94e-10-R18-SmartRepeater - Version 0.0.6
RAN

3GPP TSG RAN Meeting #94-e **RP-213490**

Electronic Meeting, December 6-17, 2021

Source: **ZTE**

Title: **Moderator's summary for discussion [94e-10-R18-SmartRepeater]**

Agenda Item: **8A.1**

Document for: **Discussion and Decision**

1 Introduction

After multiple rounds of discussion, smart repeater is considered as one of the topics for the Rel-18 RAN package with the draft SID [1] based on the NWM discussion [RAN94e-R18Prep-03] [2]. In this meeting, some contributions from individual companies also submitted to discuss the scope [3][4][5][6][7][8][9]. In addition, the scope and TU allocation for smart repeater is provided by RAN Chair in [10].

2 Initial round

As a starting point, the guidelines provided by RAN Chair in RP-213469[10] is used for the initial round discussion. . The goal is to discuss further possible refinements or updates based on the potential objectives for smart repeaters captured in [10] and [11] and shown as follows:

- Start with study item. RAN1 is the primary working group. Secondary working groups are RAN2, RAN3~~, and RAN4~~.
- Study and identify which side control information below is necessary for smart repeaters including assumption of max transmission power ~~including at least~~ [RAN1, ~~RAN2, RAN4~~]
  - Beamforming information
  - Timing information to align transmission / reception boundaries of smart repeater
  - Information on UL-DL TDD configuration
  - ~~Power control information for efficient interference management~~
  - ON-OFF information for efficient interference management and improved energy efficiency
- Study the following aspect of smart repeater
  - Identification and authorization of smart repeaters [RAN2, RAN3 (check the possibility of assumed architecture for smart repeater so that identification part for RAN3 may be removed)]
  - ~~RF requirements for smart repeater, including max transmission power and other applicable RF requirements [RAN4]~~

- Focus Rel-18 smart repeater work on the following scenario / assumptions:
    - ~~Consider smart repeaters used for extension of network coverage on FR1 and FR2 bands~~ Prioritize FR2 TDD deployments for both outdoor and O2I scenarios.
    - For only single hop stationary smart repeaters
    - Assuming smart repeaters are transparent to UEs
    - Smart repeater can maintain the gNB-repeater link and repeater-UE link simultaneously
    - Cost efficiency is a key consideration point for smart repeaters

The first bullet point about involvement of RAN WG will depend on the discussion on the subsequent bullet points. In the initial round, we can focus on the discussion on scenario/assumptions, side control information and management of smart repeater i.e. corresponding to bullet points 4, 2 and 3 respectively.

2.1 Collection of company views

2.1.1 Scenarios and assumptions

Regarding scenarios and assumptions, it is proposed to capture the followings in the objective.

Focus Rel-18 smart repeater work on the following scenario / assumptions:

- ~~Consider smart repeaters used for extension of network coverage on FR1 and FR2 bands.~~ Prioritize FR2 TDD deployments for both outdoor and O2I scenarios.
- For only single hop stationary smart repeaters
- Assuming smart repeaters are transparent to UEs
- Smart repeater can maintain the gNB-repeater link and repeater-UE link simultaneously
- Cost efficiency is a key consideration point for smart repeaters

It is understood that smart repeaters can be used for extension of network coverage on FR1 and FR2 bands. As this sentence is removed from the first sub-bullet point of scenario/assumption in the objective, it can be interpreted that the study of smart repeater should focus on FR2 with the understanding that applicability of the developed solutions in the follow-up normative work can be applicable to both FR1 and FR2. One possibility is to reflect this in the justification part if needed.

Question 2-1: Any views on the scenarios/assumptions on the smarter repeater proposed in RP-213469?

Feedback Form 1: Scenario and assumptions (Initial round)

1 – Samsung Electronics Co. We support the moderator's suggestion about prioritization on FR2
2 – AT&T GNS Belgium SPRL

We think that there was some consensus at the last meeting that both FR1 (FDD and TDD) and FR2 bands could be considered as was included in the baseline text. Therefore, we suggest to retain the following removed text: ~~Consider smart repeaters used for extension of network coverage on FR1 and FR2 bands.~~

3 – Qualcomm Incorporated

We are fine with the moderator's suggestion on FR2.

4 – ZTE Corporation

We are fine with the moderator's suggestion since it's a common understanding that the smart repeater can be used for both FR1 and FR2.

5 – NTT DOCOMO INC.

We prefer to capture the text for both FR1 and FR2 in the SID (e.g. original text, or note, or in the justification part mentioned by moderator) to reflect the common understanding of considering both FR1 and FR2.

6 – Deutsche Telekom AG

We agree with AT&T and NTT DOCOMO that there was already agreement that the work should cover FR1 FDD & TDD and FR2 TDD. As repeaters are part of the network and the deployment strategies of operators, we should listen what the operators require. Currently there is a wider FR1 deplyoment and thus an increased need for FR1 over FR2. Without explicit consideration of FR1 (both FDD & TDD) we can not agree to this SI.

7 – Deutsche Telekom AG

"Cost efficiency is a key consideration point for smart repeaters" is inappropriate for the objectives. We propose to remove this as it is obvious that 3GPP shall not develop oversophisticated high cost solutions. It is also not measureble and companies have different undertstanding what is "cost efficient".

Also we propose to rewrite "Assuming smart repeaters are transparent to UEs" to "Solution for smart repeaters shall be transparent to UEs"

8 – China Telecom Corporation Ltd.

We are ok to evaluate FR2 only in the SI, considering the SI only has 6 months, and with the understanding that the follow-up WI will cover both FR1 and FR2.

Meanwhile, in addition to adding the FR1 aspect in the justification part as proposed by moderator, we need also to add it as a NOTE in the objective.

9 – vivo Mobile Communication Co.

We support moderator's suggestion. The study can focus on FR2. The applicability of smart repeater in FR1 can be described in the justification part.

10 – ETRI

OK to focus on FR2 TDD.

11 – Telstra Corporation Limited

We support the moderators changes, the SI should focus on FR2

12 – KDDI Corporation

We support the moderator's suggestion to prioritize FR2 as the subject of the study. Also for FR1, as suggested by the moderator, we think we should clearly state in the justification part, etc. that the developed solution in the follow-up normative work can be applicable to both FR1 and FR2.

13 – NEC Corporation

We agree to set FR2 TDD with the first priority.

14 – Fujitsu Limited

We support the wording given by the moderator.

We suggest capturing the common sense in the justification part that smart repeaters could be deployed in FR1 FDD&TDD and FR2 TDD and treating the other scenarios in the following WI phase when the solution for FR2 TDD is ready as a baseline.

15 – China Mobile Group Device Co.

We have a little concern for removing the 1st sentence. Without "Consider smart repeaters used for extension of network coverage on FR1 and FR2 bands.", it could be mis-interpreted as we prioritize FR2 only but without FR1.

If the group have the common understanding that applicability of the developed solutions in the follow-up normative work can be applicable to both FR1 and FR2, it seems not harm if we add a note as,

Note: The enhancements/solutions are targeting for FR2, which should also apply to FR1.

16 – MediaTek Inc.

We're fine with moderator's suggested text above.

17 – Beijing Xiaomi Mobile Software

We are fine with moderator's change and focus on FR2 in SI.

18 – HUAWEI TECHNOLOGIES Co. Ltd.

We agree with the change made by the moderator to prioritize FR2, then can be further discussed whether it is beneficial to extend to other application scenarios. If even for FR2 the gain is very marginal, then there is no point to study other application scenarios like FR1.

19 – Motorola Mobility UK Ltd.

[Lenovo/Motorola Mobility]

We are fine with moderator's suggestion of prioritizing FR2 TDD deployment, however, we prefer the sentence "applicability of the developed solutions in the follow-up normative work can be applicable to both FR1 and FR2" explicitly captured in the objective or justification part.

20 – CEWiT

We are fine with the moderator's suggestion.

21 – Intel Korea We are in general fine with the update but, as commented by the moderator, would like to be sure that although FR2 TDD is targeted, FR1 deployments can be supported automatically by specifications without optimization and evaluation. Either reflection in justification section or in the objective itself is fine to us. Furthermore, we would like to **clarify that unlicensed bands in both FR1 and FR2 are not included**, since those require separate study, which could substantially increase the workload.
22 – Futurewei We support focusing exclusively on FR2 until performance gains are demonstrated for this scenario.
23 – Ericsson France S.A.S We are fine with the proposed objectives and support to remove the text about FR1/FR2 and prioritize FR2.
24 – Sony Group Corporation We agree to prioritize FR2 in this study. However, and as stated by a few other companies and the moderator, we prefer to explicitly capture the statement that ”the developed solutions in the follow-up normative work can be applicable to both FR1 and FR2.”
25 – Nokia Italy We support the moderator’s proposed revision.
26 – CableLabs We prefer to keep both FR1 and FR2 as part of objectives. We are fine to prioritize FR2 to reduce workload with understanding that common design can be applied to FR1.
27 – ROBERT BOSCH GmbH We prefer to have the text for both FR1 and FR2.
28 – VODAFONE Group Plc Agree with AT&T and DOCOMO
29 – Apple Poland Sp. z.o.o. Given the 1-TU budget, it is reasonable to prioritize the FR2 use case for coverage extension. Extending the solutions from FR2 to FR1 can be always discussed at the end of WI as usual in 3GPP.

2.1.2 Side control information design for smart repeater

Regarding side control information, it is proposed to capture the followings in the objective.

Study and identify which side control information below is necessary for smart repeaters including assumption of max transmission power ~~including at least~~ [RAN1~~, RAN2, RAN4~~]

- Beamforming information

- Timing information to align transmission / reception boundaries of smart repeater
- Information on UL-DL TDD configuration
- ~~Power control information for efficient interference management~~
- ON-OFF information for efficient interference management and improved energy efficiency

The goal of this objective is to study and identify which side control information should be proceeded for normative work. Based on the previous NWM discussion, RAN4 parameter like maximum transmission power is mentioned by some companies. It can be understood that study on side control information can be done in RAN1 with reference to some existing RAN4 parameters developed earlier for basic RF repeaters. With this understanding, "assumption of max transmission power" is added to the main bullet point and the explicit RAN4 involvement of this objective can be removed. In addition, power control information is removed with the understanding that efficient interference management can be achieved by ON-OFF information.

Question 2-2: Any views on the proposed objective on the side control information design in RP-213469?

Feedback Form 2: Side control information (Initial round)

1 – Samsung Electronics Co. We also support modification in the main bullet and suggestion for handling power control aspect to be considered with ON-OFF information.
2 – Qualcomm Incorporated We believe that power control can be performed via OAM and does not need to be explicitly included into side-control information.
3 – ZTE Corporation We support the updated objective. In general, basic interference management can be achieved by an on-off function. Also, the removal of RAN2 and RAN4 is also reasonable since all candidate information is PHY-related.
4 – NTT DOCOMO INC. We are fine with the updated objective.
5 – Deutsche Telekom AG If the common understanding is that the Tx power of the repeater is configured by OAM and the side control information is only enabling/diabaling the repeater (ON/OFF) this modification is acceptable for us.
6 – China Telecom Corporation Ltd. Ok with the updated objective.

7 – ETRI

OK to remove the bullet on power control.

Re the ”including assumption of max transmission power” in the main bullet, we are not sure whether this wording should be there even if we removed RAN4 from this issue. If no TUs are allocated to RAN4, the existing max transmission power requirements should be assumed without any additional clarification.

8 – vivo Mobile Communication Co.

We prefer to keep power control in the objective list.

Since FR2 is the target band, channel condition between donor and repeater unit may change dynamically. For UL relay, to make sure the signaling strength received by donor is stable, the UL output power of RU should be dynamically controlled by donor, so L1/L2 signaling is preferred other than OAM configuration.

9 – NEC Corporation

We think power control is more flexible than on-off in interference management and energy saving, or on-off can be seen as a special case of power control. So we suggest to replace “on-off” by “power control”.

10 – MediaTek Inc.

Considering limited time for the study, support to just keep ON-OFF information as side control information for baseline interference mitigation, which we think it can already provide sufficient performance gain as well as power saving gain.

11 – Fujitsu Limited

We support the modified main bullet including the removal of RAN2 and RAN4.

We think the current description on the side control information is not clear and suggest updating the main bullet as:

*Study and identify which side control information below is necessary for smart repeaters**' forwarding** including assumption of max transmission power [RAN1]*

In this way, the purpose of the side control information can be clarified not for sending/receiving smart repeater’s own signal to/from the gNB.

Furthermore, we have a question on the smart repeater itself. Can a smart repeater get the uplink timing like a normal UE? If so, we are wondering **what the difference between the uplink timing of smart repeaters own and the timing described in the second bullet is**?

We suggest marking the ‘power control information as TBD first instead of directly removing it till the OAM configuration is confirmed to be possible for smart repeaters. We think the power control information could provide more benefit than on-off.

12 – China Mobile Group Device Co.

For the SLS, except for the defined RF requirement in RF repeater spec, we also need some other parameters that are not involved in current RF spec to perform simulation. For example, the amplification gain for smart repeater UL. In most cases, repeater may not amplify with maximum output power, instead it amplifies with maximum amplification gain and the output power may be less than maximum value. About the

amplification gain for FR2, RAN4 may also need to be involved to identify a specified value for simulation. **Therefore, RAN4 is still suggested to be involved with small workload in study item.**

Repeater UL power control is very important because repeater may need to reduce its UL output power based on indication from gNB to avoid blocking gNB receiver, especially when repeater is very near to the donor gNB e.g. basement scenario. In such case, only UE side power control may not help because gNB may already been blocked before indicating UE's power control. OAM based solution is slow power control compared with gNB's indicating. **Therefore, it's still suggested to include power /amplification gain control for smart repeater UL.**

13 – Beijing Xiaomi Mobile Software

We are fine with the updated objective.

14 – HUAWEI TECHNOLOGIES Co. Ltd.

We still think that power control information should be one of the aspects to be further studied, and it cannot be replaced by ON-OFF information. Without appropriate power control, it is expected that a fixed repeater amplifying gain will be adopted, which will result in the following problems:

1. If the amplifying gain is set to a smaller value, it will limit the potential coverage that can be achieved by the smart repeater.

2. If the amplifying gain is set to a larger value, it will bring unnecessary interference for gNB uplink reception. We don't think ON-OFF can solve all the problem here, for example if repeater-UE and other normal UEs need to be scheduled simultaneously, simply turn-off the repeater is not good.

15 – Motorola Mobility UK Ltd.

[Lenovo/Motorola Mobility]

We agree that ON/OFF information together with maximum power restrictions can still be utilized for interference management, however, we think power control can provide more flexibility than simply on/off the repeater, so we prefer power control listed in the objective. We think it is good to keep the chance for studying other control information such as BW information either by retaining **at least** in the main bullet, or by adding at least the BW information to the list.

16 – Intel Korea

We would like to understand the motivation on excluding "power control" information from the list. In our view, if the intention is to remove RAN4 impact, this bullet is not directly related to RAN4 analysis/evaluation. Further, in general, we are not sure if this is a right direction to limit the scope of the study since the necessary control info anyway will be the outcome of the study.

Overall, we prefer keeping the previous list of potential side control information for study.

17 – Ericsson France S.A.S

We are OK with the objectives proposed by the moderator

18 – Futurewei

It is not clear to us why the bullet was removed, since the on/off mechanism may need to be optimized in some way to avoid more fine-grained power control. Suggest to keep the bullet, proponents can combine together the mechanisms still if appropriate.

19 – Sony Group Corporation

We also think that power control for interference management is a more general concept that on-off power information for interference management. We propose to merge bullets 4 and 5 in the following way:

”Power control information, including ON-OFF information, for efficient interference management and improved energy efficiency.”

20 – Nokia Italy

We support removing power control from the listed objectives. We view power control as an optimization not essential to providing coverage extension. Power control can be managed by proper network planning and existing UL power control mechanisms.

21 – ZTE Corporation

Re-Fujitsu’s question:

In general, the SR should be able the get the proper DL/UL timing by potential different ways to enable the transmission/reception of side control information and forwarding.

22 – ROBERT BOSCH GmbH

We are fine with the proposal.

23 – SHARP Corporation

We’re OK to remove TPC.

24 – Apple Poland Sp. z.o.o.

- Our preference is to keep the power control objective. Note that the ‘on-off’ mechanism is a sort of ‘hard’ interference coordinations, which causes some performance degradation compared to the ’soft’ interference coordination by proper power control. For backhaul link (Un link) between smart repeater and gNB, the existing power control mechanism maybe already enough by treating the smart repeater as virtual UE and standard efforts is fairly limited or even negligible. Some study maybe needed for power control for the Uu link between Smart repeater and its UE since the transmission power of SMR is set by gNB. OAM is one solution but maybe not the best and always feasible.

Moreover, it is discussed in some contributions to further clarify the general protocol structure of smart repeater, e.g., how to deliver side control information or configuration of container for side control information. To collect the views on this aspect, companies are encouraged to provide views on Question 2-3.

Question 2-3: In addition to the required side control information, are there any other aspects that should be included in the scope for smart repeater? If so, please provide your views.

Feedback Form 3: Other aspects of side control information design (Initial round)

1 – Qualcomm Incorporated

We should add one additional objective related to the transport of side control information:

“Study and identify the type of L1/L2 signaling to carry the side control information and its time granularity

(e.g., symbol/slot level)."

2 – ZTE Corporation

In my view, the corresponding discussion on signaling to carry the side control information has been covered by the existing scope and will be triggered along with the study of side control information. However, considering the views from others, we are also open to having an additional objective for this part.

Moreover, due to the limited TU in RAN2, the study can be mainly done in RAN1 with the following objectives:

- *Study and identify signaling to carry the side control information [RAN1]*

3 – ETRI

Re the ZTE's suggestion, does it mean that RAN1 can study both L1/L2 signaling? Or does it intend to down-select L1 signaling right now?

4 – vivo Mobile Communication Co.

We are OK to study the signaling, RAN1 can decide whether to use L1 or L2 signaling.

5 – Fujitsu Limited

The current SID only captures the contents of side control information. According to the proposed wording, one possible understanding is that only the contents would be considered in SI and other details would be discussed in WI. We prefer to explicitly capture how to deliver the side control information in the SID, or at least, whether there is any common understanding that this is in scope should be confirmed here. This clarification will help to achieve convergence in further WG discussions.

Regarding to the details of how to deliver side control information to smart repeaters, now seems too early to conclude anything. Even the side control information itself probably needs further clarification. For example, we are not sure whether a smart repeater could read SIB. If so, the information of UL-DL TDD config in SIB is part of the side control information or not?

6 – China Mobile Group Device Co.

For the side control information, our initial thinking is that the smart repeater should have a UE function part and it could receive the RRC configurations. Then some configurations and indications could be reused for beamforming, TDD UL-DL configurations and ect. Many configurations could be reused, reducing the work load and avoid duplicated design for certain functions.

We are not sure if the group could have a decision on which kind of signaling should be used during this meeting. Or if possible, we could leave it for the study item with the following objective.

"- Study and identify the protocol structure for smart repeater"

7 – HUAWEI TECHNOLOGIES Co. Ltd.

Regarding the signaling to carry the side control information, it sounds more like a work for WI phase. For the study phase, the focus should be identifying whether smart repeater is beneficial or not together with the corresponding necessary side control information, then details for the support of the identified side control information (if any) should go to the WI phase. Therefore, we don't see any other aspects to be added for the SI.

8 – Beijing Xiaomi Mobile Software

We are open to study the signaling to carry the side control information.

9 – Motorola Mobility UK Ltd.

[Lenovo/Motorola Mobility]

We think that the question that needs to be answered during the study in addition to **what** control information parameters are needed, is **how** these parameters can be exchanged between the smart repeater and the network. We think that some study needs to be considered to identify the nature of the channel that carries the control information, and to confirm whether the Uu interface can be reused, or a dedicated channel needs to be specified. We also think that feedback information from the repeater to the network should be considered.

10 – ZTE Corporation

Re ETRI's question: In our view, in the study phase, the discussion on the signalling can be mainly done in RAN-1 to identify the potential spec impacts.

And there is no intention to preclude the solution.

11 – Ericsson France S.A.S

We are OK with the Qualcomm suggestion (but even if considering signalling, it would be preferable to keep the scope to RAN1. We do not need to design the signaling in detail, but to identify what signalling is needed in what granularity and any effect on procedures, not the detailed design if it is L2 signaling)

12 – Sony Group Corporation

We support studying the signaling. Both L1 and L2 signaling can be studied.

13 – Nokia Italy

The aspects of beamforming information, timing information and on-off information clearly require a low-layer control channel. This should be clarified as well as means by which the control channel is to be configured. We propose adding a second sub-bullet under "Study the following aspects of smart repeater management": "Repeater control channel design, assuming L1 or L2 control channel, and that the control channel is configured by O&M."

14 – CableLabs

We are open to include the objective proposed by Qualcomm (if it does not increase workload)

15 – Futurewei

It is more important to assess the benefits in the study before jumping into the design. We do not support such addition.

16 – Apple Poland Sp. z.o.o.

We support to add the bullet about the signaling candidates and time granularity, which should be part of feasibility study for side control signaling and correspondingly judge and conclude the need of introducing them as the outcome of study item. This objective should focus on signaling candidates in SI phase and leave details design to WI.

2.1.3 Management of smart repeater

Regarding management of smart repeater, it is proposed to capture the followings in the objective:

Study the following aspect of smart repeater

- Identification and authorization of smart repeaters [RAN2, *RAN3 (check the possibility of assumed architecture for smart repeater so that identification part for RAN3 may be removed)*]

- ~~RF requirements for smart repeater, including max transmission power and other applicable RF requirements [RAN4]~~

As mentioned in [10], the pending part is whether to take RAN3 as the secondary working group. According to the contributions submitted in this meeting, there is a proposal to remove RAN3 involvement for manageable workload in SI considering the initial TU allocation in RP-213469. Further involvement of RAN3 can be considered in normative phase if relevant solutions are concluded in SI phase. In addition, RF requirements can be treated in the follow-up normative work. To collect the views on this aspect, companies are encouraged to provide views on Question 2-4.

Question 2-4: Any views regarding the removal of RAN3 and RAN4 from the secondary working groups? Please also provide your comment on whether initial TU allocation proposed in RP-213469 is sufficient

Feedback Form 4: Management of smart repeater (Initial round)

1 – Samsung Electronics Co. We also think RAN3/4 can be minimized in SID and better focus on the RAN1 aspect. Other WGs may be involved when normative work is started based on the outcome of SI.
2 – Qualcomm Incorporated RAN3 impact can be minimized if RP#94e can agree on the internal structure of the smart repeater as well as aspects related to identification and authorization of the smart repeater. For this purpose, we propose the following to be included in the SID: *It is assumed that:* *1) The smart repeater contains a full UE stack for repeater management and OAM connectivity.* *2) The smart repeater identification and authorization reuses functionality defined for the IAB-MT.* *3) A separate set of features and capabilities is defined for the smart repeater's UE function.*
3 – Samsung Electronics Co. We have a question on Qualcomm's understanding of the smart repeaters. Based on your suggestion, we think that there will be no difference between a smart repeater and an IAB in terms of identification and authorization. In this case, we have a question about the cost reduction aspect of smart repeater since we believe the low cost would be one of the key benefits in smart repeater than IAB. Can you explain more about how to distinguish?

4 – ZTE Corporation

We share the views to remove RAN3 and RAN4 from the second working group in SI phase. In our view, similar to other topics before, all potential solutions for identification/authorization can be discussed in RAN2 only. Then, other WG(s) can be involved in the normative phase if there is any identified impact.

5 – Deutsche Telekom AG

We agree with the 2nd point by Qualcomm. Repeaters will be part of the network and hence full control by the network is a must. The reuse of what has been defined for IAB in terms of authentication and configuration should be leveraged as much as possible. With this understanding RAN3 efforts could be significantly minimised.

6 – China Telecom Corporation Ltd.

Ok to remove RAN4 from the secondary WGs of the SI, since any new RF requirements required can be defined in the WI phase.

For the 6-month SI, we can take the Rel-17 RAN4 RF requirements as baseline.

7 – ETRI

We are not sure about Deutsche Telekom AG's comment that the network must have full control on the repeater. Indeed, the network would have no control on the Rel-17 RF repeater, for instance? We are OK to remove RAN4 (and RAN3 maybe) but support the current text for the first bullet as it is. We think it is premature to agree on all the assumptions from QC for now. (We are fine with the third one; 3) A separate set of features and capabilities is defined for the smart repeater's UE function.)

8 – vivo Mobile Communication Co.

OAM based connectivity can allow Identification and authorization of smart repeaters. Adopting OAM based solution can alleviate RAN3 dependency of smart repeater work. thus, we can remove RAN3 and secondary WG. But, we also agree with Qualcomm that we may consider that the smart repeater identification and authorization reuses functionality defined for the IAB-MT.

9 – NEC Corporation

We are positive to minimize the workload of smart repeaters on RAN3 and RAN4.

10 – Fujitsu Limited

The removal of RAN4 is fine with us. The removal of RAN3 is also fine with us if we could get RAN3 back when the involvement of RAN3 is concluded.

The candidate structures given by Qualcomm seem reasonable. But we still prefer careful discussions on this issue in WG.

11 – China Mobile Group Device Co.

Study work should be focused in RAN1 but RAN2, 4 may also needed with small workload.

As stated in section 2.1.2, RAN4 may be needed with small workload to help align simulation assumption, especially the parameters that are not involved in current RF spec, e.g. amplification gain.

We cannot agree to fully reuse the identification and authorization functionality defined for the IAB-MT. As the IAB will receive and re-generate the data package and send them to the UEs, it is important to manage the IAB as a network node.

But for the smart repeater, the data package and contents are transparent to the smart repeater. And smart repeater cannot schedule UEs as IAB. The identification and authorization could be loose or more flexible compared with IAB. We have the same understanding a legal or authorized smart repeater is important for the deployment. But we still have many ways for the "identification and authorization", such as dedicated SIM card, or the identification and authorization through gNB or OAM system.

As we repeated many times that, the upgrade of core network is time consuming and resource consuming and reduce the commercial interest from operators. We wanted to introduce Relay in 4G. But there are lots of difficulties for upgrade the core network or through some implementation ways to realize the same function at gNB side.

From our side, fully reuse the identification and authorization as IAB is not a good solution. We could accept it as one of the solutions, but not the only one.

RAN based and/or implementation-based solutions without core network and SA impact should be considered.

12 – HUAWEI TECHNOLOGIES Co. Ltd.

At this stage we prefer not to preclude any potential working group, since it is not clear yet how to do the identification and authorization, and it is not clear whether it is feasible to only leave the whole work to RAN2. There is no harm to leave RAN3 here at this stage, later based on further study if indeed no need to involve RAN3, then RAN3 doesn't need to work for it. Therefore, we prefer to still keep RAN3 there. In addition, in our understanding, there may be need of coordination with SA3 also, since usually authorization is SA3 normal work. Therefore, we propose to add the following note and further decide whether SA3 need to be involved or not in the study phase.

Study the following aspect of smart repeater management

- Identification and authorization of smart repeaters [RAN2, RAN3]

Note: coordination with SA3 may be needed.

13 – Motorola Mobility UK Ltd.

[Lenovo/Motorola Mobility]

We are fine with moderator's suggestion to minimize the effort of RAN3/RAN4 in the SI and consider their involvement in the follow-up normative phase depending on the progress/conclusion on RAN1/RAN2 work in the SI phase.

14 – Intel Korea

We think that study on smart repeater architecture assumption is needed, and thus RAN2/RAN3 involvements seems essential. At this point we are reluctant of deleting RAN3.

Besides, we are wondering what will be the scope of impacted signaling/procedure to support authorization and identification? Whether the objective considers a RAN-based solution only or interaction with SA is needed? It would be good to clarify those aspects during this discussion to avoid uncertainty and ambiguous discussion during SI phase.

15 – Ericsson France S.A.S

We would prefer to keep RAN3 involvement as secondary WG also during the SI. We could reword as follows: ” Identification and authorization of smart repeaters [RAN2, aligning with RAN3 as needed]”. In this way it would be clearer that RAN3 work would be on the basis of LSs from RAN2. Furthermore, RAN3 may also need to be kept in the SID for management aspects with a specific bullet in the objectives: ”study OAM requirements for smart repeaters [RAN3]”.

16 – MediaTek Inc.

We disagree with taking any assumption of reusing the IAB (-MT) framework.

A repeater of course need to be controlled by the operator making use of it, however IAB framework may simply not be the most adequate solution.

We see the repeater can be handled as a UE by the network, with necessary additional information (e.g. capability, subscription data) that distinguishes this UE as being a repeater in the RAN and CN.

17 – Sony Group Corporation

We are okay to ”check the possibility of assumed architecture for smart repeater so that identification part for RAN3 may be removed.”. However, we agree with companies that smart repeater cost should be kept low compared to IAB. Hence, the amount/level of assumed reuse should not prevent smart repeater from having a low cost.

18 – Futurewei

We agree with Intel and prefer retaining RAN3 involvement for now.

19 – Nokia Italy

We are OK to remove RAN3 and RAN4 as secondary WGs. As also commented under question 2-3, We propose adding a second sub-bullet under “Study the following aspects of smart repeater management”: “Repeater control channel design, assuming L1 or L2 control channel, and that the control channel is configured by O&M.” “

20 – AT&T

We support taking the IAB architecture as a starting point for Smart Repeater management as it can save time in the WGs and avoid RAN3 TU impact. Our proposal would be to simply state:

IAB-MT functionality is reused for Smart Repeater management and authorization.

21 – ROBERT BOSCH GmbH

It is important to focus on RAN1 in this SID.

22 – SHARP Corporation

We’re a bit late here, sorry, but we share similar views as Qualcomm. We also share the view of AT&T that IAB-MT functionality is reused for Smart Repeater management and authorization.

23 – Apple Poland Sp. z.o.o.

In general, our views on the proposals from Qualcomm is that it goes into too many details and should be part of 6-month study item phase to tradeoff between SMR cost and the scheduling flexility of SMR. We may end up with reuse part or full CP of legacy UE and IAB-MT protocol for SMR, however it should be concluded after comparing the performance benefit with other candidates solutions that have lower cost. It is a bit premature to conclude in SID description as it sounds conclusion without study yet.

Having said this, the proposal from moderator is a good starting point for us with small modification as below:

- Identification ~~and~~, authorization and configuration of smart repeaters [RAN2, RAN3]

2.1.4 Other comments on the SID including the justification part

The justification was discussed in the NWM discussion [RAN94e-R18Prep-03] which seems to be stable. Please provide any other comments on the SID[11] including the justification part in this section.

Feedback Form 5: Other comments on the SID (Initial round)

1 – Samsung Electronics Co.

Since smart repeater has not been studied before, we suggest including evaluation methodology and performance evaluation as the objectives in this SID.

2 – Qualcomm Incorporated

We disagree with Samsung. The discussion of evaluation methodology and performance evaluation would require substantially more TUs than presently allocated for this SI. This SI relates to the specification of side control (to add "smartness" to the repeater) rather than studying the benefits of a repeater. The benefits of repeaters are well understood.

3 – Samsung Electronics Co.

We understand the benefits of RF repeater but not sure about the benefit of controlling beam and on/off power at the smart repeater. These are not verified before. If TU is concerned we can minimize evaluation cases in SID or increase the SI period.

4 – ZTE Corporation

We share the views that the benefits of smart repeater (including enabling the control of smart repeater) are well understood without a strong need for further evaluation. Meanwhile, as mentioned in the assumption part, the main usage of the smart repeater is to extend the coverage of the existing network. Based on the allocated TUs, simple checking on SIR/SINR distribution will be sufficient without going into the detailed discussion on evaluation methodology.

5 – ETRI

We share similar views with ZTE.

6 – NEC Corporation

We think baseline should be considered for study stage of smart repeaters.

7 – China Mobile Group Device Co.

Share the similar view that we do not spend too much time on the evaluation methodology. From our understanding, the performance gain of smart repeater is obvious. We should focus on the techniques related to the side control. And the scenario and assumption part provide enough information for the evaluation. We do not need to include the evaluation methodology explicitly in the SID.

8 – Fujitsu Limited

In addition to the protocol structure, the functionalities/behaviors of smart repeaters in PHY layer need further considerations/discussions as well. For instance, a smart repeater looks like a MT/common UE, or a UE with limited capabilities in PHY layer. We are not sure whether this part is already captured in the SID draft or not. If so, by which objective.

9 – Ericsson France S.A.S

The sparse FR2 channels and deployment scenarios that smart repeaters are intended for implies that the link has binary qualities, i.e., either it is there, or it is not. Hence, there is little need for link level simulations. Also, the link between the gNB and the smart repeater can be considered to be good, for obvious reasons. Assessment of more or less capable side link information may of course be necessary as well as system level simulations.

10 – MediaTek Inc.

We expect the benefits of a DF repeater are well understood and would discourage spending time on evaluation methodology.

11 – Sony Group Corporation

Although the benefits of smart repeaters might be understood, we believe that some sort of baseline regarding simulation assumptions is needed, including KPIs (these can be SIR/SINR or other). As soon as two or more competing solutions are proposed, simulations may be needed to down select.

12 – Futurewei

We agree with Samsung that performance gains should be demonstrated. The benefits of smart repeaters have been argued more from a qualitative viewpoint by highlighting beamforming capability over an RF repeater and low-cost advantage over an IAB node. However, the required extent of beamforming capability at each smart repeater together with density of their deployment are not yet known in order to assess benefits from network perspective.

13 – Nokia Italy

The name of this study item is confusing, particularly given the now clarified scope. The work now seems to be focusing on the control and management framework for a network. “Smart” is not appropriate for the repeater, as all the “smartness” is actually in the gNB controlling the repeater. For this reason, we propose to rename the study “**Study on NR network-controlled repeaters**.”

2.2 Moderator's observations and proposals

2.2.1 Observations and proposals for scenarios and assumptions

As observed from the feedback received in the initial round, it seems that majority of companies are fine to remove the following sentence from the objective as long as clarification on the applicability of smart repeater for both FR1 and FR2 is explicitly made in somewhere else in the SID. It is also suggested to limit the application to licensed bands at this point.

~~Consider smart repeaters used for extension of network coverage on FR1 and FR2 bands~~

One company commented to remove the bullet point of cost efficiency but this has been discussed in previous NWM discussion. This is kept just to remind the importance of this aspect. Also it is suggested to reword the bullet point related to transparency but the wording was discussed in the previous NWM discussion. Therefore, the moderator suggests to keep the current wording unless there are more views on this.

Based on the observations, the moderator has the following proposal as the outcome from the initial round:

Proposal 1:

Delete the following sentence from the objective and put it under the last paragraph of the justification part:

~~Consider smart repeaters used for extension of network coverage on FR1 and FR2 bands~~

The objective of scenarios and assumptions is updated as follows:

The study on NR smart repeaters are to focus on the following scenarios and assumptions:

- *Prioritize FR2 TDD deployments for both outdoor and O2I scenarios.*
- *For only single hop stationary smart repeaters*
- *Assuming smart repeaters are transparent to UEs*
- *Smart repeater can maintain the gNB-repeater link and repeater-UE link simultaneously*
- *Cost efficiency is a key consideration point for smart repeaters*

The last paragraph of the justification part is updated in [12] as follows:

A smart repeater is an enhancement over conventional RF repeaters with the capability to receive and process side control information from the network. Side control information could allow a smart repeater to perform its amplify-and-forward operation in a more efficient manner. Potential benefits could include mitigation of unnecessary noise amplification, transmissions and receptions with better spatial directivity, and simplified network integration. *Moreover, while FR2 is prioritized in this study, smart repeaters can be used for extension of network coverage on both FR1 and FR2 licensed bands.*

2.2.2 Observations and proposals for side control information

As observed from the feedback received in the initial round, majority of companies are fine to remove RAN2 and RAN4. Some relevant parameters in RAN4 can also be referenced during the discussion of assumptions

for potential evaluation. For the power control part, although some companies still prefer to keep the it, it seems that majority of companies are fine to remove it by considering that the basic power control functionality can be achieved by on-off or by OAM.

In addition, based on the feedback, it seems reasonable to add one additional bullet point to allow discussion in SI phase to understand the protocol structure and identify how the side control information can be delivered to smart repeater. Based on the allocated TUs, it is more reasonable to focus on discussion in RAN1 as the only WG.

Therefore, the moderator has the following proposal as the outcome from the initial round:

Proposal 2:

The objectives related to side control information are updated as follows:

Study and identify which side control information below is necessary for smart repeaters including assumption of max transmission power [RAN1]

- *Beamforming information*
- *Timing information to align transmission / reception boundaries of smart repeater*
- *Information on UL-DL TDD configuration*
- *ON-OFF information for efficient interference management and improved energy efficiency*

Study and identify L1/L2 signaling to carry the side control information [RAN1]

2.2.3 Observations and proposals for management of smart repeater

As observed from the feedback received in the initial round, majority of companies are fine with the removal of RAN3 and RAN4 from the secondary working groups to focus the discussion in RAN2 while some companies prefer to keep RAN3. Regarding adding the detailed candidate solutions proposed by some companies, it seems premature to go with this direction and details can be left to WG-level discussion provided that there are different views on the solutions. Currently, only one meeting with 0.5TU is allocated each to RAN2 and RAN3. It is very hard to handle interaction between the two WGs if both WGs have discussion on the same topic. Therefore, it is recommended to focus on the discussion in RAN2. It's clear if some solutions with additional impacts on other WGs identified as the outcome of SI phase, we can handle it per need during the normative phase following the normal procedure. Therefore, the moderator has the following proposal as the outcome from the initial round:

Proposal 3:

The objective related to management of smart repeater is updated as follows:

Study the following aspects of smart repeater management

- *Identification and authorization of smart repeaters [RAN2]*

2.2.4 Observations for other comments

As observed from the feedback received in the initial round, most of the comments were about evaluation methodology/assumptions. Some companies commented that the benefits of smart repeater are well understood and hence evaluation work should be minimized while several companies think some evaluation may be needed. Overall, it seems most of the companies are okay without mentioning evaluation methodology/assumptions in the SID. Therefore, the moderator would like to conclude that no SID update related to evaluation methodology/assumptions is needed.

One company proposed to consider different name of this study item. The moderator suggests to hold the discussion on the naming until the scope of this study item is finalized.

3 Intermediate Round

3.1 Collection of company views

Please note that the draft SID has been updated to [12] according to the proposals from initial round.

3.1.1 Scenarios and assumptions

Please provide any views on the proposal from the initial round.

Proposal 1:

Delete the following sentence from the objective and put it under the last paragraph of the justification part:

~~Consider smart repeaters used for extension of network coverage on FR1 and FR2 bands~~

The objective of scenarios and assumptions is updated as follows:

The study on NR smart repeaters are to focus on the following scenarios and assumptions:

- *Prioritize FR2 TDD deployments for both outdoor and O2I scenarios.*
- *For only single hop stationary smart repeaters*
- *Assuming smart repeaters are transparent to UEs*
- *Smart repeater can maintain the gNB-repeater link and repeater-UE link simultaneously*
- *Cost efficiency is a key consideration point for smart repeaters*

The last paragraph of the justification part is updated in [12] as follows:

A smart repeater is an enhancement over conventional RF repeaters with the capability to receive and process side control information from the network. Side control information could allow a smart repeater to perform its amplify-and-forward operation in a more efficient manner. Potential benefits could include mitigation of unnecessary noise amplification, transmissions and receptions with better spatial directivity, and simplified network integration. *Moreover, while FR2 is prioritized in this study, smart repeaters can be used for extension of network coverage on both FR1 and FR2 licensed bands.*

Feedback Form 6: Scenarios and assumptions (Intermediate round)

1 – ETRI Support the proposal.
2 – Samsung Electronics Co. We support updated justification by the moderator.
3 – NTT DOCOMO INC. We are fine with the proposal.
4 – vivo Mobile Communication Co. We support the proposal
5 – China Telecom Corporation Ltd. Fine with the proposal, although it is more preferred if we can add a NOTE on FR1 in the objective.
6 – Fujitsu Limited We support the moderator's proposal.
7 – CATT We are generally ok with proposal 1. But we would like to have a clarification regarding the following bullet. Does the repeater-UE link refer to a control link between repeater and UE? *Smart repeater can maintain the gNB-repeater link and repeater-UE link simultaneously*
8 – Telstra Corporation Limited We support the proposal.
9 – ZTE Corporation We are fine with the proposal. Re-CATT's question, the repeater-UE link refers to the link to forwarding the data from repeater to UE. There is no control link between repeater and UE since repeater is transparent to UE as we assumed.
10 – Beijing Xiaomi Mobile Software We support the proposal.
11 – NEC Corporation We support this proposal.

12 – China Mobile Group Device Co.

We still suggest to explicitly add the note/one sentence in the objectives under the "*Prioritize FR2 TDD ...*" or in the justification part that "The solution should also apply to FR1, if applicable". As we still need a guidance for the WI that the developed solutions in the follow-up normative work should also apply to FR1.

During the first round discussion, 11(total 28) companies including all 6 operators support to retain sentence as the text in last meeting or explicitly emphasize in the SID that "the developed solutions in the follow-up normative work can be applicable for both FR1 and FR2." Since the repeaters are deployed by operators as part of network, we can't ignore operator's suggestion. We could accept to prioritize on FR2 in study phase to save workload but in the follow-up normative work, the developed solutions are still applicable for FR1. And this should be emphasized in the SID to give guidance.

13 – Deutsche Telekom AG

We do NOT agree wth the updated objective as our comment (also comments of other operators along these lines even in this round) in the initial round was ignored. It is clear that the work on smart repeaters shall cover FR1 FDD & TDD and FR2 TDD at equal priority. As always the work is contribution driven. If companies believe FR2 is more important than the can contribute accordingly.

Also "*Assuming" in the 3rd bullet point is not strong enough. We again propose to change to a stonger wording ("are", "shall", ..)*

And also the other comment from us ignored: The sentence of cost effieciency does not say anything - espcially not in the objectives section - and shall be removed.

If this these changes are not part of the objectives, we cannot agree to initiate the work in Rel-18.

14 – CHTTL

Support CMCC's comment

15 – HUAWEI TECHNOLOGIES Co. Ltd.

We are fine the change to the objective made by the moderator to prioritize FR2.

As to the new added sentence to the justification section, we prefer to change as below to match the deleted sentence better:

Moreover, while FR2 is prioritized in this study, smart repeaters with support of side control information can be **considered**~~used~~ for extension of network coverage on both FR1 and FR2 licensed bands.

16 – Ericsson France S.A.S

We support the moderator proposal

17 – Futurewei

We support the proposal.

18 – Motorola Mobility UK Ltd.

[Lenovo/Motorola Mobility]

We support the updated justification by the moderator

19 – AT&T GNS Belgium SPRL

Per our initial round comments, we still do not agree with the removal of "Consider smart repeaters used for extension of network coverage on FR1 and FR2 bands". Solutions should apply to both FR1 and FR2 licensed bands.

Additionally, we agree with Deutsche Telekom that the bullet regarding cost is not appropriate in the objectives. Mentioning "cost" usually gives anti-trust lawyers an uneasy feeling. If we choose to keep this bullet, albeit more of a justification statement, our proposal is to simply remove "cost" as follows: *~~Cost~~ Efficiency is a key consideration point for smart repeaters*

20 – CableLabs

The moderator's proposal sounds good.

21 – OPPO

Regarding to the comment from other companies for removing footprint of "cost", we understand the concern. But on the other hand, if "cost" is removed, something else needs to be added in place to differentiate this smart repeater from IAB per complexity wise. Note that by now the SID seems already include L1/L2/L3 functionalities in the study scope. Then the question would be what the criteria should be for WGs to determine the final inclusion of these functionalities in future normative work – having them should be always better than not having them from functioning perspective, but what is the difference between the final picture of this smart repeater and IAB? From our view, even in the case "cost" wording were removed from SID, some wording like below should be added to get "cost" consideration back in WG's level discussion.

– The study should start with [Or be based on] a determination of differences between smart repeater and IAB.

22 – Intel Korea

We suggest adding one bullet to explicitly capture that the study should assume in-band amplify-and-forward repeaters, as in RAN4 R17 work. Currently only justification part mentions that. To avoid potential confusions when the study starts, we propose to explicitly mention this assumption in objectives:

The study on NR smart repeaters are to focus on the following scenarios and assumptions:

- *Smart repeaters are based on R17 RF in-band amplify-and-forward repeaters*
- ....

23 – ROBERT BOSCH GmbH

We are fine with the modification.

24 – Qualcomm Incorporated

We principally support the proposal. We are fine to prioritize FR2.

We agree with many companies above that the smart repeater should support FR1 and FR2, and that this should be captured in the SID. We propose to add the original sentence back to this objective:

Consider smart repeaters used for extension of network coverage on FR1 and FR2 bands.

25 – Apple Poland Sp. z.o.o. We are ok with Moderator proposal with understanding that the intention is to better utilize the 1-TU budget and complete the design on time. As commented in the previous round, it is usual practice in 3GPP to discuss whether standardized function is limited to FR2 only or for both FR1/FR2, licensed vs. unlicensed etc.. If it is still concerned by Operators, the original WID is also acceptable as long as 'the prioritization of FR2' is explicitly listed.
26 – Nokia Italy Fine with the proposal.
27 – VODAFONE Group Plc agree with China Mobile and DT - FR1 is important
28 – Sony Group Corporation Our preference is to have the moderator's text "while FR2 is prioritized in this study, smart repeaters can be used for extension of network coverage on both FR1 and FR2 licensed bands" as a note to the objectives.
29 – Verizon UK Ltd We are fine to prioritize FR2 considering the timeline. To alleviate concerns on coverage for both FR1 and FR2 bands, the original sentence below can be restored in the objective list. ***Consider smart repeaters used for extension of network coverage on FR1 and FR2 bands.***

3.1.2 Side control information

Please provide any views on the proposal from the initial round.

Proposal 2:

Study and identify which side control information below is necessary for smart repeaters including assumption of max transmission power [RAN1]

- *Beamforming information*
- *Timing information to align transmission / reception boundaries of smart repeater*
- *Information on UL-DL TDD configuration*
- *ON-OFF information for efficient interference management and improved energy efficiency*

Study and identify L1/L2 signaling to carry the side control information [RAN1]

Feedback Form 7: Side control information (Intermediate round)

1 – ETRI

Support the proposal.

2 – Samsung Electronics Co.

We support this as the previous round.

3 – vivo Mobile Communication Co.

Power control should be listed as objective.

For UL transmission, MT UL transmission is subject to UL power control to cope with channel condition change between donor and MT, if MT and RU are collocated, it is straightforward to assume that RU UL output power is also controlled by BS to enable multiplexing between MT UL and RU UL; or, if MT and RU share panel, MT UL power control may directly impact RU UL output power considering PSD and EVM requirement.

Based on above, whether to support RU power control depends on signaling multiplexing between RU and MT, and depends on hardware structure of the repeater. It is obvious OAM based power control is not sufficient, and study the necessity of power control is straightforward.

Moreover, power control/gain control is beneficial to manage interference as commented by other companies. The gain of the RU can be adjusted based on location of serving UEs, if all the serving UEs are near to repeater, the gain of repeater can be set to a small value, which reduce amplified interference.

4 – China Telecom Corporation Ltd.

OK with the proposal.

5 – Fujitsu Limited

Firstly, we would like to thanks the reply from ZTE in the previous round.

We still have a concern on the bullet about 'timing'.

In justification part, there is "Side control information could allow a smart repeater to perform its amplify-and-forward operation in a more efficient manner." It seems to us that the intention of sending the side control information is for A&F. However, the purpose of the timing information is described in the objective part as to *align transmission / reception boundaries* rather than assisting A&F. How this timing information can help A&F and why it should be a side control information is not clear.

We suggest to update this part as:

Timing information ~~to align transmission / reception boundaries of smart repeater~~

6 – CATT

Ok with the proposal.

7 – ZTE Corporation

We support the proposals from the moderator.

8 – NEC Corporation

Power control performed via OAM of a smart repeater may lack some flexibility on granularity and timeliness. So we suggest to change sub-bullet 4 of side control information as follow:

"Power control information, for example, ON-OFF information, for efficient interference management and improved energy efficiency."

9 – China Mobile Group Device Co.

For power control, an un-negligible number of companies suggest to retain it in the objectives with/without modification in the first-round discussion.

Considering two smart repeaters deployed in different locations in the same cell, one is at the cell edge and the other could be closer to the gNB. If there is no power control or amplifier gain control for the smart repeater, the smart repeater closer to the gNB will induce higher amplified noise and impact the performance of the one at the cell edge and also normal UEs. This is the intention to introduce the power control for the smart repeater. Though the feature of on/off could solve this issue partially. But considering the network efficiency, we cannot prevent the smart repeaters working at the same time.

OAM is one kind of method to control power/amplification gain but it can't adjust the output power of smart repeater as flexibly and quickly as gNB's indication.

We still suggest to add following objectives in the SID

Power/gain control information for efficient interference management.

10 – Deutsche Telekom AG

We agree with NEC and CMCC on the Power/Gain control information. This is the preferred altenative over OAM.

11 – HUAWEI TECHNOLOGIES Co. Ltd.

1. We still think that power control information should be one of the aspects to be further studied. Based on the inputs in the initial round, we think there are much more companies (about 11 vs 4) prefer to keep power control information in the list, we don't understand why it is still removed. We don't think that power control can be replaced by ON-OFF information. Without appropriate power control, it is expected that a fixed repeater amplifying gain will be adopted, which will result in the following problems:

a) If the amplifying gain is set to a smaller value, it will limit the potential coverage that can be achieved by the smart repeater.

b) If the amplifying gain is set to a larger value, it will bring unnecessary interference for gNB uplink reception. We don't think ON-OFF can solve all the problem here, for example if repeater-UE and other normal UEs need to be scheduled simultaneously, simply turn-off the repeater is not good.

2. The signaling for the side control information is a work for WI phase, and the details for the support of the identified side control information (if any) should go to the WI phase. Therefore, we don't see the necessity to add the last sub-bullet for signaling for the SI.

12 – Ericsson France S.A.S

We are OK with the proposal

13 – Futurewei

We should retain original bullet on power control information. While ON-OFF can potentially achieve basic interference management, it can be limiting and more optimized schemes should not be ruled out at this juncture without performance evaluation. Further evaluation is necessary and can guide us towards the type and granularity of signaling needed instead of directly embarking on a detailed signaling design study. In summary, we prefer retaining power control information and not including the added bullet on study of signaling design.

14 – Motorola Mobility UK Ltd.

[Lenovo/Motorola Mobility]

We still prefer to retain the power control as it provides an efficient interference management comparing with OAM based control.

15 – CableLabs

We support the actual proposal

16 – Intel Korea

From the responses so far, we do not observe strong majority for removing "power control" related bullet: 10 out of 23 companies suggest keeping it. In that situation, since it is a study item, we believe the proper procedure is to keep the bullet and decide as an outcome of the study whether to specify anything in this regard.

Note, that the architecture/management of the repeater is also going to be discussed in the SI, that means assuming OAM for power control is premature without knowing how the repeater may be configured.

17 – ROBERT BOSCH GmbH

We are fine with the proposals.

18 – Qualcomm Incorporated

We are fine with the proposal.

19 – OPPO

Regarding to Fujitsu's comment for the following:

– *Timing information ~~to align transmission / reception boundaries of smart repeater~~*

we do not see a conflict between "alignment of Tx/Rx boundary" and "amplify & forward", where the latter one is just an aspect of transmission. However, we do want to echo what Fujitsu proposed, because this bullet seems to already setup a prerequisite that the DL-Tx/UL-Tx and DL-Rx/UL-Rx should be aligned at the repeater, which however should be a part of study itself (instead of prerequisite). So the SID can go with either of the following two ways:

– *Timing information OR*

– *Timing information to ~~align~~ assist determination of transmission/reception boundaries of smart repeater*

20 – Apple Poland Sp. z.o.o. As commented by other companies, our observation is that approximately 10 companies prefer to keep power control objectives including us. The technical reasons are also provided in previous round, e.g., near-far SMR deployments and performance difference by using on-off vs. power control mechanism. We do NOT think it is a fair proposal to remove the power control objective without strong justification, especially the spec impact is fairly small as replied in 1st round.
21 – Nokia Italy Support the proposal.
22 – Sony Group Corporation Our view is that we do not need to limit ourselves to interference management by ON-OFF switching of the smart repeaters, at this stage. The ON-OFF switching mechanism might not always be efficient for managing interference. For example, the desired amount of transmit power might depend on the direction toward which the smart repeater forwards a signal. Power control allows for more general interference management schemes. Down-selection can then be done at the end of the SI, before starting the WI. So we suggest power control to be listed as one of the objectives. We support NEC's formulation of bullet 4.
23 – Verizon UK Ltd We are fine with the proposal

3.1.3 Management of smart repeaters

Please provide any views on the proposal from the initial round.

Proposal 3:

Study the following aspects of smart repeater management

- *Identification and authorization of smart repeaters [RAN2]*

If companies have strong view on keeping RAN3, please provide your comments on how to manage the work between RAN2 and RAN3 including the work division and interaction between the WGs given that only one meeting with 0.5TU is allocated for RAN2 and RAN3 in the SI.

Feedback Form 8: Management of smart repeaters (Intermediate round)

1 – ETRI Support the proposal.
2 – vivo Mobile Communication Co. We support the proposal

3 – China Telecom Corporation Ltd.

Ok with the proposal, considering that it is difficult for RAN2 and RAN3 to do the work in parallel in one single meeting.

4 – ZTE Corporation

We support the moderator's proposals. Regarding potential impacts on RAN3 including discussion related to other groups and detailed requirements of OAM, it can be handled like other items during the normative phase once the details are clear.

5 – NEC Corporation

We support this proposal.

6 – China Mobile Group Device Co.

we support the proposal.

7 – Deutsche Telekom AG

Support

8 – HUAWEI TECHNOLOGIES Co. Ltd.

At this stage we prefer not to preclude any potential working group, since it is not clear yet how to do the identification and authorization, and it is not clear whether it is feasible to only leave the whole work to RAN2. In our understanding, at least SA3 should be involved, even the mechanism can be developed by RAN2, without the check from SA3 we cannot ensure the security of the authorization mechanism. Therefore, we suggest to make the following changes:

Study the following aspect of smart repeater management

- Identification and authorization of smart repeaters [RAN2]

Note: coordination with SA3 may be needed

9 – Ericsson France S.A.S

As stated before, RAN3 needs to be involved for a) authorization aspects (which are likely to involve network signaling with the core network, in RAN3 scope) and b) OAM requirements for smart repeaters (in RAN3 scope). RAN3 involvement can be minimal, possibly on the basis of LSs from RAN2 (this part was probably missed by the Moderator). We could reword as follows: "Identification and authorization of smart repeaters [RAN2, aligning with RAN3 as needed]" and add "study OAM requirements for smart repeaters [RAN3]".

10 – ZTE Corporation

Regarding Ericsson's proposal on LS, based on current TU allocation, it seems not possible to exchange the LS since there is only a single meeting. Do you imply that adjustment on TU is needed?

For the OAM requirements, it's more reasonable to consider it once the solution(s) is clear. It can be handled in the normative phase similar to other items.

11 – Motorola Mobility UK Ltd. **[Lenovo/Motorola Mobility]** We support moderator's proposal
12 – CableLabs Support the proposal
13 – Intel Korea We can accept removing RAN3 from the responsible groups, but we would assume that RAN3 can be contacted by RAN2 using LS mechanisms, thus RAN3 can still be involved.
14 – Qualcomm Incorporated We don't believe that a technical problem can be solved by removing the responsible WG from the SID objective. The authorization of the smart repeaters falls into RAN3 realm, so RAN3 needs to do it. If the goal is to reduce RAN3 involvement, then the SID needs to be appropriately rescoped. This can be done by reusing an existing solution for repeater authorization. We propose to include: ***- The authorization of the smart repeater may reuse the functionality defined for the IAB-MT*** This at least would justify why RAN3 is not included here.
15 – Futurewei We prefer to retain RAN3 at-least as a secondary WG. This will facilitate in RAN3 being able to consider LS from RAN2.
16 – Nokia Italy The wording of the objective on L1/2 control leaves open the question of how the L1/2 control signalling is intended to be configured. We assume that the configuration is handled strictly by O&M, and this should be clearly stated. (If this were not the case, then it would be necessary to add a further objective to study details of configuration, with potential RAN2/3 involvement.)
17 – VODAFONE Group Plc OK - sounds likely to requires SA2 and SA3 engagement.
18 – Verizon UK Ltd We agree with Qualcomm view above. RAN3 should be kept as a secondary WG or the scope of the SID needs to be clarified.

3.2 Moderator's observations and proposals

3.2.1 Observations and proposals for scenarios and assumptions

Although majority of companies are supportive of proposal 1, some companies including operators still prefer to highlight the applicability of developed solutions for FR1 case in the objective. In addition, one company has concern on keeping the bullet point of cost efficiency in the objective but another company tends to think some description on cost efficiency is needed. Similar to the previous NWM discussion [2], there are quite

strong views to keep these two bullet points under the objective part. Therefore, the moderator suggests to put these bullet points under NOTE in the objective part since both may not directly impact the study including possible evaluation. Also, it is suggested by one company to change the wording of the bullet point of transparency i.e. remove ”assuming”. The moderator thinks it does not make much difference since these are assumptions for study anyway. Based on this observation, the moderator suggests to update the objective of scenarios and assumptions as follows:

The study on NR smart repeaters are to focus on the following scenarios and assumptions:

- *Prioritize FR2 TDD deployments for both outdoor and O2I scenarios.*
- *For only single hop stationary smart repeaters*
- *Smart repeaters are transparent to UEs*
- *Smart repeater can maintain the gNB-repeater link and repeater-UE link simultaneously*

NOTE1: Consider smart repeaters used for extension of network coverage on FR1 and FR2 bands.

NOTE2: Cost efficiency is a key consideration point for smart repeaters

It is suggested by one company to add a new bullet point ”Smart repeaters are based on R17 RF in-band amplify-and-forward repeaters”. Since this has been mentioned in the justification part and it would need more discussion on the wording e.g. ”based on” if this is added to the objective, the moderator suggests not to add any new bullet point at this late stage provided that this list has been quite stable from the previous NWM discussion in [2].

3.2.2 Observations and proposals for side control information

As observed from the feedback received in the intermediate round, majority of companies are fine with proposal 2. The only controversial point is whether to put back the bullet point of power control. From the moderator’s perspective, it would be better if we can reduce the scope given that there are only two RAN1 meetings in this SI. As mentioned by some companies, it is more desirable if we can focus on ON-OFF which can also achieve interference management. However, since there is fairly good demand on putting back the bullet point of power control, the moderator suggests to take this as the second priority.

Also, it is suggested by a couple of companies to change the wording of the bullet point related to timing information. Given that this wording has been stable from the previous NWM discussion[2], it can be understood that discussion will anyway be done in study phase on whether/how timing alignment is done. So the moderator suggests to keep the current wording to avoid further discussion on wording refinement at this stage.

Regarding the bullet point related to signaling design, a large majority of companies are fine with adding the bullet point while only a couple of companies have different view.

Based on this observation, the moderator suggests to update the objectives of side control information as follows:

Study and identify which side control information below is necessary for smart repeaters including assumption of max transmission power [RAN1]

- *Beamforming information*
- *Timing information to align transmission / reception boundaries of smart repeater*
- *Information on UL-DL TDD configuration*
- *ON-OFF information for efficient interference management and improved energy efficiency*
- *Power control/gain information for efficient interference management (as the 2nd priority)*

Study and identify signaling to carry the side control information [RAN1]

3.2.3 Observations and proposals for management of smart repeaters

As observed from the feedback received in the intermediate round, majority of companies are fine with the removal of RAN3 to focus the discussion in RAN2 while some companies still prefer to keep RAN3. As pointed out by some companies, it is very hard to handle interaction between the two WGs if both WGs have discussion on the same topic in parallel. A couple of companies suggested to do LS exchange to align the discussion between RAN2 and RAN3 but this does not seem to be feasible given that there is only one single meeting for RAN2 and RAN3 in parallel in this SI. The moderator suggests to add RAN3 back at this point but companies are encouraged to provide constructive comments on how to manage the discussion in RAN2 and RAN3 in parallel.

A couple of companies mentioned coordination with SA WG(s). There was discussion on this aspect in previous NWM discussion [2] but it was concluded that no strong necessity identified at this point on the need for interaction with SA/CT. Whether it needs interaction may depend on solutions identified in RAN. It's clear if some solutions with additional impacts on other TSG/WGs identified as the outcome of SI phase, we can handle it during the normative phase following the normal procedure.

Based on this observation, the moderator suggests to update the objectives of management of smart repeaters as follows:

Study the following aspects of smart repeater management

- *Identification and authorization of smart repeaters [RAN2, RAN3]*

4 Final Round

4.1 Collection of company views

Based on the observations from the intermediate round, it is proposed by the moderator to adopt the latest version of SID in [13] which has captured the following updated objectives:

Proposal 4:

The study on NR smart repeaters are to focus on the following scenarios and assumptions:

- *Prioritize FR2 TDD deployments for both outdoor and O2I scenarios.*

- *For only single hop stationary smart repeaters*
- *Smart repeaters are transparent to UEs*
- *Smart repeater can maintain the gNB-repeater link and repeater-UE link simultaneously*

NOTE1: Consider smart repeaters used for extension of network coverage on FR1 and FR2 bands.

NOTE2: Cost efficiency is a key consideration point for smart repeaters.

Study and identify which side control information below is necessary for smart repeaters including assumption of max transmission power [RAN1]

- *Beamforming information*
- *Timing information to align transmission / reception boundaries of smart repeater*
- *Information on UL-DL TDD configuration*
- *ON-OFF information for efficient interference management and improved energy efficiency*
- *Power control information for efficient interference management (as the 2nd priority)*

Study and identify L1/L2 signaling to carry the side control information [RAN1]

Study the following aspects of smart repeater management

- *Identification and authorization of smart repeaters [RAN2, RAN3]*

Please provide your final comments on the SID [13] with the above proposed objectives.

Feedback Form 9: Final comments on the SID [13]

1 – InterDigital Communications We support the proposal.
2 – ETRI We support the proposal.
3 – China Telecom Corporation Ltd. We support the proposal, and we'd like to support the SID.
4 – China Mobile Group Device Co. we support current proposal from FL. For the cost efficiency, we propose to retain it in the objectives.

First, it was carried forward from the Oct email discussion according to companies' proposal. The cost efficiency covers two aspects

- one is reducing the cost of deployment including the low-price product, easy deployment and from our perspective without upgrade of core networks.

  As we repeated many times that, the upgrade of core network is time consuming and resource consuming and reduce the commercial interest from operators. We have a not very good experience during the LTE relay deployments. As the core network have to be upgraded for relay, or we have to upgrade each parent node of relay based on some implementation-based solutions, which is to simulate some functions of the core network, the progress of relay deployment is slow.
- The other aspect is the simplified protocols, reusing some and necessary functions to enable the "smartness" of repeaters.

If the cost efficiency is removed, we may lose the original motivation for the smart repeater.

As commented by some companies, the cost efficiency is the main difference between smart repeater and IAB. We also share the same view. Compared with IAB, smart repeater could be low-price since the structure is much simplified. **If we delete the "cost efficiency", we may lose one important criterion for the technique selection.**

For even we remove those key words, we still need some wording to be added to give "cost" consideration for the following work. Considering this is the final round discussion, we propose to retain the Note 2 of cost efficiency.

5 – NTT DOCOMO INC.

We support the proposal, and we would like to be listed as a supporting IM.

6 – CEWiT

We support the proposal and the SID.

7 – HUAWEI TECHNOLOGIES Co. Ltd.

1. Regarding power control, we can accept the latest version, though we don't see good reason(s) to set it as 2nd priority.

2. We have strong concern on precluding the possibility to do further coordination with SA in the study phase, the following note shall be added to the SID (which is already a compromise from our side):

Study the following aspect of smart repeater management

- Identification and authorization of smart repeaters [RAN2]

Note: coordination with SA3 may be needed

Firstly, it is not clear right now that whether it is feasible to only leave the whole work to RAN2, because usually authorization belongs to the normal work of SA. Even the mechanism can be studied by RAN2, without the check from SA3 we cannot ensure the security of the authorization mechanism.

Secondly, we don't agree that SA3 can be involved in normative work phase but not study phase, since without the check from SA3 at least from security perspective, RAN2 may even not be able to make the decision whether the mechanism is feasible or not.

Thirdly, we can understand that some companies think that if the IAB authorization mechanism is reused, then SA3 is not needed to be involved in SI, however base on the discussion it is clear that reusing IAB mechanism is only one of the candidates, which means that it is not clear right now that we don't need to

involve SA, it should depend on what mechanism to choose. Therefore, it should be very reasonable to at least leaving a note to make it clearer that further coordination with SA may be needed.

8 – Intel Korea

Thanks for putting everything together.

We understand that it may be perceived as a late addition, but we still think the suggested bullet "Smart repeaters are based on R17 RF in-band amplify-and-forward repeaters" is important to set the basis for RAN1 study. Note, that the study scope is determined by the objectives, not the justification section. We welcome any other wording suggestions if the proposal is not very clear. As a compromise, it can be added as a NOTE3.

For the 2nd priority of "power control" info, we would like to get clarification what does it mean in terms of organized study?

We may have additional comments later.

9 – KDDI Corporation

We support the proposal and the SID.

10 – ZTE Corporation

Re Intel's comments:

Firstly, for comment to add the note, in our view, the dependency of Rel-17 repeater is already well reflected in the justification and the previous WI in Rel-17 is also marked as the related Work item in section 2.3 of the SID. Based on these, I assume that as a common understanding, the outputs/assumption of Rel-17 repeater will be considered for the discussion of some features.

Regarding the power control part, as the 2nd priority, in our view, the study and discussion related to this part can be triggered later once decent progress on other side control information is made. It's also a traditional way to handle it.

11 – Deutsche Telekom AG

Dear Ruyue, unfortunately you continuously ignore Deutsche Telekom's comments on the equal priority for FR1 FDD & TDD and FR2 TDD we posted in the initial and intermediate round ! The (equal) importance of FR1 FDD & TDD and FR2 TDD has been mentioned throughout the thread by at least 7 operators (maybe more, if I mis-counted).

So, Deutsche Telekom request that equal priority for FR1 FDD & TDD and FR2 TDD is mentioned in the objective text and not hidden in a vaguely worded note. Without this, pleasse consider the SI as not approvable. Thanks.

12 – Samsung Electronics Co.

We support the moderator's proposal and are happy to be supporting IM.

13 – NEC Corporation

We support this proposal in general. And we have a little concern about the meaning of "2nd priority" for power control information. Is the priority of power control relative to that of ON-OFF information? Or relative to all the other control information? If it's the former, then we suggest to change it as follow:

Study and identify which side control information below is necessary for smart repeaters including assumption of max transmission power [RAN1]
Beamforming information
Timing information to align transmission / reception boundaries of smart repeater
Information on UL-DL TDD configuration
~~ON-OFF i~~Information for efficient interference management and improved energy efficiency, including ON-OFF information (as the 1st priority), power control information (as the 2nd priority)
~~Power control information for efficient interference management (as the 2nd priority)~~
Study and identify L1/L2 signaling to carry the side control information [RAN1]

14 – CAICT

We support the proposed SID and would like to add CAICT as a supporting company.

15 – Deutsche Telekom AG

With regard to my comment above, I provided an update suggestion to the moderator, which is hopefully acceotable to all other supporters.

16 – ROBERT BOSCH GmbH

We can only support FR1 and FR2 and no prioritization for FR2.

17 – ZTE Corporation

Re NEC's question: Thanks for your support. As replied to Intel above, the 2nd priority is relative to all the other control information. And it seems to be the best we can achieve to balance the needs from both sides. Hope it's acceptable to you.

18 – Futurewei

We agree with CMCC and support retaining of Cost efficiency. We are OK with listing both FR1

and FR2 in the note but a study only for FR2 would be realistically possible.

Performance evaluation (with a common evaluation methodology) is not mentioned anywhere so we

are unsure how identification of necessary side control information will be done. We still prefer to keep power control in the main bullet and mention as ON-OFF as a special case. The outcome of the SI could be that ON-OFF is sufficient.

We maintain our concern raised in the previous rounds on listing study of signaling for carrying side information since it significantly increases scope of the study and is more appropriate in a WI stage.

19 – InterDigital Communications

Please add InterDigital as a supporting company as we indicated our support on this proposal.

20 – MediaTek Inc.

We support moderator's proposal and are also okay to have equal priority for both FR1 and FR2 proposed by Deutsche Telekom. Though some side control information may not be needed for FR1 FDD and TDD bands, at least "*ON-OFF information for efficient interference management*" side control information is beneficial. We don't expect the evaluation works would increase vastly due to this change and existing TU plan should be able to accommodate.

21 – Nokia Italy

We have three remaining comments:

- We do not support adding power control as a second priority. It is not clear how a second priority is to be understood in guiding the SI scope. Given the limited time window, it does not make sense to add lower priority objectives. Our understanding is that the introduction of second priority objectives will take the already limited time away from the primary objectives of achieving essential functionality for directional repeaters. This will happen whether the objective is listed as a 1st or a 2nd priority.
- After "*Study and identify L1/L2 signaling to carry the side control information*", it should be added "It is assumed that configuration of the L1/L2 signaling is done by O&M and therefore is outside the scope of this study.
- As already commented, we strongly recommend renaming the SI to "**Study on NR network-controlled repeaters**" in order to give a more accurate message regarding the content of the SI. There is no smartness in the proposed node; all the smartness is in the network control, so we should be careful to name the SI appropriately.

22 – ZTE Corporation

Moderator:

Deutsche Telekom provided me the following update to the original first bullet point of scenario/assumption like:

"Smart repeaters are used for extension of network coverage on FR1 FDD/TDD and FR2 TDD bands, while during the study FR2 TDD deployments may be prioritized for both outdoor and O2I scenarios."

I hope this is a middle ground which can be acceptable to both sides. Please let me know if you have any concern on this wording.

23 – ZTE Corporation

Moderator:

Nokia proposed to renaming the SI to **"Study on NR network-controlled repeaters"** . Please let me know if you have any concern on this name.

24 – Motorola Mobility UK Ltd.

[Lenovo/Motorola Mobility]

In general, we are fine with the proposal including the later suggestion by the moderator related to FR1 note. However, we would prefer to treat the power control with equal priority as other information.

25 – Ericsson France S.A.S

We are fine with the draft objectives and the moderator proposals to update according to the DT suggestion on FR1/FR2 and Nokia suggestion on SI naming.

26 – OPPO

For Nokia's proposal to change the SI name to "**Study on NR network-controlled repeaters**", we would like to learn whether it is a common understanding that this change would NOT mean the objective on "*Identification and authorization of smart repeaters [RAN2, RAN3]*" is somehow already registered into future normative work.

27 – AT&T GNS Belgium SPRL

We support the update to the FR1/FR2 prioritization objectives as proposed by Deutsche Telekom and the moderator.

We would also like to point out that we were not the only company suggesting "cost" should be removed from the objectives clause. Public documents from industry forums should strongly refrain from using terms such as cost or price as it could be misconstrued as being relevant to antitrust. We propose to rephrase this (as we understand the intentions) as follows: *NOTE2: ~~Cost~~ Network efficiency is a key consideration point for smart repeaters.* [or alternatively *Network deployment efficiency*]

28 – VODAFONE Group Plc

We support the need for FR1. The moderator's comment #22 seems good, thanks.

29 – Qualcomm Incorporated

We are principally fine with the present draft.

We agree with the inclusion of FR1/FR2 support suggested by DT.

We also agree with keeping RAN3 in the loop for repeater identification and authorization.

We agree with China Mobile that cost efficiency should remain in the SID.

We don't have a strong view on the naming of the SID.

We don't believe that SA3 coordination needs to be explicitly included. This is a SI and any issues related to security can be handled via LS to SA3 (business as usual). This is how it was done, e.g., for IAB SI in Rel-15, and it worked well.

We strongly DISAGREE with FW's indication that the side control signaling should NOT be part of the SID, i.e., supported via OAM. The specification of side control is the main reason why this effort is in 3GPP. If side control was handled via OAM, the repeater would be proprietary device, there would be no interoperability and 3GPP effort would not be necessary.

30 – Charter Communications

We strongly support including FR1 in the scope, as echoed by other operators.

31 – Sony Group Corporation

We support the proposal, but our preference is to keep power control in the main bullet and, as proposed by Futurewei, list ON-OFF information as a particular case. It is not necessary to assign a second priority to power control for the SI.

32 – Verizon UK Ltd

We support the SI, please include Verizon in the list of supporting companies.

1) We are fine with the note of FR1/FR2 with understanding that FR2 is prioritized.

2) As AT&T pointed out the word ”cost” needs to be replaced to avoid misunderstanding. The idea here is for the node to be simple so that the cost is lower. So we would like to replace with the following alternative:

”NOTE2: Node simplicity is a key consideration for smart repeaters”

3) No strong view on renaming proposal by Nokia. Slight preference to keep the current name as node becomes smart with network assistance.

33 – SHARP Corporation

We support the proposal.

34 – Futurewei

Our suggestion was to identify necessary side-control information and not directly jump into design study of how such control information is delivered. The latter should follow identification of necessary side-control information and is more appropriate in a WI stage. Moreover, as we understand the additional bullet on study of L1/L2 control signaling was not accounted for in the initial TU estimate and hence can be a significant addition. As a compromise, we think this can be pursued time permitting after the identification step of necessary control information has concluded

35 – Apple Poland Sp. z.o.o.

1) We are fine with the modified wording to address operator concerns on FR1 use case.

2) On the re-naming WID, we do not see clear motivation to do that as the name has been used in many plenary meetings. If there is concern, it expects to be bough up at the very beginning. Focusing on the title itself, as discussed here, the baseline is Rel-17 RF repeater and with introducing side control information, it seems very clear that the node becomes ’smarter’ as clearly described in justification section e.g., in terms of spatial directional transmission, interference coordination etc. The name of ’Smart repeater’ is very proper title in this sense.

3) On the stating ’the side control signaling should NOT be part of the SID’, we disagree on this. If it is true, why we need to standardize this side control signaling involving RAN1 WG? In addition, if it is the case, RAN1 should not be leading wording group.

5 Conclusion

After three rounds of discussion, companies still have different views on:

- The name of this new Rel-18 study item
- The description on the note of cost efficiency
- Whether power control should be kept as the 2nd priority of side control information
- Whether the bullet point of ”study and identify L1/L2 signaling...” should be kept and how it should be described.
- Whether a note is needed for possible coordination with SA WG(s)

Although there are still different views on the above aspects, it is observed that the following set of objectives under the Final Proposal represents good majority of views. Therefore, the moderator proposes to adopt the following final proposal as the objectives for Rel-18 SID on NR Smart Repeaters [14].

Final Proposal:

The study on NR smart repeaters is to focus on the following scenarios and assumptions:

- *Smart repeaters are used for extension of network coverage on FR1 FDD/TDD and FR2 TDD bands, while during the study FR2 TDD deployments may be prioritized for both outdoor and O2I scenarios.*
- *For only single hop stationary smart repeaters*
- *Smart repeaters are transparent to UEs*
- *Smart repeater can maintain the gNB-repeater link and repeater-UE link simultaneously*

NOTE: Cost efficiency is a key consideration point for smart repeaters.

Study and identify which side control information below is necessary for smart repeaters including assumption of max transmission power [RAN1]

- *Beamforming information*
- *Timing information to align transmission / reception boundaries of smart repeater*
- *Information on UL-DL TDD configuration*
- *ON-OFF information for efficient interference management and improved energy efficiency*
- *Power control information for efficient interference management (as the 2nd priority)*

Study and identify L1/L2 signaling to carry the side control information [RAN1]

Study the following aspects of smart repeater management

- *Identification and authorization of smart repeaters [RAN2, RAN3]*

6 References

[1] RP-212703 New SI: Study on NR Smart Repeaters

[2] RP-212663 Moderator's summary for discussion on [RAN94e-R18Prep-03] Additional topological improvements - smart repeater, RAN1 Chair (Samsung)

[3] RP-213044 Discussion on smart repeater CMCC

[4] RP-213045 Views on upper layer aspects of smart repeater Qualcomm

[5] RP-213071 On the structure of smart repeater Fujitsu

[6] RP-213165 Comments on Rel-18 smart repeater draft SID, Huawei, HiSilicon

[7] RP-213326 Views on smart repeater NEC

[8] RP-213393 Discussion on Smart Repeater in Rel-18 ZTE, Sanechips

[9] RP-213422 On repeaters in Rel-18 Nokia, Nokia Shanghai Bell

[10] RP-213469 RAN R18 package summary

[11] http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_94e/Inbox/Drafts/[94e-10-R18-SmartRepeater]/RP-21xxxx_Draft_SID_on_SmartRepeater_v0.doc

[12] http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_94e/Inbox/Drafts/[94e-10-R18-SmartRepeater]/RP-21xxxx_Draft_SID_on_SmartRepeater_v1.doc

[13] http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_94e/Inbox/Drafts/[94e-10-R18-SmartRepeater]/RP-21xxxx_Draft_SID_on_SmartRepeater_v2.doc

[14] http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_94e/Inbox/Drafts/[94e-10-R18-SmartRepeater]/RP-21xxxx_Draft_SID_on_SmartRepeater_v4.doc