**3GPP TSG RAN meeting #97-e RP-22xxxx**

**Electronic Meeting, September 12-16, 2022**

## Status Report to TSG

**Agenda item:** 9.2.4

|  |  |
| --- | --- |
| **WI / SI Name** | Study on network energy savings for NR |
| included in this status report | Study Item: Yes | Core part: No | Performance part:No | Testing part:No |
| **Acronym** | FS\_Netw\_Energy\_NR |
| **Unique ID** | 940080 |
| **TSG Tdoc of latest approved WI/SI description (if any)** | RP-221443 |
| **Target Completion Date****(indicate if changed)** | Study Item: 12/2022 | Core part:  | Performance part:  | Testing part:  |
| **Overall Completion level** | Study Item: 45 % | Core part:  | Performance Part:  | Testing part:  |

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** | RAN1 |
| **Rapporteur** | **Name** | Yi Wang |
| **Company** | Huawei |
| **Email** | wangyi6@huawei.com |

## 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

##### 2.1.1.1 RAN1#109e

The following email discussions were carried out:

* [109-e-R18-NW\_ES-01] Email discussion and approval of TR skeleton
* [109-e-R18-NW\_ES-02] Email discussion on performance evaluation
* [109-e-R18-NW\_ES-03] Email discussion on NW energy saving techniques

The following were agreed via email discussion and/or GTW sessions:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Agreement**TR skeleton for TR 38.864 Study on network energy savings for NR is endorsed in R1-2205307.**Agreement**For evaluation purpose, the energy consumption modeling for a BS includes at least the following:* Reference configuration
	+ - FFS other details
		- Note FR1 and FR2 to be separately considered for detailed parameters
* Multiple power state(s) including sleep/non-sleep mode(s) with relative power, and associated transition time/energy
* Scaling method to be applied at least for non-sleep mode.
	+ - FFS other details including scaling for sleep mode

**Agreement**For evaluation purpose, the BS energy consumption model should at least include the power consumption of BS on slot-level.* Note that symbol-level power consumption to reflect different BW (or RB utilization) / time-occupancy / tx-rx direction of different symbols in a slot is considered.
	+ - FFS details (e.g. explicit symbol-level power modelling, scaling slot-level power to symbol level power for various cases, etc.)
		- Note: system simulation evaluations can be per slot regardless of detailed approach for calculating symbol-level power consumption.

**Agreement*** For evaluation, at least for non-sleep mode and TDD, the BS power consumption for DL and UL are separately modelled, allowing DL-only transmission or UL-only reception.
	+ - FFS: whether UL-only reception energy consumption model can be derived/simplified from DL-only transmission energy consumption model
* FFS: the impact of UL reception and/or DL transmission on sleep modes and associated transition time/energy
* FFS: whether/how to define an idle state, where BS is neither transmitting nor receiving but also doesn’t enter into any sleep mode or define it as sleep mode
* FFS: whether the model for FDD can be based on the model for TDD

**Agreement**For evaluation purpose, * Study how to define sleep modes and determine the characteristics for each mode from one or multiple of the below
	+ Relative power
	+ Transition time
	+ Transition energy
	+ Other approaches are not precluded
	+ Note: BS components that can be turned off can be considered for discussion purpose when defining the specific values of the characteristics for sleep modes.
* Study whether sleep mode is defined for DL(TX) and UL(RX) jointly or separately
* Study the assumption of order for BS entering/resuming from a sleep mode to another mode (sleep or non-sleep) and the associated transition time and energy, i.e. state machine which may have impact on the transition energy.

**Agreement**For evaluation, the scaling in a BS energy consumption model can be considered based on one or more of the following,* Number of used physical antenna elements, or TX/RX RUs
	+ FFS: Mapping between used TX/RX RUs and used antenna ports
	+ FFS: Mapping between physical antenna elements and TX/RX RUs
* Occupied BW/RBs for DL and/or UL in a slot/symbol in one CC
* number of CCs in CA
	+ FFS dependency of RF sharing
* number of TRPs
* PSD or transmit power
	+ FFS dependency on BW scaling
	+ FFS: PA energy efficiency value
* number of DL and/or UL symbols occupied within a slot
* FFS other domain scaling
* FFS scaling is linearly or else, for each domain

Above does not necessarily imply that BS energy consumption model that takes into account all listed scaling factors will be developed**Agreement**For BS energy consumption evaluation, in addition to the energy saving gain,* At least UPT/UE power consumption/access delay/latency should be considered for performance impact evaluation
* Note: this doesn’t necessarily mean that all the above are considered for all evaluation results. However, multiple KPIs are expected to be evaluated for a given technique. And this does not preclude to consider other KPIs when found appropriate for certain techniques/scenarios.

**Agreement**At least urban macro is prioritized for FR1. FFS the baseline deployment assumption for FR2.**Agreement*** FTP3 (0.5MB as packet size, 200ms as mean inter-arrival time), FTP3 IM (0.1MB as packet size, 2s as mean inter-arrival time) and VOIP can be considered in the evaluation
* FFS: with possible further prioritization, different model between DL and UL, and/or other traffic models that can be optionally considered.

FFS associated scenarios/configurations, e.g. C-DRX.**Agreement**For evaluation and BS energy consumption modeling purpose, for single CC case, at least the following in table should be considered for reference configuration* Note: other TX-RX RU number and corresponding BS antenna configuration can be considered in SLS assumptions

|  |  |  |  |
| --- | --- | --- | --- |
|  | Set 1 FR1 | Set 2 FR1 | Set 3 FR2 |
| Duplex | TDD | FDD | TDD |
| System BW | 100 MHz | 20 MHz | 100 MHz |
| SCS | 30 kHz | 15 kHz | 120 kHz |
| Number of TRP | 1 | 1 | 1 |
| Total number of DL TX RUs | 64 | (working assumption) 32 | 2 |
| Total DL power level | 55dBm | [49dBm] – to be further discussed and finalized in future meetings | 43dBm – to be further discussed and finalized in future meetingsEIRP limited to 78dBm – to be further discussed and finalized in future meetings |
| Total number of UL Rx RUs | 64 | (working assumption) 32 | 2 |

**Agreement**As a starting point,* macro cell BS for FR1 is assumed for energy consumption model.
* FFS: micro cell BS for FR2 is assumed for energy consumption model.

**Agreement**The evaluation baseline for energy saving study/evaluation for BS includes at least NR R15 mandatory without capability features. Optional features from R15 onwards (e.g. CA, MIMO) as well as implementation-based energy saving techniques should be explicitly reported and described if used in the evaluation baseline.* FFS: need of alignment for certain configurations/implementation-based schemes.

**Agreement*** Similar to UE power saving study, percentage of energy consumption reduction from the baseline is used to express BS energy saving gain.
* SLS is considered as baseline evaluation method. Other method, including numerical analysis and LLS can also be considered. At least one of the methods should be selected and used for evaluation of a specific technique (selection and criteria is up to proponent).

**Working assumption**For evaluation, for energy consumption modelling for FDD and the case of simultaneous DL transmission and UL reception for non-sleep mode, study the following with potential down-selection in RAN1#110* Option 1: the power consumption is the total of DL and UL power consumption
* Option 2: the power consumption for UL is neglected
* Other option is not precluded
* Note the DL (or UL) power consumption can be obtained using a same approach as that obtained from the DL (or UL)-only in TDD model

**Agreement**Further study techniques and enhancements for increasing time domain energy saving opportunities by the gNB, including (but not limited to) the following aspects:1. potential methods of reducing/adapting transmission/reception of common channels/signals, e.g. SSB, SIB1, other SI, paging, PRACH, and its impact to initial access procedure, cell (re)selection, handover, synchronization and measurements performed by the idle/inactive/connected UE;
	* potential methods of reducing transmission/reception of common channels/signals can include no- or reduced-transmission/reception, increased periodicity, enablement of on-demand transmission/reception of common channels/signals, or offloading of common channels/signals to other carriers or use of light or relaxed versions of common channels /signals
2. potential methods of reducing/adapting transmission/reception of periodic and semi-persistent signals and channels configuration such as CSI-RS, group-common/UE-specific PDCCH, SPS PDSCH, PUCCH carrying SR, PUCCH/PUSCH carrying CSI reports, PUCCH carrying HARQ-ACK for SPS, CG-PUSCH, SRS, positioning RS (PRS), etc.
3. semi-static and/or dynamic cell on/off in one or more granularity, e.g. /subframe/slot/symbol; some examples are:
	* Cell/network node activation request by the UE, for example using signal/channel from UE for gNB’s wake-up request
	* enhancements to L1/L2 based mobility to efficiently enable a network node (e.g. TRP, repeater) on/off operation within a cell (within network energy saving SI scope)
	* signaling enhancements for indication of semi-static and/or dynamic cell/subframe/slot/symbol on/off duration
4. support of periodic and/or on-demand reference signal(s) from the gNB to aid discovery of a cell;
5. dynamic adaptation of UE C-DRX configurations in a UE-group or cell-specific manner
6. Mechanism to utilize potential energy saving states or sleep modes and the transition between states from leveraging cell on/off opportunities
	* including studies of waking up gNB due to user traffic, or user density, or gNB receiving wake up signal
	* including technique to allow discovery and measurement of cells in sleep or dormant states
7. UE assistant information facilitating BS time domain adaptation

Note: For all techniques above, study of time domain techniques is applicable for single component carrier and multi-component carrier cases. Use of UE grouping and its interaction with proposed techniques can be considered.**Agreement**Further study techniques and enhancements for frequency resource usage adaptation by the gNB, including (but not limited to) the following aspects:1. For operations with single-carrier or within a single CC
2. Enhancements to dynamic bandwidth adaptation
	* + including adjustments to RBs and/or BWP used by (Rel-18) UEs for transmission and reception, reducing BWP switch delay, UE-group BWP switching, and joint adaptation of transmission bandwidth and power spectral density
3. supporting UE group-common BWP or cell-specific BWP or dedicated BWP for network energy savings, and related BWP switching mechanism
4. Enhancements for the case of frequent BWP switching such as resource configurations for SPS PDSCH and Type-2 CG PUSCH
5. For operation with multi-carrier
6. enablement of reducing/adapting common channels/signals for some CC in multi-carrier operations
	* + including enablement of SSB-less secondary cell operation for some CC in case of inter-band CA. For SSB-less cell operation enablement, study the conditions and restrictions required for the operation and the related procedures for idle/inactive/connected UEs including SCell activation procedure with potential RAN4 involvement
		+ including enablement of SIB-less operation for some CC in case of intra-band and inter-band CA.
		+ Reducing/adapting gNB’s transmission/reception of other common channels/signals (than SSB) and TRS for some CC in multi-carrier operations
7. enhancements on Scell activation and deactivation, enhancements on Scell dormancy and dynamic Pcell switching
	* + including triggering conditions and methods for signaling activation/deactivation
		+ including UE group common dynamic Pcell switching

**Agreement**Further study techniques and enhancements for the adaptation of number of spatial elements of the gNB, including (but not limited to) the following aspects:1. Note: spatial elements may include antenna element(s), TxRU(s) (with sub-array/full-connection), antenna panel(s), TRxP(s) (co-located or geographically separated from each other), logical antenna port(s) (corresponding to specific signals and channels)
2. impact to UE operations from dynamic adaptation of spatial elements, e.g. measurements, CSI feedback, power control, PUSCH/PDSCH repetition, SRS transmission, TCI configuration, beam management, beam failure recovery, radio link monitoring, cell (re)selection, handover, initial access, etc.,
3. feedback/assistance information from the UE required for support dynamic spatial element adaptation
	* for example, CSI measurement and reports, SR, etc
4. signaling methods, including reduced signaling, for enabling dynamic spatial element adaptation
	* for example, group-common L1 signaling, broadcast signaling, MAC CE, etc.
5. dynamic TRxP adaptation;
	* study of triggering on/off conditions for TRxP(s)
		+ note this may not have specification impact and could potentially be up to network implementation.
	* study of SSB, PL-RS, TRS, and CSI-RS re-configuration and its impact to initial access procedure, synchronization and measurements performed by the idle/inactive/connected UE
6. dynamic logical port adaptation and efficient port reconfigurations
	* study details of signaling the port (e.g. NZP CSI-RS ports) (if required to be known by the UE)
	* study dynamic adaptation (including activation/deactivation) of CSI measurement or report configuration for port adaptation
7. Joint adaptation of spatial-domain, frequency-domain and/or power-domain configurations to avoid coverage loss
8. grouping of UEs to reduce transmission and reception footprint at the gNB; including but not limited to the following
	* grouping of users in spatial domain

**Agreement**Further study the necessity of RAN1 change for techniques and enhancements for adaptation of transmission power/processing and/or reception processing of signals/channels by the gNB, including (but not limited to) the following aspects:1. dynamic adjustment of transmission power
	* including which signals/channels the adaptation of transmission power should be applicable for. For example, dynamic DL power control for specific channel / reference signal, such as CSI-RS, adjustment of maximum PSD assigned to PRBs of PDSCH, etc.
	* studying potential UE feedback/assistance information for adjustment of transmission power
	* studying PA efficiency improvements to maintain transmission quality (e.g., EVM) when operating at higher efficiency, potentially with RAN4 involvement
	* studying geographical area/user density to adjust the transmission power
2. adaptation of gNB transceiver algorithms and processes to improve power efficiency:
	* including techniques aided by UE, e.g., utilizing legacy or enhanced feedback mechanism;
	* for example, adaptation of digital pre-distortion (DPD), use of digital post distortion (for improving power efficiency) by the UE, adaptation to transceiver filtering operation
	* impact to UE implementation and power consumption should be considered
3. tone reservation techniques (to improve PAPR and power efficiency);
	* It is noted that tone reservation techniques for UE will be studied in Rel-18 further NR coverage enhancement WI, as indicated in RP-213579

**Agreement**Further study techniques and enhancements on assistance information from the UE to aid the gNB to perform energy saving techniques* Some examples of assistance information are, but not limited to:
	+ preferred SSB configurations,
	+ indication of semi-static UL channel transmissions,
	+ indication of UE’s buffer status for UL channel transmissions,
	+ UE traffic information such as service priority, delay tolerance, data rate, data volume, traffic type, time criticality, and packet size(s),
	+ coverage, mobility status, location.
	+ conditions for triggering the assistance information from the UE
 |

##### 2.1.1.2 RAN1#110

The following email discussions were carried out:

[110-R18-NW\_ES] To be used for sharing updates on online/offline schedule, details on what is to be discussed in online/offline sessions, tdoc number of the moderator summary for online session, etc – Yi (Huawei)

[Post-110-R18-NW\_ES1] Finalization of TR for submission to RAN by September 1 – Yi (Huawei)

[Post-110-R18- NW\_ES2] Email discussion on remaining details of NW EnSav performance evaluation methodology by September 1 – Yi (Huawei)

Moderator summaries can be found below:

R1-2207910 FL summary#1 for EVM for NR NW energy savings Moderator (Huawei)

R1-2207987 FL summary#2 for EVM for NR NW energy savings Moderator (Huawei)

R1-2208216 FL summary#3 for EVM for NR NW energy savings Moderator (Huawei)

R1-2208311 TR 38.864 comments collection for Post-110-R18-NW\_ES1 Moderator (Huawei)

R1-2208312 FL summary for Post-110-R18- NW\_ES2 Moderator (Huawei)

The following were agreed

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Agreement**For non-sleep mode, the relative power value in power model table for UL reception and/or DL transmission is provided based on reference configuration.**Agreement**For set 2 FR1 FDD TxRx reference configuration, confirm the WA as 32 in reference configuration.**Agreement**The total DL power level is 49 dBm for set 2 FR1 FDD reference configuration.**Agreement**For the purpose of evaluation, adopt the following as BS power consumption model. These entries for this table is per reference configuration set.* FFS: One or multiple values for relative power and transition time.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Power state** | **Characteristic** | Relative Power | Additional transition energy3 | **Total transition time** |
| Deep sleep1 | There is neither DL transmission nor UL reception. Time interval for the sleep should be larger than the total transition time entering and leaving this state.  | P1=1 | E1 | T1  |
| Light sleep | There is neither DL transmission nor UL reception. Time interval for the sleep should be larger than the total transition time entering and leaving this state.(P2>P1) | P2 | E2 | T2  |
| Micro sleep | There is neither DL transmission nor UL reception.Immediate transition is assumed for network energy saving study purpose from or to a non-sleep state. | P3 | 0 | 0 |
| Active DL | There is only DL transmission. | P4 | NA | NA |
| Active UL | There is only UL reception.~~FFS: Whether multiple P5 values are needed to address low power UL mode~~ | P5 | NA | NA |
| Note 1: Depending on implementations, there could be a state that the power is lower than deep sleep and requires larger total transition time, e.g. hibernating sleep or Quasi-off, which is not explicitly modeled in this study for evaluation purpose. Note 3: Unit in relative power times duration. FFS: Details on how transition energy is defined. |

* For simultaneous DL and UL transmission for FDD, the power for UL reception is neglected in this study.
* FFS: Optionally, a state machine where BS may transit between sleep modes without entering non-sleep mode can be considered. Companies are to report the involved sleep modes and the assumptions for inter-sleep mode transition time used in their evaluations.
* FFS: Details on how to use the above table for low power uplink reception (e.g. for WUS).

**Working Assumption****For reference configuration set 1, the values are provided as below. FFS set2 and set 3.**

|  |  |  |
| --- | --- | --- |
| **Power state** | **Relative Power *P*** | **Total transition time *T*** |
| Deep sleep | 1 | 1 | Cat 1:50ms  | Cat 2: 10s |
| Light sleep | Cat 1: 25 | Cat 2: 2.1 | Cat 1: 6 ms | Cat 2: 640 ms |
| Micro sleep | Cat1: 55 | Cat 2: 5.5 | 0 | 0 |
| Active DL | Cat 1: 280 | Cat 2: 32 | N.A. | N.A. |
| Active UL | Cat 1: 110 | Cat 2: 6.5 | N.A. | N.A. |

**Agreement**For evaluation purpose, * a load (L) of a cell is a percentage of resources used for UE specific PDSCH / PUSCH
* The following load scenarios are considered

|  |  |
| --- | --- |
| Load scenario | Characteristics |
| Idle/empty load | * Include cell-specific signals and channels, and
* L = 0
 |
| low load | * Include cell-specific signals and channels, and
* 0 < L≤15
 |
| Light load | * Include cell-specific signals and channels, and
* 0 < L≤ ~~[~~30~~]~~
 |
| Medium load | * Include cell-specific signals and channels, and
* ~~[~~30~~]~~ < L≤ ~~[~~50~~]~~
 |
| For CA, the companies report whether the load is defined per CC or across all CCs. |

**Agreement*** For FR1, urban micro can be optionally considered.
* For FR2, urban micro is prioritized, with ISD=200 m is assumed.

**Agreement**It is up to company report which traffic model is used among the agreed three traffic models in their evaluations.* Other models may be used as well. Parameter (e.g. packet size and arrival rate) adjustment can be optionally considered and reported.

**Agreement**For set 3 FR2 reference configuration, the total DL power level and EIRP limit is set as 33 dBm and 63 dBm respectively. Note EIRP limit is also scaled with the number of TxRU.**Agreement**For evaluation purpose, network energy saving gain is computed based on the energy consumptions for a technique and the baseline over the same duration.  |

#### 2.1.2 Remaining Open issues

Remaining aspects related to

* Definition of a base station energy consumption model
* Definition of evaluation methodology and KPIs
* Techniques on the gNB and UE side to improve network energy savings in terms of both BS transmission and reception
	+ Companies are encouraged to review the summary of description of potential techniques of the moderator summary in Section 3 of R1-2208185. It should be noted that the description of the techniques are a draft and additional updates and modification of the description are expected.
	+ Based on the summary, companies are encouraged to work further to formulate description of potential network energy techniques to be eventually captured into the SI TR.

## 2.2 RAN2

#### 2.2.1 Agreements

**RAN2#119-e (August 2022)**

Agreements for NES technique and assistance information:

* We will prioritize time domain and frequency domain techniques until RAN1 further progresses on other techniques.
* RAN2 to adopt the term “assistance information from the UE” as agreed in RAN1

Solution groups:

1 Adaption of MIB/SSB/SIB

 - partial/simplified SSB

2 Increase of SSB/SIB periodicity

3 On demand SSB/SIB1 (FFS if there are enhancements for other SIBs)

 - FFS for on-demand MIB

4 Receiving SSB/SIB on one carrier/cell and performing access to another carrier/cell

5 Handover/Fast PCell change for NES

 - CHO or new configuration

 - group HO

6 Resource adaptation (frequency and time domain)

 - Including PRACH, SRS, PUSCH, PUCCH resources and periodicities

 - cell DTX/DRX

 - measurement

 - reference signal type and configuration of reference signal pattern for connected mode

 - BWP adaptation

7 Any Cell activation/re-activation or UE wake up request signal (connected/idle)

8 Paging enhancements (includes paging-less solutions)

9 Cell selection/reselection (ie. cell prioritization also including legacy UEs)

Things to study:

1 Study group configuration and signalling for transitions for different solutions

 - pre-configuration and L1/L2 signaling to trigger change of configuration

2 Identify/capture RAN2 impact to legacy for the different solutions

3 Awareness of the NES states at the UE side for the different solutions

4 Aim to minimize DL signalling for NES

5 Consider UE complexity and energy consumption

6 UE assistance information for the specific network energy technique, it’s benefits and impact to UE/NW

#### 2.2.2 Remaining Open issues

* Details/impact/benefit of the solution groups and other related aspects

## 2.3 RAN3

#### 2.3.1 Agreements

The pCR on the TR 38.864 skeleton with RAN3 aspects of NR network energy savings was agreed in R3-225090.

The LS on skeleton of TR 38.864 for NR network energy savings was agreed in R3-225203.

The following general aspects were agreed:

* 1. Regarding the applicable scenarios for NES, RAN3 can consider both the overlaid scenario (i.e. heterogeneous scenario) and the non-overlaid scenario.
	2. Regarding the load scenarios for NES, RAN3 can prioritise idle/empty and low/medium load scenarios, for which the SID has already described.
	3. For those techniques determined by other groups, RAN3 can study the potential network interface impacts following the analysis/conclusions made in other groups. Note that parallel discussions are also possible due to the parallel meeting time.

RAN3 can study the network energy saving issues without involvement from other WG case by case.

#### 2.3.2 Remaining Open issues

Remaining aspects related to

* Beam level activation/deactivation.
* Enhanced cell on/off mechanisms.
* Time domain techniques.
* Other related techniques.

## 2.4 RAN4

#### 2.4.1 Agreements

#### 2.4.2 Remaining Open issues

## 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

**RAN1#109e**

|  |  |  |  |
| --- | --- | --- | --- |
| [1] | [R1-2203172](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203172.zip) | Discussion on performance evaluation for network energy saving | Huawei, HiSilicon |
| [2] | [R1-2203173](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203173.zip) | Discussion on network energy saving techniques | Huawei, HiSilicon |
| [3] | [R1-2203224](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203224.zip) | NW energy savings performance evaluation | Nokia, Nokia Shanghai Bell |
| [4] | [R1-2203225](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203225.zip) | Network energy saving techniques | Nokia, Nokia Shanghai Bell |
| [5] | [R1-2203226](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203226.zip) | Others | Nokia, Nokia Shanghai Bell |
| [6] | [R1-2203341](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203341.zip) | Discussion on performance evaluation of network energy savings | Spreadtrum Communications |
| [7] | [R1-2203342](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203342.zip) | Discussion on network energy saving techniques | Spreadtrum Communications |
| [8] | [R1-2203481](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203481.zip) | Evaluation Methodology and Power Model for Network Energy Saving | CATT |
| [9] | [R1-2203482](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203482.zip) | Network Energy Saving techniques in time, frequency, and spatial domain | CATT |
| [10] | [R1-2203483](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203483.zip) | Evaluation results of network energy saving | CATT |
| [11] | [R1-2203575](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203575.zip) | Discussions on NW energy savings performance evaluation | vivo |
| [12] | [R1-2203576](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203576.zip) | Discussions on network energy saving techniques | vivo |
| [13] | [R1-2203577](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203577.zip) | Initial evaluation results for network energy saving scheme | vivo |
| [14] | [R1-2203603](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203603.zip) | Discussion on NW energy saving performance evaluation | ZTE, Sanechips |
| [15] | [R1-2203604](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203604.zip) | Discussion on NW energy saving techniques | ZTE, Sanechips |
| [16] | [R1-2203605](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203605.zip) | Consideration about NW energy saving | ZTE, Sanechips |
| [17] | [R1-2203636](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203636.zip) | On Network Energy Saving Techniques | Fraunhofer IIS, Fraunhofer HHI |
| [18] | [R1-2203662](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203662.zip) | Discussion on network energy saving performance evaluation methods | China Telecom |
| [19] | [R1-2203663](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203663.zip) | Discussion on network energy saving techniques | China Telecom |
| [20] | [R1-2203830](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203830.zip) | Discussions on performance evaluation of network energy saving | xiaomi |
| [21] | [R1-2203831](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203831.zip) | Discussions on techniques for network energy saving | xiaomi |
| [22] | [R1-2203919](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203919.zip) | NW energy savings performance evaluation | Samsung |
| [23] | [R1-2203920](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203920.zip) | Network energy saving techniques | Samsung |
| [24] | [R1-2203936](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203936.zip) | Discussion on network energy saving techniques | NEC |
| [25] | [R1-2203947](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203947.zip) | TR 38.864 skeleton for study on network energy savings for NR | Rapporteur (Huawei) |
| [26] | [R1-2204010](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204010.zip) | Study on network energy saving techniques | OPPO |
| [27] | [R1-2204043](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204043.zip) | Discussion on network energy saving techniques | CENC |
| [28] | [R1-2204073](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204073.zip) | On network energy savings evaluation methodology and power model | Panasonic |
| [29] | [R1-2204074](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204074.zip) | Discussion on potential network energy saving techniques | Panasonic |
| [30] | [R1-2204100](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204100.zip) | Base station energy consumption model, evaluation methodology, and KPIs for network energy saving | FUTUREWEI |
| [31] | [R1-2204101](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204101.zip) | Potential enhancements for network energy saving | FUTUREWEI |
| [32] | [R1-2204256](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204256.zip) | On NW energy savings performance evaluation | Apple |
| [33] | [R1-2204257](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204257.zip) | Discussion on Network energy saving techniques | Apple |
| [34] | [R1-2204318](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204318.zip) | Discussion on network energy saving performance evaluation | CMCC |
| [35] | [R1-2204319](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204319.zip) | Discussion on network energy saving techniques | CMCC |
| [36] | [R1-2204320](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204320.zip) | Discussion on network energy saving scheme in deployment | CMCC |
| [37] | [R1-2204391](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204391.zip) | Discussion on NW energy savings performance evaluation | NTT DOCOMO, INC. |
| [38] | [R1-2204392](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204392.zip) | Discussion on NW energy saving techniques | NTT DOCOMO, INC. |
| [39] | [R1-2204424](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204424.zip) | Network energy saving techniques | Lenovo |
| [40] | [R1-2204443](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204443.zip) | Study on potential L1 network energy saving techniques for NR | ITRI |
| [41] | [R1-2204628](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204628.zip) | Discussion on performance evaluation for network energy savings | LG Electronics |
| [42] | [R1-2204629](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204629.zip) | Discussion on physical layer techniques for network energy savings | LG Electronics |
| [43] | [R1-2204686](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204686.zip) | NW energy savings performance evaluation | MediaTek Inc. |
| [44] | [R1-2204687](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204687.zip) | Network energy saving techniques | MediaTek Inc. |
| [45] | [R1-2204756](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204756.zip) | Discussion on Network energy saving techniques | CEWiT |
| [46] | [R1-2204811](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204811.zip) | Discussion on Network Energy Saving Evaluations | Intel Corporation |
| [47] | [R1-2204812](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204812.zip) | Discussion on Network Energy Saving Techniques | Intel Corporation |
| [48] | [R1-2204831](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204831.zip) | Performance evaluation for network energy saving | InterDigital, Inc. |
| [49] | [R1-2204832](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204832.zip) | Potential techniques for network energy saving | InterDigital, Inc. |
| [50] | [R1-2204881](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204881.zip) | Modeling and evaluation methodology for network energy saving | Ericsson |
| [51] | [R1-2204882](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204882.zip) | Network energy saving techniques | Ericsson |
| [52] | [R1-2204883](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204883.zip) | Other aspects related to network energy saving | Ericsson |
| [53] | [R1-2204918](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204918.zip) | Discussion on information assistance for network energy saving | Huawei, HiSilicon |
| [54] | [R1-2204919](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204919.zip) | Work plan for NR network energy savings | Huawei |
| [55] | [R1-2205045](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2205045.zip) | NW energy savings performance evaluation | Qualcomm Incorporated |
| [56] | [R1-2205046](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2205046.zip) | Network energy saving techniques | Qualcomm Incorporated |
| [57] | [R1-2205070](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2205070.zip) | Potential Techniques of Network Energy Savings | Rakuten Mobile |
| [58] | [R1-2205083](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2205083.zip) | Initial views on NW energy savings performance evaluation | Fujitsu Limited |
| [59] | [R1-2205084](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2205084.zip) | Initial views on network energy saving techniques | Fujitsu Limited |
| [60] | [R1-2205140](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2205140.zip) | Discussion Summary for energy saving techniques of NW energy saving SI | Moderator (Intel Corporation) |
| [61] | [R1-2205141](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2205141.zip) | Summary #1 for email discussion on energy saving techniques of NW energy saving SI | Moderator (Intel Corporation) |
| [62] | [R1-2205160](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2205160.zip) | Evaluation results of network energy saving | CATT |
| [63] | [R1-2205175](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2205175.zip) | Initial evaluation results for network energy saving scheme | vivo |
| [64] | [R1-2205178](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2205178.zip) | Discussion on NW energy saving performance evaluation | ZTE, Sanechips |
| [65] | [R1-2205307](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2205307.zip) | TR 38.864 skeleton for study on network energy savings for NR | Rapporteur (Huawei) |
| [66] | [R1-2205308](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2205308.zip) | FL summary#1 for performance evaluation for NR NW energy savings | Moderator (Huawei) |
| [67] | [R1-2205402](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2205402.zip) | FL summary#2 for performance evaluation for NR NW energy savings | Moderator (Huawei) |
| [68] | [R1-2205468](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2205468.zip) | FL summary#3 for performance evaluation for NR NW energy savings | Moderator (Huawei) |
| [69] | [R1-2205533](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2205533.zip) | Summary #2 for email discussion on energy saving techniques of NW energy saving SI | Moderator (Intel Corporation) |
| [70] | [R1-2205551](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2205551.zip) | FL summary#4 for performance evaluation for NR NW energy savings | Moderator (Huawei) |
| [71] | [R1-2205554](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2205554.zip) | Summary #3 for email discussion on energy saving techniques of NW energy saving SI | Moderator (Intel Corporation) |

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| [72] | [R1-2205755](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2205755.zip) | BS Energy Consumption Model and Sleep States | FUTUREWEI |
| [73] | [R1-2205756](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2205756.zip) | Enhancements for network energy saving | FUTUREWEI |
| [74] | [R1-2205860](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2205860.zip) | Discussion on performance evaluation for network energy saving | Huawei, HiSilicon |
| [75] | [R1-2205861](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2205861.zip) | Discussion on network energy saving techniques | Huawei, HiSilicon |
| [76] | [R1-2205999](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2205999.zip) | Discussion on performance evaluation of network energy savings | Spreadtrum Communications |
| [77] | [R1-2206000](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206000.zip) | Discussion on network energy saving techniques | Spreadtrum Communications |
| [78] | [R1-2206053](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206053.zip) | Discussions on NW energy savings performance evaluationns on | vivo |
| [79] | [R1-2206054](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206054.zip) | Discussions on network energy saving techniques | vivo |
| [80] | [R1-2206074](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206074.zip) | NW energy savings performance evaluation | Nokia, Nokia Shanghai Bell |
| [81] | [R1-2206075](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206075.zip) | Network energy saving techniques | Nokia, Nokia Shanghai Bell |
| [82] | [R1-2206141](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206141.zip) | On network energy savings evaluation methodology and power model | Panasonic |
| [83] | [R1-2206142](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206142.zip) | Discussion on potential network energy saving techniques | Panasonic |
| [84] | [R1-2206172](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206172.zip) | Discussion on NW energy savings performance evaluation | Fujitsu |
| [85] | [R1-2206173](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206173.zip) | Discussion on Network energy saving techniques | Fujitsu |
| [86] | [R1-2206242](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206242.zip) | Discussion on network energy saving techniques | NEC |
| [87] | [R1-2206308](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206308.zip) | Discussion on NW energy savings performance evaluation | OPPO |
| [88] | [R1-2206309](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206309.zip) | Discussion on network energy saving techniques | OPPO |
| [89] | [R1-2206411](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206411.zip) | Evaluation Methodology and Power Model for Network Energy Saving | CATT |
| [90] | [R1-2206412](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206412.zip) | Network Energy Saving techniques in time, frequency, and spatial domain | CATT |
| [91] | [R1-2206517](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206517.zip) | Network energy saving techniques | Lenovo |
| [92] | [R1-2206595](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206595.zip) | Discussion on Network energy saving performance evaluations | Intel Corporation |
| [93] | [R1-2206596](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206596.zip) | Discussion on Network energy saving techniques | Intel Corporation |
| [94] | [R1-2206655](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206655.zip) | Discussions on techniques for network energy saving | Xiaomi |
| [95] | [R1-2206665](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206665.zip) | Performance evaluation for network energy saving | InterDigital, Inc. |
| [96] | [R1-2206666](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206666.zip) | Potential techniques for network energy saving | InterDigital, Inc. |
| [97] | [R1-2206696](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206696.zip) | Discussion on BS energy saving model and evaluation | China Telecom |
| [98] | [R1-2206697](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206697.zip) | Discussion on potential techniques for network energy saving | China Telecom |
| [99] | [R1-2206838](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206838.zip) | NW Energy Savings Performance Evaluation | Samsung |
| [100] | [R1-2206839](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206839.zip) | Network energy saving techniques | Samsung |
| [101] | [R1-2206925](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206925.zip) | Discussion on network energy saving performance evaluation | CMCC |
| [102] | [R1-2206926](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206926.zip) | Discussion on network energy saving techniques | CMCC |
| [103] | [R1-2206947](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206947.zip) | On Network Energy Saving Techniques | Fraunhofer IIS, Fraunhofer HHI |
| [104] | [R1-2206979](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206979.zip) | NW energy savings performance evaluation | MediaTek Inc. |
| [105] | [R1-2206980](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206980.zip) | Network energy saving techniques | MediaTek Inc. |
| [106] | [R1-2207020](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207020.zip) | TR 38.864 v0.1.0 for study on network energy savings for NR | Huawei |
| [107] | [R1-2207037](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207037.zip) | Discussion on performance evaluation for network energy savings | LG Electronics |
| [108] | [R1-2207038](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207038.zip) | Discussion on physical layer techniques for network energy savings | LG Electronics |
| [109] | [R1-2207059](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207059.zip) | Discussion on NW energy saving performance evaluation | ZTE, Sanechips |
| [110] | [R1-2207060](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207060.zip) | Discussion on NW energy saving techniques | ZTE, Sanechips |
| [111] | [R1-2207074](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207074.zip) | Discussion on Network energy saving techniques | CEWiT |
| [112] | [R1-2207079](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207079.zip) | Evaluation and power model for network energy savings | Rakuten Symphony |
| [113] | [R1-2207119](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207119.zip) | Discussion on network energy saving techniques | Rakuten Mobile Inc. |
| [114] | [R1-2207245](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207245.zip) | NW energy savings performance evaluation | Qualcomm Incorporated |
| [115] | [R1-2207246](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207246.zip) | Network energy saving techniques | Qualcomm Incorporated |
| [116] | [R1-2207343](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207343.zip) | On NW energy savings performance evaluation | Apple |
| [117] | [R1-2207344](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207344.zip) | Discussion on Network energy saving techniques | Apple |
| [118] | [R1-2207418](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207418.zip) | Discussion on NW energy savings performance evaluation | NTT DOCOMO, INC. |
| [119] | [R1-2207419](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207419.zip) | Discussion on NW energy saving techniques | NTT DOCOMO, INC. |
| [120] | [R1-2207437](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207437.zip) | Network energy consumption modeling and evaluation | Ericsson |
| [121] | [R1-2207438](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207438.zip) | Network energy savings techniques | Ericsson |
| [122] | [R1-2207446](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207446.zip) | Discussion on potential L1 network energy saving techniques for NR | ITRI |
| [123] | [R1-2207481](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207481.zip) | Discussion on network energy saving techniques | KT Corp. |
| [124] | [R1-2207685](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207685.zip) | Discussion on NW energy savings performance evaluation | OPPO |
| [125] | [R1-2207694](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207694.zip) | Discussion on Network energy saving performance evaluations | Intel Corporation |
| [126] | [R1-2207697](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207697.zip) | Discussion Summary for energy saving techniques of NW energy saving SI | Moderator (Intel Corporation) |
| [127] | [R1-2207841](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207841.zip) | Discussion Summary#1 for energy saving techniques of NW energy saving SI | Moderator (Intel Corporation) |
| [128] | [R1-2207910](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207910.zip) | FL summary#1 for EVM for NR NW energy savings | Moderator (Huawei) |
| [129] | [R1-2207987](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207987.zip) | FL summary#2 for EVM for NR NW energy savings | Moderator (Huawei) |
| [130] | R1-2208027 | Discussion Summary#2 for energy saving techniques of NW energy saving SI | Moderator (Intel Corporation) |
| [131] | [R1-2208185](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2208185.zip) | Discussion Summary#2 for energy saving techniques of NW energy saving SI | Moderator (Intel Corporation) |
| [132] | [R1-2208216](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2208216.zip) | FL summary#3 for EVM for NR NW energy savings | Moderator (Huawei) |
| [133] | R1-2208311 | TR 38.864 comments collection for Post-110-R18-NW\_ES1 | Moderator (Huawei) |
| [134] | R1-2208312 | FL summary for Post-110-R18- NW\_ES2 | Moderator (Huawei) |

**RAN2#119-e**

1. R2-2207037 Discussion on NW energy saving KDDI Corporation
2. R2-2207115 Efficient operation of adaptation for network energy saving Intel Corporation
3. R2-2207116 Additional UE assistance information and UE feedback Intel Corporation
4. R2-2207246 Time domain NES techniques InterDigital
5. R2-2207247 Frequency domain and UE assistance NES techniques InterDigital
6. R2-2207292 Finer granularity configuration for NES NEC Telecom MODUS Ltd.
7. R2-2207293 Assistance information to support choice of NES configuration NEC Telecom MODUS Ltd.
8. R2-2207406 Consideration on network energy saving Fujitsu
9. R2-2207414 Efficient PCell and SCell handling for network energy saving Fujitsu
10. R2-2207423 Initial discussion on RAN2 work of Network energy saving Apple
11. R2-2207424 On-demand measurement for network energy saving Apple
12. R2-2207511 Network energy savings: issues for investigation in RAN2 CATT
13. R2-2207512 Consideration on UE Assistance Information CATT
14. R2-2207545 NW energy saving in CONNECTED Nokia, Nokia Shanghai Bell
15. R2-2207546 NW energy saving in IDLE Nokia, Nokia Shanghai Bell
16. R2-2207786 discussions on time domain techniques for network energy saving vivo
17. R2-2207787 discussion on frequency domain and UE-assisted Network Energy saving techniques vivo
18. R2-2207799 Discussion on network energy savings OPPO
19. R2-2207800 Discussion on the UE assistance information OPPO
20. R2-2207919 Discussion on supporting of network energy savings for NR Lenovo
21. R2-2207920 Discussion on the state transition in NES Lenovo
22. R2-2207960 Alignment of UE and Network Energy Saving Fraunhofer IIS, Fraunhofer HHI
23. R2-2208026 Assistance information from the UE for NW energy savings Ericsson
24. R2-2208031 Miscellaneous mechanisms for network energy savings Ericsson
25. R2-2208120 Network Energy Savings Techniques Qualcomm Incorporated
26. R2-2208233 gNB operation for NES ETRI
27. R2-2208297 Network Energy savings - UE grouping for efficient signaling Rakuten Mobile, Inc
28. R2-2208330 Supporting access via assistant cell for network energy saving ZTE corporation, Sanechips
29. R2-2208331 Techniques in various domains and UE assistance information for network energy saving ZTE corporation, Sanechips
30. R2-2208339 Work plan for NR network energy savings Huawei
31. R2-2208340 TR 38.864 skeleton for study on network energy savings for NR Huawei
32. R2-2208341 General consideration of RAN2 study Huawei
33. R2-2208342 Discussion on network energy saving techniques for single carrier Huawei, HiSilicon, Deutsche Telekom
34. R2-2208343 Discussion on network energy saving techniques for multi-carrier case Huawei, HiSilicon, China Unicom, Deutsche Telekom
35. R2-2208431 Discussion on the technical directions for network energy saving CMCC
36. R2-2208432 Analysis on power consumption in base station CMCC
37. R2-2208573 Energy saving on system information transmission Xiaomi
38. R2-2208592 Feedback and Assistance Information for NES Samsung
39. R2-2208593 Network Energy Saving (NES) Techniques Samsung
40. R2-2208606 Coexistence considerations in network energy saving MediaTek Inc.

**RAN3#117e**

1. R3-224731 Work plan for NR network energy savings Huawei
2. R3-224732 TR 38.864 skeleton for NR network energy savings SI Huawei
3. R3-224358 Discussion on other energy saving techniques Huawei
4. R3-224464 Initial discussion on RAN3 aspects of energy saving study Nokia, Nokia Shanghai Bell
5. R3-224465 Minimum activation time and probing Nokia, Nokia Shanghai Bell
6. R3-224526 Discussion on Network Energy Saving SI Ericsson
7. R3-224528 Text Proposal to Network Energy Saving SI Ericsson
8. R3-224614 Information exchange over network interfaces for network energy savings Qualcomm Incorporated
9. R3-224653 Discussion on NR Network Energy Saving Scenarios and Technologies CATT
10. R3-224654 [Draft] LS on supported scenarios for Network Energy Saving CATT
11. R3-224733 Time-domain network energy saving techniques Huawei
12. R3-224939 Initial consideration on Network Energy Saving ZTE
13. R3-224940 TP for NW energy saving for 38.864 ZTE
14. R3-225090 RAN3 aspects of NR network energy savings Huawei
15. R3-225203 LS on skeleton of TR 38.864 for NR network energy savings RAN3

 01.08.2022 minor adaptations for RAN #97e

 21.05.2022 minor adaptations for RAN #96

 10.01.2022 minor adaptations for RAN #95e

 04.10.2021 minor adaptations for RAN #94e

 08.08.2021 minor adaptations for RAN #93e

 17.05.2021 minor adaptations for RAN #92e

 28.01.2021 minor adaptations for RAN #91e

 09.11.2020 minor adaptations for RAN #90e

 31.08.2020 minor adaptations for RAN #89e

 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

v04.66 16.11.2014 minor adaptations for RAN #66

v04.65 16.08.2014 minor adaptations for RAN #65

v04.64 22.05.2014 minor adaptations for RAN #64

v04.63 24.01.2014 restructuring for RAN #63 to cover Core & Perf. in one doc file

v03.62 11.11.2013 section 1.2.3 adapted for RAN #62

v03 11.08.2013 section 1.2.3 added on time budget

v02 07.05.2010 history added, some spelling corrections

v01 13.11.2009 First version of the template