

RAN-R18-WS-eMBB-KDDI - Version 0.0.4

RAN

3GPP TSG RAN Rel-18 workshop RWS-210529

Electronic Meeting, June 28 - July 2, 2021

Title: Email discussion summary for [RAN-R18-WS-eMBB-KDDI]

Agenda item: 4.1 eMBB-driven Functional Evolution

Source: Moderator (KDDI)

Document for: Discussion

1 Input documents covered in this email discussion

- RWS-210137, Conditional Handover enhancement, KDDI Corporation
- RWS-210286, Considerations on flexible duplex, KDDI Corporation
- RWS-210300, NR repeaters and Reconfigurable Intelligent Surface, KDDI Corporation

2 Round 1 Questions/Comments

Feedback Form 1: Company general comments

1 – KDDI Corporation

Please provide your comments and questions

2 – Intel Corporation (UK) Ltd

Thank you for the contributions. Please see our questions below:

[Flexible Duplex]

1. Given that basic feasibility of FD @ gNB needs to be determined by RAN4 as a first step, what is your view on managing the studies across RAN1 and RAN4? Specifically, under what assumptions should RAN1 proceed with for their study w/o information on isolation and self-, adjacent channel interference effects, etc. that would need RAN4 expertise?

2. Do you consider that use case is limited to TDD bands only?

3. What levels of isolation/cancelation, guard bands, etc. have been assumed for the results indicating 50% latency reduction in slide #3?

[Reconfigurable intelligent surface]

4. What are benefits of using RIS connected to gNB using BH link comparing to RRH connected to gNB? Would it be easier/more efficient to just deploy RRH?

5. Is there any impact of RIS on other operator deployment?

[Smart repeaters]

6. Smart repeater may require support of selected L1/L2 functionality. Given this is it expected that they will provide more cost-efficient solution than IAB nodes?

7. Is it expected that Rel-17 FR2 RF repeaters performance will be insufficient to ensure good performance in FR2 deployments?

3 – Huawei Tech.(UK) Co.. Ltd

Thank you for the contribution. Is flexible duplex CA-based or single carrier based?

4 – Lenovo (Beijing) Ltd

Thanks for the contribution.

In RWS-210137, for the proposal that support the UE maintains CHO configurations after handover, is there any key issue? For example, after the UE handovers to the target cell, if the target cell has a new NCC, is key information included in the previous CHO configuration still available?

Feedback Form 2: Company comments/questions on RWS-210137 Conditional Handover enhancement

1 – KDDI Corporation

Please provide your comments and questions

2 – MediaTek Inc.

Q1. Stored CHO configurations: Are there any assumptions to allow this, e.g. inter-CU?

Q2. Admission control: Agree that there may be such problems. But can't this be resolved by network implementation?

3 – Sony Europe B.V.

We support storing CHO configuration and think probably problem of resource reservation could be left to implementation. Do you think that the objectives can be extended to NTN where we think the stored CHO configuration can save signaling to provide CHO configuration every few seconds.

4 – Nokia Corporation

Overall we think this could be considered in scope of mobility enhancements for Rel-18.

Q1: What is assumed of the stored CHO configurations? E.g. does UE decode them when receiving them?

Q2: Are there any restrictions to this operation, e.g. only intra-DU cases?

Q3: Is this intended to cover both FR1 and FR2?

5 – Spreadtrum Communications

Thanks for this nice contribution on mobility.

It is a very big challenge to ensure that the CHO related configuration is valid after the UE moving to other cell. How to ensure its validity?

6 – Samsung Electronics Co.

We are so interested in the intention of the suggested enhancement.

We have identified a large amount of Uu signaling due to HO command, especially in any specific scenario, e.g. subway, train etc. Thus, we have assumed that the enhancement could provide a significant gain in such scenario. Please see our question below:

Q: We have a question on spec impact and additional complexity to achieve it. For instance, probably, we may need further Xn signaling.

7 – Apple Benelux B.V.

It seems likely that with such a functionality the number of CHO preparations would increase, which can potentially require more resources both on the UE and the network sides. On the other hand, it is likely that after UE mobility to a new cell, some of the previously CHO-prepared configurations will no longer be relevant. In summary, the proposed functionality has the potential to decrease signaling, but there is a cost to that. Is there an analysis showing when such tradeoff is beneficial?

Feedback Form 3: Company comments/questions on RWS-210286 Considerations on flexible duplex

1 – KDDI Corporation

Please provide your comments and questions

2 – China Telecommunications

Thank you for the proposal. Regarding the flexible duplex enhancement for TDD spectrum, we have the following questions for clarification:

- 1) Does the scope also include simultaneous UL and DL in a carrier at the UE side?
- 2) NR already supports UE specific UL DL TDD configuration and flexible symbols in which the transmission direction can be determined by dynamic scheduling. If the scope only include flexible duplex at gNB side, can it be implemented by different UL DL TDD configurations for different UEs and gNB scheduling for different UEs simultaneous non-overlapping UL DL in a carrier? What is the specification impact from the UL DL configuration perspective?
- 3) Does it require some guard PRBs between simultaneous UL and DL in a carrier?

In our material, we think flexible duplex is also necessary for FDD spectrum to adapt the traffic with asymmetric DL UL, how do you think about FDD spectrum?

3 – Rakuten Mobile

Thanks for contribution KDDI.

We too support sub band full duplex for better utilization of resources.

4 – LG Electronics Inc.

Thanks for the contribution. For proposed evaluation scenarios, it seems that performance evaluation is operated in the scenarios (i.e., TDD spectrum at least on FR1, Urban Micro/Macro).

We think evaluation assumption for co-existence evaluation for CLI handling in Rel-16 (TR38.828) and for evaluation for flexible duplex in Rel-14 (TR38.802) can be a starting point of performance evaluation for flexible duplex / full duplex. In the evaluation assumption, two frequency ranges (i.e., FR1 and FR2)

and three deployment scenarios (i.e., Urban macro, Indoor, Dense Urban). Do you think these scenarios are acceptable for performance evaluation for flexible duplex / full duplex?

5 – Intel Corporation (UK) Ltd

Thank you for the contributions. Please see our questions below:

[Flexible Duplex]

1. Given that basic feasibility of FD @ gNB needs to be determined by RAN4 as a first step, what is your view on managing the studies across RAN1 and RAN4? Specifically, under what assumptions should RAN1 proceed with their study w/o information on isolation and self-, adjacent channel interference effects, etc. that would need RAN4 expertise?

2. Do you consider that use case is limited to TDD bands only?

3. What levels of isolation/cancelation, guard bands, etc. have been assumed for the results indicating 50% latency reduction in slide #3?

PS: apologize for posting questions in two tabs since we missed additional forms originally

6 – Futurewei Technologies

current TDD band situation, UL capacity is not sufficient due to DL domination TDD configuration, and UL latency is also not sufficient due to the dominant factor of the time spent waiting for UL slot. The duplex mode that gNB applies flexible duplex and UE uses TDD operation is in line with our thinking;

It is suggested that, for the performance metric part, MIL and area traffic capacity be also added for study;

For the comparison of UL packet delay in the air interface, it is suggested an analysis be added to explain the expected delay gain;

We are supportive of first to study only flexible duplex at gNB side. Please take a look at our contribution RWS-210036 (https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_AHs/2021_06_RAN_Rel18_WS/Docs/RWS-210036.zip) and feel free to comment at: <https://nwm-trial.etsi.org/#/documents/4580>

7 – Samsung Electronics Co.

Thanks for your view on duplex enhancement in TDD. We are quite aligned view about this. BTW, what is KDDI's view on enhancing duplex for FR2 and also using inter-carrier operation? Also can you share you view expectation for schedule? (SI or SI and WI in Rel18?)

8 – Ericsson LM

For the proposed objectives for solutions for intra-operator inter-gNB and inter-UE CLI, some solutions were discussed and specified in the RIM_CLI item. Could you clarify if there are particular additional enhancements that you have in mind?

Feedback Form 4: Company comments/questions on RWS-210300 NR repeaters and Reconfigurable Intelligent Surface

1 – KDDI Corporation

Please provide your comments and questions

2 – ZTE Corporation

Thanks for your proposal. We also have strong interests on the RIS part as proposed in our contribu-

tion (RWS-210465 in AI 4.1). In our tdoc, the introduction of this technique can be justified by the gains observed from both simulation and field measurement. From our side, there are clear benefits on system performance by deploying additional simple and energy-efficient nodes in NR networks. With consideration on the current development of this RIS solution and potential commercial deployment, we share the views that it's the right time to initialize the corresponding study on this technique.

For example, we can start with channel model discussion along with scenario identification. Meanwhile, potential enhancement on some aspects (e.g., adaptive control of beamforming mentioned in both contributions) can also be considered for evaluation. We appreciate if you can also share your view on the study scope on RIS.

3 – China Telecommunications

We also think RIS is a promising technique. Based on your contribution, we have some questions as follows:

- 1) What is the difference between smart repeater and RIS?
- 2) What is the component of RIS, does it have digital processor?
- 3) IS RIS capable of demodulating some reference signals transmitted by gNB?
- 4) It is mentioned in your contribution that “RIS is designed to be accessible” by Rel-15/Rel-16 UE, is RIS transparent to these UEs or not? What is “accessible” hear means?

4 – Rakuten Mobile

Thanks for contribution.

We too support smart repeater & RIS for work item in rel 18.

5 – Sony Corporation

Thank you for your contribution. We share your interest in RIS, see our contribution RWS-210306. Here are a few questions from us:

1. Regarding the identification of “features that smart repeaters and RIS should have,” could you please elaborate on which, in your opinion, are the key features of smart repeaters and RIS, respectively.
2. Although it is still early, in your opinion, do you foresee a Rel-18 item (i.e., SI or WI) joint for smart repeaters and RIS, or do you advance some critical differences between the two technologies that would rather motivate separate Rel-18 items?

6 – Intel Corporation (UK) Ltd

Thank you for the contribution. Please see our questions below:

[Reconfigurable intelligent surface]

1. What are benefits of using RIS connected to gNB using BH link comparing to RRH connected to gNB? Would it be easier/more efficient to just deploy RRH?
2. Is there any impact of RIS on other operator deployment?

[Smart repeaters]

3. Smart repeater may require support of selected L1/L2 functionality. Given this is it expected that they will provide more cost-efficient solution than IAB nodes?
4. Is it expected that Rel-17 FR2 RF repeaters performance will be insufficient to ensure good performance in FR2 deployments?

7 – DOCOMO Communications Lab.

Thank you for contribution. We are also interested in Smart Repeater/RIS. Let me ask a couple of questions.

-

Do you have views on what is the different between smart repeater and RIS? They are transparent from UE, then main difference is RAN4 aspect? or some capability of signaling from/to gNB is also different?

-

Which aspect is motivation that you assume? e.g. coverage enh., reliability enh., data rate improvement, etc. Only coverage enhancement? or also others?

8 – Fraunhofer HHI

Thank you very much for the contribution on Smart Repeaters and RIS. On slide 2 you are explicitly stating the scenarios in FR2. Are you excluding FR1 from such study?

3 Round 1 Answers/Responses

Thank you very much for the questions/comments/supports. For our responses to the questions posted on Company general comments, please refer to each separated topic section below.

Responses on RWS-210137 Conditional Handover enhancement

4 Lenovo (Beijing) Ltd

<Q>

In RWS-210137, for the proposal that support the UE maintains CHO configurations after handover, is there any key issue? For example, after the UE handovers to the target cell, if the target cell has a new NCC, is key information included in the previous CHO configuration still available?

<A>

That is the issue to be addressed in the work. For inter CU handover case, the old key information is not valid any more as you mention, so one possible solution may be updating the key information.

2 MediaTek Inc.

<Q1>

We assume to work on both intra-CU and inter-CU. For inter-CU, we also discuss how to address the key information issue.

<A1>

We assume to work on both intra-CU and inter-CU. For inter-CU, we also discuss how to address the key information issue.

<Q2>

Admission control: Agree that there may be such problems. But can't this be resolved by network implementation?

<A2>

We think that the interface among multiple gNBs should be specified in RAN3 to manage admission control over multiple gNBs. In other words, interface enhancement is needed to inform other gNBs of whether the gNB can accommodate the connection or not.

3 Sony Europe B.V.

<Q>

We support storing CHO configuration and think probably problem of resource reservation could be left to implementation. Do you think that the objectives can be extended to NTN where we think the stored CHO configuration can save signaling to provide CHO configuration every few seconds.

<A>

Technically we think it can be extended to NTN. But usually NTN objectives and non-NTN objectives are not placed in the same work item/study item. So, it's better to add the similar objectives to Rel-18 NTN WI.

4 Nokia Corporation

<Q1>

What is assumed of the stored CHO configurations? E.g. does UE decode them when receiving them?

<A1>

Yes. We assume UE decodes CHO configurations when receiving, same as the current CHO.

<Q2>

Are there any restrictions to this operation, e.g. only intra-DU cases?

<A2>

At this moment, we don't assume any restrictions.

<Q3>

Is this intended to cover both FR1 and FR2?

<A3>

Yes. Our motivation is to develop a solution works for FR2. But in RAN2/3 perspective, the solution can cover both FR1 and FR2, frequency agnostic.

5 Spreadtrum Communications

<Q>

It is a very big challenge to ensure that the CHO related configuration is valid after the UE moving to other cell. How to ensure its validity?

<A>

The question is little bit unclear, could you elaborate more? Are you talking about the key information issue?

6 Samsung Electronics Co.

<Q>

We have a question on spec impact and additional complexity to achieve it. For instance, probably, we may need further Xn signaling.

<A>

Yes. We have the same understanding. Multiple gNB-CUs/gNB-DUs should coordinate together, so further Xn signaling enhancement is needed.

Responses on RWS-210286 Considerations on flexible duplex

Huawei

<Q1>

Is flexible duplex CA-based or single carrier based?

<A1>

Considering the difficulty of operation, we assume single carrier based flexible duplex operation at this time. But we are open to discuss this.

China Telecommunications

<Q2>

Does the scope also include simultaneous UL and DL in a carrier at the UE side?

<A2>

We do not consider any full duplex operation at the UE side. For duplex operation at the UE side in Rel-18, we prefer to focus on half duplex operation only.

<Q3>

NR already supports UE specific UL DL TDD configuration and flexible symbols in which the transmission direction can be determined by dynamic scheduling. If the scope only include flexible duplex at gNB side, can it be implemented by different UL DL TDD configurations for different UEs and gNB scheduling for different UEs simultaneous non-overlapping UL DL in a carrier? What is the specification impact from the UL DL configuration perspective?

<A3>

We propose not flexible symbol based dynamic TDD configuration, but subband wise full duplex operation at gNB side in our contribution. (Sorry for the confusion) To enable this operation, for example, configuring multiple TDD configurations for UE and mechanism to switch these configurations may be needed to specify.

<Q4>

Does it require some guard PRBs between simultaneous UL and DL in a carrier?

<A4>

It depends on RAN4 study for accurate analysis. For UE to UE CLI perspective, interference effect can be avoided by scheduling operation using Rel-16 CLI/SRS measurement and some additional solutions in Rel-18, if any. For gNB self-interference perspective, if the orthogonality between UL carrier and DL carrier can be maintained, we think that many guard band PRBs are not necessary.

<Q5>

In our material, we think flexible duplex is also necessary for FDD spectrum to adapt the traffic with asymmetric DL UL, how do you think about FDD spectrum?

<A5>

Our motivation for flexible duplex is to enhance UL performance on many aspects, i.e., latency reduction, capacity and coverage enhancement, and we expect to see significant performance gains. Considering the size of system bandwidth, SCS and interference impacts to adjacent carriers, we would like to consider TDD spectrum as a priority over FDD spectrum.

Rakuten Mobile

<Q6>

We too support sub band full duplex for better utilization of resources.

<A6>

Thank you for the comment. We are the same thinking that sub band full duplex can bring a lot of gain in many aspects.

LG Electronics

<Q7>

Do you think these scenarios are acceptable for performance evaluation for flexible duplex / full duplex?

<A7>

We are fine to align three deployment scenarios in study first. In the study, we need to consider interference handling scheme so that much interference scenarios such as dense urban is fine. Also, since the relation between UL Tx power and DL reception power is key parameter to consider interference handling, we believe that various ISD scenarios should be considered.

Intel

<Q8>

Given that basic feasibility of FD @ gNB needs to be determined by RAN4 as a first step, what is your view on managing the studies across RAN1 and RAN4? Specifically, under what assumptions should RAN1 proceed with for their study w/o information on isolation and self-, adjacent channel interference effects, etc. that would need RAN4 expertise?

<A8>

We understand your proposal that RAN4 study should be first ahead of RAN1 work due to RAN4 workload. But, depending on the progress of Rel-18 workshop, we are open to discuss whether RAN4 should study first ahead of RAN1 or RAN1 and RAN4 in parallel.

<Q9>

Do you consider that use case is limited to TDD bands only?

<A9>

Our motivation for flexible duplex is to enhance UL performance on many aspects, and we expect to see significant performance gain. Considering system bandwidth size, SCS and interference impact to adjacent carrier, we would like to consider TDD spectrum as a priority over FDD spectrum.

<Q10>

What levels of isolation/cancelation, guard bands, etc. have been assumed for the results indicating 50% latency reduction in slide #3?

<A10>

At this stage, we performed a simple simulation to compare the time from UL data arrival to actual UL data transmission. The gain of UL latency reduction can be observed due to the reduction of the time spent waiting for UL slot to transmit data.

Futurewei

<Q11>

It is suggested that, for the performance metric part, MIL and area traffic capacity be also added for study;

<A11>

We are fine to add MIL and traffic capacity to the performance metric in the study.

<Q12>

For the comparison of UL packet delay in the air interface, it is suggested an analysis be added to explain the expected delay gain;

<A12>

Thank you for pointing out. We think that the performance gain depends on UL and DL traffic model, interference scenario such as UL Tx power, DL reception power, etc., and isolation technologies.

Samsung

<Q13>

BTW, what is KDDI's view on enhancing duplex for FR2 and also using inter-carrier operation?

<A13>

We are open to discuss a duplex operation for FR2. If interference to adjacent carrier can be avoided/mitigated, we believe that operation should be as simple as possible such as inter-carrier operation.

<Q14>

Also can you share your view expectation for schedule? (SI or SI and WI in Rel18?)

<A14>

We believe that SI and WI should be done in Rel-18. Several duplex combinations are open on gNB and/or UE side, but considering the aspect of interference handling difficulty, we believe that Rel-18 SI and WI should focus on flexible duplex operation at gNB side and do not consider any full duplex scheme at UE side.

Ericsson

<Q15>

For the proposed objectives for solutions for intra-operator inter-gNB and inter-UE CLI, some solutions were discussed and specified in the RIM_CLI item. Could you clarify if there are particular additional enhancements that you have in mind?

<A15>

For intra-operator inter-UE CLI, in our understanding, Rel-16 RIM_CLI does not specify exchange of SRS-RSRP measurement resources between nodes due to signaling overhead perspective. To enable more flexible scheduling between nodes, at least such information should be specified in Rel-18 RAN3 work. For inter-gNB CLI, we are open to discuss the solution, but some solutions such as inter-gNB channel estimation should be considered for the scenario when transmission and reception between nodes occur simultaneously.

Responses on RWS-210300 NR repeaters and Reconfigurable Intelligent Surface

1 ZTE Corporation

<Q1>

Thanks for your proposal. We also have strong interests on the RIS part as proposed in our contribution (RWS-210465 in AI 4.1). In our tdoc, the introduction of this technique can be justified by the gains observed from both simulation and field measurement. From our side, there are clear benefits on system performance by deploying additional simple and energy-efficient nodes in NR networks. With consideration on the current development of this RIS solution and potential commercial deployment, we share the views that it's the right time to initialize the corresponding study on this technique.

For example, we can start with channel model discussion along with scenario identification. Meanwhile, potential enhancement on some aspects (e.g., adaptive control of beamforming mentioned in both contributions) can also be considered for evaluation. We appreciate if you can also share your view on the study scope on RIS.

<A1>

Thank you very much for your comment. We also see the RIS as a simple and low-cost way to address the problem of area coverage such as dead spot. We also understand that the simulation and field measurement result you have presented in your contribution are very beneficial in facilitating discussion. Let us continue to discuss RIS so that many companies will have a better understanding of its effectiveness and specification will be promoted.

2 China Telecommunications

<Q1>

We also think RIS is a promising technique. Based on your contribution, we have some questions as follows:

1) What is the difference between smart repeater and RIS?

<A1>

Thank you very much for your question. RIS is a device that only reflects radio waves, it does not amplify them. The smart repeater, on the other hand, has the ability to amplify and re-radiate radio waves. We understand that this is a major difference between smart repeater and RIS.

<Q2>

2) What is the component of RIS, does it have digital processor?

<A2>

The RIS itself does not demodulate the received signal and only reflects the radio wave, so it does not have a digital processor. The main component is a phase shifter that controls the reflection characteristics (reflection phase) of each element in order to determine the direction of radio wave reflection. This time, however, we would like to consider controlling its reflection characteristics from the gNB, and we would like the RIS to have the function to receive the control information.

<Q3>

3) Is RIS capable of demodulating some reference signals transmitted by gNB?

<A3>

We think that it is desirable for gNB to be able to control the reflection direction of the RIS. We also think that it would be better if the information for the control can be notified from the gNB to the RIS in the NR system. In order for RIS to demodulate this information, it is necessary to perform channel estimation using DM-RS, so in that sense it is necessary to be able to demodulate the reference signal.

<Q4>

It is mentioned in your contribution that “RIS is designed to be accessible” by Rel-15/Rel-16 UE, is RIS transparent to these UEs or not? What is “accessible” hear means?

<A4>

We believe that RIS should be transparent to legacy UEs. In other words, these UEs should be able to

communicate with the gNB without being aware of the RIS, if it exists. We would like to continue to discuss whether this is possible.

3 Rakuten Mobile, Inc

<Q1>

Thanks for contribution. We too support smart repeater & RIS for work item in rel 18.

<A1>

Thank you very much for your comment. Let us continue to discuss smart repeater and RIS so that many companies will have a better understanding of their effectiveness and specification will be promoted.

4 Sony Corporation

<Q1>

Thank you for your contribution. We share your interest in RIS, see our contribution RWS-210306. Here are a few questions from us:

1. Regarding the identification of “features that smart repeaters and RIS should have,” could you please elaborate on which, in your opinion, are the key features of smart repeaters and RIS, respectively.

<A1>

Thank you very much for your question. For smart repeater, we believe that the adaptive beam control of smart repeater toward UE is at least a necessary feature. On the other hand, for RIS, we believe that the adaptive control the reflection direction of each downlink and uplink is at least a necessary feature. In order to realize those controls, an interface between the gNB and the smart repeater/RIS is required, and it is desirable to unify the interface between the smart repeater case and the RIS case as much as possible.

<Q2>

2. Although it is still early, in your opinion, do you foresee a Rel-18 item (i.e., SI or WI) joint for smart repeaters and RIS, or do you advance some critical differences between the two technologies that would rather motivate separate Rel-18 items?

<A2>

At this point, we do not have a strong view on whether smart repeater and RIS should be treated in the same SI/WI. However, no matter what framework we discuss, as we mentioned in our answer to your previous question, it is desirable to unify the interface for control from gNB between smart repeater case and RIS case as much as possible.

5 Intel Corporation (UK) Ltd

<Q1>

Thank you for the contribution. Please see our questions below:

[Reconfigurable intelligent surface]

1. What are benefits of using RIS connected to gNB using BH link comparing to RRH connected to gNB? Would it be easier/more efficient to just deploy RRH?

<A1>

Thank you very much for your question. We think that RIS can address the coverage issue more easily and at a lower cost than RRH. Specifically, we think that RIS (or smart repeater) can reduce the cost of laying cables, while RRH requires it.

<Q2>

[Reconfigurable intelligent surface]

2. Is there any impact of RIS on other operator deployment?

<A2>

RIS may also reflect signals from other operators' bands, and we recognize that this inter-operator problem is one of the open issues. We will continue to discuss how to recognize and deal with this issue in our future study or work in 3GPP.

<Q3>

[Smart repeaters]

3. Smart repeater may require support of selected L1/L2 functionality. Given this is it expected that they will

provide more cost-efficient solution than IAB nodes?

<A3>

If the smart repeater is to receive control information from the gNB, then we think it needs to support some of the L1/L2 functions as you mentioned. On the other hand, it is not necessary for the smart repeater to have the DU function of the IAB-node, so we guess that it can be realized at a lower cost compared to the IAB. However, we would like to hear the opinions of vendors on this point.

<Q4>

[Smart repeaters]

4. Is it expected that Rel-17 FR2 RF repeaters performance will be insufficient to ensure good performance in FR2 deployments?

<A4>

Yes, the Rel-17 FR2 RF repeaters do not have adaptive beamforming capability, so the gain in coverage extension is not significant, and the effect of installing them is expected to be small.

6 DOCOMO Communications Lab.

<Q1>

Thank you for contribution. We are also interested in Smart Repeater/RIS. Let me ask a couple of questions.

Do you have views on what is the different between smart repeater and RIS? They are transparent from UE, then main difference is RAN4 aspect? or some capability of signaling from/to gNB is also different?

<A1>

Thank you very much for your question. As you pointed out, there is a major difference between smart repeater and RIS from RAN4 point of view, and we guess we need to discuss them separately.

On the other hand, as for signaling from/to gNB, the required signaling may differ depending on the level of functionality to be provided to both smart repeater and RIS. In our opinion, at least dynamic controls of beam for smart repeater and reflection direction for RIS are necessary, and it would be desirable to unify signaling for those purpose as much as possible. We do not have a strong view on further functions (e.g., transmit power

control and interference control for smart repeaters, etc.) at this moment, but we think that signaling may differ depending on the differences in those functions.

<Q2>

Which aspect is motivation that you assume? e.g. coverage enh., reliability enh., data rate improvement, etc. Only coverage enhancement? or also others?

<A2>

Our motivation is to address the coverage issues. Strictly speaking, however, we believe that smart repeater and RIS target different issues. The smart repeater is capable of power amplification, so we believe that coverage expansion can be realized by the smart repeater. The RIS is not capable of power amplification, so it should not be able to realize coverage expansion, but should be able to address dead spots in the coverage and also improve the MIMO effect by intentionally creating a multipath environment.

7 Fraunhofer HHI

<Q1>

Thank you very much for the contribution on Smart Repeaters and RIS. On slide 2 you are explicitly stating the scenarios in FR2. Are you excluding FR1 from such study?

<A1>

Thank you very much for your question. We are basically focusing on FR2, but we are not trying to exclude FR1, and FR1 can be a subject of discussion.

4 Round 2 Questions/Comments

Feedback Form 5: Company general comments

1 – HuaWei Technologies Co.

Regarding RWS-210137 of keeping the configuration for conditional HO, we think whether to release or keep the previous configuration was also discussed for L1/L2 mobility in RAN2. We actually think to have multiple configuration of cells (like CHO configuration) with L1/L2 signaling to switch the cell could get better performance and apply to wider scenarios, do you agree?

2 – China Unicom

Thank you for your contribution. Do you foresee L2 are necessary functions of RIS or smart repeater for

beam management?

Feedback Form 6: Company comments/questions on RWS-210137 Conditional Handover enhancement

1 – Spreadtrum Communications

Thanks for your detailed response.

Yes, we have concerns on the key information issue.

Feedback Form 7: Company comments/questions on RWS-210286 Considerations on flexible duplex

1 – Samsung Electronics Co.

Thanks for your clarification, we are quite aligned with direction for XDD in Rel-18.

2 – LG Electronics Inc.

Thanks for your kind answer.

We think that it is important to support legacy UE even if gNB FD & UE HD is assumed. If you have in mind this, please share your idea how to support legacy UE?

Feedback Form 8: Company comments/questions on RWS-210300 NR repeaters and Reconfigurable Intelligent Surface

1 – ZTE Corporation

Thanks for your replies.

For the RIS study, as shown in the 1st round, at least we need to start with the channel model and other enhancement, e.g., beam management related issue. It seems that the latter part may be overlapped with the discussion on smart repeater, which is also interested from your side. So, I just wonder from your perspective, any views on how to organize the corresponding study for these two topics? Is it possible to start with the SI phase first to identify the issue and specify the necessary aspect later in one item?

2 – Sony Corporation

Thank you very much for your replies to the first Q&A round. We have a further question. Do you see RIS and/or smart repeaters as being transparent to the UEs, or do you think there might be advantages of UEs knowing about RIS and/or smart repeaters?

3 – Huawei Technologies France

Thanks for the contribution. Do you think smart repeater&IRS is only beneficial for FR2? Is that necessary to discuss the related topic for FR1?

4 – China Unicom

Thank you for your contribution and reply in round 1. And we also want you to clarify:
Is RIS/smart repeater a L1 or L2 device?

5 Round 2 Answers/Responses

Thank you very much for the further questions/comments. Please find our responses below.

Responses on RWS-210137 Conditional Handover enhancement

1 Huawei Technologies Co.

<Q>

Regarding RWS-210137 of keeping the configuration for conditional HO, we think whether to release or keep the previous configuration was also discussed for L1/L2 mobility in RAN2. We actually think to have multiple configuration of cells (like CHO configuration) with L1/L2 signaling to switch the cell could get better performance and apply to wider scenarios, do you agree?

<A>

If we can get the same benefit from the mechanism, we are fine.

1 Spreadtrum Communications

<Q>

Thanks for your detailed response. Yes, we have concerns on the key information issue

<A>

Thanks for the comment. How to address the concern, we can discuss it under the Rel-18 WI.

Responses on RWS-210286 Considerations on flexible duplex

Samsung

<Q>Thanks for your clarification, we are quite aligned with direction for XDD in Rel-18.

<A>Thank Samsung for the reply.

LG Electronics

<Q1>

We think that it is important to support legacy UE even if gNB FD & UE HD is assumed. If you have in mind this, please share your idea how to support legacy UE?

<A1>

Thank LGE for the nice question. We believe that, by appropriate scheduling, gNB could accommodate legacy UE, and legacy UE could avoid interference by UE grouping based on UE reports on gNB side.

Responses on RWS-210300 NR repeaters and Reconfigurable Intelligent Surface

1 ZTE Corporation

<Q>

Thanks for your replies.

For the RIS study, as shown in the 1st round, at least we need to start with the channel model and other enhancement, e.g., beam management related issue. It seems that the latter part may be overlapped with the discussion on smart repeater, which is also interested from your side. So, I just wonder from your perspective, any views on how to organize the corresponding study for these two topics? Is it possible to start with the SI phase first to identify the issue and specify the necessary aspect later in one item?

<A>

Thank you very much for your additional question. We think this is a very good discussion point.

At this point, we do not have a strong view on whether smart repeater and RIS should be treated within one SI and followed by WI. We think that whether or not RIS and smart repeater can be treated as a single item depends on whether smart repeater needs a study item phase or the discussion for smart repeater can start

directly from the work item. For smart repeater, if it is necessary to identify through some evaluations in advance in the study item phase which features are to be specified, then the study item phase is necessary for smart repeater as well. In that case, we think that RIS and smart repeater can be studied in the same item. However, we would like to hear other companies' opinions on this point.

2 Sony Corporation

<Q>

Thank you very much for your replies to the first Q&A round. We have a further question. Do you see RIS and/or smart repeaters as being transparent to the UEs, or do you think there might be advantages of UEs knowing about RIS and/or smart repeaters?

<A>

Thank you very much for your additional question.

In our opinion, at least legacy UEs should also be able to benefit from RIS and smart repeaters, and therefore RIS and smart repeaters should be transparent for these UEs. On the other hand, we think the baseline for Rel.18 and later UEs is to be transparent as well, but if there is a benefit by knowing that they exist, then such an extension could be discussed.

3 - Huawei Technologies France

<Q>

Thanks for the contribution. Do you think smart repeater & IRS is only beneficial for FR2? Is that necessary to discuss the related topic for FR1?

<A>

Thank you very much for your question. We are basically focusing on FR2, but we are not trying to exclude FR1, and FR1 can be a subject of discussion.

4 - China Unicom

<Q>

Thank you for your contribution. Do you foresee L2 are necessary functions of RIS or smart repeater for beam management?

<A>

Thank you very much for your question.

We assume that physical channels/signals to/from the UE will be relayed on L1. Therefore, we think L2 is not necessary from that point of view. On the other hand, for beam-related control of the RIS/smart repeater by the gNB, the RIS and smart repeater need to receive information from the gNB. Therefore, from this point of view, we think that L2 is necessary between gNB and RIS/smart repeater.

<Q>

Thank you for your contribution and reply in round 1. And we also want you to clarify:

Is RIS/smart repeater a L1 or L2 device?

<A>

We think the purpose of this question is the same as the previous one. Please refer to the answer to the previous question.

6 Moderators' summary for RWS-210137 Conditional Handover enhancement

6 companies provided the feedback. The important takeaways from the discussion are summarized as below.

1. Key information

The key information issue for inter-CU should be addressed in the work, should be included in the WI objectives. If we limit the work to intra-CU, we don't have to care the issue.

2. RAN3 impacts

Xn signaling enhancement is needed to the coordination among multiple gNB-CUs/gNB-DUs. The purposes are admission control (inform other gNBs of whether the gNB can accommodate the connection or not) and sharing the UE configurations

3. Alternative solution

Huawei pointed out that L1/L2 signaling to switch the active cells can be an alternative solution.

4. NTN

The possibility to adopt the solution to NTN use cases can be discussed with NTN experts within the NTN relevant email discussion.

7 Moderators' summary for RWS-210286 Considerations on flexible duplex

8 companies participated in the two rounds of discussion on flexible duplex enhancements for Rel-18 in total. Based on the discussions, moderator propose that at least following items/aspects be further discussed in the next quarter's continued discussions.

- For UE and gNB side, considering isolation, cancellation, guard band, etc., which types of duplex enhancements to at least study and/or specify in Rel-18.
- How to proceed the study with tight coordination between RAN1 and RAN4 in Rel-18.
- For paired and unpaired spectrum, whether one or both spectrums should be prioritized.

- A mechanism to accommodate legacy UEs in enhanced duplex scheme should be studied and specified.

8 Moderators' summary for RWS-210300 NR repeaters and Reconfigurable intelligent surface

9 companies provided feedbacks and questions. Based on the discussion we recognize that the following aspects should be clarified to develop Rel-18 SI description for NR smart repeater and Reconfigurable intelligent surface (RIS).

1 Smart repeaters

1.1 Motivation and justification in terms of cost and performance. (Intel)

1.2 Usage scenarios. (NTT docomo, Fraunhofer, Huawei)

1.3 High level architecture assumptions or features that smart repeater should have, to identify possible enhancements for smart repeater (i.e., whether smart repeater should have L2 functions, etc.). (Sony, NTT Docomo, China Unicom)

1.4 Whether smart repeater is transparent to UEs or not. (Sony)

2 RIS

2.1 Motivation and justification including advantage and disadvantage of RIS. (Intel)

2.2 Usage scenarios. (NTT docomo, Fraunhofer, Huawei)

2.3 Discussion topics in the study item including channel model discussion. (ZTE)

2.4 High level architecture assumptions or features that RIS should have, to identify possible enhancements for RIS (i.e., whether RIS needs to receive and demodulate channels and/or signals, whether RIS should have L2 functions, etc.). (China Telecommunications, Sony, intel, NTT Docomo, China Unicom)

2.5 Whether RIS is transparent to UEs or not. (China Telecommunications, Sony)

3 Aspects common to smart repeater and RIS

3.1 How should we discuss smart repeater and RIS? For example, should these two topics be treated in one item or in different items?, etc. (ZTE, Sony)