neighbor cell measurement relaxation for UEs capable of LP-WUS, do not define additional MR-based criterion over the R16 criteria. RAN2 assume ‘UE not at cell edge’ is reused, FFS on ‘UE with low mobility’.
* 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.

**RAN2#128**

**Agreements on RRM measurement relaxation**

* **The entry condition for serving cell RRM relaxation is at least ‘if serving cell quality measured by MR is higher than relaxation threshold, e.g. RSRP and/or RSRQ’. FFS if LR measurement is needed.**
* **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**
* **FFS if the entry condition for serving cell RRM measurement relaxation is the same as neighbour cell RRM measurement relaxation.**

**RAN2#129**

* The entry condition for MR serving cell RRM relaxation can include both MR and LR measurements.
* If LR threshold is configured, the entry condition is when both MR and LR measurement are above the configured thresholds.

**RAN2#129bis**

* RAN2 assumes for the entry/ exit conditions of serving cell measurement offloading and serving cell RRM measurement relaxation: separate MR thresholds (according to RAN1 agreement)/LR thresholds can be configured for different types of LP WUR if a cell supports both types of LRs (can revisit based on RAN1 and RAN 4 progress, if any).
* 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 mesasuring SSB threhold or both.
* It is up to NW to configure either serving cell relaxation or serving cell offloading or both in one cell.
* The metrics for RRM measurement offloading/relaxation criteria include (LP-)RSRP and optional (LP-)RSRQ.
* How to define LP-RSRP and LP-RSRQ is up to RAN1.
* The duplication between RAN2 and RAN4 specification on RRM relaxation and offloading should be avoided, details up to running CR rapporteur and companies’ review.
* Merge the entry/exit condition for Serving Cell RRM measurement relaxation and Rel-19 Neighboring Cell RRM measurement relaxation (higher priority frequency is separate discussion).