3GPP TSG RAN WG4 Meeting #106bis-e R4-23xxxx

Online, April 17 – April 26, 2023

**Title: Reply LS to RAN1 on low-power wake-up receiver architectures**

**Release: Rel-18**

**Work Item: FS\_NR\_LPWUS**

**Source: RAN4**

**To: RAN1**

**Cc:**

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**Attachments:** **None**

# 1 Overall description

In this meeting, to evaluate the RF impacts of LP-WUR architecture, RAN4 reach further basic agreements for next-step evaluation, some of ACS/ASCS and guard RBs related agreements have been attached in the Annex.

In addition, RAN4 also has the following question:

* Whether the case when the WUS/WUR is same as NR channel bandwidth, e.g. 5MHz WUS within 5MHz NR CBW (Max 25 RBs/15kHz SCS), is considered for LP-WUS/WUR evaluation.

# 2 Actions

**To** **RAN1:**

**ACTION:** 3GPP RAN4 respectfully asks RAN1 to take the above feedback into account.

# 3 Dates of next TSG-RAN WG4 meetings

TSG-RAN WG4 Meeting #107 22-26 May, 2023 Incheon, KR

TSG-RAN WG4 Meeting #108 21-25 August, 2023 Toulouse, FR

# Annex (Agreements for ACS/ASCS and Guard RBs evaluation) needs update as same as final WF

**Issue 2-2-1: Guardgap definition for LP-WUS**

Agreements:

* RAN4 use guard RBs (if needed) for LP-WUS, which is Granularity of RB. The traditional guardband for NR channel bandwidth defined in TS 101-1 should not be changed.
  + For case when WUS is smaller than NR channel bandwidth
    - For case 2-1, the LP-WUS guard RB is number RBs between LP-WUS and NR signals (edge of WUR RB location to nearest edge of eMBB RB)
    - For case 2-2, the WUS is placed at the edge of the NR channel bandwidth, i.e. the lowest/highest RB of WUS with guard RBs is aligned with the lowest/highest NR transmission bandwidth configuration in spec TS 38.101-1.
  + [For case when the WUS/WUR is same as NR channel bandwidth]
    - For case 1, the LP-WUS guard RBs is number RBs between LP-WUS and traditional guardband (edge of WUR RB location to Outermost of NRB)
    - RAN4 should further check with RAN1 for this case
* FFS whether the guard RBs should be symmetric within the WUS channel bandwidth.

**Issue 2-2-2: Whether guardgap is needed for LP-WUR**

Agreement:

* How many RBs for guard is FFS. RAN4 should further evaluate this number based on the cases identified in issue 2-2-1.
* The size of guard RBs from implementation perspective for LP-WUS should be determined in RAN4.

### Sub-topic 2-3 UE Adjacent Carrier/Sub-Carrier Selectivity (ACS/ASCS) evaluation

**Issue 2-3-1: General evaluation framework for both ACS and ASCS**

Agreement:

*  The following aspects can be starting point for further discussions
* Framework in RAN4 that the ACS and ASCS value can be evaluated based on the following aspects:
  + Typical filter characteristic, e.g. filter order, pass BW, cut-off frequency
  + Guard RB size within LP-WUS channel bandwidth
  + RF impairment can also be considered
* Averaged power antennation at ACS or ASCS frequency range
* FFS whether SINR of the wanted signal at detector input is needed
* FFS whether use ICS to instead ASCS
* Coexistence-simulation-based framework can also be considered
  + FFS on details of coexistence study (if needed) of LP-WUS
  + Coverage should be considered

**Issue 2-3-2: LP-WUS evaluation scenarios for study purpose**

Agreements:

* Consider a limited set of WUS scenarios in table below for study purpose in RAN4

**Table 1: LP-WUS evaluation scenarios**

|  |  |
| --- | --- |
| NR RF channel BW | **Decided in 2nd round** |
| Guardband of NR channel | Unchanged, defined in Clause 5.3.3 in TS 38.101-1 |
| WUS BW within NR channel | 1.44MHz, 5.04 MHz |
| WUS RB allocation (Note 1) | [6] RB in 1.44 MHz, total 8 RBs, or other number of RBs  [24] RB in 5.04 MHz, total 28 RBs, or other number of RBs |
| WUS placement within NR channel | 3 cases:   * case 1: Center; * case 2: edge; * case 3: between center and edge of NR channel |
| Guard RB size of LP-WUS | * 0 RB, 1RB at each side, 2RBs at each side, or other number of RBs. * Asymmetric guard RB can also be considered |
| ACS interferer | According to RF CBW |
| Filter characteristic | ~~Lowpass,~~ 2nd to 5th order Butterworth  Both analog and digital filter can be considered |
| Filter passband BW | At least WUS bandwidth (number of RBs), depends on guard RB size |
| LO frequency | Case 1: In the middle of WUS (modeling fixed WUS position)  Case 2: In the middle of RF channel (modeling flexible WUS location) |
| Target ACS | TBD |
| Target ASCS | TBD |
| Target WUS SNR | TBD |
| RF impairment | FFS |
| Note 1: the maximum number of allocated WUS RBs, depends on how many Guard RBs are needed. 5MHz WUS within 5MHz NR CBW is not considered currently. | |

### Sub-topic 2-5 BS RF impacts

**Issue 2-5-1: Whether and which power boosting level RAN4 should study LP-WUS power boosting**

Proposals:

* + Option 1: RAN4 should study the power boosting assumed by RAN1, to check whether the values are feasbible from RAN4 perspective
  + Option 2: other

Proposed Agreements:

* + Option 1

**Issue 2-5-3: other gNB impacts**

**Agreements:**

* RAN4 recommends RAN1 to prioritize signal design which allow re-use of current gNB HW.