

[94e-08-R18-NetworkEnergy] - Version 0.0.5
RAN

3GPP TSG RAN Meeting #94-e

RP-213488

Electronic Meeting, Dec 06-17, 2021

Source: Huawei

Title: Moderator's summary for [94e-08-R18-NetworkEnergy]

Agenda item: 8A.1 (8.6.1)

Document for: Discussion and decision

1 Introduction

Proposals on network energy savings were provided to the 3GPP RAN Rel-18 workshop in June 2021. Network energy savings was subsequently identified as a topic for further email discussions in RWS-210659. Further discussion on NWM took place before RAN#93-e under thread [RAN93e-R18Prep-13], with final summary in RP-211663. Network energy savings was included as a potential RAN1-led item in the RAN Chair's Summary for RAN Release 18 in RP-212608. Further discussion took place in October 2021 under thread [RAN94e-R18Prep-09], leading to the summary in RP-212669 and a draft Study Item Description in RP-212709.

RP-213469 provided as RAN R18 package summary input to RAN#94-e by the RAN Chair shows a plan for a study item for 9 months with TUs in RAN1, RAN2 and RAN3 (1 per meeting for RAN1 and RAN2, 0.5 for RAN3), followed by a work item for 9 months with an increase to 2 TU for RAN1 and the additional involvement of RAN4. The detailed scope proposed for discussion suggests slight revisions to RP-212709 (specifically targeting "base station model energy consumption model" rather than "network energy consumption model", and moving the list of example scenarios to the justification section).

A corresponding draft revision of RP-212709 is provided as a starting point for the discussion at https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_94e/Inbox/Drafts/%5B94e-08-R18-NetworkEnergy%5D

The goal of this email discussion is to finalize the scope of a Rel-18 study item on network energy savings for NR for approval at RAN#94 under discussion thread [94e-08-R18-NetworkEnergy].

For that purpose, a number of proposals and questions are formulated by the moderator, starting in section 2 (initial phase), taking into account past discussions and new documents provided at RAN#94e [7-13]. Note that the proposals in [7-13] are not copied in this document for readability reasons, so please refer to these references for answering initial questions.

Companies' feedback on the proposals for the initial phase is requested by 17:00 UTC on Tuesday December 7th.

Companies' feedback on the proposals for the intermediate phase is requested by 19:00 UTC on Wednesday December 8th.

Companies' feedback on the proposals for the final phase is requested by 19:00 UTC on Friday December 9th.

2 Initial Phase

Please provide your answers to the questions below by the deadline of 17:00 UTC on Tuesday December 7th.

2.1 Initial phase questions

Q1: general questions and comments on the revised SID

(https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_94e/Inbox/Drafts/%5B94e-08-R18-NetworkEnergy%5D/RP-21xxxx_wasRP-212709%20Study%20on%20network%20energy%20savings%20v001.doc).

You may already indicate here if you would like your company to be added to the list of supporting companies (knowing that there may still be changes until the final version of the SID).

Feedback Form 1: Questions and comments on the draft SID v000 in inbox/draft folder [94e-08-R18-NetworkEnergy]

1 – Beijing Xiaomi Mobile Software

Generally fine with the draft SID. And would like to add an note in the objective part "UE power consumption and performance should not be obviously negatively impacted by network energy saving techniques"

2 – MediaTek Inc.

Thanks for moderators previous efforts in generating a good starting point for the final discussion of the SID. Below please find our comments for the revised SID:

- The guidance of RP-213469 indicates "Should try to avoid "generic enhancements"-like scope!". On the other hand, current objective item 3, "Study and identify techniques...", looks somehow very "generic". To follow the guidance, it is suggested to move part of the third paragraph in justification, starting from "The study should investigate how to achieve ...", as the sub-bullet for the objective item 3 for clarity of the technologies to be studied.
- MediaTek also submitted a contribution related to network energy saving, RP-213356, to Agenda Item 8A.5 (due to misunderstanding 8A.1 is only for moderators' proposals). In the contribution, we share SLS results and show
 - o The feasibility of dynamic system-wise (BS and UE) power saving under a typical system loading, 30% RU, which then motivates using "network-wise energy savings in terms of both BS and UE transmissions and receptions" in current objective item 3.

- The trade-off between BS energy saving and the impact to legacy UEs, which suggests that KPI design should be able to downgrade a scheme with marginal network energy saving gain but large impact to legacy UEs

MediaTek is happy to support this SI/WI when the above comments can be properly incorporated in the final SID.

3 – CATT

We are generally OK with the overall draft objectives in RP-212709 in power models, evaluation methodologies/KPI, and network energy saving techniques.

- We believe that the network energy consumption model should include all components of energy consumptions at the gNB, which include the RF, baseband and backhaul. Thus, the network energy consumption model should not only include DL and UL Tx/Rx at Uu but also the backhaul power consumption.
- We are very supporting of current draft objective of the study of network energy saving techniques without any specific domains or details. This will allow the study of network energy saving in comprehensive way.
- The deployment scenarios and prioritization should be left to working groups and not necessary to be included in the draft SIB.

4 – Futurewei Technologies

We support the current draft SID.

5 – Spreadtrum Communications

We share the similar view as Xiaomi and MTK. UE power consumption should be balanced as well. And the network/system-wise power saving is the real target. In R16/R17, we have developed the UE power saving, if the gNB power saving is opposite to the UE power saving, the effort is in vain. In fact, the power saving for both gNB and UE can be achieved simultaneously, e.g. the power-off of gNB and UE in cell wise. Spreadtrum is happy to co-sign the SID if it is the common understanding that the UE power saving is balanced or even improved in the study of network power savings.

6 – China Telecom Corporation Ltd.

We are generally fine with the current SID. However, the objective 3 maybe a little generic, we prefer to add some details in it, e.g. the domains should be included, so that the SID can be more converged.

7 – CAICT

We support the draft SID and would like to co-sign.

8 – SoftBank Corp.

We are fine with the draft SID and happy to be the supporting IM.

9 – SHARP Corporation

We are fine with the justification and objective in the SID. We would like to be included as a supporting company.

10 – Intel

Generally ok with the proposed draft SID. RAN4 should be included for objective 3. Additionally, RAN4 can be removed from the text “The study should coordinate with SA5 and RAN4 as needed.”

Objective of the study may not need to specify UE power/performance should not be negatively impacted, as we can review this aspect during the SI and make sure appropriate features are selected for WI by taking UE aspects into account.

11 – ZTE Corporation

We are generally okay with the draft SID. But the objective 3 is too open-ended, which will result in a divergent discussion in the study phase. Considering that it is suggested to be 9-month study item, a more focused scope will be beneficial to the convergence of discussion within the limited TU. Therefore, we think it is better to put the potential enhancement directions in the justification section in the objective 3.

3. Study and identify techniques on the gNB and UE side to improve network energy savings in terms of both BS transmission and reception [RAN1, RAN2, RAN3, [RAN4]],

including one or more network energy saving techniques in time, frequency, spatial, and power domains, potential UE assistance information, and information exchange/coordination over network interfaces.

- Other solutions are not precluded.

12 – Telstra Corporation Limited

We are mostly supportive of the direction of the SID with an *addition* to objective 3

- Study and identify techniques on the gNB and UE side to improve network energy savings in terms of both BS transmission and reception *without impacting SLA assurance for RAN slices. The study may need to consider how energy saving initiatives integrate with an orchestrator.*

13 – VODAFONE Group Plc

We are generally fine with the SID but would prefer that the example scenarios are kept in the objective rather than the justification.

As an alternative, DSS configurations should be explicitly mentioned alongside the low/medium load scenarios in the objective.

DSS is important here because, in a multi-cell sector, it is normal to (use implementation specific means to) turn off lightly loaded cells completely after moving their load onto other frequency bands in the sector. Hence the 3GPP specified features are likely to be employed only on the last few frequency bands in a sector - and these bands will be the ones that had to be retained to support LTE IoT traffic and hence are in use with DSS.

14 – China Mobile Com. Corporation

we are supportive for the network energy saving study and general fine with the draft SID, with the following comments,

- For the dynamic and semi-static network energy saving techniques, both backward compatible schemes and non backward compatible schemes should be considered. For example, with SSB/SIB less schemes in some carriers, there will be more flexibility and more time to go to sleep for gNB. This may have some effect on legacy UEs, but for new NR bands, the power saving benefit is obvious, so such non

backward compatible schemes should also be considered, and how to reduce the effect can be part of the study.

This can be added to the justification part as suggested by our contribution RP-213471.

- To evaluate the impact on network and user performance, some qualitative KPIs such as handover performance, call drop rate, initial access performance besides those listed in second objective such as spectral efficiency, capacity, UPT, latency should also be considered, and Negative impact on such KPIs should be avoided.

This can be added to justification part or to the second objective.

15 – LG Electronics France

In general, we are supportive to the contents of the draft SID

16 – NEC Telecom MODUS Ltd.

We would like to support this SID.

17 – HUAWEI TECHNOLOGIES Co. Ltd.

We support MTK comments regarding to avoid“generic enhancements”-like scope. With that, to simply list all the potential domains may not help much. The study should firstly focus on how to achieve more dynamic and finer granularity adaptation of transmissions and/or receptions. Note that most of semi-static adaption methods have already been realized through gNB implementation, and the semi-static method often lead to some notable performance loss. However, given there seems to be one or two companies concerning to explicitly have detailed techniques, we make it clearer that these are examples for further consideration, which provide more focused guidance while does not preclude study of other techniques. Therefore, we suggest to modify objective 3 as below:

1. Study and identify techniques on the gNB and UE side to improve network energy savings in terms of both BS transmission and reception [RAN1, RAN2, RAN3, [RAN4]], e.g.

- dynamic and finer granularity adaptation of transmissions and/or receptions in one or more different domains (e.g., time, frequency, spatial, power). [RAN1]*
- network and/or UE feedback/assistant information. [RAN1, RAN2, RAN3]*

For the second comment from MTK and Spreadtrum about UE power saving, in general we also agree it is optimal to have a balanced design concerning both BS and UE side, which we think is already captured in the current draft SID.

18 – CEWiT

We support the current draft SID

19 – Panasonic Corporation

We are fine with the revised SID.

20 – Motorola Mobility UK Ltd.

Fine with moving the example scenarios to the Justification section and replacing “network” with “base station” in energy consumption model.

21 – vivo Communication Technology

We are generally fine with the SID. For the objective 2, “2. Definition of an evaluation methodology and KPIs [RAN1]”, the new solutions for network energy saving which have less impact / complexity / power consumption to UE side should be taken first priority for consideration.

22 – MediaTek Inc.

While having the potential enhancements for the study in the Justification is fine, it is still critical to define clear work split/coordination for the WGs; otherwise, we worry about potentially overlapped efforts among WGs can risk the tight study schedule with only 1 TU and 9 months. In this regard, the following should be worthy of further considerations:

- RAN4 can focus on check power-domain/PA-related BS energy consumption model and scaling provided by RAN1 since RAN4 load for R17 is expected to remain high during the study phase
- RAN2 can focus on time domain candidate techniques to reduce BS and UE transmissions and receptions for idle/inactive-mode UEs since the corresponding BS and UE operations are simpler (with narrow band, baseline MIMO/beamforming, and QPSK). Also, since RAN2 load for R17 is expected high during the study phase, evaluation aid by RAN1 will be useful.
- RAN3 study is expected to be important for gNB communications aspect, and the study scope can be specified further

In addition to the above WG work split/coordination consideration, MediaTek, as one NR UE chip vendor, would also like to strengthen the importance of **Backwards compatibility with legacy UE and no impact to legacy UE operation**. By the above, the following revisions to objectives 2 and 3 are therefore suggested (with **changes in bold face**):

2. Definition of an evaluation methodology and KPIs [RAN1]

- The evaluation methodology should target for evaluating system-level network energy consumption and energy savings gains, as well as assessing/balancing impact to network and user performance (e.g. spectral efficiency, capacity, UPT, latency), energy efficiency, and UE power consumption/-complexity.
 - o **RAN4 to confirm the power-domain/PA related BS energy consumption model and scaling provided by RAN1**
- The evaluation methodology should not focus on a single KPI, and should reuse existing KPIs whenever applicable; where existing KPIs are found to be insufficient new KPIs may be developed as needed.
 - o **Backwards compatibility with legacy UE and no impact to legacy UE operation are part of the considered KPIs**

3. Study and identify techniques on the gNB and UE side to improve network-wise energy savings in terms of both BS **and** UE transmissions and receptions [RAN1, RAN2, ~~[RAN3]~~,~~[RAN4]~~

- **RAN1 to study and conclude candidate techniques to reduce BS and UE transmissions and receptions in time, frequency, spatial and power domains for connected-mode UEs**

- **RAN2 to study and conclude candidate techniques to reduce BS and UE transmissions and receptions in time domain for idle/inactive mode UEs**
 - o RAN1 evaluation works for the candidate techniques can be triggered by RAN2, if needed
- [TBD RAN3 study scope]

23 – Qualcomm Incorporated

In Objective 1, we propose to make the following change:

“... including relative energy consumption for DL and UL (considering factors like PA efficiency, number of TxRU, ~~network~~ base station load, etc)”

24 – TELECOM ITALIA S.p.A.

We are generally supportive of the proposal (plus the comments from Telstra and Vodafone).

However we have concern with the change

Definition of a network base station energy consumption model

This could lead to sub-optimal solutions, and in general we should have a holistic view of what is the system level impact of a solution (either from UE or BTS).

If these concerns are taken into account, Telecom Italia is happy to co-sign the proposal

25 – Telia Company AB

We are supporting this SID and cosigned already. Objectives look in general fine currently.

26 – Deutsche Telekom AG

We are generally supportive of the SI proposal.

Just 2 comments to the listed scenarios:

- We would prefer to have the list of scenarios in the justification section (as it was in the former version).
- From our perspective the scenarios ”Urban/Rural macro in FR1 ...” and ”EN-DC/NR-DC macro ...” should be listed first to highlight their importance with respect to energy saving potentials for operators.

27 – Verizon UK Ltd

We are in general, supportive of the proposal. We are also sympathetic to MTK’s concerns so we are also in principle supportive of MTK’s suggestion.

28 – Ericsson LM

Ericsson supports this SI/WI and is happy to co-source.

In the justification section, the square brackets around FR2 in the below bullet should be removed.

- *EN-DC/NR-DC macro with FDD PCell and TDD/Massive MIMO on higher FR1/{FR2} frequency*

Objective 3 in the current shape is too broad and we prefer the below text to be moved from justification section to become a sub-bullet under Objective 3. Moreover, it should be clear where different RAN groups are expected to contribute.

- *The study should investigate how to achieve more efficient operation dynamically and/or semi-statically and finer granularity adaptation of transmissions and/or receptions in one or more of network energy saving techniques in time, frequency, spatial, and power domains, with potential support/feedback from UE, potential UE assistance information, and information exchange/coordination over network interfaces.*

29 – Nokia France

We are fine with the SID, and Nokia and Nokia Shanghai Bell can be supporting companies.

30 – InterDigital Belgium. LLC

We are generally fine with the contents of the SID.

31 – Orange

We are fully supportive of this SID and also agree with DT that the top priority scenarios are those for FR1 macro cells and should be top of the list of the examples.

Q2: question on the SID title “Study on network energy savings for NR and EN-DC/NR-DC” or “Study on network energy savings for NR”

EN-DC/NR-DC was included in the title by MCC, presumably because example scenarios include EN-DC and NR-DC. With the understanding that energy savings for a NR base station can also provide energy savings in EN-DC or NR-DC or other deployment architectures including NR as a radio, and that the study does not target energy savings for a LTE base station, should the title simply be “Study on network energy savings for NR” as written in the RAN Chair’s input document in RP-213469? Is it clear to all companies that the study does not target solutions requiring changes to the LTE base station, even if the study evaluates solutions for EN-DC and NR-DC deployment scenarios?

Feedback Form 2: Responses to question 2 on the SID title

1 – Beijing Xiaomi Mobile Software

The scope of “Study on network energy savings for NR ” is clear, no LTE base station would be included. And we prefer it more for its simplicity.

2 – MediaTek Inc.

“Study on network energy savings for NR” should be sufficient since the focus on this SI/WI should be specification of “NR” UE behaviors/requirements for network energy savings. **Specifying the behaviors/requirements for LTE UEs would not be very practical due to limited implementation upgrade, and the corresponding energy saving schemes for LTE eNB can just be network implementation.**

3 – CATT

We believe the study of network energy saving should focus on NR only. The study of network energy saving for LTE had been completed in Rel-10.

4 – Futurewei Technologies

We prefer “Study on network energy savings for NR”.

5 – Spreadtrum Communications

We are not sure about whether network power savings is up to eNB implementation or has spec impact for ENDC scenario. If there is spec impact and NSA deployment is also important in some areas, we are open to discuss it. In the real world, there could be some people occasionally turning off the 5G access in their 5G mobile phone, because the user experience with the 4G access is enough for them. Studying the ENDC scenario can be a part of study, and also there should be little spec impact to LTE.

6 – China Telecom Corporation Ltd.

We think the ”Study on network energy savings for NR” is sufficient. The NR and LTE DC/NR DC can only be a scenario for NR, and the study of network energy savings for LTE should not be included in this item.

7 – CAICT

We also think the ”Study on network energy savings for NR” is sufficient.

8 – SHARP Corporation

We share the same view that “Study on network energy savings for NR” should be used due to its sufficiency and simplicity.

9 – Intel

Agree with Mediatek and others, the title of the SI is “for NR”. It should be understood that the SI does not include study of potential enhancements for LTE.

10 – ZTE Corporation

We prefer ”Study on network energy savings for NR”, which is clear and sufficient. And we agree that the SI is not intended for the enhancement on LTE.

11 – NTT DOCOMO INC.

Although EN-DC/NR-DC should be included as a scenario in this SI, we think it is not intended for the enhancements on LTE. Thus, ”Study on network energy savings for NR” is sufficient.

12 – Telstra Corporation Limited

Agree with Docomo

13 – VODAFONE Group Plc

it is important that 3GPP works on realistic scenarios not theoretical ones. Hence inclusion of DSS in the scope of the work is essential.

Hence a title such as ”Study on network energy savings for NR and DSS” would be more appropriate.

<p>14 – China Mobile Com. Corporation</p> <p>Agree with the moderator, Study on network energy savings for NR is enough for the SID title.</p>
<p>15 – LG Electronics France</p> <p>We think “Study on network energy savings for NR” is enough.</p>
<p>16 – NEC Telecom MODUS Ltd.</p> <p>We suggest keeping the title aligning with that written in the RAN Chair’s input document.</p> <p>The title of “Study on network energy savings for NR” is clear for the scope of this study item. As the moderator clarified, there is a common understanding of the companies involved in the discussion that this topic ONLY targets solutions to NR base stations. And the EN-DC/NR-DC scenarios have been included in the current SID. Simply including ‘EN-DC’ in the title may confuse other people, as it cannot illustrate that solutions will not be introduced to LTE base stations.</p>
<p>17 – Samsung Electronics Co.</p> <p>Agree with moderator’s clarification. Better to have “Study on <u>base station</u> energy savings for NR”? (as commented above Q1)</p>
<p>18 – HUAWEI TECHNOLOGIES Co. Ltd.</p> <p>We are fine with a simple title as “Study on network energy savings for NR”.</p>
<p>19 – CEWiT</p> <p>We prefer ”Study on network energy savings for NR”</p>
<p>20 – Panasonic Corporation</p> <p>We think “Study on network energy savings for NR” should be sufficient.</p>
<p>21 – Motorola Mobility UK Ltd.</p> <p>Given that the study aims for NR base station energy saving, we think the title “Study on network energy savings for NR” should be used. If necessary, can include a Note under Objective stating that energy saving techniques should not require changes to LTE base stations.</p>
<p>22 – vivo Communication Technology</p> <p>We think “Study on network energy savings for NR” should be sufficient.</p>
<p>23 – Qualcomm Incorporated</p> <p>We would prefer the shorter alternative title: “Study on network energy savings for NR”.</p>
<p>24 – TELECOM ITALIA S.p.A.</p> <p>We are concerned with the moderator’s proposal. it is clear that the scope is on NR, ma as mentioned by Vodafone (on DSS), we need to evaluate the system impact of the proposed solutions.</p> <p>We prefer to keep the current title, and in any case, the ”simplification” of the title must not be an excuse not to evaluate the impact (system level) in case of EN/DC and DSS</p>

<p>25 – Telia Company AB</p> <p>Title is not so important, content is. Ok for us to have the current one. Simplification is also possible but it should not rule out later EN-DC/NR-DC or DSS parts to be evaluated.</p>
<p>26 – Deutsche Telekom AG</p> <p>The shorter title “Study on network energy savings for NR” should be sufficient even if EN-DC and DSS combinations are under consideration.</p>
<p>27 – Ericsson LM</p> <p>We are supportive of including EN-DC and NR-DC with both FR1 and FR2 within the scope of the SI. Regarding title, we do not have strong view as long as the above is made clear in justification/objectives. It is good to add an explicit note that this study does not target solutions requiring changes to LTE specifications.</p>
<p>28 – Nokia France</p> <p>Adding “EN-DC/NR-DC” is potentially confusing, and just “NR” is sufficient.</p>
<p>29 – InterDigital Belgium. LLC</p> <p>The title ”Study on network energy savings for NR” is sufficient.</p>
<p>30 – Orange</p> <p>Our preference is: ”Study on network energy savings for NR”</p>
<p>31 – Apple Italia S.R.L.</p> <p>We agree that the study should target for the energy saving for NR base stations only, and we prefer “Study on network energy savings for NR” as the SID title.</p>

Q3: comments on proposals in RP-213086 [7]

Feedback Form 3: Q3: comments on proposals in RP-213086 [7]

<p>1 – MediaTek Inc.</p> <p>Thanks for China Telecom contribution. We are supportive of the proposed changes to objective item 3 and the justification. For the suggested change to objective item 1, we however see there is limited information for power consumption model in TR38.913, and the power difference in multiple domains can be discussed as part of evaluation methodology (as defining the power scaling in TR 38.840). Therefore, the suggested change to objective item 1 may not be necessary.</p>
<p>2 – Futurewei Technologies</p> <p>We are ok with the additional details for objective 3 though these are the obvious options for study and can live without it as well. We do not think the proposed change to objective 1 is really needed at this point.</p>

3 – Spreadtrum Communications

For the Views on objective 3 in RP-213086, we think the possible techniques are indeed a part of study. For the time/frequency/spatial/power domains, it is about all domains and no extra informations. For assistance and exchanged informations, we are not sure what they are actually. If the assistance information is the feedback timely from UE side, or the information that a idle UE reports its presence/location in a cell to the gNB in each cell reselection to assist gNB to estimate the cell loading, then it will shift the power consumption from gNB to UE reporting. We should avoid such non-balanced design. Therefore, we suggest not mentioning the possible techniques (ambiguous so far) in the SID objectives.

4 – Intel

Generally ok with suggested changes. Should merge with changes proposed by ZTE/Huawei in RP-213309 and RP-213164

5 – China Mobile Com. Corporation

We are fine to remove the network energy saving techniques to objective 3.

As to the modification to objective 1, TR 38.913 gives definition of scenarios and KPIs, and also the requirements that NR should fulfil. It is more related to objective2, the evaluation methodology and KPI part. And it can be the detail reference of the SI, as has been done for all the past SIs, and may be there is no need to list it explicitly.

For the modification to objective 2, for the relative model method, how to reflect the EE as KPI needs to be studied, so may be it can be in a general description as current objective.

6 – LG Electronics France

We are ok with removing detailed examples in justification part as in the first proposal in RP-213086.

7 – NEC Telecom MODUS Ltd.

The relative model is a good start point for evaluating the techniques of network energy saving. However, the details given in objective 1 seem no need in the SID.

8 – Samsung Electronics Co.

We don't see the need to update objective 1.

Current objective 3 is general enough as is.

9 – HUAWEI TECHNOLOGIES Co. Ltd.

We support the idea to have clearer guidance/at least high level description for the potential techniques, as given in our replies to Q1.

10 – CEWiT

11 – Motorola Mobility UK Ltd.

Objective 1: We are okay to include a network energy efficiency metric of TR38.840 in Objective 1. Can add a sentence "Additionally, a network energy efficiency metric in TR38.840 can be considered for evaluation".

Objective 3: We think that mentioning potential solution directions in the justification is sufficient.

12 – vivo Communication Technology

For the revision to object 3, we think in principle we are fine.

13 – Qualcomm Incorporated

Thanks China Telecom for the contribution.

For Objective 1, we think the proposed addition seems unnecessary. Such details can be further discussed during the study.

For Objective 2, the proposed addition is not necessary since it is already captured in the following text: “impact to network and user performance (e.g. spectral efficiency, capacity, UPT, latency), energy efficiency, and UE power consumption/complexity”

For Objective 3, we generally agree with the suggestion. To make it more concrete, we prefer copying the related text from the justification section to Objective 3 as follows:

“Study and identify techniques on the gNB and UE side to improve network energy savings in terms of both BS transmission and reception [RAN1, RAN2, RAN3, [RAN4]]

- Investigate how to achieve more efficient operation dynamically and/or semi-statically and finer granularity adaptation of transmissions and/or receptions in one or more of network energy saving techniques in time, frequency, spatial, and power domains, with potential support/feedback from UE, potential UE assistance information, and information exchange/coordination over network interfaces. Other solutions are not precluded.”

14 – Telia Company AB

Thanks China Telecom for contribution.

Proposal to change objective 3’s second bullet to be:

Other **techniques** should not be precluded.

solutions -> techniques

15 – Ericsson LM

We support China Telecom in making Objective 3 more detailed as also substantiated in our answer to Q1.

Regarding updating Objective 1, our preference is to discuss the details during the study and from that perspective, the current text seems to be OK.

16 – Nokia France

We are generally OK with these proposals, though not sure that they are essential. In particular, the change to objective 1 does not seem necessary; the focus should be on relative power. If the proposed change were to be made to objective 3, “should” should be changed to “may”, since not all of the listed domains necessarily have to be studied in order for the SI to be considered complete.

17 – Apple Italia S.R.L.

Thanks CTC for the contribution.

On the proposed change for objective 1, we do not think it should be added. We think it is sufficient to define relative power model.

On the proposed change for objective 2, we do not think it is needed. The applicable KPIs can be discussed during the study.

On the proposed changes on justification and objective 3, we agree in principle that some details should be provided for objective 3. We suggested moving the sentence in justification to objective, but we are open to discuss exactly how to capture it.

18 – InterDigital Belgium. LLC

Agree to move "the study should investigate [...]" to the objectives section. The second proposed addition may not be necessary.

Q4: comments on proposals in RP-213164 [8]

Feedback Form 4: Q4: comments on proposals in RP-213164 [8]

1 – MediaTek Inc.

Thanks for Huawei and HiSilicon contribution. We are supportive of all the 4 proposals, particularly Proposal 2 that clarifies what specific metrics for UE side can be considered.

2 – MediaTek Inc.

Thanks for CATT contribution. We are supportive of using relative power consumption model as in TR 38.840. On the other hand, the intention to model the power consumption of backhaul connection is not very clear to us since our impression on BS power consumption issue is that it is dominated by the RF/Antenna system instead of backhaul connection. But this can be part of BS power model discussion.

3 – MediaTek Inc.

Sorry for the ill placement of #2 response that is for Q5. Please skip it.

4 – Futurewei Technologies

Ok with the proposals though we think the current draft version is good enough also.

5 – Spreadtrum Communications

For "Techniques to enable network energy saving", we think the possible techniques are a part of study. For "Example scenarios for the study on network energy saving", we are fine to move it to the justification part.

6 – China Telecom Corporation Ltd.

Thanks for Huawei and Hisilicon's proposals. We are supportive of all the 4 proposals, and we are also fine to move the examples of scenarios to the justification part.

7 – Intel

Generally ok with suggested changes. One minor comment is that the power aspects of the objective 3 should include RAN4 (not just RAN1). Should merge with changes proposed by ZTE in RP-213390 and China Telecom in RP-213086

8 – ZTE Corporation

We are OK with the proposals in RP-213164 , and we think that the candidate techniques and features should be added in the objective.

9 – China Mobile Com. Corporation

We are fine with the proposals. The relative model has been discussed during previous email discussion and has been supported by most of the companies including us. May be it is supported in current version since the power model in TR 38.840 is also based on relative model?

10 – NEC Telecom MODUS Ltd.

We are generally fine with the proposals. Regarding Proposal 3, we suggest discussing details on energy saving techniques in the study stage. RAN does not need to discuss it at this stage.

11 – Samsung Electronics Co.

(As commented above) Current objective 3 is general enough as is.

12 – HUAWEI TECHNOLOGIES Co. Ltd.

Yes, as given in our replies to Q1, we think it is better to make it more focused.

13 – Motorola Mobility UK Ltd.

For proposal 3, we think efficient “semi-static” adaptation should also be studied. We prefer to keep potential solution directions as they are in the justification section.

14 – VODAFONE Group Plc

Disagree on proposal 4 (and to a certain extent on proposal 1). It is important to focus on real-world gains: these are “absolute gains” rather than relative gains on some small power consuming feature, and, the cells that have not (by implementation) been completely powered down are very likely to be operating in DSS mode - hence the DSS scenario needs to be moved to the forefront of companies’ minds.

15 – vivo Communication Technology

Proposal 1: A relative power consumption model should be defined for network power consumption model, by adapting the power model for UE in TR 38.840 suitably.

-> We support it.

Proposal 2: For the evaluation methodology, both the network energy saving gains and the network/user performance should be evaluated.

For evaluating network/user performance, at least the coverage of common signals for Idle UEs and the UPT of data transmission for connected UEs should be considered.

-> We don't think study coverage of the common signal is part of the study and thus not support this proposal.

Proposal 3: For the candidate techniques and features, support to focus on the following two areas:

- **dynamic and finer granularity adaptation of transmissions and/or receptions in one or more different domains (e.g., time, frequency, spatial, power). [RAN1]**
- **network and/or UE feedback/assistant information. [RAN1, RAN2, RAN3]**

-> *In principle we are fine.*

Proposal 4: The description on example scenarios in the objective section should be moved to the justification section.

-> *In principle we are fine.*

16 – Qualcomm Incorporated

Thanks Huawei for the contribution.

Proposal 1 looks fine to us.

Proposal 2 should be discussed during the study.

We agree on the focused areas of Proposal 3. In particular, we prefer to update Objective 3 as follows:

“Study and identify techniques on the gNB and UE side to improve network energy savings in terms of both BS transmission and reception [RAN1, RAN2, RAN3, [RAN4]]

- Investigate how to achieve more efficient operation dynamically and/or semi-statically and finer granularity adaptation of transmissions and/or receptions in one or more of network energy saving techniques in time, frequency, spatial, and power domains, with potential support/feedback from UE, potential UE assistance information, and information exchange/coordination over network interfaces. Other solutions are not precluded.”

17 – TELECOM ITALIA S.p.A.

We tend to agree with Vodafone. A large relative gain may have a negligible system gain. We should look at the overall system performance when evaluating different solutions

18 – Telia Company AB

We seem to agree with Vodafone and TIM comments. Overall system performance of realistic scenarios should be kept in mind in the evaluation work.

19 – Ericsson LM

We agree that Objective 3 should be more detailed to have a more focused discussion in the WGs. We are fine with having the scenarios either in objectives or in the justification.

20 – Nokia France

Generally we think the original text of the moderator’s draft revision of RP-212709 is fine. We are not sure that any changes are needed for proposals 1 and 2. If the additional bullets were to be included in objective 3, they should be prefaced by “which may include”, i.e. “3. Study and identify techniques on the gNB and UE side to improve network energy savings in terms of both BS transmission and reception, which may include: ”

21 – Apple Italia S.R.L.

Thanks Huawei/HiSilicon for the contribution.

For P1 and P2, we are not sure how this affects the draft SID.

For P3, we agree in principle that some details should be provided for objective 3. We suggested moving the sentence in justification to objective, but we are open to discuss exactly how to capture it.

P4 is already reflected in the current draft SID.

22 – InterDigital Belgium. LLC

Fine with P1, P3 and P4. Also fine with the intention of P2, but if this is included would suggest to add "latency" at least for the connected UEs.

Q5: comments on proposals in RP-213309 [10]

Feedback Form 5: Q5: comments on proposals in RP-213309 [10]

1 – MediaTek Inc.

Thanks for CATT contribution. We are supportive of using relative power consumption model as in TR 38.840. On the other hand, the intention to model the power consumption of backhaul connection is not very clear to us since our impression on BS power consumption issue is that it is dominated by the RF/Antenna system instead of backhaul connection. But this can be part of BS power model discussion.

2 – Futurewei Technologies

Including backhaul power consumption needs further clarification. Questions such as what kind of backhaul(s), how to model its power consumption, and how to model the activities over the backhaul, portion of power consumption relative to the whole BS power consumption, and the involvements with other network entities and other WGs. At this point of time, we prefer the study to be more focused and leave backhaul out.

3 – Spreadtrum Communications

Similar as other companies, we are not sure about the power consumption of backhaul. In our view, the power consumption in air-interface is much higher than that of backhaul. Does it mean the information though the backhaul can be shifted to air-interface? If it is not clear enough, we can postpone it to the study phase.

4 – China Telecom Corporation Ltd.

Thanks for CATT's contribution. We are supportive to adopting the relative power consumption model in TR 38.840. But we are not clear why the backhaul power consumption should be included in this work item. We think what really matters for network energy saving is to reduce the dynamic energy consumption of the AAU and the static part of the BBU. The motivation for including the backhaul power consumption needs further clarification.

5 – Intel

We are generally ok to include various NW and gNB architecture aspects as part of to the power model study component of the SI. However, not sure if we need to start listing the specific items that needs to be part of the study. While this can be done, then we will need further review of the contents. We can revisit whether backhaul aspects should be included in the WID when WID objectives are refined later.

6 – ZTE Corporation

We agree that the energy saving gain should be “relative” energy saving gain, while whether to include backhaul power consumption needs more clarification.

7 – China Mobile Com. Corporation

We are also supportive for the relative gain evaluation. For the backhaul link power model, we share similar view as other companies, more clarification is needed.

8 – NEC Telecom MODUS Ltd.

For the power consumption of backhaul, we share similar views as other companies. There seems no need to include the power consumption of the backhaul link in standardisation work.

9 – Samsung Electronics Co.

We share the view of “relative” energy saving gain.

10 – HUAWEI TECHNOLOGIES Co. Ltd.

Regarding the study for backhaul link, it seems more implementation related. Similar to many others’ comments, what would be the potential spec impact and how/what to study it is quite unclear at this stage. This could be revisited later.

11 – Panasonic Corporation

Our view is backhaul is not part of the discussion as there can be really multiple ways of the realizations and to be focused on air interface to manage the amount of TUs.

12 – Motorola Mobility UK Ltd.

We think RAN1 should be able to evaluate energy saving gains in Uu links without considering a power model for backhaul links. If RAN3 identifies an energy saving technique for a backhaul link, a backhaul link energy saving gain can be separately assessed in RAN3.

13 – VODAFONE Group Plc

The paper and the above discussion shows why we need to consider absolute power savings. i.e. whether a 50% power saving on a lower power element is more or less important than a 2% power saving on a high power component of the system.

14 – vivo Communication Technology

We support “relative” energy saving gain in the SI

15 – Qualcomm Incorporated

Thanks CATT for the contribution.

It is unclear if by backhaul, IAB is meant or rather fibre/cabled connection. In principle, backhaul energy consumption should be included in either case, but it is unclear if any significant fraction of energy consumption is spent on backhaul, in other than the IAB cases.

16 – TELECOM ITALIA S.p.A.

See the answer to the previous question: in line with Vodafone we need to look at the overall system performance and not at a simple relative gain

17 – Ericsson LM

We prefer to keep current scope and do not see need to further expand scope to other aspects as proposed in RP-213309.

18 – Nokia France

We agree with Mediatek’s comment. We are not sure that the backhaul link will be particularly relevant to this RAN1-led study. It is better to focus on the more significant aspects that can be influenced by the RAN1.

19 – Apple Italia S.R.L.

Thanks CATT for the contribution.

We are not sure about the motivation for including backhaul power consumption. Compared to air interface, the backhaul power consumption can much more network implementation dependent.

We are supportive of using relative power model.

20 – InterDigital Belgium. LLC

Same concern as other companies about adding ”backhaul connection” - prefer to focus scope on air interface aspects. Fine with ”relative” gain.

Q6: comments on proposals in RP-213390 [11]

Feedback Form 6: Q6: comments on proposals in RP-213390 [11]

1 – MediaTek Inc.

Thanks for ZTE contribution. We are supportive of the proposed changes to objective item 3. Having RAN4 involvement, particularly for power/PA domain of enhancement, will be very useful.

2 – Futurewei Technologies

We are ok to have RAN4 involvement on objective 3.

<p>3 – Spreadtrum Communications</p> <p>For the modification of objective 3, we still think the possible techniques are a part of study. If it is the majority view, we can live with it.</p>
<p>4 – China Telecom Corporation Ltd.</p> <p>Thanks for ZTE’s proposals. In fact, we have the extremely similar views on objective 3 with ZTE.</p>
<p>5 – Intel</p> <p>Ok with ZTE’s suggested changes. Should merge with proposed change by Huawei RP-213164 and China Telecom in RP-213086.</p>
<p>6 – ZTE Corporation</p> <p>Agree.</p>
<p>7 – China Mobile Com. Corporation</p> <p>We are fine with the proposal.</p>
<p>8 – Samsung Electronics Co.</p> <p>Support adding RAN4, but not support adding detailed techniques (to be studied and identified during the study phase)</p>
<p>9 – HUAWEI TECHNOLOGIES Co. Ltd.</p> <p>Yes, as given in our replies to Q1, we think it is better to make it more focused.</p>
<p>10 – Panasonic Corporation</p> <p>We support the involvement of RAN4.</p>
<p>11 – Motorola Mobility UK Ltd.</p> <p>We prefer to leave potential solution directions in the justification section. Preferred solutions and recommendations for normative work can be decided as a conclusion of the Study Item.</p>
<p>12 – VODAFONE Group Plc</p> <p>We are fine with the proposal.</p>
<p>13 – vivo Communication Technology</p> <p><i>In principle we are fine to support the update of objective 1.</i></p>
<p>14 – Qualcomm Incorporated</p> <p>Thanks ZTE for the contribution. We agree that we should have some guidance in Objective 3. We prefer copying the related text from the justification section to Objective 3 as follows:</p> <p>“Study and identify techniques on the gNB and UE side to improve network energy savings in terms of both BS transmission and reception [RAN1, RAN2, RAN3, [RAN4]]</p>

- Investigate how to achieve more efficient operation dynamically and/or semi-statically and finer granularity adaptation of transmissions and/or receptions in one or more of network energy saving techniques in time, frequency, spatial, and power domains, with potential support/feedback from UE, potential UE assistance information, and information exchange/coordination over network interfaces. Other solutions are not precluded.”

15 – TELECOM ITALIA S.p.A.

Support adding RAN4

16 – Ericsson LM

We support to make Objective 3 more detailed as also substantiated in our response to Q1.

17 – Nokia France

The proposal is OK but not essential. We could say ”which may include” rather than ”including one or more techniques....”

18 – Apple Italia S.R.L.

Thanks ZTE/Sanechips for the contribution.

The proposal is aligned with our suggestion, so we are supportive in general.

19 – InterDigital Belgium. LLC

Support updating objective 3 and also fine with Qualcomm proposal.

Q7: comments on proposals in RP-213209 [9] and RP-213471 [12]

Feedback Form 7: Q7: comments on proposals in RP-213209 [9] and RP-213471 [12]

1 – MediaTek Inc.

Thanks for CMCC contribution. We are supportive of both proposals, where Proposal 1 is to categorize the investigated schemes into “backward compatible” or “non-backward compatible”. For “backward compatible”, it will also be helpful by further specifying “which release” due to different UE capability requirements. Regarding Proposal 2, it is highly appreciated that both gNB and UE KPIs are considered.

2 – Futurewei Technologies

We appreciate CMCC’s proposals. About backward compatible perspective, since it is sometimes not easy to define the backward compatibility of a design (for example, turning off a carrier), and that we already have the text on ”assessing/balancing impact to network and user performance”, we can simply state that ”impact on KPIs of gNB and UEs should be considered” without mentioning ”backward compatibility”.

3 – Spreadtrum Communications

For ”backward compatibility” and ”non-backward compatibility”, we are fine to have the more descriptions on them in justification part.

4 – China Telecom Corporation Ltd.

Thanks for CMCC’s contribution. We are supportive of the modification of the SID on the examples of the scenarios. We are fine with motivations of the two proposals. However, for the first proposal, we think at least for the SI period, we should study all the potential solutions first then further identify the solutions are backward compatible or not, it maybe a little early to talk about the ”back compatibility” at this point. As for the second proposal, we think the description of objective2 has already indicated the solutions should have as little negative impact on the KPIs of gNB and UE as possible, so the adding part may not needed here.

5 – SHARP Corporation

Appreciate for CMCC’s contribution. We also believe it is beneficial to keep in mind that network energy saving might cause different impacts on Rel-18 UEs and legacy UEs. We are not clear on definition of “non-backward compatible”, more specifically, whether “legacy UEs may have problems to work on such bands ...” means the legacy UEs cannot properly work or the legacy UEs suffer degraded performance.

6 – Intel

No specific comments for the justification changes.

The text “without impact on KPIs of gNB and UE” may not be needed, at the very least may require further clarification. We think the concerns from CMCC could potentially resolved during WID objective drafting once the techniques are identified. Companies can review the KPIs from the SI, and select the techniques for WI. So this change may not be needed for SI.

7 – ZTE Corporation

We agree with China Telecom that we should study all the potential solutions first in the study phase, then further discuss whether the solutions are backward compatible or not. For the second proposal in RP-213209/RP-213471, the description of the current objective 2 which includes impact on NW and UE as KPIs is enough.

8 – NTT DOCOMO INC.

We agree with ZTE and China Telecom that all the potential solutions should be studied first and then it should be discussed whether each solution can be backward compatible or not depending the details on the solution. Accordingly, there is no need to describe ”backward compatibility” in the SID.

9 – LG Electronics France

We are not supportive to explicitly support non-backward compatible schemes as in proposal as in proposal 2 in RP-213209 for the moment, since it can be something discussed during the SI phase and the current description of compatibility with legacy UEs seems general enough.

10 – China Mobile Com. Corporation

For the first proposal, our intention is that the study should not preclude SSB less schemes since legacy UEs can not work on such carriers. During previous email discussion, there are some arguments that SSB less carriers may have problems to serve legacy UEs. But we think this can be very useful for re-farmed spectrum or new allocated NR bands, so clarification is needed in the justification part and it should be in the scope.

For the second proposal, we think qualitative KPIs such as handover performance, call drop rate, and initial access performance need also to be considered when design network energy saving schemes.

11 – NEC Telecom MODUS Ltd.

We are generally fine with introducing both backward compatible and non-backward compatible techniques explicitly to NW energy saving. Further discussion might be needed on how to evaluate the KPIs.

12 – Samsung Electronics Co.

‘Note 1’ in current draft SID seems to address the proposal 1 [12] already.

13 – HUAWEI TECHNOLOGIES Co. Ltd.

In our understanding, the consideration for legacy UEs is already captured in the note 1 as copied below:

Note 1: legacy UEs should be able to continue accessing a network implementing Rel-18 network energy savings techniques, with the possible exception of techniques developed specifically for greenfield deployments.

Also share similar views as some companies, it is indeed difficult to clearly define what is (non-)backward compatible, and it is preferred not to use the term of “compatible” in the draft SID.

For the second proposal, similar to Intel, we generally agree with it and think it would naturally be part of study like all other topics where UE impact needs to be studied.

In summary, it seems the two proposals are business as usual and there is no need to specially/explicitly set an objective as proposed.

14 – Panasonic Corporation

We support to clarify that the R18 network saving study should include both backward compatible schemes and non backward compatible schemes that can be applied to newly allocated 5G bands.

15 – Motorola Mobility UK Ltd.

We are also open to study non-backward compatible energy saving schemes. In our understanding, Note 1 (copied below) under Objective addresses both backward compatible and non-backward compatible solutions.

“Note 1: legacy UEs should be able to continue accessing a network implementing Rel-18 network energy savings techniques, with the possible exception of techniques developed specifically for greenfield deployments.”

We don’t think it is necessary to list out detailed techniques in the SID.

16 – vivo Communication Technology

UE backward compatibility is important for consideration. For non-backward compatible solutions, we think it should be very limited to some simple extension of existing solution which has less UE complexity.

17 – Qualcomm Incorporated

Thanks CMCC for the contribution. Regarding the following proposed addition to the justification section: “... by techniques such as SSB/SIB less or SSB/SIB periodicity adaptation, dynamic TX/RX or RS port adaptation, or dynamic transmit power level adjustment, etc. and related enhancements”, we think that listing these detailed example techniques is unnecessary at this stage. We can leave this consideration to the study.

18 – Ericsson LM

We agree with CMCC that non-backward solutions for specific bands can be considered.

19 – Nokia France

We think it is best left to the study item itself to consider the impacts of non-backward-compatible schemes if any are proposed. We don’t see the need to mention anything in the SID explicitly. Note 1 already states *”legacy UEs should be able to continue accessing a network implementing Rel-18 network energy savings techniques, with the possible exception of techniques developed specifically for greenfield deployments”*.

20 – Apple Italia S.R.L.

Thanks CMCC for the contribution.

For P1, we are open to study non-backward compatible scheme, if that is the majority view. Alternatively, it can be left to discussion during the study.

For P2, we are generally supportive of the intention. However, it may not be possible to have no impact on the KPIs at all. It is probably better to say “minimizing the impact”, instead of “without impact”.

21 – InterDigital Belgium. LLC

For P1, the current ”Note 1” may be sufficient.

For P2, this may be ok but would replace ”avoid” with ”minimize” as suggested by Apple.

2.2 Initial phase summary

Thank you for the responses. Since similar proposals were discussed in multiple questions, the summary is provided for each topics raised in the questions and responses, rather than for each question separately.

Title of the SID and impact to LTE base station

The vast majority of companies prefer the title “Study on network energy savings for NR” rather than “Study on network energy savings for NR and EN-DC/NR-DC”, with the understanding that power consumption of NR base station will be studied under various scenarios including EN-DC, NR-DC and DSS, but no impact to LTE base station is expected.

Proposed WF: keep the title of the study as “Study on network energy savings for NR”, and clarify with a note in the objectives section of the SID that solutions should not require changes to LTE base stations.

Summary of comments on example scenarios

The guidance from the RAN Chair was to move the list of example scenarios from the objectives section to the justification section. Several operators expressed a preference to keep the list of example scenarios in the objectives section, and proposed to re-order the list starting the macro cell scenarios. There was no strong preference to have the list of example scenarios only in the justification section. It is the moderator's feeling that having the list of example scenarios in justification or objectives section doesn't make much difference overall. Let's see if we can move forward keeping the example scenarios in the objectives section. A note is added to clarify that the scenarios are listed in no particular order. The bracket around FR2 is removed in the updated SID version, according to Ericsson's comment.

Proposed WF: keep the list of example scenarios in the objectives section, and clarify that the scenarios are listed in no particular order.

Summary of comments on impact to UE performance and power consumption, and backward compatibility

Several device manufacturers asked for adding a note saying "UE power consumption and performance should not be obviously negatively impacted by network energy saving techniques". It was additionally proposed that network-wise energy savings should be targeted by the study. On the other hand, it was commented by other companies that this is business as usual and does not require further clarification, and that objective 2 was already formulated based on such comments in the past so those comments were already addressed by the following text: "as well as assessing/balancing impact to network and user performance (e.g. spectral efficiency, capacity, UPT, latency), energy efficiency, and UE power consumption/complexity". Therefore, it is the moderator's understanding that no further clarification is needed in the objective section. Clarifications can be considered in the justification section, as also broadly supported based on CMCC's proposal 1 in RP-213471 [12] (see Q7). Regarding aspects related to backward compatibility discussed in response to Q7, there were concerns on directly using the wording on backward compatibility as it may not be clearly defined, and it was noted that this is sufficiently addressed by "Note 1: legacy UEs should be able to continue accessing a network implementing Rel-18 network energy savings techniques, with the possible exception of techniques developed specifically for greenfield deployments.". While certain companies asked for not allowing solutions with impact to backward compatibility, other companies did not agree to limit the scope of the study.

Proposed WF: consider additions to the justification section on aspects of impact to UE performance and power consumption and other example KPIs, based on the text in objective 2, proposal 1 in RP-213471 and comments in the initial round.

Summary of comments on clarifying the scope of objective 1

The proposed changes were about changing "network" to "base station". While the vast majority of companies supported the change, TIM expressed concerns arguing that this could lead to sub-optimal solutions, and to have a holistic view of what is the system level impact of a solution (either from UE or BTS). The moderator would like to clarify that objective 2 clarifies that the holistic view is included in the definition of the evaluation methodology (similar as concerns on UE performance and power consumption discussed above), and that the goal of objective 1 is precisely to develop a model for BS energy consumption, since the model for UE energy consumption was already defined by RAN1 in TR38.840.

Proposed WF: confirm changing occurrences of "network" to "base station" in objective 1.

Summary of comments on clarifying the scope of objective 3

Comments were received in responses to Q1, Q3, Q4 and Q6. As in the past, there were different views on whether to add sub-bullets to objective 3 to clarify the scope of the objective, or to leave it generic as in the current draft SID, but the majority would prefer a clarification even if it does not limit the scope of the solutions to be studied. It was also pointed out that this may help clarify the expected study in RAN1, RAN2 and RAN3. There were also a few proposals to add further details or narrow the space of the solutions that can be considered in the different WGs (e.g. MediaTek proposed to limit RAN2 looking at time-domain techniques only). However, considering past discussions, it is the moderator's feeling that narrowing the space of solutions is likely not going to be acceptable given this is the first RAN study on this topic. The moderator's proposal is therefore to move the text back from the justification section to objective 3 without changes.

Proposed WF: consider adding the following sub-bullet to objective 3 (moving back from the justification section and splitting into separate sub-bullets to clarify the responsibilities of each WG)

- Dynamic and finer granularity adaptation of transmissions and /or receptions in one or more of time, frequency, spatial, and power domains with potential support/feedback from UE [RAN1, RAN2]*
- Potential UE assistance information [RAN2]*
- Information exchange/coordination over network interfaces [RAN3]*

Summary of comments on involving RAN4 as a secondary responsible WG

A few companies asked for adding RAN4 as a secondary WG to objective 3, while currently the SID considers that RAN4 may only need to be involved by LS as needed, e.g. for input to the power consumption model of certain components of the base station to be modeled in objective 1. More views will be sought in the intermediate round. It should be noted that RAN4 TU have not been considered for this study item according to the scope in RP-212709. It was not clear to the moderator whether proposals to add RAN4 to objective 3 was intended to be in support of the solutions studied by RAN1, or for RAN4 to independently study RAN4-only solutions.

Proposed WF: discuss in intermediate round whether the intent for adding RAN4 as a responsible WG for objective 3 is in support of the solutions studied by RAN1, or for RAN4 to independently study RAN4-only solutions. Also discuss whether RAN4 should be added to objective 1.

Summary of comment on impact to SLA assurance for RAN slices

Telstra proposed adding the following to objective 3: Study and identify techniques on the gNB and UE side to improve network energy savings in terms of both BS transmission and reception without impacting SLA assurance for RAN slices. The study may need to consider how energy saving initiatives integrate with an orchestrator. The moderator's proposal is to add this as an additional note in the objective section, as it is not clear that RAN WGs can directly work on this, but if there is any doubt then liaison can be done with SA5. The note would ensure keeping this aspect in mind during the study.

Proposed WF: add the following note into the objectives section:

Note 3: the identified techniques should avoid impacting SLA assurance for RAN slices. The study may need to consider how energy saving initiatives integrate with an orchestrator.

Summary of comments on considering backhaul energy consumption in RP-213309 [10]

CATT proposed that the study should not only focus on the NR base station, but also consider the power consumption of the backhaul. While responses recognized that power consumption also occurs in the backhaul, there seems to be a preference to focus on the power consumption on the base station for this short study. Questions were raised on which type of backhaul was intended to be modelled (e.g. fiber, cable, wireless such as IAB), and it was also pointed out that this would expand the scope of solutions. It is the moderator's feeling that while power consumption in the backhaul is certainly relevant, the scope and duration of the study for Rel-18 would only allow studying the base station, while backhaul power consumption could be considered in a later release, with the understanding that in most cases the network power consumption is not dominated by the backhaul.

Proposed WF: do not consider backhaul energy consumption in the Rel-18 study item. Backhaul energy consumption may be considered in a later release.

Summary of responses to other proposals in Q3, Q4, Q5, Q6 and Q7

Regarding proposals other than the ones summarized above, there was either lack of support, or unanimous support for proposals (e.g. some proposals in RP-213164) that are already consistent with the current draft SID. Therefore no further action is needed.

3 Intermediate Phase

Please provide your answers to the questions below by the deadline of 19:00 UTC on Wednesday December 8th. The proposals below are reflected in v002 of the draft SID with blue highlights.

3.1 Intermediate phase questions

Proposal 1: Keep the title of the study as "Study on network energy savings for NR", and clarify with a note in the objectives section of the SID that solutions should not require changes to LTE base stations.

– Note 2: the identified techniques should not require changes to LTE base stations.

Feedback Form 8: Responses to proposal 1

1 – Guangdong OPPO Mobile Telecom.

We can accept with or without added note.

<p>2 – SoftBank Corp.</p> <p>fine with the moderator proposal</p>
<p>3 – New H3C Technologies Co.</p> <p>We support the moderator proposal.</p>
<p>4 – SHARP Corporation</p> <p>We are fine with Proposal 1.</p>
<p>5 – China Telecom Corporation Ltd.</p> <p>We support the proposal 1.</p>
<p>6 – China Mobile Com. Corporation</p> <p>We are fine with Proposal 1.</p>
<p>7 – DOCOMO Communications Lab.</p> <p>We are fine with the proposal 1.</p>
<p>8 – LG Electronics France</p> <p>We are fine with the proposal</p>
<p>9 – Spreadtrum Communications</p> <p>Fine for the proposal.</p>
<p>10 – Panasonic Corporation</p> <p>We support the proposal.</p>
<p>11 – MediaTek Inc.</p> <p>We are fine with this proposal.</p>
<p>12 – CAICT</p> <p>Support.</p>
<p>13 – ZTE Corporation</p> <p>It is clear that the network energy saving should focus on NR only, so we are fine with or without the note.</p>
<p>14 – HUAWEI TECHNOLOGIES Co. Ltd.</p> <p>Support the proposal.</p>

15 – China Telecom Corporation Ltd.

According to the note in the Chairman’s summary of CA enhancement, the inter-band CA with SSB-less in Scell is expected to be implicitly/explicitly considered as part of network energy savings, we suggest to modify the example list of the scenarios as follows:

The following example scenarios are listed in no particular order.

- Urban micro in FR1, including TDD massive MIMO (note: this scenario can also model small cells)
- FR2 beam-based scenarios (note: this scenario can also model small cells)
- Urban/Rural macro in FR1 with/without DSS (no impact to LTE expected in case of DSS)
- EN-DC/NR-DC macro with FDD PCell and TDD/Massive MIMO on higher FR1/FR2 frequency
- **inter-band CA with SSB-less in Scell**

16 – Motorola Mobility UK Ltd.

Fine with the proposal 1.

17 – Deutsche Telekom AG

We are fine with Proposal 1.

18 – vivo Communication Technology

We support.

19 – Samsung Electronics Co.

The intention of Note 2 is obvious even without it.

20 – Futurewei Technologies

We support

21 – Ericsson LM

This looks fine to us.

22 – Telia Company AB

Proposal 1 is ok for us.

23 – CATT

We are OK with the proposal

24 – Apple Italia S.R.L.

We are fine with the proposal.

25 – AT&T

Support the proposal

<p>26 – NEC Telecom MODUS Ltd.</p> <p>We support this proposal.</p>
<p>27 – Nokia France</p> <p>We support proposal 1.</p>
<p>28 – Intel</p> <p>Ok with proposal 1</p>
<p>29 – Qualcomm Incorporated</p> <p>Agree with Proposal 1.</p>
<p>30 – InterDigital Belgium. LLC</p> <p>Fine with proposal 1.</p>
<p>31 – VODAFONE Group Plc</p> <p>No, the note should say that changes to LTE UEs are not required. LTE and NR base stations are quite integrated, so there is no great problem in changing them.</p>
<p>32 – Verizon UK Ltd</p> <p>Support the proposal</p>

Proposal 2: keep the list of example scenarios in the objectives section, and clarify that the scenarios are listed in no particular order.

Feedback Form 9: Responses to proposal 2

<p>1 – Guangdong OPPO Mobile Telecom.</p> <p>We actually prefer to move the scenarios into the Justification. The reason is it is more about the use cases of the enhancement.</p> <p>Putting scenarios, even they are examples, into Objectives is quite unusual for a SI. Its more like a procedure issue.</p>
<p>2 – SoftBank Corp.</p> <p>We are fine with the proposal</p>
<p>3 – New H3C Technologies Co.</p> <p>We are fine with moderator’s proposal</p>
<p>4 – SHARP Corporation</p> <p>We are fine with Proposal 2.</p>

<p>5 – TELECOM ITALIA S.p.A.</p> <p>we are fine with the proposal</p>
<p>6 – China Telecom Corporation Ltd.</p> <p>We prefer to move the example list of scenarios in the justification, it looks a little weird to be in the objective, while it is actually not an objective. The former version in initial phase would be better.</p>
<p>7 – China Mobile Com. Corporation</p> <p>We also think it is better to move this to justification part, however we can accept proposal 2 if it is majority view and agree with moderator that it doesn't make much difference overall.</p>
<p>8 – DOCOMO Communications Lab.</p> <p>We are fine with the proposal 2.</p>
<p>9 – Spreadtrum Communications</p> <p>Fine for the proposal.</p>
<p>10 – Panasonic Corporation</p> <p>We support the proposal.</p>
<p>11 – MediaTek Inc.</p> <p>We think objective should be specific enough for execution while current wording uses "example" scenarios and emphasize "no particular order", which looks just for information only. In this regard, moving the information to justification part would be better for the clarity of the objectives</p>
<p>12 – CAICT</p> <p>We are fine with the proposal.</p>
<p>13 – ZTE Corporation</p> <p>We are fine with the proposal.</p>
<p>14 – HUAWEI TECHNOLOGIES Co. Ltd.</p> <p>We can accept the proposal, though we think it is better to move to the justification.</p>
<p>15 – Motorola Mobility UK Ltd.</p> <p>Fine with the proposal 2.</p>
<p>16 – Deutsche Telekom AG</p> <p>We are fine with Proposal 2.</p>
<p>17 – vivo Communication Technology</p> <p>We are fine to keep the scenario in the object so that we can have a clear target.</p>

<p>18 – Samsung Electronics Co.</p> <p>Prefer to keep it in the justification section as in v001.</p>
<p>19 – Futurewei Technologies</p> <p>We prefer to keep it in the justification section but can accept the proposal if that's the majority view.</p>
<p>20 – Ericsson LM</p> <p>We prefer to have the scenarios in the justifications section</p>
<p>21 – Telia Company AB</p> <p>We agree with proposal 2.</p>
<p>22 – CATT</p> <p>We would prefer to move the scenarios in the justification section. If the scenarios are included in the objectives, we suggested to be included as "examples".</p>
<p>23 – Apple Italia S.R.L.</p> <p>We prefer to have the scenarios in justification section, but we would be fine to have it in objectives section if that is the majority view.</p>
<p>24 – AT&T</p> <p>Support the proposal</p>
<p>25 – NEC Telecom MODUS Ltd.</p> <p>We are fine with this proposal.</p>
<p>26 – Nokia France</p> <p>We are OK either way.</p>
<p>27 – Intel</p> <p>Ok with Proposal 2.</p>
<p>28 – Qualcomm Incorporated</p> <p>We do not think keeping the example scenarios in the objectives is necessary.</p>
<p>29 – InterDigital Belgium. LLC</p> <p>Ok with Proposal 2.</p>
<p>30 – VODAFONE Group Plc</p> <p>Support the proposal.</p>

31 – Verizon UK Ltd

Fine

Proposal 3: consider additions to the justification section on aspects of impact to UE performance and power consumption and other example KPIs, based on the text proposal in v002 of the updated draft SID copied below:

The study should not only evaluate the potential network energy consumption gains, but also assess and balance the impact on network and user performance, e.g. by looking at KPIs such as spectral efficiency, capacity, user perceived throughput (UPT), latency, energy efficiency, UE power consumption, complexity, handover performance, call drop rate, initial access performance, etc. The techniques to be studied should avoid having a large impact to such KPIs.

Feedback Form 10: Responses to proposal 3

1 – Guangdong OPPO Mobile Telecom.

The text seems more suitable for putting into a objectives.

As UE vendor, we also have strong interesting the ensure the UE complexity, Power Consumption and Backward compatibility. A bullet in objectives is suggested as.

A network power saving schemes should not significantly impact the UE complexity, Power Consumption and Backward compatibility.

2 – SoftBank Corp.

It looks to us that this description is more suitable for objective part. We are OK to go with majority view, though.

3 – New H3C Technologies Co.

We are fine with *additions to the justification section on aspects of impact to UE performance*. It belongs to trade-off issue.

4 – SHARP Corporation

We believe it is Okay to keep the text in justification section.

5 – China Telecom Corporation Ltd.

We are fine with the proposal.

6 – Telstra Corporation Limited

We are also ok with the moderators proposal.

7 – DOCOMO Communications Lab.

We are fine with the proposal 3.

8 – Spreadtrum Communications

The suggestion of OPPO is our first preference. If it is majority view to include it in the justification part, we can live with it.

9 – Panasonic Corporation

We support the proposal.

10 – China Mobile Com. Corporation

We are fine with the proposal.

According to the comments of first round, we see support for study of non backward compatibility schemes, and we can accept with no modification as long as it is common understanding that the study does not preclude schemes such as SSB less carriers, where legacy UE can not be served on those carriers.

11 – MediaTek Inc.

Thanks moderator for adding this paragraph and including more metrics/KPIs (handover performance, call drop rate, initial access performance) that are related to "impact to legacy UE operations". We would like to provide the following suggestions:

- Given the listed metrics/KPIs are all important and critical, the last sentence, "The techniques to be studied should avoid having a large impact to such KPIs." may somehow give the impression: *Medium impact to such KPIs are acceptable.*
 - o If this is not the intention, we would suggest to revise it as:
"The techniques to be studied should avoid having a **large negative** impact to such KPIs."
- We also suggest to add the following metrics/KPIs to Objective 2: handover performance, call drop rate, initial access performance

12 – CAICT

We are fine with the update.

13 – HUAWEI TECHNOLOGIES Co. Ltd.

We can accept the proposal. There is no need to move this kind of note to the objective section, especially the current objective 2 already reflects the main idea in our understanding.

14 – ZTE Corporation

We are okay with the additions to the justification, we think the version suggested by moderator is more acceptable.

15 – Motorola Mobility UK Ltd.

Fine with the proposal 3.

<p>16 – Deutsche Telekom AG</p> <p>There is a strong overlap with the text proposed to be added at the end of the Justification section with the text in the Objective section under "2. Definition of an evaluation methodology and KPIs".</p> <p>Therefore, we would like to propose to shorten the KPI list in the Justification section and to refer to the list in Objective part for details.</p>
<p>17 – vivo Communication Technology</p> <p>We think this part can be part of the objective.</p>
<p>18 – Samsung Electronics Co.</p> <p>The proposed text looks more in line with objective. It imposes additional requirement for the study, i.e., "The techniques to be studied should avoid having a large impact to such KPIs."</p>
<p>19 – Futurewei Technologies</p> <p>We are fine with the proposal</p>
<p>20 – Ericsson LM</p> <p>We support the proposal</p>
<p>21 – Telia Company AB</p> <p>We are fine with Proposal 3.</p>
<p>22 – CATT</p> <p>We are OK with Proposal to be included in the justification. The details should leave to working group to identify during the study.</p>
<p>23 – NEC Telecom MODUS Ltd.</p> <p>We are generally fine with the main concept of assessing and balancing the impact on network and user performance. However, it is not clear how to evaluate the 'large impact to such KPIs'.</p>
<p>24 – Apple Italia S.R.L.</p> <p>We are fine with the proposal.</p>
<p>25 – Intel</p> <p>Ok with Proposal 3</p>
<p>26 – Nokia France</p> <p>There is no fundamental problem with including this text in the justification, but it does not really add anything either. There is a lot of repetition of what is already in the objectives. And it is strange to say that the techniques should avoid having a large impact on energy efficiency!</p>

<p>27 – Qualcomm Incorporated</p> <p>We support this change, although some of the same will be achieved by using Energy/bit/sec as a KPI already.</p>
<p>28 – InterDigital Belgium. LLC</p> <p>Support Proposal 3.</p>

Proposal 4: confirm changing occurrences of “network” to “base station” in objective 1. Note that one corresponding change was also made to the justification section in draft SID v002.

Feedback Form 11: Responses to proposal 4

<p>1 – Guangdong OPPO Mobile Telecom.</p> <p>We are fine to limit its only for gNB,</p>
<p>2 – SoftBank Corp.</p> <p>we are fine with the proposal</p>
<p>3 – New H3C Technologies Co.</p> <p>We support it.</p>
<p>4 – SHARP Corporation</p> <p>We are fine with Proposal 4.</p>
<p>5 – China Telecom Corporation Ltd.</p> <p>We are fine with the proposal.</p>
<p>6 – China Mobile Com. Corporation</p> <p>We are fine with Proposal 4.</p>
<p>7 – DOCOMO Communications Lab.</p> <p>We are fine with the proposal.</p>
<p>8 – LG Electronics France</p> <p>We are fine with the proposal</p>
<p>9 – Spreadtrum Communications</p> <p>Fine for the proposal.</p>

<p>10 – Panasonic Corporation</p> <p>We support the proposal.</p>
<p>11 – MediaTek Inc.</p> <p>We are fine with this proposal.</p>
<p>12 – CAICT</p> <p>Support.</p>
<p>13 – HUAWEI TECHNOLOGIES Co. Ltd.</p> <p>Fine.</p>
<p>14 – ZTE Corporation</p> <p>OK with the proposal.</p>
<p>15 – Motorola Mobility UK Ltd.</p> <p>Fine with the proposal 4.</p>
<p>16 – Deutsche Telekom AG</p> <p>Ok for us.</p>
<p>17 – vivo Communication Technology</p> <p>Support the proposal</p>
<p>18 – Futurewei Technologies</p> <p>We are fine with the proposal</p>
<p>19 – Ericsson LM</p> <p>We support the proposal</p>
<p>20 – Telia Company AB</p> <p>We agree with proposal 4.</p>
<p>21 – CATT</p> <p>We are OK to change from Network to base station. However, the power consumption at base station for network connection between two base stations and between base stations and core network should not be ignored.</p>
<p>22 – AT&T</p> <p>Support the proposal</p>

<p>23 – NEC Telecom MODUS Ltd.</p> <p>We are fine with this proposal.</p>
<p>24 – Apple Italia S.R.L.</p> <p>support</p>
<p>25 – Intel</p> <p>Ok with proposal 4</p>
<p>26 – Nokia France</p> <p>We support the proposal.</p>
<p>27 – Qualcomm Incorporated</p> <p>We support making this change.</p>
<p>28 – InterDigital Belgium. LLC</p> <p>Support Proposal 4.</p>

Proposal 5: consider adding the following sub-bullets to objective 3 (moving back from the justification section and splitting into separate sub-bullets to clarify responsibilities of each WG)

Objective 3. Study and identify techniques on the gNB and UE side to improve network energy savings in terms of both BS transmission and reception [RAN1, RAN2, RAN3, [RAN4]], which may include:

- How to achieve more efficient operation dynamically and/or semi-statically and finer granularity adaptation of transmissions and/or receptions in one or more of network energy saving techniques in time, frequency, spatial, and power domains, with potential support/feedback from UE [RAN1, RAN2]
- Potential UE assistance information [RAN2, RAN1]
- Information exchange/coordination over network interfaces [RAN3]

Feedback Form 12: Responses to proposal 5

<p>1 – Guangdong OPPO Mobile Telecom.</p> <p>We prefer original objectives 3. The new proposal seems need more discussion in the SI</p>
<p>2 – New H3C Technologies Co.</p> <p>From our perspective, main bullet is enough and all of 3 subbullets can be discussed during SI stage.</p>
<p>3 – LG Electronics France</p> <p>The second sub-bullet can be removed since the same is already included in the first sub-bullet as ‘UE feedback’. What is important in the TR would be only to figure out the candidates of techniques for net-</p>

work energy saving and potential assistance information to/from UE, rather than concluding the details of assistance information delivery.

4 – Spreadtrum Communications

We are supportive to the main bullet and the first bullet. For the second/third bullet, we think it may not be a part of technique but more like a signaling design.

5 – Panasonic Corporation

We support the proposal.

6 – China Mobile Com. Corporation

We support the proposal.

7 – China Telecom Corporation Ltd.

We support the proposal.

8 – CAICT

It's fine for us to add some examples here and the details may depend on the discussions in SI.

9 – China Telecom Corporation Ltd.

And we think that a sub-bullet "**Other techniques are not precluded**" can be added.

10 – HUAWEI TECHNOLOGIES Co. Ltd.

We can accept the proposal, though we think it is better to remove "and/or semi-statically" from the first bullet. Compared to only listing the main bullet, we think this proposal is better, since the three sub-bullets can still provide the guidance on the potential techniques to study to some extent.

11 – ZTE Corporation

We support to add the sub-bullets to objective 3, which will be beneficial to the convergence of discussion within the limited TU.

12 – MediaTek Inc.

We are supportive to have more explicit work directions and work split for each WG. On the other hand, RAN2 may not be able to conduct effective study before RAN1 provides detailed evaluation methodology. In this regard, having RAN2 to start with a simpler aspect, e.g., time domain techniques for the case with idle/inactive UEs, would be more reasonable. Also having RAN1 evaluation support is also helpful for the study progress. In this regard, we suggest to revise 1st subbullet of Objective 3 as follows:

3. Study and identify techniques on the gNB and UE side to improve network energy savings in terms of both BS transmission and reception [RAN1, RAN2, RAN3], which may include:

- How to achieve more efficient operation dynamically and/or semi-statically and finer granularity adaptation of transmissions and/or receptions in one or more of network energy saving techniques in time, frequency, spatial, and power domains, with potential support/feedback from UE [RAN1, RAN2]

- o **RAN2 to start with identifying candidate techniques to reduce BS transmission and reception in time domain for idle/inactive mode UEs. RAN1 evaluation works for the candidate techniques can be triggered by RAN2, if needed.**

- ...

13 – Motorola Mobility UK Ltd.

We are okay to move the texts back to Objective 3.

14 – Deutsche Telekom AG

We are generally fine with the proposal for Objective 3 except of the 2nd bullet point "Potential UE assistance information [RAN2, RAN1]" as in the first bullet point it is already stated "... with potential support/feedback from UE [RAN1, RAN2]".

For us the difference is unclear. Without further explanation for differentiation the 2nd bullet point should be removed.

15 – vivo Communication Technology

We think it can be discussed during the study item.

16 – Samsung Electronics Co.

Keep RAN4 in the main bullet and 1st sub-bullet

17 – Futurewei Technologies

We support this proposal

18 – Ericsson LM

We support the proposal

19 – Telia Company AB

We agree with Proposal 5. China Telecom comment could be added also.

""Other techniques are not precluded"" can be added"

20 – CATT

We are OK with the proposal.

21 – NEC Telecom MODUS Ltd.

We suggest discussing details on energy saving techniques in the study stage. RAN does not need to discuss it at this stage.

22 – Intel

We think that sub-bullet#2 and #3 depend on what energy saving techniques are evaluated in sub-bullet#1. Hence, we do not think that there is a need to split sub-bullet#2 and #3 from sub bullet#1 or they should be indicated as related to sub-bullet#1. Also it is still unclear to us what is the difference between 'potential

support/feedback from UE’ and ‘Potential UE assistance information’, we think that they can group into one. Suggest to update the objective as follow:

Objective 3. Study and identify techniques on the gNB and UE side to improve network energy savings in terms of both BS transmission and reception [RAN1, RAN2, RAN3, ~~RAN4~~], which may include:

- How to achieve more efficient operation dynamically and/or semi-statically and finer granularity adaptation of transmissions and/or receptions in one or more of network energy saving techniques in time, frequency, spatial, and power domains, with potential support/feedback/assistance from UE, and information exchange/coordination over network interfaces [RAN1, RAN2, RAN3]

~~Potential UE assistance information~~ [RAN2, RAN1]

~~Information exchange/coordination over network interfaces~~ [RAN3]

Or

Objective 3. Study and identify techniques on the gNB and UE side to improve network energy savings in terms of both BS transmission and reception [RAN1, RAN2, RAN3, ~~RAN4~~], which may include:

- How to achieve more efficient operation dynamically and/or semi-statically and finer granularity adaptation of transmissions and/or receptions in one or more of network energy saving techniques in time, frequency, spatial, and power domains, ~~with potential support/feedback from UE~~ [RAN1, ~~RAN2~~]

- Potential support/feedback/assistance~~UE assistance information~~ from UE [RAN2, RAN1]

- Information exchange/coordination over network interfaces [RAN3, RAN1]

23 – Qualcomm Incorporated

We are ok with this addition.

Although the main bullet has “which may include”, we prefer to add as a last sub-bullet “**Other techniques are not precluded.**”

24 – Nokia France

We agree with the companies who proposed deleting the second sub-bullet as it duplicates what is already covered by the first.

We think that it is unnecessary to add “other techniques are not precluded”, as the list already says “which may include”, which clearly indicates that it is not exhaustive.

25 – Apple Italia S.R.L.

We are generally supportive of adding sub-bullets for objective 3 to clarify the direction of investigation. As far as we understand, study will focus on techniques to allow time/freq/spatial domain adaptation to save network power, and the corresponding signaling (RAN1/RAN2/RAN3) to support it. Therefore we would like to suggest the rewording as follows:

Study and identify techniques on the gNB and UE side to improve network energy savings in terms of both BS transmission and reception [RAN1, RAN2, RAN3, ~~RAN4~~], which may include:

- *How to achieve more efficient operation dynamically and/or semi-statically and finer granularity adaptation of transmissions and/or receptions in one or more of network energy saving techniques in time, frequency, spatial, and power domains, **with***
 - o ***Potential support/feedback from UE [RAN1, RAN2]***
 - o ***Potential UE assistance information [RAN2, RAN1]***
 - o ***Potential information exchange/coordination over network interfaces [RAN3]***

We actually wonder, for the companies who don't support adding the sub-bullet, what other directions are being considered beyond "How to achieve more efficient operation dynamically and/or semi-statically and finer granularity adaptation of transmissions and/or receptions in one or more of network energy saving techniques in time, frequency, spatial, and power domains". Regardless of how SID is written, this is important to understand so that we know better the scope of the SID.

26 – InterDigital Belgium. LLC

Support Proposal 5.

Proposal 6: should RAN4 be added as a responsible WG for objective 1? If so, is it expected that RAN4 would only have to respond to requests from RAN1, or work independently on a BS energy consumption model?

Feedback Form 13: Responses to proposal 6

1 – Guangdong OPPO Mobile Telecom.

Maybe some LS based task could be asked to RAN4. But now RAN4 may not be listed as we not identified yet.

2 – New H3C Technologies Co.

During SI stage, it isn't necessary to include RAN4. After the completion of SI stage, if needed, RAN4 can be involved into this objective.

3 – China Telecom Corporation Ltd.

We are open to include the RAN4 for objective 1. But we think the RAN4 only needs to respond to requests from RAN1, the major work on energy consumption model should be done by RAN1.

4 – LG Electronics France

We think adding RAN4 would makes confusion on how to split the work between RAN1 and RAN2. RAN1 can proceed with appropriate information exchange with RAN4 depending on the necessity

5 – Spreadtrum Communications

Either wayforward is fine for us.

6 – MediaTek Inc.

For Objective 1, we expect the first base station energy consumption model and scaling will be provided by RAN1 for work efficiency. RAN4 can help to confirm the power-domain/PA related model for work

accuracy. In this regard, include RAN4 in Objective 1 is fine, but we suggest to specify RAN4 work for clarity:

1. Definition of a base station energy consumption model [RAN1, RAN4]

- Adapt the framework of the power consumption modelling and evaluation methodology of TR38.840 to the base station side, including relative energy consumption for DL and UL (considering factors like PA efficiency, number of TxRU, base station load, etc), sleep states and the associated transition times, and one or more reference parameters/configurations.
 - o **RAN4 to confirm the power-domain/PA related BS energy consumption model and scaling provided by RAN1**

Regarding Objective 3, we think RAN4 can help to clarify and/or confirm the questions from other WGs while there is currently no dedicated study topic proposed by companies. In this regard, we would suggest to remove RAN4 from Objective 3:

3. Study and identify techniques on the gNB and UE side to improve network energy savings in terms of both BS transmission and reception [RAN1, RAN2, RAN3, ~~RAN4~~], which may include:

- ...

7 – CAICT

We are open to include RAN4 if necessary.

8 – HUAWEI TECHNOLOGIES Co. Ltd.

We are fine to list RAN4, however RAN4 would only have to respond to the requests from RAN1. Similar as UE power consumption model, RAN1 should lead the work.

9 – ZTE Corporation

As to objective 1, we think RAN4 needs to only respond to requests from RAN1, otherwise, it is unclear about how to coordinate two groups about the development of the power consumption.

10 – Motorola Mobility UK Ltd.

In our view, it is sufficient that RAN4 only responds to requests from RAN1.

11 – vivo Communication Technology

For study item, we do not see particular work for RAN4, RAN 1 can also handle the power model.

12 – Samsung Electronics Co.

Keep RAN4. RAN1 requires RAN4 consultation for objective 1.

13 – Futurewei Technologies

Ok to keep RAN4 and RAN4 only need to respond to RAN1 request.

14 – Ericsson LM

We do not see the need to add RAN4 as a responsible for Objective 1. RAN1 can handle this objective and if there is an absolute need an LS can be sent to RAN4.

<p>15 – CATT</p> <p>We support to include RAN4 in the objective.</p>
<p>16 – NEC Telecom MODUS Ltd.</p> <p>There is probably no need to involve RAN4’s work into SI stage.</p> <p>If RAN4 is included in Objective 1, RAN4 only responses RAN1’s requests, if any. Independent work is not expected in RAN4.</p>
<p>17 – Intel</p> <p>We think it should be considered for objective 1. Analysis of PA efficiency aspects that is explicitly listed is something that RAN1 can not perform. This is in the expert domain of RAN4. Therefore, we believe RAN4 should be added.</p>
<p>18 – Qualcomm Incorporated</p> <p>We don’t think adding RAN4 is necessary. Of course, it is expected that RAN4 input is requested on select topics with LS exchanges.</p>
<p>19 – Nokia France</p> <p>RAN4 should not be included in objective 1. RAN1 is capable of defining the model, as it did for the UE model, and RAN4 is already overloaded.</p>
<p>20 – Apple Italia S.R.L.</p> <p>We think RAN4 work will be based on RAN1 LS, if needed. In this sense, it may not be necessary to include RAN4 at this stage.</p>
<p>21 – InterDigital Belgium. LLC</p> <p>No need to add RAN4. RAN4 can respond to requests from RAN1.</p>

Proposal 7: should RAN4 be added as a responsible WG for objective 3? If so, is it expected that RAN4 would be in support of the solutions studied by RAN1 and RAN2, or for RAN4 to independently study RAN4-only solutions?

Feedback Form 14: Responses to proposal 7

<p>1 – Guangdong OPPO Mobile Telecom.</p> <p>same as Q6</p>
<p>2 – New H3C Technologies Co.</p> <p>During SI stage, RAN4 isn’t necessary to be involved.</p>

3 – China Telecom Corporation Ltd.

We share the similar view as New H3C that it may not be needed to add RAN4 as a responsible WG during the SI stage since there seems little specific work for RAN4 to do with the techniques at this point. However, after study all the potential techniques, we can reevaluate the necessity of involving the RAN4.

4 – LG Electronics France

We think it is sufficient to focus on RAN1/RAN2/RAN3 leading work in this aspect in Rel-18 since RAN4 may be already over-loaded.

5 – Spreadtrum Communications

Either wayforward is fine for us.

6 – MediaTek Inc.

Regarding Objective 3, we think RAN4 can help to clarify and/or confirm the questions from other WGs while there is currently no dedicated study topic proposed by companies. In this regard, we would suggest to remove RAN4 from Objective 3:

3. Study and identify techniques on the gNB and UE side to improve network energy savings in terms of both BS transmission and reception [RAN1, RAN2, RAN3, ~~RAN4~~], which may include:

- ...

7 – CAICT

We are open to include RAN4 if necessary.

8 – HUAWEI TECHNOLOGIES Co. Ltd.

We are fine to list RAN4, however RAN4 would only have to respond to the requests from RAN1, otherwise it would be difficult to do the coordination/interaction between RAN1 and RAN4. At this stage, it is not clear whether there is any specific technique that would only need RAN4 work, thus better to leave it to RAN1 to study first.

9 – ZTE Corporation

We think RAN4 should be added as a responsible WG for objective 3. And it is expected that RAN4 would be in support of solutions studied by RAN1/RAN2.

10 – Motorola Mobility UK Ltd.

We don't think it is necessary to include RAN4 for objective 3.

11 – vivo Communication Technology

For study item, we do not see particular work for RAN4, RAN 1 can also handle the solution.

12 – Samsung Electronics Co.

Keep RAN4 without bracket. Whether RAN4 would be in support of RAN1/RAN2 or study RAN4-only solutions or both is up to SI progress.

<p>13 – Futurewei Technologies</p> <p>Ok to include RAN4 and RAN4 only need to respond to RAN1 request</p>
<p>14 – Ericsson LM</p> <p>In our opinion, some areas particularly when impacting UE measurements may have RAN4 impact, nevertheless, this is better to deal with during WI phase rather than SI phase.</p>
<p>15 – CATT</p> <p>We are OK to include RAN4.</p>
<p>16 – NEC Telecom MODUS Ltd.</p> <p>Independent work is not expected in RAN4.</p>
<p>17 – Intel</p> <p>For objective 3, since the objective is about mainly identifying techniques, addition of RAN4 may not be needed.</p>
<p>18 – Qualcomm Incorporated</p> <p>We don't think adding RAN4 is necessary. RAN4 input can be requested in LS exchanges.</p>
<p>19 – Nokia France</p> <p>RAN4 should not be included in objective 3. The other WGs are capable of doing this study, and RAN4 is already overloaded.</p>
<p>20 – Apple Italia S.R.L.</p> <p>We do not think it is necessary to include RAN4 for objective 3. The necessary involvement of RAN4 is not clear at this point.</p>
<p>21 – InterDigital Belgium. LLC</p> <p>No need to add RAN4. RAN4 can respond to requests from other WGs.</p>

Proposal 8: add the following note into the objectives section:

- Note 3: the identified techniques should avoid impacting SLA assurance for RAN slices. The study may need to consider how energy saving initiatives integrate with an orchestrator.*

Feedback Form 15: Responses to proposal 8

<p>1 – TELECOM ITALIA S.p.A.</p> <p>support</p>
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<p>2 – China Telecom Corporation Ltd.</p> <p>We are fine with the motivation but don't think it is needed here. It looks better if the content of note 3 move to the justification. However, we are fine to go with the majority view.</p>
<p>3 – Telstra Corporation Limited</p> <p>We of course support the additon and thank the moderator for the consideration.</p>
<p>4 – LG Electronics France</p> <p>We can add 'e.g.," as below since SLA assurance is not restricted to RAN slices but applicable in general. – Note 3: <i>the identified techniques should avoid impacting SLA assurance, e.g., for RAN slices. The study may</i></p>
<p>5 – Spreadtrum Communications</p> <p>Fine</p>
<p>6 – CAICT</p> <p>Support.</p>
<p>7 – HUAWEI TECHNOLOGIES Co. Ltd.</p> <p>We are fine with the proposal.</p>
<p>8 – ZTE Corporation</p> <p>We agree that the NW energy saving techniques with large impact are not preferred. However, in our understanding, the similar requirements have already been reflected by the addition in justification in proposal 3 and the KPIs in objective 2. Therefore, it seems no need to include another note into the objectives. Moreover, clarification/examples are appreciated about the integration.</p>
<p>9 – Deutsche Telekom AG</p> <p>We don't see the need for this note dedicated to slice SLAs as it is in principle captured with the last sentence in the Justification section "<i>The techniques to be studied should avoid having a large impact to such KPIs.</i>" The term "<i>SLA assurance related KPIs</i>" can be explicitly added to the KPI lists in the Justification or Objective section.</p> <p>If the note is finally kept, the sentence "<i>The study may need to consider how energy saving initiatives integrate with an orchestrator.</i>" should be rephrased as it is unclear what is meant in this context with "<i>orchestrator</i>" (interworking with OAM?).</p>
<p>10 – Samsung Electronics Co.</p> <p>Does this require any SA WG involvement other than SA5?</p>
<p>11 – Futurewei Technologies</p> <p>We prefer no substantial SA involvement for SI. So same question as Samsung.</p>

<p>12 – Ericsson LM</p> <p>In our opinion, this note is not necessary considering Objective 2 clarifies that typical KPIs such as UE throughput, latency, etc., should not be impacted.</p>
<p>13 – Telia Company AB</p> <p>We support this.</p>
<p>14 – CATT</p> <p>We don't see the need of adding the Note. The network energy saving should consider all different network hardware and software architecture. A specific example should not be included in the objective. If needed, the note could be included in the justification section.</p>
<p>15 – Motorola Mobility UK Ltd.</p> <p>We support the first part (i.e. SLA assurance) in Note 3. For the second part, we'd like to hear more specific examples for integration with an orchestrator, e.g. providing new KPI to the orchestrator?</p>
<p>16 – NEC Telecom MODUS Ltd.</p> <p>We are fine with this proposal.</p>
<p>17 – Intel</p> <p>We generally think limitation of features for consideration can be revisited during the WI drafting. With that said, we would be ok with the note as it is understood as limiting the scope of the study.</p>
<p>18 – Nokia France</p> <p>The first sentence is fine and sufficient. If the second sentence were to be included, it should be written as an objective, but it is not clear which RAN group should address it and how; indeed, it seems more addressed at SA than RAN.</p>
<p>19 – InterDigital Belgium. LLC</p> <p>Fine with first sentence.</p>
<p>20 – Apple Italia S.R.L.</p> <p>Even though we can understand the motivation of the proponents, the exact implication of adding such a note is unclear to us, in terms of: (1) what kind of techniques are excluded by such a note? (2) what WGs are impacted by this note?</p> <p>We also wonder why this particular aspect needs to be emphasized while we have the general goal of minimizing the impact overall.</p>

Proposal 9: do not consider backhaul energy consumption in the Rel-18 study item. Backhaul energy consumption may be considered in a later release.

Feedback Form 16: Responses to proposal 9

1 – Guangdong OPPO Mobile Telecom. Agree
2 – SoftBank Corp. we are fine with the proposal
3 – New H3C Technologies Co. We support this proposal.
4 – SHARP Corporation We are fine with Proposal 9.
5 – China Telecom Corporation Ltd. We are fine with the proposal.
6 – DOCOMO Communications Lab. We are fine with the proposal.
7 – LG Electronics France We are fine with the proposal.
8 – Spreadtrum Communications It can be studied in SI but with low priority.
9 – Panasonic Corporation We support the proposal.
10 – MediaTek Inc. We are fine with the proposal
11 – CAICT Support.
12 – HUAWEI TECHNOLOGIES Co. Ltd. We support the proposal.
13 – ZTE Corporation We are supportive of the proposal.

<p>14 – Motorola Mobility UK Ltd.</p> <p>Support the proposal 9.</p>
<p>15 – Deutsche Telekom AG</p> <p>Proposal is fine for us.</p> <p>Nevertheless, during assessment of solutions it should be evaluated if there is any strong impact expected on backhaul (NG/Xn) or midhaul (F1).</p>
<p>16 – vivo Communication Technology</p> <p>we support this proposal.</p>
<p>17 – Futurewei Technologies</p> <p>We support the proposal</p>
<p>18 – Ericsson LM</p> <p>We support the proposal.</p>
<p>19 – Telia Company AB</p> <p>We agree.</p>
<p>20 – CATT</p> <p>The connection test and sanity check of backhaul connection is the first step of base station field deployment (similar to setup internet connection at home to have network connection first before WiFi link). The base station would not trigger any DL Tx/UL Rx without any backhaul connection. The power consumption of backhaul connection is one of the critical element in determining the energy saving techniques in base station. If we don't include backhaul power consumption, some energy saving techniques might not work as they claims.</p>
<p>21 – NEC Telecom MODUS Ltd.</p> <p>We are fine with this proposal.</p>
<p>22 – Intel</p> <p>Not entire sure about the motivation to not consider something that may be integral to base station operation. Just because power consumption is considered or not considered may not necessarily always lead to standardizing a specific feature during WI. If the goal to not consider network saving enhancements for IAB, then it would be better to state it that way.</p> <p>We don't think further notes or clarification are needed regarding backhaul energy consumption in the SID.</p>
<p>23 – Qualcomm Incorporated</p> <p>Agree with Proposal 9.</p>

<p>24 – Nokia France</p> <p>We support the proposal.</p>
<p>25 – InterDigital Belgium. LLC</p> <p>Support proposal 9.</p>
<p>26 – Apple Italia S.R.L.</p> <p>Support</p>

Other comments can be provided in the form below.

Feedback Form 17: Other comments on draft SID v002 in in-box/draft folder [94e-08-R18-NetworkEnergy]

<p>1 – CHTTL</p> <p>Sorry to miss the comment in the initial phase, we also support the draft SID and would like to be the supporting IMs, thank you.</p>
<p>2 – MediaTek Inc.</p> <p>For Objective 2, we see the necessity of aligning the metrics/KPIs with the newly added paragraph in Justification session. In additional, the listed network, user and UE metrics/KPIs should be explicitly considered for the study so that companies have explicit indices for recommending the solution that has minimum impact to legacy UEs. In this regard, the following revision to Objective 2 is suggested:</p> <p>2. Definition of an evaluation methodology and KPIs [RAN1]</p> <ul style="list-style-type: none"> - The evaluation methodology should target for evaluating system-level network energy consumption and energy savings gains, as well as assessing/balancing any negative impact to network and user performance (e.g. spectral efficiency, capacity, UPT, latency), energy efficiency, and UE power consumption/, complexity, handover performance, call drop rate, initial access performance, etc. The evaluation methodology should not focus on a single KPI, and should reuse existing KPIs whenever applicable; where existing KPIs are found to be insufficient new KPIs may be developed as needed. <ul style="list-style-type: none"> o The listed network, user and UE metrics are part of the considered KPIs
<p>3 – InterDigital Belgium. LLC</p> <p>We support this study and would be happy to be included in the list of supporting IMs.</p>
<p>4 – Apple Italia S.R.L.</p> <p>For some reason, we did not manage to post our comments to Q1 in the initial phase. Please add Apple to the list of supporting companies.</p>

3.2 Intermediate phase summary

Proposal 1: Keep the title of the study as “Study on network energy savings for NR”, and clarify with a note in the objectives section of the SID that solutions should not require changes to LTE base stations.

– *Note 2: the identified techniques should not require changes to LTE base stations.*

Moderator’s summary: All companies agree to keep the title as “Study on network energy savings for NR”. To address Vodafone’s comment, the proposal is changed to “the identified techniques should not require changes to LTE”. It may be sufficient to capture this as part of the final summary of this email discussion rather than with a note in the SID.

Proposal 2: keep the list of example scenarios in the objectives section, and clarify that the scenarios are listed in no particular order.

Moderator’s summary: About 20 companies support listing the example scenarios in the objective section, while 10 companies have a preference for the justification section. Therefore, the moderator will keep the example scenarios in the objective section, with the sentence clarifying that the examples scenarios are listed in no particular order.

Proposal 3: consider additions to the justification section on aspects of impact to UE performance and power consumption and other example KPIs, based on the text proposal in v002 of the updated draft SID.

The study should not only evaluate the potential network energy consumption gains, but also assess and balance the impact on network and user performance, e.g. by looking at KPIs such as spectral efficiency, capacity, user perceived throughput (UPT), latency, energy efficiency, UE power consumption, complexity, handover performance, call drop rate, initial access performance, etc. The techniques to be studied should avoid having a large impact to such KPIs.

Moderator’s summary: the vast majority of companies agree to the additional text provided for the justification section. Some companies pointed out the repetition with objective 2 and asked to align the list of example KPIs, so this will be reflected in the updated SID v003. It was also pointed out that energy efficiency is not one of the KPIs relevant to the last sentence, so energy efficiency will be deleted from this paragraph in the justification section (but will remain in objective 2). One company asked to change “avoid having a large impact” to “avoid having a negative impact”. As this proposal was discussed in initial round Q7 but it was not agreeable because even a small negative impact is a negative impact and this was felt too drastic a rule to disqualify potential techniques.

Two companies mentioned the scenario of inter-band CA with SSB-less carriers. CMCC asked whether it is common understanding that the study does not preclude schemes such as SSB less carriers, where legacy UE cannot be served on those carriers. This is clarified in the RAN Chair’s summary in RP-213469, where page 18 of “Detailed scope for potential R18 items for email discussion” shows the note saying “This aspect is expected to be implicitly/explicitly considered as part of network energy savings” in reference to objectives proposed for CA enhancements on SCells without SSB. Therefore, the moderator would like to confirm CMCC’s understanding that such scenario of inter-band CA with SSB-less carriers and corresponding techniques are not precluded from the study.

Proposal 4: confirm changing occurrences of “network” to “base station” in objective 1.

Moderator’s summary: All companies supported the proposal, and CATT added that the power consumption at base station for network connection between two base stations and between base stations and core network should not be ignored.

Proposal 5: consider adding the following sub-bullets to objective 3 (moving back from the justification section and splitting into separate sub-bullets to clarify responsibilities of each WG)

3. Study and identify techniques on the gNB and UE side to improve network energy savings in terms of both BS transmission and reception [RAN1, RAN2, RAN3, [RAN4]], which may include:

- o How to achieve more efficient operation dynamically and/or semi-statically and finer granularity adaptation of transmissions and/or receptions in one or more of network energy saving techniques in time, frequency, spatial, and power domains, with potential support/feedback from UE [RAN1, RAN2]*
- o Potential UE assistance information [RAN2, RAN1]*
- o Information exchange/coordination over network interfaces [RAN3]*

Moderator’s summary: the majority of companies supported adding sufficient details to guide the WGs, while 4 companies still preferred leaving the objective with the main bullet only. Several companies pointed out that the second sub-bullet looks redundant with the potential support/feedback from UE in the first sub-bullet. Therefore, the moderator suggests keeping the first and second sub-bullets together for RAN1 and RAN2. Several companies asked for adding “Other techniques are not precluded”. Even though this may be redundant with “which may include”, it is nevertheless a harmless clarification. MediaTek reiterated the proposal to add “RAN2 to start with identifying candidate techniques to reduce BS transmission and reception in time domain for idle/inactive mode UEs”, which still did not gather support from other companies. The proposal that RAN1 evaluation works for the candidate techniques can be triggered by RAN2, if needed, should be the common understanding and business as usual without explicitly writing it down.

Proposal 6: please provide your views on adding RAN4 as a responsible WG for objective 1, and whether it is expected that RAN4 would only have to respond to requests from RAN1, or work independently on a BS energy consumption model.

Moderator’s summary: The majority of companies preferred not to list RAN4 for objective 1. The common understanding seems to be that RAN4 may be asked for support by RAN1, e.g. in terms of modelling energy consumption of power amplifier, without the need to list RAN4 as a responsible WG for objective 1.

Proposal 7: please provide your views on adding RAN4 as a responsible WG for objective 3, and whether this would be in support of the solutions studied by RAN1, or for RAN4 to independently study RAN4-only solutions.

Moderator’s summary: A large majority of companies preferred not to list RAN4 for objective 3. The common understanding seems to be that RAN4 may be asked for support by RAN1, and may not need to be involved at all in the study, without the need to list RAN4 as a responsible WG for objective 3.

Proposal 8: add the following note into the objectives section:

- *Note 3: the identified techniques should avoid impacting SLA assurance for RAN slices. The study may need to consider how energy saving initiatives integrate with an orchestrator.*

Moderator’s summary: while a number of companies supported the proposal, questions were raised on whether the potential impact on SLA assurance for RAN slices may already be covered by the sentence “The techniques to be studied should avoid having a large impact to such KPIs” that was added to the justification section. The moderator’s proposal is to add “SLA assurance related KPIs” as suggested by DT to the list of example KPIs. Questions were also raised on what is meant by orchestrator. The moderator’s proposal is to capture this aspect in section 8 as “The study should coordinate with SA5 as needed, e.g. on how the potential energy saving techniques integrate with 3GPP management system”. Note that the revised formulation was provided offline by the SA5 Vice Chair, so hopefully this can be considered clear enough for RAN.

Proposal 9: do not consider backhaul energy consumption in the Rel-18 study item. Backhaul energy consumption may be considered in a later release.

Moderator’s summary: the vast majority of companies supported the proposal. DT and CATT provided more detailed comments, but the moderator would like to clarify that the proposal does not intend to preclude solutions that may require defining new signalling over the backhaul in support of the base station energy saving techniques. No objective of the study that precludes this. One useful suggestion by Intel may be to clarify that the study of energy savings specifically for IAB is not part of the scope. This is added to the draft SID v003 as a note “the study of energy savings specifically for IAB is not part of the scope.”

4 Final phase

Please provide your final comments (if any) by the deadline of 19:00 UTC on Friday December 9th.

4.1 Final phase questions

The draft SID should start looking stable at this point of time. The latest changes provided in summary of the intermediate round are highlighted in yellow. It remains to be checked whether v003 is acceptable to all companies. The TU sheet is also provided.

Feedback Form 18: Any final comment on the draft SID in v003 in inbox/draft folder [94e-08-R18-NetworkEnergy]?

1 – SHARP Corporation
Thanks moderator for the great efforts. We are fine with the updated SID.
2 – SHARP Corporation
Please include SHARP in the list of supporting IM.

3 – New H3C Technologies Co.

We support the revised SID.

Please add H3C in the list of supporting IM.

4 – China Telecom Corporation Ltd.

Thanks for the moderator’s great efforts.

We proposed to add the scenario of inter-band CA with SSB-less Scell in the intermediate phase. The moderator’s summary has confirmed that though not explicitly included in the objective, this scenario is considered in the SID, we are fine with it.

We support the revised SID, please add China Telecom in the supporting list.

5 – Spreadtrum Communications

Fine for it. Please add Spreadtrum in the supporting list.

6 – China Mobile Com. Corporation

Thanks moderator for the great efforts. We are fine with the draft SID in v003, please add CMCC in the supporting IM list.

7 – CEWiT

We are fine with the draft SID, please add CEWiT in the supporting list.

8 – CAICT

Thanks moderator’s great efforts and CAICT would like to be a supporting company.

9 – Nokia France

Thank you, the latest draft SID is fine.

10 – Guangdong OPPO Mobile Telecom.

We see some misplaces of bullet in Objectives and Justification. But we understand they can still guide the works in WGs. We can support the SID.

11 – MediaTek Inc.

Thanks for moderator’s efforts in merging companies’ feedbacks. We only have one suggestion for Objective 3. Given that the power consumption model and evaluation methodology will both be developed in RAN1 but there is only 1 RAN1 meeting in Q2 2022’, we would worry about how RAN2 may start the study with limited information on the power consumption model and the evaluations. We understand companies are not willing to restrict RAN2 study scope, but practically some suggested ”order” as RAN Plenary guidance will be helpful. In this regard, the following revision to Objective 3 is suggested:

3. Study and identify techniques on the gNB and UE side to improve network energy savings in terms of both BS transmission and reception, which may include:

- How to achieve more efficient operation dynamically and/or semi-statically and finer granularity adaptation of transmissions and/or receptions in one or more of network energy saving techniques in time, frequency, spatial, and power domains, with potential support/feedback from UE, and potential UE assistance information [RAN1, RAN2]
 - o **RAN2 to start with studying time-domain techniques and, depending on RAN1 evaluation outcomes, continue identifying techniques for other dimension(s).**

12 – AT&T

Please add AT&T as supporting company

13 – NEC Telecom MODUS Ltd.

Thanks for the moderator’s great efforts in summarising the proposals. We are generally fine with the draft SID. We just have the following suggestions:

- Regarding the last paragraph of the Justification section, the description of ‘*The techniques to be studied should avoid having a large impact to such KPIs*’ seems not critical. We suggest modifying the wording to ‘*The techniques to be studied should ~~avoid having a large~~ not have negative impacts to-on such KPIs*’.
- The KPIs given in the Justification section and Objective section are unnecessarily overlapped. The KPIs could be listed in either Justification or Objective section.

14 – CATT

We are OK with the updated objectives. Please include CATT as the supporting company.

15 – Apple Italia S.R.L.

We are fine with the updated version v003.

16 – Motorola Mobility UK Ltd.

We support the updated SID (v003). Please add Lenovo and Motorola Mobility as supporting companies. Thank you.

17 – Futurewei Technologies

We support the updated SID (v003). Thanks.

18 – Intel

SID is acceptable.

On the TU assignment, it is our understanding that RAN2 discussion will be based on the RAN1 evaluation on ‘more efficient operation dynamically and/or semi-statically and finer granularity adaptation of transmissions and/or receptions in one or more of network energy saving techniques in time, frequency, spatial, and power domains’. With RAN2 discussion starting only 1 meeting after RAN1 discussion, depending on the progress from RAN1 evaluation of potential techniques in 1 meeting, it may be premature for RAN2 to start discussing UE assistance after one RAN1 meeting unless it can be clearer what is expected from the UE assistance in the objective 3.

Therefore, we suggest starting RAN2/3 discussion after at least 2 RAN1 meeting have been complete.

<p>19 – Verizon UK Ltd</p> <p>We support the SID - please add Verizon as a supporting company. Thank you.</p>
<p>20 – VODAFONE Group Plc</p> <p>We are fine with the version v003. Please add Vodafone as a supporting company.</p>
<p>21 – Telia Company AB</p> <p>Thank you for the moderator. Great work.</p>
<p>22 – Qualcomm Incorporated</p> <p>No further comments from us.</p> <p>Please add Qualcomm as a supporting company.</p>
<p>23 – ZTE Corporation</p> <p>Using KPIs to assess the impact on network and user performance is important. However, it is not easy or need to have a complete list. We think highlighted (also new) KPIs in the justification and objective 2 need further discussion.</p> <p>For handover performance, the call drop rate and initial access performance, it is unclear how to evaluate these metrics. And adding duplicated KPIs should be avoided.</p> <p>For SLA assurance related KPI, it falls into SA5 scope. If it is added in objective 2, we think SA5 should also be involved. Therefore, to make it easier, we think the new note with regard to coordination with SA5 is sufficient, there is no need to add it in metrics evaluated by RAN1.</p> <p>Moreover, there are more than 10 KPIs listed in the objective 2. The simulation workload will be excessive if all the KPIs are considered. Therefore, we prefer to add the following note in the objective 2 to provide a chance to reduce the work to a reasonable level.</p> <p><i>Note: The study is not required to evaluate all the KPIs listed above.</i></p> <p>As to the objective 3, we think more restriction on a particular WG is too premature and not needed.</p>

4.2 Final phase summary

The overwhelming majority of companies support the SID in v003 without any further changes. Although a few companies pointed out the repetitions of some paragraphs in both the justification and objectives sections, it is the result of compromise between different preferences of putting those aspects in either the justification or objectives sections. It is to be noted that justification and objectives sections should preferably be self-contained, so considering these aspects the moderator doesn't suggest any change on this point.

Intel suggested suggest starting RAN2/3 discussion after at least 2 RAN1 meeting have been completed. The moderator recognizes the dependency on the discussion on potential techniques in RAN1. On the other hand this would leave just 2 meetings with 0.5 TU each for the entire study in RAN2 and RAN3. The moderator doesn't really see harm to start the work as planned in Q3/2022. RAN2 and RAN3 can at least start looking into the techniques proposed directly in RAN2 and RAN3, better understand them and start describing them before starting evaluations and analysis. So the moderator thinks it is preferable to stay with the current TU plan.

With the same time-constraint in mind, Mediatek suggested adding a sub-bullet to objective 3 to focus the scope of solutions that RAN2 has to study:

- RAN2 to start with studying time-domain techniques and, depending on RAN1 evaluation outcomes, continue identifying techniques for other dimension(s).

ZTE responded to the comment suggesting not to add more restriction on a particular WG in objective 3. Similar to the suggestion from Intel, the moderator still believes that it is best to leave this workplan aspect for RAN2 management.

ZTE suggested adding a note clarifying that the study is not required to evaluate all the KPIs listed in objective 3. The moderator believes the note makes sense and allows the WGs to decide which of the example KPIs need to be evaluated, and also clarifies that the objective doesn't require RAN WGs to evaluate the impact to SLA assurance related KPIs. After further clarification, the note added to objective 2 reads "Note: WGs will decide KPIs to evaluate and how."

Therefore, the only change to the draft SID after the final round is adding "Note: WGs will decide KPIs to evaluate and how." to objective 2, which was provided as v005 in inbox/draft folder [94e-08-R18-NetworkEnergy].

5 Conclusion

The moderator would like to thank all companies who participated in improving the study item description in such constructive manner.

This section summarizes aspects clarified during the discussion that didn't require explicit changes to the SID, but that are useful to note in conclusion of the discussion.

It was clarified during the discussion that the techniques identified by the study should not require changes to LTE. This is not explicitly captured in the SID since the study is for NR only, so this should be the common understanding. It is also the common understanding that power consumption of NR base station will be studied under various scenarios including EN-DC, NR-DC and DSS, but no impact to LTE is expected.

It was also concluded not to consider backhaul energy consumption in the Rel-18 study item due to workload constraints. Backhaul energy consumption may be considered in a later release. It was clarified that this does not preclude defining new signalling over the backhaul in support of the base station energy saving techniques studied in Rel-18.

As clarified in the RAN Chair's summary in RP-213469, where page 18 of "Detailed scope for potential R18 items for email discussion" shows the note saying "This aspect is expected to be implicitly/explicitly considered as part of network energy savings" in reference to objectives proposed for CA enhancements on SCells without SSB, it is confirmed that scenario of inter-band CA with SSB-less carriers and corresponding techniques are not precluded from the study.

It was also clarified as part of the discussion that coordination among RAN WGs is as usual, i.e. that RAN4 expertise can be sought by LS on e.g. modelling of energy consumption of power amplifiers, and that RAN1 evaluations of techniques considered in RAN2 can be triggered by LS from RAN2 if needed. Potential coordination with SA5 was also identified.

The final SID is provided in RP-213554.

6 References

1. RWS-210659 Summary of RAN Rel-18 Workshop, June 2021 RAN Chair
2. RP-211663 Moderator's summary for discussion [RAN93e-R18Prep-13] Network energy savings Huawei
3. RP-212608 RAN Chair's Summary for RAN Release 18 RAN Chair
4. RP-213469 RAN R18 package summary RAN Chair
5. RP-212669 Moderator's summary for discussion [RAN94e-R18Prep-09] Network energy savings Huawei
6. RP-212709 New SI: Study on network energy savings for NR and EN-DC/NR-DC RAN1 vice-chair (Huawei)
7. RP-213086 Discussion on network energy saving for Rel-18 China Telecom
8. RP-213164 Comments on Rel-18 draft SID on network energy saving Huawei, HiSilicon
9. RP-213209 Discussion on SID on network energy savings for NR and EN-DC/NR-DC CMCC
10. RP-213309 Views on Rel-18 Network Energy Saving CATT
11. RP-213390 Discussion on Rel-18 network energy saving ZTE, Sanechips
12. RP-213471 Discussion on SID on network energy savings for NR and EN-DC/NR-DC CMCC
13. RP-213488 Moderator's summary of discussion [94e-08-R18-NetworkEnergy] Huawei