**3GPP TSG RAN Meeting #105 RP-24XXXX**

**Melbourne, Australia, September 9-12, 2024**

## Status Report to TSG

**Agenda item:** 9.3.1.4

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **WI / SI Name** | Low-power wake-up signal and receiver for NR (LP-WUS/WUR) | | | | |
| included in this status report | Study Item:  No | Core part:  Yes | Performance part:  Yes | | Testing part:  No |
| **Acronym** | NR\_LPWUS | | | | |
| **Unique ID** | 1020094 | | | | |
| **TSG Tdoc of latest approved WI/SI description (if any)** | [RP-240801](https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_103/Docs/RP-240801.zip) | | | | |
| **Target Completion Date**  **(indicate if changed)** | Study Item:  N/A | Core part: 09/2025 | Performance part: 03/2026 | Testing part: N/A | |
| **Overall Completion level** | Study Item:  n/a | Core part:  30% | Performance Part: 0% | Testing part: N/A | |

Note: Overall completion level percentage numbers should use one of the colors below:

* xx%: Normal progress, no RAN plenary action needed
* xx%: Progress behind schedule, may need RAN plenary intervention. If so, SR should clearly define requested action
* xx%: Progress critically behind, RAN plenary shall intervene. SR should define requested action

**Source:**

|  |  |  |
| --- | --- | --- |
| **Leading WG** | | RAN 1 |
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## 1 Work plan related evaluation

|  |  |
| --- | --- |
| **Do you want to modify the time budget for this WI/SI compared to what was endorsed at the last RAN meeting?** | **No** |

*If you answered No: Then please remove the Excel file from the zip file of this status report.*

*If you answered Yes: Then please fill out the attached Excel template to request a modification of the time budgets for your WI /SI. The Excel table has to be filled out for all affected RAN WGs and up to the target date of the WI/SI. The basis are the endorsed time budgets of the last RAN meeting. Please highlight all changes of the values.  
 One time unit (TU) corresponds to ~ 2 hours in the meeting.  
 If this status report covers a WI with Core and Performance part, then please have one line for each in the attached Excel table.  
 Note: If no Excel table is attached, then this means no time budget change.*

**Additional explanations/motivations for the time budget changes in the attached Excel table:**

## 2. Detailed progress in RAN WGs since last TSG meeting (for all involved WGs)

NOTE: Agreements and Open issues impacted cross-TSG aspects shall be explicitly highlighted

## 2.1 RAN1

#### 2.1.1 Agreements

##### **RAN1#118: LP-WUS and LP-SS design**

**Agreement**

For RRC idle/inactive state, support the following option for at least indicating subgroup information using LP-WUS:

* Option 2: A LP-WUS indicates a codepoint value corresponding to one or more subgroup(s) from N subgroups for part of, one or more POs
  + UE monitoring one or more MOs (up to X MOs) for the same beam within an LO is supported
    - Value of X is larger than 1. FFS on additional details of X.

**Agreement**

[H][FL1] Proposal 3.1-1: Confirm the Working Assumption that OOK-4 with M=4 for 15KHz SCS is supported for LP-WUS.

|  |
| --- |
| **Agreement**  For OOK-4 with M >1, support M=2 & M=4 ~~(working assumption)~~ for LP-WUS.   * M=4 for 15KHz SCS * M=4 for 30KHz SCS (working assumption) * FFS M=1 for OOK-4 |

**Agreement**

Regarding the LP-WUS information to trigger PDCCH monitoring of RRC connected UEs (for non-CA case), select at least one from the following

* Option 1: A bitmap with each bit corresponding to [one or more] UEs
* Option 3: A codepoint value corresponding to [one or more] UEs
* FFS details for extension of option 1 and/or 3 when UE is configured with CA

**Agreement**

For overlaid OFDM sequences for LP-WUS, support option 1-1 for OOK-4 M>1.

* Option 1-1: overlaid sequence(s) are the sequence(s) of an OOK on symbol before DFT/LS processing

**Agreement**

For overlaid OFDM sequences for LP-WUS, further down-selection between following two options for OOK-1 and OOK-4 with M=1(if supported)

* Option 1-1: Overlaid sequence(s) are the sequence(s) of an OOK on symbol before DFT/LS processing
* Option 2: Overlaid sequence(s) are the sequence(s) of an OFDM symbol before IFFT processing
* Note: Different options for OOK-1 and OOK-4 with M=1 (if supported) is not precluded – in which case, it should be deemed necessary

**Agreement**

The number of binary LP-SS sequences is 4.

**Agreement**

To determine the binary sequences for LP-SS, the evaluation assumes the following:

* Sync accuracy: timing estimation error smaller than T us for P=90 % of the time for at least SNR=-3dB and SNR=-6dB (lower priority),
  + T=2us(optional), 5us for OOK-1
  + T=1us(optional), 2us for OOK-4 with M=2
  + T=0.5us(optional), 1us for OOK-4 with M=4
  + Other values of SNR, T, M are up to company report.
  + Additionally, companies can submit results on SINR with details on how the interference was modelled.
  + Assume one-shot estimation
  + The time error is based on 20ppm maximum frequency error for the detection of the first LP-SS
  + Note: Companies can assume other values inside of 20ppm maximum as long as the values are justified
* RRM measurement accuracy: measurement accuracy within range ± XdB for Q=90% measurements based on Y LP-SS samples within a period comparable to Z=the length of I-DRX cycle that is larger or equal to 1.28s for at least SNR=-3dB and SNR=-6dB (lower priority), X, Y, and Z is up to company report, other values of SNR are up to company report.
  + As a starting point, the time error is based on 5-10ppm residual frequency error.
  + Note: 5-10ppm assumes frequency error correction is performed, e.g., RTC calibration and/or MR assistance
  + Note: Companies can assume other values outside of 5-10ppm as long as the values are justified
* The frequency error: up to company report
* Sampling rate: 3.84MHz (optional) or 7.68MHz assumed for 30kHz SCS.
* Channel: AWGN and TDL-C 300ns is assumed.
* Consider cross-correlation for 4 binary sequences under time and frequency error
* Companies are encouraged to provide details on other additional simulation assumptions, high level description of their receiver algorithm, and assessment on power consumption

**Agreement**

For OOK-based LP-WUR, the LP-WUS design assumes the following:

* As starting point, the time error is based on the 5-10ppm residual frequency error after frequency error correction without considering impact of drift.
* The frequency error: up to company report.
* Note: 5-10ppm assumes frequency error correction is performed, e.g., RTC calibration and/or MR assistance
* Note: Companies can assume other values outside of 5-10ppm as long as the values are justified

**Agreement**

As a starting point, for both time error and frequency error, the overlaid OFDM sequence design of LP-WUS assumes that the residual frequency error is 0.1-5ppm for OFDM-based LP-WUR after frequency error correction without considering impact of drift.

* Note: Companies can use any value within the above range with justification on the value (including impact on power consumption)

**Agreement**

Support Manchester coding for LP-WUS

* FFS other coding schemes

##### **RAN1#118: LP-WUS operation in IDLE/INACTIVE modes**

**Agreement**

The definitions of LP-RSRP and LP-RSSI for LP-RSRQ are updated as follows:

LP-RSRP is the linear average of received power of LP-SS in OOK ON symbols over the frequency resources defined by the number of REs that carry LP-SS.

LP-RSSI is the linear average of total received power in ON and OFF LP-SS OOK symbols over the frequency resources defined by the number of REs that carry LP-SS.

**Agreement**

At least support 1:1 association between LP-WUS MO(s)/LP-SS transmissions and SSB beams.

**Agreement**

For the wake-up delay, consider the following options:

Option 2: UE reports one value from X candidate values for the wake-up delay via UE capability reporting.

* FFS: X is 2, 3, 4

Above applies for IDLE/INACTIVE mode.

Definition of wake-up delay: Minimum gap time between LP-WUS reception and MR to start PDCCH monitoring

**Agreement**

For the maximum number of subgroups per PO (X), down-select from the following options in RAN1#118bis:

* Option 1: X = 8
* Option 2: X = 16
* Option 3: X = 32
* Option 4: X = 64
* Option 5: X = 128
* Option 6: X = 256

For decision in RAN1#118bis, companies are encouraged to provide the maximum number of information bits per LP-WUS (Z), the number of OFDM symbols occupied by LP-WUS per MO, the number of MOs for their preferred option.

**Conclusion**

There is no consensus in RAN1 on the support of dynamic PO.

**Agreement**

On the LO configuration for iDRX, offset value(s) between a LO and a reference PO/PF is/are configured.

* FFS: one or multiple offset values, and if multiple offset values are supported, how a UE decides which value to use
* FFS: the exact definition of the reference PF/PO and the detailed procedure for UE to determine the LO(s) corresponding to Option 1, 2, or 3 (if supported)
* (Working Assumption) For each UE, the periodicity of LO is the same as its iDRX cycle.
* If a UE receives a wake-up indication in a LP-WUS, consider the following alternatives
  + Alt 1: it monitors the PO associated with the offset.
  + Alt 2: it monitors the first PO after its reported wake-up delay.
  + Other alternatives are not precluded

Note: The PO mentioned above refers to legacy PO configured for the UE.

**Agreement**

Send an LS to RAN2 and RAN4 to convey the following

In RAN1, the common understanding is that UE may not support LP-WUS reception on all the bands supported by the UE. Request RAN2 and RAN4 to check if there is any issue and specification support needed for IDLE/INACTIVE UEs.

Final LS in R1-2407559.

**Conclusion**

RAN1 will not initiate work on entry/exit conditions based on RRM measurement and RRM measurement offloading/relaxation conditions unless triggered by RAN2 and RAN4

##### **RAN1#118: LP-WUS operation in CONNECTED modes**

**Agreement**

For option 1-2 of LP-WUS CONNECTED mode operation, the followings are assumed from RAN1 perspective.

* LP-WUS monitoring outside at least legacy C-DRX active time according to the LP-WUS monitoring configuration to trigger PDCCH monitoring.
* UE is configured with legacy C-DRX configurations as Rel-18
* UE is expected to be configured with LP-WUS monitoring configuration (periodicity and offset can be different from those from C-DRX configuration)
  + FFS potential restriction for LP-WUS configuration in relation with C-DRX configuration
* LP-WUS triggers the start of a timer during which UE monitors PDCCH
  + FFS the timer is existing timer and/or new timer
* UE PDCCH monitoring behaviors related to other legacy DRX timers are not affected
  + drx-InactivityTimer, drx-RetransmissionTimerDL, drx-RetransmissionTimerUL, drx-HARQ-RTT-TimerDL, drx-HARQ-RTT-TimerUL
* No impact on RRM/RLM/BFD measurement requirements is assumed
* For periodic CSI/L1-RSRP reporting, UE can be configured with one of the following (same as Rel-16 DCP and option 1-1)
  + Periodic CSI/L1-RSRP is not reported if UE is not indicated to wake-up
  + Periodic CSI/L1-RSRP is periodically reported regardless if UE is indicated to wake-up or not
* UE PDCCH monitoring is not triggered by legacy C-DRX cycle and drx-onDurationTimer when monitoring LP-WUS

**Working Assumption**

From RAN1 perspective, for RRC CONNECTED mode, PDCCH monitoring is triggered by LP-WUS with C-DRX configuration

* Support Option 1-1: LP-WUS monitoring according to the LP-WUS monitoring configuration before drx-onDurationTimer to trigger the starting of the drx-onDurationTimer.
* Support Option 1-2: LP-WUS monitoring outside at least legacy C-DRX active time according to the LP-WUS monitoring configuration to trigger PDCCH monitoring.
* FFS whether/how to support both Option 1-1 and Option 1-2 simultaneously configured for the same UE

Note: Above can be revisited considering RAN2 decisions.

**Agreement**

Select one of the following alternatives in RAN1#118bis

Alt 1: For RRC CONNECTED mode, UE reports one value for each SCS from X candidate values for the determination of the minimum time gap between LP-WUS reception and MR to start PDCCH monitoring via UE capability reporting.

* + FFS: X
  + FFS: definition of reported value

Alt2: For RRC CONNECTED mode, UE reports multiple values for each SCS from X candidate values for the determination of the minimum time gap between LP-WUS reception and MR to start PDCCH monitoring via UE capability reporting.

* + FFS: X
  + FFS: definition of reported value
  + Different minimum time gaps correspond to different sleep states
  + Companies are encouraged to details on how the reported values are to be used by the network

**Agreement**

LP-WUS is at least supported for the case where a UE is configured with CA in RRC CONNECTED mode

* FFS: DC

**Agreement**

For LP-WUS monitoring in RRC CONNECTED mode, SSB and/or CSI-RS can be the QCL source of LP-WUS

* FFS applicable QCL type(s)

#### 2.1.2 Remaining Open issues

* Remaining details of an LP-WUS design commonly applicable to both IDLE/INACTIVE and CONNECTED modes
  + Remaining details of OOK (OOK-1 and/or OOK-4) based LP-WUS with overlaid OFDM sequence(s) over OOK symbol
* For IDLE/INACTIVE modes
  + Remaining details of 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
  + Remaining details of LP-SS with periodicity with Yms for LP-WUR, for synchronization and/or RRM for serving cell.
    - Remaining details of LP-SS based on OOK-1 and/or OOK-4 waveform with or without overlaid OFDM sequences.
* For CONNECTED mode, remaining details of procedures to allow UE MR PDCCH monitoring triggered by LP-WUS including activation and deactivation procedure of LP-WUS monitoring

## 2.2 RAN2

#### 2.2.1 Agreements

##### **RAN2#127: Procedure and configuration of LP-WUS in RRC\_IDLE/INACTIVE**

* Baseline: The network does not need to be aware of whether the UE is monitoring LP-WUS or not in RRC\_IDLE/INACTIVE
* Separate entry/exit thresholds can be configured for OFDM-based and OOK-based WUR if a cell supports both types of LRs. Signalling details are FFS.
* Working assumption (can revisit if R1/R4 reached different conclusions): If the entry/exit conditions are configured, besides MR-based thresholds, LP-WUS monitoring entry condition can also include LR-based thresholds.
* The metrics for serving cell quality measured by MR/LR for entry condition includes (LP-)RSRP and optional (LP-)RSRQ.
* The metrics for serving cell quality measured by LR for exit condition includes (LP-)RSRP and optional (LP-)RSRQ.

##### **RAN2#127: RRM measurement relaxation and offloading in RRC\_IDLE/INACTIVE**

* 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#127: Procedures for LP-WUS in RRC\_CONNECTED**

* For option 1-2,
  + - After LP-WUS triggers the UE to perform PDCCH monitoring, the UE starts one timer. When the timer is running, the UE monitors PDCCH. FFS on the timer (e.g., newly defined timer or legacy timer.)
    - The timer is started at a time offset after receiving the LP-WUS indication for PDCCH monitoring. The range of time offset is left for RAN1.

#### 2.2.2 Remaining Open issues

* For IDLE/INACTIVE modes
  + Remaining details of 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
  + Remaining details of 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
* For CONNECTED mode, remaining details of procedures to allow UE MR PDCCH monitoring triggered by LP-WUS including activation and deactivation procedure of LP-WUS monitoring

## 2.3 RAN3

#### 2.3.1 Agreements

**🡺 New IEs should be introduced to support LP-WUS on NG, Xn and F1.**

#### 2.3.2 Remaining Open issues

* For IDLE/INACTIVE modes
  + Remaining details of 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

## 2.4 RAN4

#### 2.4.1 Agreements

##### **RAN4#112 RRM core requirements for LP-WUS/WUR**

**Issue 1-1-1: Cases/states to be considered for RRM relaxation and serving cell measurement offloading**

Agreement:

* Support case #3
  + For serving cell measurement, further discuss:
    - Option 1: Further discuss whether to combine the measurements across the two radios, i.e., MR and WUR
    - Option 2: From RAN4 requirement perspective, not consider combining the measurements across the two radios, i.e., MR and WUR
    - Option 3: It is up to UE implementation whether to combine the measurement across the two radios.
    - Other options are not precluded.

|  |  |  |  |
| --- | --- | --- | --- |
| RRM measurement case index | MR serving cell measurement | MR neighbouring cell measurement | LR measurement |
| #3 Relaxed case b | On with relaxation measurement | On with relaxation measurement | ON |

* + Note: In RAN4 understanding, the discussion of the related measurement criteria (i.e., whether to use the legacy or new criteria) is out of RAN4 responsibility.

**RAN4#112 Simulation assumptions and results**

**Issue 2-1-1: SINR setting**

Agreement:

* + As starting point for RAN4 RRM simulation purpose only, -3dB, 0.5dB, 2dB dB Ês/Iot value is used for serving cell for both OOK based and OFDM based LP-WUR.
    - The SINR value can be updated if any update on the noise figure value in RF session.
  + FFS the side condition for RAN4 requirement.

**Issue 2-1-1-1: SNR setting for serving and interference cell derivation from SINR setting**

Agreement:

* Consider two cells for RAN4 simulation: one serving cell and one interference cell.

Agreement:

* To derive SNR for serving cell and interference cell from serving cell Ês/Iot, a relationship for the SNR or transmission power between serving cell and interference cell need be pre-defined.
* Consider the SNR/transmission power of the interference cell is 9 dB or 6 dB lower compared with that of the serving cell. Other value can be considered.

**Issue 2-1-3: Time/frequency error**

Agreement:

*Residual frequency error:*

OFDM based receiver [5] ppm

OOK based receiver [ 10 20] ppm

**Issue 2-1-5: Measurement interval**

Agreement:

Use 320ms for SSB based LP-WUR firstly.

**Other agreements for simulation assumptions**

Table 1: General parameters

|  |  |
| --- | --- |
| **Simulation parameters** | **Comments/values** |
| Carrier frequency for Cell 1 and Cell 2 | Agreement: 2.6 GHz initially |
| Subcarrier spacing | 30KHz initially  TBD for 15 KHz |
| LP-SS/SSB measurement interval | LP-SS: 320 ms  SSB: 320 ms |
| LP-SS BW | 132 subcarriers for SCS=30kHz for LP-SS initially  TBD for 15KHz SCS |

Table 2: Cell-specific parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Cell 1 | Cell 2 |
| RF Channel number | - | Channel 1 | Channel 1 |
| NR-PSS, NR-SSS (OFDM based LP-WUR) | - | To be indicated by companies | To be indicated by companies |
| LP-SS |  | OOK-1; or  OOK-4 with M = [2,4]  Note: M value [2 4] are up to company selection | when Cell 1 uses OOK-1; OOK-1 or NR signal is used for Cell 2  when Cell 1 uses OOK-4,  OOK-4 with same M value as cell 1 or NR signal is used for Cell 2 |
| LP-SS pattern |  | [M sequence]  [Golden sequence]  [Computer search sequence]  Note: Company can simulate one or all of them | [M sequence]  [Golden sequence]  [Computer search sequence]  Note: Company can simulate one or all of them |
| Frequency offset relative to UE frequency reference | Hz | OFDM based receiver [5] ppm  OOK based receiver [ 10 20] ppm | N/A |
| SNR | dB | SNR setting for serving and interference cell are derived based on agreement of Issue 2-1-1-1 | |
| When Ês/Iot = -3 dB   * When SNR of cell 2 is 9 dB lower compared with cell 2;   SNR = [-2.7]   * When SNR of cell 2 is 6 dB lower compared with cell 2   SNR = [-2.4] | When Ês/Iot = -3 dB   * When SNR of cell 2 is 9 dB lower compared with cell 2;   SNR = [-11.7]   * When SNR of cell 2 is 6 dB lower compared with cell 2;   SNR = [-8.4] |
| When Ês/Iot = -0.5 dB  Note: Determine the SNR based on based on agreement of Issue 2-1-1-1 | When Ês/Iot = -0.5 dB  Note: Determine the SNR based on based on agreement of Issue 2-1-1-1 |
| When Ês/Iot = 2 dB  Note: Determine the SNR based on based on agreement of Issue 2-1-1-1 | When Ês/Iot = 2 dB  Note: Determine the SNR based on based on agreement of Issue 2-1-1-1 |
| Ês/Iot | dB | -3; -0.5dB; 2dB | N/A |

##### **RAN4#112: LP-WUS UE RF**

**Sub-topic 1-1 General**

**Issue 1-1-1: New RAN4 TR to capture simulation and analysis of LP-WUS receiver and requirements**

Agreement:

* RAN4 suggest having a new RAN4 TR to capture the simulations and analysis for LP-WUS RF.

**Issue 1-1-2: Performance metric for Rx RF requirements**

Agreement:

* 1% MDR for evaluation [and core requirements]
* FFS on the testability issue.

**Issue 1-1-3: Performance metric for Demodulation requirements**

Agreement:

* [1% or 0.1%] FAR as assumption for MDR result calibration.

**Issue 1-1-6: Specify FR2 LP-WUS RF requirements**

Agreements:

* Wait to RAN1 progress on FR2 LP-WUS work.

**Sub-topic 1-2 System parameters**

**Issue 1-2-1: Channel raster for LP-WUR**

Agreements:

* + RAN4 can further discuss and align understandings on whether new channel raster is needed for LP-WUS.
  + RAN1 and RAN2 status on how to indicate the centre operation frequency of LP-WUS will be helpful.

**Issue 1-2-3: number of RBs for LP-WUS with 15kHz SCS**

Agreements:

* + Leave RAN1 to make decision.
  + RAN4 can discuss assumption of RBs under 15kHz SCS for simulation

**Issue 1-2-5: Whether need to define CBW for LP-WUR?**

Agreements:

* + No need to define BW for LP-WUR

**Sub-topic 2-1 SNR simulation and values**

**Issue 2-1-1: Channel model to specify LP-WUS RF requirements**

Agreement:

* + Follow typical RF requirements approach, AWGN should be selected.

**Issue 2-1-2: Target SNR simulation condition**

Agreement:

* + Follow similar approach of MR NR, no repetition should be used when simulate target SNR.

**Issue 2-1-3: Whether RAN4 should conclude a target SNR first**

Agreement:

* Target SNR is the basis for many Rx requirements discussion. Group should conclude SNR definition and SNR values first.

**Issue 2-1-4: Target SNR value**

Agreements:

* + RAN4 further discuss target SNR value for LP-WUS
  + FFS single SNR for OOK-based and OFDM-based receiver

**Sub-topic 2-2 NF and REFSENS requirements**

**Issue 2-2-2: Baseline architecture for OOK-based LP-WUS**

Agreement:

* + use zero-IF receiver as a baseline architecture for envelop based LP\_WUR

**Issue 2-2-3: Baseline architecture for OFDM-based LP-WUS**

Agreements:

* + Wait for RAN1’s conclusion on the OFDM-based LP-WUR.

**Issue 2-2-4: whether different NF for OOK-based and OFDM-based**

Agreement:

* + Differentiate NF for OOK-based and OFDM-based receiver.

**Issue 2-2-9: MDR value for REFSENS test case**

Agreements:

* + FFS the MDR for conformance testing should be aligned with the value for RF requirement.

**Sub-topic 2-3 ASCS simulation and requirements**

**Issue 2-3-1: ASCS requirements value**

Agreements:

* + RAN4 further discuss how to specify ASCS requirement based on simulation outcome.

**Issue 2-3-2: Required number of guard RB for ASCS**

Agreements:

* + RAN4 further discuss the required number of guard RBs for ASCS requirement based on simulation outcome.

**Issue 2-3-3: Test parameters for ASCS**

Agreements:

* + RAN4 further discuss the test parameters for ASCS requirement.

**Sub-topic 2-4 ACS simulation and requirements**

**Issue 2-4-2: ACS requirements value**

Agreements:

* + RAN4 further discuss how to specify ACS requirements based on simulation outcome.
  + FFS same as MR, or further relaxed

**Issue 2-4-3: Required guard RB for ACS requirements**

Agreements:

* + RAN4 further discuss the number of guard RBs for ACS requirement based on simulation outcome.

**Issue 2-4-4: Test parameters for LP-WUR ACS case**

Agreements:

* + RAN4 further discuss the test parameters for ACS requirement.

**Sub-topic 4-1 Testability for UE RF requirements**

**Issue 4-1-1: General framework on LP-WUS testing**

Agreements:

* + RAN4 further discuss the high-level approach on how to achieve LP-WUS performance verification.

##### **RAN4#112: LP-WUS BS RF**

**Issue 1-1: Manufacture declaration on LP-WUS power boosting**

* WF
  + FFS on following options:
    - Option 1: Set the LP-WUS power boosting a complete manufacture declaration feature, including whether supporting LP-WUS power boosting and the supported boosting level.
    - Option 2: Minimum power boosting level in core specification together with manufacturer declaration in the conformance test specification.

**Issue 1-2: Concept of LP-WUS power boosting**

* WF
  + FFS on following options:
    - Introduce EPRE ratio to define LP-WUS power boosting, since it has the merit that power boosting does not vary with different CBWs.
      * Option 1: *The LP-WUS power boosting is the difference between the average power of LP-WUS REs (which occupy certain REs within a NR transmission bandwidth configuration and the average power NR REs (the NR carrier excluding the LP-WUS REs).*
      * Option 2: *The LP-WUS RB power dynamic range (or LP-WUS power boosting) is the difference between the average power of an LP-WUS RE (averaged power per RE based on all LP-WUS REs within a NR transmission bandwidth configuration) and the average power of a non-LP-WUS RE (averaged power from all REs from the NR carrier excluding the LP-WUS REs).*
    - Adopt following definition rather than introduce EPRE ratio.
      * Option 3: *The LP-WUS RB power dynamic range (or LP-WUS power boosting) is the difference between the average power of LP-WUS REs (which occupy certain REs within a NR transmission bandwidth configuration) and the average power over all REs (from both LP-WUS and the NR carrier containing the LP-WUS REs)*.

**Issue 1-3: Whether to preclude small CBW for consideration of LP-WUS power boosting**

* WF
  + FFS on following options:
    - Option 1: Preclusion on small CBW respective to different power boosting level and/or power degradation on NR signal can be considered for LP-WUS power boosting.
      * Option 1-1: Also introduce the maximum allowed power degradation as one of the core requirements for LP-WUS power boosting.
      * Option 1-2: Operator inputs on the tolerable power degradation can be considered for the determination on the CBW to be precluded.
      * Option 1-3: other option does not excluded.
    - Option 2: No need to preclude any CBW, only if the LP-WUS power boosting can be defined as dynamic range where the level is up to manufacturer declaration and 0dB as minimum core requirement.

**Issue 1-4: On applicable BS type for LP-WUS**

* WF
  + FFS whether all available BS types can be considered for LP-WUS due to the support of LP-WUS is optional and the power boosting level could be up to manufacturer declaration.
  + FFS whether only conductive based BS RF requirements should be defined for LP-WUS:

**Issue 1-5: On minimum value for LP-WUS power boosting**

* WF
  + FFS on the following options:
    - Option 1: If power boosting will be defined as EPRE ratio, use 3dB as minimum requirement.
    - Option 2: If power boosting will be defined as dynamic range, based on existing specification for OOK-1 waveform, the core requirement for the dynamic range should be limited to 3dB.
    - Option 3: Not to introduce minimum value for LP-WUS power boosting.

**Issue 1-6: Whether a cap for LP-WUS power boosting should be considered**

* WF
  + FFS on the following options:
    - Option 1: It should be considered as 3dB.
    - Option 2: It should be considered as 6dB
    - Option 3: Not to introduce maximum value for LP-WUS power boosting.

**Issue 1-7: Unwanted emissions**

* WF
  + The legacy BS unwanted emission requirements should apply to LP-WUS.

**Issue 1-8: Transmitted signal quality**

* WF
  + Option 1: Legacy transmitted signal quality requirements apply, no impact when BS transmitting LP-WUS signal.
  + Option 2: The OOK-based EVM should be defined for LP-WUS. FFS on how to specify this requirement with consideration of RAN1 waveform design.

**Issue 1-9: Multi-band operation**

* WF
  + FFS on multi-band operation.

#### 2.4.2 Remaining Open issues

* RRM：For IDLE/INACTIVE modes
  + Remaining details of 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.
  + Remaining details of LP-SS with periodicity with Yms for LP-WUR, for synchronization and/or RRM for serving cell.
  + Remaining details of requirements for further RRM relaxation of UE MR for both serving and neighbor cell measurements, and requirements for UE serving cell RRM measurement offloaded from MR to LP-WUR.
* RF：
  + Remaining details of UE low-power wake-up receiver requirements, at least REFSENS, ACS and ASCS requirements with consideration of possible new methodology to assess the low-power wake-up receiver performance
  + Study and if necessary specify or support by declaration, the corresponding BS requirements, e.g., dynamic range for LP-WUS/LP-SS.
* Demod：
  + Not started

## 2.5 RAN5

#### 2.5.1 Agreements

#### 2.5.2 Remaining Open issues

#### 2.5.3 Remaining Open issues with cross-WG dependencies

## 2.6 RAN6

#### 2.6.1 Agreements

#### 2.6.2 Remaining Open issues

## 3. Detailed progress in SA/CT WGs since last TSG meeting (for all involved WGs)

NOTE: This section only needs to be filled in for WI/SIs where there is a corresponding relevant WI/SI in SA/CT.

## 3.1 SAx/CTs

#### 3.1.1 Agreements with cross-TSG impacts

#### 3.1.2 Remaining Open issues with cross-TSG impacts

NOTE: This section should also flag any critical dependencies that need TSG attention.

## 4. References

NOTE: This can be e.g. a list of all related Tdocs in the affected WGs since last TSG, references to LSs, produced TRs/TSs, the work/study item description or status reports of previous TSGs.

**RAN1#118**

1. [R1-2405806](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2405806.zip) Discussion on LP-WUS and LP-SS Design FUTUREWEI
2. [R1-2405867](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2405867.zip) Signal Design of LP-WUS and LP-SS Huawei, HiSilicon
3. [R1-2405919](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2405919.zip) Discussion on LP-WUS and LP-SS design Spreadtrum Communications
4. [R1-2405966](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2405966.zip) Preliminary Assessment on Low-Power Wake-Up Receiver Tejas Networks Limited
5. [R1-2405996](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2405996.zip) Discussion on LP-WUS and LP-SS design CMCC
6. [R1-2406083](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406083.zip) Discussion on LP-WUS and LP-SS Design EURECOM
7. [R1-2406104](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406104.zip) Discussion on LP-WUS and LP-SS Design TCL
8. [R1-2406193](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406193.zip) Discussion on LP-WUS and LP-SS design vivo
9. [R1-2406222](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406222.zip) Signal design for LP-WUS and LP-SS OPPO
10. [R1-2406295](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406295.zip) Discussion on LP-WUS and LP-SS design Xiaomi
11. [R1-2406379](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406379.zip) Design of LP-WUS and LP-SS CATT
12. [R1-2406412](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406412.zip) Discussion on LP-WUS design ZTE Corporation, Sanechips
13. [R1-2406422](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406422.zip) LP-WUS and LP-SS design Nokia
14. [R1-2406480](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406480.zip) LP-WUS and LP-SS design Sony
15. [R1-2406498](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406498.zip) Discussion on LP-WUS and LP-SS design framework for Low power WUS InterDigital, Inc.
16. [R1-2406504](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406504.zip) Discussion on LP-WUS and LP-SS design Everactive
17. [R1-2406537](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406537.zip) Discussion on LP-WUS and LP-SS design NEC
18. [R1-2406583](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406583.zip) Discussion on LP-WUS and LP-SS design HONOR
19. [R1-2406597](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406597.zip) Discussions on LP-WUS and LP-SS design Ruijie Networks Co. Ltd
20. [R1-2406611](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406611.zip) Discussion on LP-WUS and LP-SS design LG Electronics
21. [R1-2406661](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406661.zip) Discussion on LP-WUS and LP-SS design Samsung
22. [R1-2406762](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406762.zip) LP-WUS and LP-SS design MediaTek Inc.
23. [R1-2406785](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406785.zip) Discussion on the LP-WUS and LP-SS design Panasonic
24. [R1-2406814](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406814.zip) Discussion on LP-WUS and LP-SS design Lenovo
25. [R1-2406850](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406850.zip) LP-WUS and LP-SS design Apple
26. [R1-2406881](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406881.zip) Discussion on LP-WUS and LP-SS design Sharp
27. [R1-2406941](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406941.zip) Discussion on LP-WUS and LP-SS design NTT DOCOMO, INC.
28. [R1-2407040](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2407040.zip) LP-WUS and LP-SS design Qualcomm Incorporated
29. [R1-2407059](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2407059.zip) LP-WUS and LP-SS design Ericsson
30. [R1-2407136](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2407136.zip) On LP-WUS and LP-SS design Nordic Semiconductor ASA
31. R1-2407287 Summary #1 of discussions on LP-WUS and LP-SS design Moderator (vivo)
32. R1-2407356 Summary #2 of discussions on LP-WUS and LP-SS design Moderator (vivo)
33. R1-2407420 Summary #3 of discussions on LP-WUS and LP-SS design Moderator (vivo)
34. R1-2407491 Summary #4 of discussions on LP-WUS and LP-SS design Moderator (vivo)
35. [R1-2405807](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2405807.zip) Discussion on LP-WUS Operation in IDLE/INACTIVE Modes FUTUREWEI
36. [R1-2405868](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2405868.zip) Procedures and functionalities of LP-WUS in IDLE/INACTIVE mode Huawei, HiSilicon
37. [R1-2405920](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2405920.zip) Discussion on LP-WUS operation in IDLE/INACTIVE modes Spreadtrum Communications
38. [R1-2405997](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2405997.zip) Discussion on LP-WUS operation in IDLE/INACTIVE modes CMCC
39. [R1-2406105](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406105.zip) Discussion on LP-WUS Operation in IDLE/INACTIVE modes TCL
40. [R1-2406194](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406194.zip) Discussion on LP-WUS operation in IDLE/INACTIVE modes vivo
41. [R1-2406223](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406223.zip) Further consideration on LP-WUS operation in RRC\_IDLE/INACTIVE modes OPPO
42. [R1-2406296](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406296.zip) Discussion on LP-WUS operation in Idle/Inactive modes Xiaomi
43. [R1-2406380](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406380.zip) System design and procedure of LP-WUS operation for UE in IDLE/Inactive Modes CATT
44. [R1-2406413](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406413.zip) Discussion on LP-WUS operation in IDLE/INACTIVE mode ZTE Corporation, Sanechips
45. [R1-2406423](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406423.zip) LP-WUS operation in IDLE/INACTIVE mode Nokia
46. [R1-2406481](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406481.zip) LP-WUS operation in IDLE / INACTIVE modes Sony
47. [R1-2406499](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406499.zip) Discussion on LP-WUS operation in IDLE/INACTIVE modes InterDigital, Inc.
48. [R1-2406519](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406519.zip) Discussion on LP-WUS operation in IDLE/INACTIVE modes Fujitsu
49. [R1-2406538](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406538.zip) Discussion on LP-WUS operation in RRC IDLE/INACTIVE mode NEC
50. [R1-2406567](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406567.zip) Discussion on LP-WUS operation in IDLE/INACTIVE modes KT Corp.
51. [R1-2406612](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406612.zip) Discussion on LP-WUS operation in IDLE/INACTIVE modes LG Electronics
52. [R1-2406662](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406662.zip) Discussion on LP-WUS operation in IDLE/INACTIVE modes Samsung
53. [R1-2406735](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406735.zip) Discussion on LP-WUS operation in IDLE/INACTIVE modes ETRI
54. [R1-2406763](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406763.zip) LP-WUS operation in IDLE INACTIVE modes MediaTek Inc.
55. [R1-2406786](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406786.zip) Discussion on LP-WUS operation in IDLE/INACTIVE modes Panasonic
56. [R1-2406815](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406815.zip) Discussion on LP-WUS operation in Idle/Inactive modes Lenovo
57. [R1-2406851](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406851.zip) LP-WUS operation in IDLE/INACTIVE modes Apple
58. R1-2406853 Summary #1 on LP-WUS operation in IDLE/INACTIVE mode Moderator (Apple)
59. R1-2406854 Summary #2 on LP-WUS operation in IDLE/INACTIVE mode Moderator (Apple)
60. R1-2406855 Summary #3 on LP-WUS operation in IDLE/INACTIVE mode Moderator (Apple)
61. R1-2407506 Summary #4 on LP-WUS operation in IDLE/INACTIVE mode Moderator (Apple)
62. [R1-2405869](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2405869.zip) Procedures and functionalities of LP-WUS in CONNECTED mode Huawei, HiSilicon
63. [R1-2405921](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2405921.zip) Discussion on LP-WUS operation in CONNECTED modes Spreadtrum Communications
64. [R1-2405998](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2405998.zip) Discussion on LP-WUS operation in CONNECTED mode CMCC
65. [R1-2406195](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406195.zip) Discussion on LP-WUS operation in CONNECTED modes vivo
66. [R1-2406224](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406224.zip) Further consideration on LP-WUS operation in connected mode OPPO
67. [R1-2406297](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406297.zip) Discussion on LP-WUS operation in Connected mode Xiaomi
68. [R1-2406381](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406381.zip) System design and procedure of LP-WUS operation for UE in CONNECTED Modes CATT
69. [R1-2406390](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406390.zip) Discussion on LP-WUS operation in CONNECTED mode Panasonic
70. [R1-2406414](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406414.zip) Discussion on LP-WUS operation in CONNECTED mode ZTE Corporation, Sanechips
71. [R1-2406424](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406424.zip) LP-WUS operation in CONNECTED mode Nokia
72. [R1-2406482](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406482.zip) LP-WUS operation in CONNECTED mode Sony
73. [R1-2406500](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406500.zip) Discussion on RRC CONNECTED mode LP-WUS monitoring InterDigital, Inc.
74. [R1-2406510](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406510.zip) Discussion on LP-WUS operation in CONNECTED modes Lenovo
75. [R1-2406539](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406539.zip) Discussion on LP-WUS operation in RRC CONNECTED mode NEC
76. [R1-2406613](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406613.zip) Discussion on LP-WUS operation in CONNECTED modes LG Electronics
77. [R1-2406663](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406663.zip) Discussion on LP-WUS operation in CONNECTED modes Samsung
78. [R1-2406736](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406736.zip) Discussion on LP-WUS operation in CONNECTED modes ETRI
79. [R1-2406764](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406764.zip) LP-WUS operation in CONNECTED modes MediaTek Inc.
80. [R1-2406852](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406852.zip) LP-WUS operation in CONNECTED modes Apple
81. [R1-2406883](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406883.zip) Discussion on LP-WUS operation in CONNECTED modes Sharp
82. [R1-2406943](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2406943.zip) Discussion on LP-WUS operation in CONNECTED mode NTT DOCOMO, INC.
83. [R1-2407042](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2407042.zip) LP-WUR operation in connected mode Qualcomm Incorporated
84. [R1-2407061](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2407061.zip) LP-WUS operation in CONNECTED mode Ericsson
85. [R1-2407104](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1\TSGR1_118\Docs\R1-2407104.zip) Discussion on LP-WUS procedures in Connected mode TCL Late submission
86. R1-2407301 FL summary #1 on LP-WUS operation in CONNECTED mode Moderator (NTT DOCOMO)
87. R1-2407378 FL summary #2 on LP-WUS operation in CONNECTED mode Moderator (NTT DOCOMO)
88. R1-2407516 FL summary #3 on LP-WUS operation in CONNECTED mode Moderator (NTT DOCOMO)

**RAN2#127**

1. R2-2406787 Discussion on procedure and configuration of LP-WUS in RRC\_IDLE/INACTIVE Huawei, HiSilicon
2. R2-2407240 Discussion on LP-WUS operation in RRC\_IDLE/INACTIVE modes InterDigital, Inc.
3. R2-2407156 LP-WUS operation in RRC\_IDLE and RRC\_INACTIVE LG Electronics Inc.
4. R2-2407096 LP-WUS operation in IDLE/Inactive state Qualcomm Incorporated
5. R2-2407396 LP-WUS in Idle and Inactive Ericsson
6. R2-2407013 LP-WUS in IDLE and INACTIVE Nokia
7. R2-2406730 Procedure and configuration of LP-WUS in RRC\_IDLE/INACTIVE Apple
8. R2-2406427 Discussion on LP-WUS WUR in RRC\_IDLE INACTIVE vivo
9. R2-2407543 Discussion on Procedure and configuration in RRC\_IDLE-INACTIVE NTT DOCOMO INC..
10. R2-2406772 Discussion on procedure and configuration of LP-WUS in RRC\_IDLE/INACTIVE OPPO
11. R2-2406447 Procedure and configuration of LP-WUS for IDLE and INACTIVE mode ZTE Corporation, Sanechips
12. R2-2406495 LP-WUS procedure in RRC\_IDLE INACTIVE NEC
13. R2-2406575 LP-WUS in RRC\_IDLE/INACTIVE CATT
14. R2-2406585 General considerations on the procedure for RRC\_IDLE\_INACTIVE Xiaomi Communications
15. R2-2406617 RAN2 aspects on LP-WUS/WUR in RRC Idle/Inactive mode Sony
16. R2-2406753 Discussion on LP-WUS operation in IDLE/INACTIVE mode Spreadtrum Communications
17. R2-2406802 Discussion on entry exit conditions for LP-WUS monitoring Sharp
18. R2-2406900 LP-WUS Operation in RRC\_IDLE/INACTIVE China Telecom
19. R2-2406985 LP-WUS operation in IDLE/INACTIVE modes CMCC
20. R2-2407127 Procedure and Configuration of LP-WUS in RRC Idle/ Inactive Lenovo
21. R2-2407310 Procedure and Configuration of LP-WUS in RRC Idle Inactive Mode Samsung
22. R2-2407357 Procedure of LP-WUS in RRC\_IDLE and INACTIVE HONOR
23. R2-2406496 LP-WUS RRM measurement NEC
24. R2-2406754 Discussion on RRM measurement relaxation and offloading in IDLE/INACTIVE mode Spreadtrum Communications
25. R2-2406803 Discussion on RRM measurement offloading and relaxation Sharp
26. R2-2406970 Discussion on RRM measurement relaxation and offloading in RRC\_IDLE INACTIVE CMCC
27. R2-2406285 RRM measurement relaxation and offloading in RRC\_IDLE or RRC\_INACTIVE Huawei, HiSilicon
28. R2-2406428 Discussion on RRM measurement relaxation and offloading in RRC\_IDLE/INACTIVE vivo
29. R2-2406448 RRM measurement relaxation and offloading in RRC\_IDLE and RRC\_INACTIVE mode ZTE Corporation, Sanechips
30. R2-2406576 RRM Relaxation and Offloading in RRC\_IDLE/INACTIVE CATT
31. R2-2406586 Discussion on RRM measurement relaxation for RRC\_IDLE\_INACTIVE Xiaomi Communications
32. R2-2406618 Discussion on RRM aspects for LP-WUS/WUR Sony
33. R2-2406731 RRM measurement relaxation and offloading in RRC\_IDLE/INACTIVE Apple
34. R2-2406739 Discussion on RRM measurement relaxation and offloading in RRC\_IDLE/INACTIVE mode China Telecom
35. R2-2406767 Discussion on RRM measurement in RRC IDLE and INACTIVE OPPO
36. R2-2406882 RRM measurement relaxation and offloading in RRC\_IDLE/INACTIVE Lenovo
37. R2-2407014 RRM measurement relaxation in RRC\_IDLE/INACTIVE Nokia
38. R2-2407098 LP-WUS RRM measurement relaxation and offloading Qualcomm Incorporated
39. R2-2407157 RRM relaxation and RRM offloading LG Electronics Inc.
40. R2-2407241 Discussion on RRM measurement relaxation and offloading InterDigital, Inc.
41. R2-2407311 RRM measurement relaxation and offloading in RRC Idle Inactive Mode Samsung
42. R2-2407397 LP-WUS and RRM measurements Ericsson
43. R2-2406587 Discussing on LP-WUS monitoring for RRC\_Connected Xiaomi Communications
44. R2-2406449 Procedures for LP-WUS in RRC\_CONNECTED ZTE Corporation, Sanechips
45. R2-2406577 Analysis on LP-WUS for RRC\_CONNECTED Mode CATT
46. R2-2406429 Discussion on LP-WUS WUR in RRC\_Connected vivo
47. R2-2406497 LP-WUS procedure in RRC\_CONNECTED NEC
48. R2-2406619 Considerations on LP-WUS/WUR in RRC Connected mode Sony
49. R2-2406717 Discussion on LP-WUS for RRC\_CONNECTED mode Huawei, HiSilicon
50. R2-2406732 Procedures for LP-WUS in RRC\_CONNECTED Apple
51. R2-2406768 Discussion on LP-WUS in RRC\_CONNECTED OPPO
52. R2-2406901 Discussion on LP-WUS in RRC\_CONNECTED China Telecom
53. R2-2406978 Discussion on LP-WUS operation in CONNECTED mode CMCC
54. R2-2407097 LP-WUS operation in CONNECTED state Qualcomm Incorporated
55. R2-2407134 LP-WUS in RRC Connected Mode Lenovo
56. R2-2407242 Discussion on LP-WUS operation in RRC\_CONNECTED mode InterDigital, Inc.
57. R2-2407286 Discussion on Procedures for UE MR PDCCH monitoring triggered by LP-WUS in RRC\_CONNECTED Mode LG Electronics Inc.
58. R2-2407312 Procedures for LP-WUS in RRC Connected Mode Samsung
59. R2-2407358 Discussion on LP-WUS in RRC\_CONNECTED HONOR
60. R2-2407398 LP-WUS in Connected Ericsson
61. R2-2407406 LP-WUS in RRC\_CONNECTED Noki
62. R2-2407512 Discussion on LP-WUS in RRC\_CONNECTED NTT DOCOMO INC..

**RAN3#125**

1. R3-244069 Work plan for Rel-19 WI on LP-WUSWUR (vivo)
2. R3-244070 Discussion on signaling design for LP-WUS subgrouping (vivo, NTT DOCOMO INC.)
3. R3-244513 Discussion on potential RAN3 impacts of LP-WUS (CATT)
4. R3-244424 Overview of RAN3 impacts of LP-WUS (Nokia )
5. R3-244095 (TP to TS 38.413, 38.473, 38.423) Discussion on LP-WUS subgrouping (ZTE Corporation)
6. R3-244605 Discussion on LP-WUS subgrouping (Samsung)
7. R3-244409 Discussion of LPWUS impacts on NG-RAN architecture (Ericsson)
8. R3-244076 (TP for TS 38.413 and TS 38.423) Discussion on Low-power wake-up signal and receiver for NR (Huawei)
9. R3-244096 [draft] LS on LP-WUS subgrouping (ZTE Corporation)
10. R3-244147 Support LP-WUS subgrouping (Qualcomm Inc.)
11. R3-244199 Initial discussion on LP-WUS subgrouping (NTT DOCOMO INC..)
12. R3-244425 Support of LP-WUS (Nokia )
13. R3-244514 (TP on BLCR for TS 38.300)Support of LP-WUS (CATT)
14. R3-244626 BLCR for TS 38.300 on support of LP-WUS (vivo)
15. R3-244410 Introduction of LP-WUS paging monitoring (Ericsson)
16. R3-244077 Introduction of low-power wake-up signal and receiver for NR (Huawei)
17. R3-244606 (TP to BLCR for TS 38.413, 38.423, 38.473) LP-WUS Assistance Information to support subgrouping (Samsung)
18. R3-244611 Discussion on support LP-WUS indicating paging monitoring (CMCC)

**RAN4#112**

1. R4-2411094 Further discussion on BS RF requirements for LP-WUS CATT
2. R4-2411095 Further discussion on system parameters for LP-WUS CATT
3. R4-2411227 Further consideration on general aspects for Rel-19 LP-WUS Huawei, HiSilicon
4. R4-2411228 Further consideration on UE RF REFSENS, ACS, ASCS requirements for Rel-19 LP-WUS Huawei, HiSilicon
5. R4-2411229 Further consideration on UE RF other Rx requirements for Rel-19 LP-WUS Huawei, HiSilicon
6. R4-2411230 Further consideration on UE RF testability issue for Rel-19 LP-WUS Huawei, HiSilicon
7. R4-2411231 Further consideration on BS RF for Rel-19 LP-WUS Huawei, HiSilicon
8. R4-2411361 Discussion on simulation assumptions for LP-WUR measurement CATT
9. R4-2411362 Discussion on RRM requirements for LP-WUS/WUR CATT
10. R4-2411449 On simulation assumption for LP-WUR based measurement Apple
11. R4-2411450 On RRM core requirements for LP-WUR Apple
12. R4-2411493 Discussion on core requirements for LP-WUS WUR OPPO
13. R4-2411494 Discussion on RX requirements of REFSENS for LP-WUR Spreadtrum Communications
14. R4-2411495 Discussion on systems parameters for LP-WUR Spreadtrum Communications
15. R4-2411538 views on requirements of the low-power wake-up receiver Sony
16. R4-2411616 Simulation assumptions and results for LP-WUS/WUR Xiaomi
17. R4-2411617 Discussion on RRM core requirements for LP-WUS/WUR Xiaomi
18. R4-2411645 On Low-power Wake-up Receiver for NR Apple
19. R4-2411653 System parameters for LP-WUR Nokia
20. R4-2411654 Fundamental RX requirements for LP-WUR Nokia
21. R4-2411655 Other RX requirements for LP-WUR Nokia
22. R4-2411656 Testability aspects of LP-WUR Nokia
23. R4-2411683 Discussions on RRM core requirements for LP-WUS/WUR NTT DOCOMO, INC.
24. R4-2411694 Discussion on UE RF requirements for LP-WUR Samsung
25. R4-2411730 (NR\_LPWUS-Core) Discussion on LP-WUS UE system parameters requirements CMCC
26. R4-2411731 (NR\_LPWUS-Core) Discussion on LP-WUS UE RF Rx requirements of REFSENS, ASCS and ACS CMCC
27. R4-2411732 (NR\_LPWUS-Core) Discussion on LP-WUS UE RF Rx requirements of IBB, OBB, intermodulation, spurious emissions and others CMCC
28. R4-2411733 (NR\_LPWUS-Core) Discussion on LP-WUS BS RF requirements CMCC
29. R4-2411762 (NR\_LPWUS-Core) Discussion on RRM impact of LP-WUR CMCC
30. R4-2411818 Topic summary for [112][223] NR\_LPWUS Moderator (vivo)
31. R4-2411894 Discussion on BS RF requirements for LP-WUS/WUR ZTE Corporation, Sanechips
32. R4-2411895 Discussion on system parameters for LP-WUS/WUR ZTE Corporation, Sanechips
33. R4-2411896 Discussion on REFSENS, ASCS, ACS for LP-WUR ZTE Corporation, Sanechips
34. R4-2411897 Discussion on receiver characteristics for LP-WUR ZTE Corporation, Sanechips
35. R4-2411898 Discussion on testability for UE RF requirements ZTE Corporation, Sanechips
36. R4-2412041 Discussion on RRM requirements for LP-WUS/WUR LG Electronics Inc.
37. R4-2412057 Discussion on LP-WUS general vivo
38. R4-2412058 Discussions on LP-WUS system parameters vivo
39. R4-2412059 Discussions on LP-WUS REFSENS, ASCS and ACS vivo
40. R4-2412061 Discussions on LP-WUS Testability vivo
41. R4-2412062 Discussions on LP-WUS BS RF requirements vivo
42. R4-2412121 Discussion on RRM core requirements for LP-WUS/WUR China Telecom
43. R4-2412275 Discussion on IBB and OBB requirements for LP-WUS LG Electronics France
44. R4-2412276 Discussion on REFSENS and ASCS for the LP-WUS/WUR LG Electronics France
45. R4-2412290 Consideration on simulation assumptions and results for LP-WUR vivo
46. R4-2412291 Consideration on RRM requirements for LP-WUR vivo
47. R4-2412441 Simulation assumptions and results for LP-WUS/WUR measurement OPPO
48. R4-2412505 Discussion on LP-WUS RRM requirement Ericsson
49. R4-2412506 Simulation on LP-WUS RRM measurement Ericsson
50. R4-2412531 RRM impact for Rel-19 LP-WUS/WUR Samsung
51. R4-2412595 BS RF requirements for low-power wake-up signal for NR Nokia
52. R4-2412669 Simulation assumption for LP-WUR measurement Huawei, HiSilicon
53. R4-2412670 Discussion on RRM requirements for LP-WUR Huawei, HiSilicon
54. R4-2412801 Discussion on LP-WUS RRM simulation assumptions and results Nokia
55. R4-2412802 Discussion on LP-WUS RRM core requirements Nokia
56. R4-2412835 Topic summary for [112][133] NR\_LPWUS\_UERF Moderator(VIVO)
57. R4-2412974 BS RF requirement overview for LP-WUS Ericsson
58. R4-2412975 On general issues for WUR Ericsson
59. R4-2412976 On system paramter for WUR Ericsson
60. R4-2412977 On WUR RF requirement testability Ericsson
61. R4-2412978 WUR RF requirement other than REFSENS Ericsson
62. R4-2412979 WUR RF requirement REFSESN ASC ASCS Ericsson
63. R4-2413041 Discussion on LP-WUS for core part ZTECorporation,Sanechips
64. R4-2413223 On UE Rx requirements for the LPWUR Qualcomm Incorporated
65. R4-2413324 Simulation assumptions for R19 LP-WUS MediaTek inc.
66. R4-2413325 Discussion on the RRM core requirements for LP-WUS MediaTek inc.
67. R4-2413409 Topic summary for [112][309] NR\_LPWUS Moderator (Huawei)
68. R4-2413452 RRM requirements for LP-WUR Qualcomm Incorporated
69. R4-2413511 Draft LS to RAN1 on power boosting for LPWUS Huawei
70. R4-2413512 Way Forward for [112][309] NR\_LPWUS Huawei
71. R4-2413898 Coffee break discussion minutes for [112][223] NR\_LPWUS Vivo
72. R4-2413899 WF for RRM core requirements for LP-WUSWUR Vivo
73. R4-2414309 WF on LP-WUS UE RF requirements Vivo

17.05.2021 minor adaptations for RAN #92e

28.01.2021 minor adaptations for RAN #91e

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20.04.2020 minor adaptations for RAN #88e

18.02.2020 minor adaptations for RAN #87e

14.11.2019 minor adaptations for RAN #86

18.08.2019 minor adaptations for RAN #85

12.05.2019 minor adaptations for RAN #84

27.02.2019 minor adaptations for RAN #83

21.11.2018 completion levels with colours added (for RAN #82)

v04.81 31.07.2018 simplification of template and addition of cross-TSG aspects (for RAN #81)

v04.80 21.05.2018 minor adaptations for RAN #80

v04.79 26.02.2018 minor adaptations for RAN #79

v04.78 18.11.2017 minor adaptations for RAN #78

v04.77 06.08.2017 minor adaptations for RAN #77

v04.76 15.05.2017 minor adaptations for RAN #76

v04.75 31.01.2017 minor adaptations for RAN #75

v04.74 28.10.2016 minor adaptations for RAN #74

v04.73 01.09.2016 adaptations for RAN #73 (time units in extra Excel table, RAN6 reporting included)

v04.72 26.05.2016 adaptations for RAN #72 (introduction of NR & GERAN TUs)

v04.71 10.02.2016 minor adaptations for RAN #71

v04.70 30.10.2015 minor adaptations for RAN #70

v04.69 12.08.2015 minor adaptations for RAN #69

v04.68 21.05.2015 minor adaptations for RAN #68

v04.67 01.02.2015 minor adaptations for RAN #67

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v03.62 11.11.2013 section 1.2.3 adapted for RAN #62

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