RAN-R18-WS-eMBB-vivo - Version 0.0.3

RAN

3GPP TSG RAN Rel-18 workshop RWS-210546

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Agenda Item: 4.1

Source: vivo

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

1 Introduction

This NWM document is used to capture the Q&A about the following vivo contributions for Rel-18 eMBB enhancements.

Table 1:

RWS-210161	Mobility enhancements in Rel-18	vivo
RWS-210162	Further MIMO enhancements in Rel-18	vivo
RWS-210163	Enhanement on IRC receiver performance in Rel-18	vivo
RWS-210164	Enhanced support for XR services in Rel-18	vivo
RWS-210165	Further CA/DC enhancements in Rel-18	vivo
RWS-210166	Further enahncements to IAB in Rel-18	vivo

2 Questions and comments

2.1 General questions and comments

Feedback Form 1: 1st round of general questions and comments

Feedback Form 2: 2nd round of general questions and comments

2.2 Mobility enhancements (RWS-210161)

In this contribution, it is proposed to study the following aspects in Rel-18

1. IDLE/INACTIVE mode UE measurement and/or paging monitoring on the SFN-based DL signal from network, for the reduction of UE power consumption and paging miss rate.

2. UL signal-based mobility

1) In IDLE/INACTIVE mode to reduce the paging overhead and network energy

2) In CONNECTED mode to reduce the handover failure rate

2.2.1 1st Round-Questions

Feedback Form 3: 1st round of questions and comments to RWS-210161

1 – China Unicom

Thanks for this contibution.

We support the UL signal-based mobility enhancement.

For SFN-based DL signal, what is the potential impacts on RAN1 or other RAN work group?

2 – MediaTek Inc.

Regarding "UL-based mobility", we believe that this requires non-serving cell to receive some signals sent from UE. How corresponding physical resources should be allocated in non-serving cell?

3 – CATT

What is the main scenario for ul-signal based mobility?

4 – Sony Europe B.V.

We support UL signal based mobility and can be found in our paper RWS-210317. Do you have both RRM measurements and/or L1/L3 measurements based on UL signal in mind?

5 – ZTE Corporation

On P3, it is proposed that IDLE UE measures the SFN based signal for power saving. If the SSB for measurement in IDLE mode is transmitted in SFN manner, it means all the cells within the SFN area should have the same PCI. From the UE perspective, there is only one physical cell with multiple TRPs transmitting signals in SFN manner. So it seems to be an implementation issue. What is the spec impact?

On P8, it is proposed to study UL-based mobility for IDLE/INACTIVE and CONNECTED UE. This can save paging overhead and NW energy since the paging is sent only by the suitable cell who detects the UL

signal. For IDLE/INACTIVE state, what signals is used for UL-based mobility and how to configure the different UL-RS for different UEs?

If the UL-based mobility is introduced, is the traditional cell selection/reselection procedure based on DL signal for IDLE UE still needed? If it is not needed, i.e., cell selection/reselection only relies on UL-based mobility, how does the UE find the suitable cell to receive the paging. Some clarification are highly appreciated. Thanks.

6 – Intel Corporation (UK) Ltd

1. How often the UE should send the UL, and what UL should be based on which frequency? If network is power off how can the network receives the UL signal? And which frequency the network should switch on?

7 – Lenovo (Beijing) Ltd

Cells could be on-demand power on

=> If power off, the cell may miss the UL signal when the new UE enters the coverage. In addition, what is the 'on-demand'? UL signal detection?

Paging could be sent only on the cell where UL signal is detected

=> After the UE has already entered new tracking area, the previous cell belonging to the previous tracking area may also detect the UL signal. AMF may also trigger the paging on the previous cell.

8 – Apple Hungary Kft.

Thanks for the contribution. We are wondering on the spec impact from this as the NW actions based on the UE UL is upto the NW and RAN2 does not need to specify.

9 – Spreadtrum Communications

Thanks for this nice contribution on mobility.

What does the "SFN-based" mean exactly?

10 – Nokia Corporation

If in UL based mobility the handover is still triggered by network node, then we should have the same issues as baseline handover (instead of using DL measurement, now we will use UL measurements). How can we achieve better performance than CHO?

Further, for UL based mobility it is shown that handover failure rate is significantly reduced, also compared to CHO. Could you please share how it is achieved (e.g. the HO is triggered on-time and not too early/late?)?

11 – China Mobile Com. Corporation

Thanks for the contribution.

We also have the question that for IDLE/INACTIVE state, what signals is used for UL-based mobility?

2.2.2 1st Round-Answers

Table 2:

Respond to	Answers

China Unicom	Thanks for the question. in our understanding, SFN have the potential impacts on RAN1 and RAN2, e.g. Configuration of SFN, and impact on RS, SI, Paging, RACH, etc. But we are open to discuss whether to have SFN based SI/paging/RACH/etc.
MediaTek	Thanks for the question. That is true, this requires non-serving cell to receive signals from UE. We understand this issue needs to be resolved during study phase. But we believe non-serving cell receiving signals sent from UEs is feasible.
CATT	Thanks for the question. we think the main scenario for UL-signal based mobility is for ultra-dense network or the network with high speed UEs. In these scenarios, UEs perform frequent cell search / measurement for cell (re)-selection in idle mode and frequent measurement / report for handover in connected mode, which will introduce high power consumption for UE and degrade UE mobility performance, e.g., paging miss and handover failure.
Sony	Thanks for the question. In our understanding, RRM measurement based on DL signal (e.g. RS) is still needed for synchronization at UE side. While at network side, RRM measurement should be performed at network side based on UL signals. Regarding L1/L3 measurements based on UL signal, we assume it is gNB implementation issue and does not need to be specified.

ZTE	Thanks for the question. The approach you mentioned is one possibility, which is up to network implementation. I assume this is the deployment in current high speed train. Another mode for SFN is: individual cells in SFN area have different PCI, and a new SFN-SSB is introduced for all the cells. The cells in SFN will transmit this SFN-SSB. The cells could be identified by SFN_ID+PCI at UE side. Rel-18 UEs in SFN area will only need to monitor SFN-SSB, while legacy UEs still monitors the per cell SSB. In our understanding, reusing the existing signals (e.g. RACH, SRS) should be prioritized whenever possible, designing new UL signals might be considered if existing signal is not feasible. In connected mode, different SRS could be configured for different UEs. While in idle mode, we think this part needs further study, but one possible way is to differentiate UE groups. This is a very good question. In our understanding, UL signal based cell selection/reselection should rely on UL measurement at network side. Network needs to inform UEs for cell selection/reselection. If only UL signal based cell selection/reselection is adopted, there is overhead and additional power consumption for UEs. That is why we think it should be used together with SFN. In this way, it is not so frequent to inform UEs cell selection/reselection (e.g. only inform SFN change), but we could also have benefit for UL signal at network side, e.g. by on-demand gNB power on/off, and by saving some paging overhead.
Intel	Thanks for the question. We assume not very frequent UL signal should be sent at UE side. Otherwise, high power will be consumed at UE side. In the simulation, we assume the period of 1.28s for UL signal, which is the same as i-DRX cycle. And if the UL signal transmission occasion is closed to the DL reception activities for SSB or paging, the additional power consumption for UE is limited.

Lenovo	Thanks for the question. In our understanding, only the gNB Tx is“power off”, which is the main contribution of the NW power consumption, while gNB can still receive the UL signal from the UE. We assume UE is periodically sending UL signals, while network knows the location for the UE (e.g. in a range of cells). In the case that paging is sending in a cell cluster, this area (i.e. in cell cluster) of course should belong to one TA. In short, the cell cluster should be the subset of TA.
Apple	Thanks for the question. That is true, the measurement and handover decision are performed at network side, which will not be specified. The specification impact will be UL signaling transmission. Besides, the UL signaling could be received by multiple cells, and coordination between cells may need to be specified.
Spreadtrum	Thanks for the question. Very good question. We are also discussing what SFN-based means and what should be SFN-based. Our understanding is that it could be DL signal (e.g. SSB) transmitted in SFN-manner in a cell cluster.
Nokia	Thanks for the question. In the simulation, the mobility model in TR 36.839 is used. In CHO, TTT is also modelled, causing handover delay. But in UL based mobility, as the handover decision is made at network side. Handover could be triggered based on the instantaneous UL measurement without TTT. In this case, with UL based mobility could handover be done exactly on-time, while CHO may still suffer from handover delay. So mobility performance in high speed scenario (i.e. 120km/h) for UL-based mobility could be better than CHO.
China Mobile	Thanks for the question. In our mind, reusing the existing signals (e.g. RACH, SRS)should be prioritized whenever possible, designing new UL signals might be considered if existing signal is not feasible.

2.2.3 2nd Round-Questions

Feedback Form 4: 2nd round of questions and comments to RWS-210161

1 – HuaWei Technologies Co. Thanks for the paper. We are wondering if the UL-based mobility is something similar as what we have discussed in Rel-15? Given that it is not introduced in NR so far, do you see any particular gains to have so in Rel-18, compared with other mobility enhancement schemes?
2 – China Unicom Thanks for your contributions and clarification. What's the difference between the design of new SFN-SSB and current SSB? And does the newly designed SFN-SSB differ between FR1 and FR2?

2.2.4 2nd Round-Answers

Table 3:

Respond to	Answers
Huawei	Thanks for the question. That is true. There was some discussion on UL-based mobility in Rel-15, but finally, it was not introduced. We understand Rel-18 will be a new branch for NR. FR2 which could enable high data rate and large capacity with wider bandwidth, will be a key deployment scenario, especially for 5G advance. In this case, mobility enhancement for FR2 scenario should be considered. UL-based mobility would be a beneficial and simple approach. Meanwhile, with UL signaling, network energy (which is a critical issue for 5G deployment) and overhead for paging transmission could be also saved. Thus, we propose UL-based mobility in Rel-18.
China Unicom	Thanks for the question. I assume these issues are what we need to be discussed during study phase. In our mind, SFN-SSB could be either same or different from current SSB design. Regarding whether need difference between FR1 and FR2, more discussion in RAN1 is needed according to the detailed requirement for UL signal.

2.3 Further MIMO enhancements (RWS-210162)

In this contribution, it is proposed to work on the following enhancements in Rel-18 FeMIMO:

1. UL MIMO enhancements

2. Further enhancement on L1/L2-centric inter-cell operation

3. Further enhancement for high-speed scenario

4. Further enhancement on multi-beam operation

5. Distributed DL MIMO (coherent JT)

2.3.1 1st Round-Questions

Feedback Form 5: 1st round of questions and comments to RWS-210162

1 – LG Electronics Inc.

On the proposed enhancement for high-speed scenario, could you explain further on the difference from the features being discussed in Rel-17 (e.g. SRS related enhancements and Doppler feedback for HST-SFN)

2 – Samsung Research America

(p2) Since adding more (statistically less correlated) layers increases PAPR, could you elaborate how to increase the rank for DFT-s-OFDM without PAPR increase?

3 – ZTE Corporation

Thanks so much for sharing this contribution. Please find our following comment(s) for clarification.

- On UL-MIMO, we wonder about the motivation of enhancing flexible switching between DFT-s-OFDM and CP-OFDM and greater than 1 layer for DFT-s-OFDM. In our views, if higher RANK transmission is preferred, only the number of layers need to be increased, rather than switching of waveform.

4 – NTT DOCOMO INC.

(p.4) “Timing offset configuration/reporting ”:

- Do you mean UE transmits UL channels to different TRPs with different time offset, and UE receives DL channels from different TRPs with different time offset? For UL, what is the difference from the case that UE has different TA values for different TRPs?

5 – Beijing Xiaomi Mobile Software

- Q1: We think the support of multi-layer PUSCH transmission with DFT S OFDM needs more discussion and study.
- Q2: We can’t see the use case in which more flexible switching of UL waveform is needed.

-

Q3: We think further discussion on if it is feasible/necessary to enhance the coherent joint transmission is needed.

6 – Apple GmbH

Q1. For mobility enhancement, if we consider async case, does UE need to receive or transmit simultaneously from/to different cells, or perform dynamic toggling between the reception or transmission from/to different cells. This issue was a difficult topic even for DAPS

7 – MediaTek Inc.

Q1: How can the cross-talk issue be alleviate by standardized method? Can you give an example?

Q2: For L1/L2-centric operation,

- Does UL-centric measurement involves SRS transmissions? If yes, how would it interact with DL-centric measurement? and is there is negative impact on UE power consumption?

8 – Intel Corporation (UK) Ltd

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

1. What is the specification impact in RAN1 or other WGs due to enhancements to address power imbalance and cross-talk between RF chains issues?

2. For high speed scenario, what kind of SRS based enhancement is expected given that frequency offset compensation is already performed at TRP for UL demodulation?

9 – Beijing Lenovo Software Ltd.

Q1: On UL MIMO, what is the motivation of flexible waveform switching?

Q2: On L1/L2-centric inter-cell operation, could you further clarify the specification impac on UL-centric mobility?

Q3: On HST, do you want to explicitly support CDD based mTRP transmission scheme?

10 – Spreadtrum Communications

Thanks for the contribution. We also support MIMO enahancement to increase UL throughput. We have some clarification issue on enhancement for DFT-s-OFDM. In our views, DFT-s-OFDM is only configured to achieve low PAPR for cell edge UEs. For multi layer PUSCH with DFT-s-OFDM, is it configured for cell edge UEs or cell center UEs? If it's for cell center UEs, what's the benefit to configure DFT-s-OFDM comparing with CP-OFDM? If it's for cell edge UEs, how to ensure the coverage?

Regarding the flexible waveform switching, in our views, DFT-s-OFDM and OFDM are used in different coverage areas, the switching between them doesn't need to be more flexible than RRC based. Can you clarify on the use case/benefit for flexible waveform switching?

11 – Qualcomm communications-France

Q1: Regarding "crosstalk between RF chains, power imbalance" in UL MIMO enhancements, can you elaborate more the scenario in mind? E.g., is it within the same device?, is it related to full duplex operations?

Q2: Regarding "distributed DL MIMO (CJT)", what are the potential RS enactments required? For example, which aspect of DMRS requires potential enhancements? Also, is this limited to FR1 or both FR1 and FR2 can be considered?

Q3: On P4, what is difference for measurement and report for sync and non-sync scenarios? What is timing offset config/report? Any more detailed explanation on interference measurement due to non-sync scenario?

12 – HuaWei Technologies Co.

Thanks for the contribution, we have the following comments and questions:

1. We are supportive on SRS enhancements for high speed UE, and also support the SRS enhancements in coherent joint transmission cases (such as inter-cell SRS interference mitigation) in Rel-18.

2. DMRS enhancement (such as more DMRS ports) is more beneficial for high order MU for CP-OFDM (including coherent joint transmission cases), why to be restricted in DFT-S-OFDM?

3. On Page 4: Increased power consumption is mentioned as one motivation for considering UL-centric measurement. Still, wouldn't frequent UL transmission leads to higher power consumption at UE? Is 'power consumption' here referring to gNB power consumption?

13 – Qualcomm communications-France

Could you please elaborate what aspects of SRS need to be enhanced to address the high-speed issue?

14 – Ericsson LM

- Can you clarify the potential need/motivation for RS enhancements for C-JT?

15 – CATT

1. On UL enhancement, are there any numerical results to support higher-rank DFT-o-OFDM, and flexible switching between UL waveforms? what's the baseline scheme?

2. On asynchronous scenario with larger than CP latency between TRPs, is there any numerical analysis on the probability of a UE operating in inter-TRP mode observing larger than CP timing difference between TRPs? Last CoMP study in LTE showed CoMP UE tends to have small RSRP difference (and hence pathloss difference) across TRPs, and it is unclear if it is that challenging for TRPs engaed in coordination to be synchronized.

3. On CSI enhancement for high-sped, is there any numerical/quantitative analysis on the potential gain? What's the baseline? Normally when UE mobility is high it is way simpler to just fall-back to a low dimension MIMO (with gNB side virtualization using a wide beam).

4. On beam management enhancement, could you please clarify the details of inter-band CBM?

2.3.2 1st Round-Answers

Table 4: Answers to the 1st round of questions

Respond to	Answers

LG	Thank you very much for the question. . Please find answers below: In Rel-17 HST scenario SRS transmission from UE is used for Doppler estimation. Also in Rel-17 the enhancement of HST focuses on Doppler feedback. In this proposal, basic intention is for enhancing CSI in high speed scenario, e.g., CSI information of HST-SFN operation which is not touched in Rel-17. SRS could be used for CSI prediction at gNB, not for Doppler shift estimation in Rel-17.
Samsung	Thank you very much for the question. . Please find answers below: In general PAPR is important issue for UE, one way to support higher rank for DFT-s-OFDM without PAPR increase is to only support non-coherent codebook subset where multiple layers are transmitted from separate antennas.
ZTE	Thank you very much for the question. . Please find answers below Dynamic waveform switching is for the case of UE configured with CP-OFDM waveform, at cell edge with single layer UL transmission DFT-s-OFDM waveform is better in terms of power efficiency. Currently, waveform is RRC configured which is not efficient. Support of higher rank with DFT-s-OFDM waveform can somehow address the issue of PAPR at cell edge however spectral efficiency of CP-OFDM with rank>1 is better than DFT-s-OFDM. Hence, it provides flexible network configuration.
DOCOMO	Thank you very much for the question. Please find answers below: For the specific mentioned bullet “Timing offset configuration/reporting”, the intention is only for measurement. With configured timing offset, the measurement complexity would be reduced. With timing offset report, the TRPs that can be received simultaneously can be selected based on report. With the intention you mentioned for asynchronous inter-ell multi-TRPs, we are supportive to further discuss UE receives DL channel/signals with different timing offset especially in non-sync mTRP scenario to extend the inter-cell mTRP currently being specified in Rel-17 for non-sync case.

Xiaomi	Thank you very much for the question. Please find answers below: A1: Agree, more discussion is needed considering PAPR increase. A2: Currently waveform is RRC configured, since it is mandatory for UE to support 2 Tx network configures CP-OFDM, however at cell edge DFT-s-OFDM waveform is better in terms of coverage (power efficiency). RRC reconfiguration is not flexible and seldom happens. A3: Yes, further study on coherent joint transmission including application scenarios is needed.
Apple	Thank you very much for the question. Please find answers below: Both sync and non-sync cases should be considered in the study, and UE complexity shall be considered from the beginning. Applicable scenario and gain should be carefully studied. Transmit simultaneously to different cells should not be touched from our side. Receive simultaneously from different cells can be studied for example for FR2. What you mentioned to perform dynamic toggling between the reception or transmission from/to different cells is also one of the possibilities.

MTK	Thank you very much for the question. Please find answers below: A1: Our motivation is study potential techniques to address this issue, if the issue of crosstalk can be alleviated by base band algorithm such as pre-compensation will greatly improve implementation flexibility at RF front end which may on the other hand enhance UL MIMO performance especially for larger number of Tx antennas. One potential study area is related to cross talk calibration: currently cross talk calibration is difficult between RF chains. Specification can be enhanced to facilitate such calibration. A2: We have separate contribution on mobility enhancement discussing in more details. In this paper, the focus is mainly for connected mode. The referred signal is SRS but others are not precluded. We think with UL mobility, there would be gains from both power consumption and latency perspective. For example, UE would need to perform up to several seconds of DL measurement to search all possible beams in one or multiple neighboring cells. But with uplink based mobility, such measurement can be saved with a few shots of SRS transmission. Interaction between DL-centric measurement and UL-centric measurement can be further studied, e.g., regarding whether they are conducted in parallel or sequentially to expedite procedure.

Intel	Thank you very much for the question. Please find answers below: A1: Our motivation is study potential techniques to address this issue, if the issue of crosstalk can be alleviated by base band algorithm such as pre-compensation will greatly improve implementation flexibility at RF front end which may on the other hand enhance UL MIMO performance especially for larger number of Tx antennas. One potential study area is related to cross talk calibration: currently cross talk calibration is difficult between RF chains. Specification can be enhanced to facilitate such calibration. With higher order MIMO in UL, power imbalance will be more pronounced and potential solution should be studied including how to improve the DL/UL performance due to such power imbalance. A2: For high speed scenario, there are proposals on CSI prediction at gNB based on UE reporting, we are considering CSI prediction at gNB based on SRS, and open for study. This is different from HST scenarios discussed in Rel-17 where only frequency offset compensation is considered.
Lenovo	Thank you very much for the question. Please find answers below: A1: Currently waveform is RRC configured, since it is mandatory for UE to support 2 Tx network configures CP-OFDM, however at cell edge DFT-s-OFDM waveform is better in terms of coverage (power efficiency). RRC reconfiguration is not flexible and seldom happens. A2: We have separate contribution on mobility enhancement discussing in more details. In this paper, the focus is mainly for connected mode. The referred signal is SRS but others are not precluded. We think with UL mobility, there would be gains from both power consumption and latency perspective. For example, UE would need to perform up to several seconds of DL measurement to search all possible beams for one or multiple neighboring cells. But with uplink based mobility, such measurement can be saved with a few shots of SRS transmission. A3: in HST, CDD generally performs better, it is not necessary to explicitly support in spec however related feedback information can be considered.

Spreadtrum	Thank you very much for the question. Please find answers below: Yes, for spectral efficiency CP-OFDM is better than DFT-s-OFDM when rank>1. The motivation of supporting rank>1 for DFT-s-OFDM is considering better performance at cell edge with compromised cell center performance. When CP-OFDM is configured, the cell edge performance is compromised, hence dynamic switching to DFT-s-OFDM for cell edge UE is beneficial. Currently waveform is configured by RRC which is not flexible. Supporting rank>1 for DFT-s-OFDM and dynamic waveform switching provides flexible configuration at network.
Qualcomm	Thank you very much for the question. Please find answers below: A1: cross-talk, power imbalance is within same device, it is not related to full duplex operation at UE. With UL MIMO supported, we observed from measurement that cross-talk between different chains is significant which has detrimental impact on UL performance. We are open to study techniques which allow better flexibility at RF front end improving overall UL MIMO performance especially for larger number of Tx antennas. A2: For DL CJT, each layer is transmitted from separate TRPs in the same time-frequency resource, it is like SFN more or less. Potential RS enhancement may need further study: e.g., possible enhancement on the QCL assumptions of CSI-RS/DMRS/TRS, whether the CSI-RS framework for MTRP CSI feedback in Rel-17 can work for CJT scenarios, etc. In our mind, FR1 should be prioritized for CJT. A3: For measurement for sync and non-sync case, the complexity would be different since non-sync measurement would require multiple FFT windows. With configured timing offset for non-sync case, the measurement complexity would be reduced e.g. potentially reduce the searching window size for non-sync measurement . With timing offset report e.g. as part of CSI, the TRPs that can be received simultaneously can be selected based on report and thus the corresponding PDSCH reception performance can be improved. For interference measurement, the related timing assumption should also be clarified for non-sync case especially the interference measurement resource and channel measurement resource are also from different cells. A4: potential SRS enhancement for CSI prediction at gNB can be studied

Huawei	Thank you very much for the question. Please find answers below: A1: thank you A2: we are open to study overall DMRS enhancement considering various use cases A3: We have separate contribution on mobility enhancement discussing in more details. In this paper, the focus is mainly for connected mode. The referred signal is SRS but others are not precluded. We think with UL mobility, there would be gains from both power consumption and latency perspective. For example, UE would need to perform up to several seconds of DL measurement to search all possible beams from one or multiple neighboring cells. But with uplink based mobility, such measurement can be saved with a few shots of SRS transmission.
Ericsson	Thank you very much for the question. Please find answers below: For CJT DL, each layer is transmitted from separate TRPs in the same time-frequency resource, it is like SFN more or less. Potential RS enhancement may need further study: e.g., possible enhancement on the QCL assumptions of CSI-RS/DMRS/TRS, whether the CSI-RS framework for MTRP CSI feedback in Rel-17 can work for CJT scenarios, etc.

CATT	Thank you very much for the question. Please find answers below: A1: DFT-s-OFDM for rank>1 is supported in LTE, technically NR can use similar mechanism, yes, further evaluation including PAPR is required. On dynamic waveform switching, since CP-OFDM is configured, the cell edge performance is compromised, hence dynamic switching to DFT-s-OFDM for cell edge UE is beneficial from coverage perspective. Currently waveform is configured by RRC which is not flexible. A2: We are open to study especially considering FR2 where larger SCS is used and CP becomes smaller A3: it is true with current CSI feedback mechanism, performance degrades sharply with increase vehicular speed of UE and falls back to lower order MIMO (open loop in LTE) for reliability, we are considering potential SRS enhancement for CSI prediction at gNB to improve DL performance, can be further studied A4: in RAN4 study, it is observed that inter-band CBM performance is not optimal, on the other hand inter-band IBM will cause more overhead and latency. We are considering to study inter-CBM under unified TCI framework currently being specified in Rel-17 leveraging fast beam indication.

2.3.3 2nd Round-Questions

Feedback Form 6: 2nd round of questions and comments to Further MIMO enhancements (RWS-210162)

1 – Beijing Xiaomi Mobile Software Thanks for your answers to “more flexible switching of UL waveform”, we want to further clarify that you intend to dynamically switch the UL waveform for cell edge UE, not to use CP-OFDM for cell center UE while use DFT-S-OFDM for cell edge UE? In other words, what is the problem if only DFT-s-OFDM is used for cell edge UE?
2 – Spreadtrum Communications Thanks for your reply. Based on your explaination of the use case for flexible waveform switching, do you propose to support switching only from CP-OFDM to DFT-s-OFDM? For SRS based enhancement for high speed scenario, is it applicable for both FDD and FDD, or only TDD? Whether CSI prediction is working independently from or jointly with CSI feedback?
3 – Samsung Research America - (p4) Interference measurement for asynchronized multi-TRP: if timing difference can be well compen-

sated, why do we still need to consider interference measurement for asynchronized setting? Is this measurement for residual interference after timing difference compensation? And if so, how to characterize/-model the residual interference?

- (p4) For UL centric measurement, this would require sending SRS (or UL measurement signal) to different cells. Do you envision sending the SRS signal at the same time to different cells?

4 – Samsung Research America

Comment on DFT-sOFDM based high-rank:

- Since DFT-sOFDM is intended for low PAPR transmission, introducing high rank transmission would void most of the power efficiency benefit. Note that low PAPR transmission is intended for coverage/power limited scenrio where high rank is misplaced.
- From LTE, it has been known that implementing advanced MIMO receiver at the gNB for DFT-sOFDM is quite complex and burdensome. This is one reason NR decided to use OFDM(A) for SU-MIMO. So proposing to support SU-MIMO (high rank) with DFT-sOFDM is backward to LTE.
- It is also known that Rel-10 UL SU-MIMO has met considerable challenge to get deployed in real NWs, perhaps even until now. Overall we need to be careful that this work (if included in Rel-18) wouldn't end up being a feature that never gets implemented.

5 – MediaTek Inc.

Thanks for your replies. For A2, we acknowledge there may be gain from SRS-based measurement. However, the gain depends very much how to harmonize UL/DL measurement, since DL measurement can be reduced but not removed entirely. Please could vivo give one example of a procedure that believe would provide gain?

6 – ZTE Corporation

Thank you so much for your reply. In technical, one out of these two approaches, e.g., flexible switching and >1 layer for DFT-s-OFDM seems to be sufficient if really some enhancement is needed, although this issue is not popular for us. Anyway, we are open to have further discussion.

7 – Qualcomm CDMA Technologies

Regarding "distributed DL MIMO (CJT)", we have the following follow-up questions:

Q1: Is the time alignment error (TAE) across TRPs envisioned to be the same as existing RAN4 requirements for MIMO (i.e., 65ns)? How this can be achieved?

Q2: Are you envisioning that the distributed TRPs share the same clock / PLL? If not, what are the phase drift requirements for CJT to work in practice?

8 – HuaWei Technologies Co.

One further question: what are the potential SRS enhancements used for CSI for high speed case in your mind?

9 – LG Electronics Inc.

Thanks for the answer. SRS can always be used by NW for CSI estimation but it is still not clear for us what needs to be enhanced for SRS based CSI estimation/prediction from spec perspective as it might belong to an implementation area. Could you explain a bit further on this?

2.3.4 2nd Round-Answers

Table 5:

Respond to	Answers
Xiaomi	Thank you very much for further question. One UE could be configured with CP-OFDM waveform, for example when the UE is in cell center and most likely is not power limited, it can support rank=>1 with CP-OFDM. When the UE moves to cell edge and where most likely is power limited, current spec support network reconfigure waveform to DFT-s-OFDM by RRC which is slow and when the UE moves to cell center RRC reconfiguration is required again to support CP-OFDM waveform. And, we noticed that RRC reconfiguration is seldom used although supported by spec. Hence, the motivation is to use the waveform based on channel condition (e.g. whether the UE is in cell center or cell edge) to maximize spectral efficiency and coverage.
Spreadtrum	Thank you very much for further question. Yes, the motivation is to switch from CP-OFDM to DFT-s-OFDM, because for a UE with 2 Tx the network configures CP-OFDM to support UL rank=2 transmission. Our motivation is to facilitate channel prediction at gNB in TDD, however we are open to discuss whether it is applicable for FDD. In TDD, how to derive overall CSI can be up to gNB.

Samsung	Thank you very much for further questions. A1: On interference measurement for async mTRP, the intention is not for the case where the timing difference is compensated. Such timing difference compensation may not be possible for DL transmission based on typical implementations. Thus, it is necessary to consider how much interference is due to reception of signals with different timing if synchronized operation cannot be guaranteed. Exact model and characterization of interference can be left for further discussion. A2: On UL centric measurement, for example, the UE performs SRS beam sweeping to initiate handover procedure, which can be received by same or different cells, this can be considered as part of L1-centric mobility where network relies on L1 measurement. A3: on rank>1 for DFT-s-OFDM, although LTE supports rank up to 4 in UL, however the main hurdle was at the terminal side, there was no UEs supporting more than 1 Tx. Since DFT-s-OFDM waveform is already supported for rank=1 and implemented, we don't understand the complexity issue at gNB. Yes, PAPR is important for UL hence precoder design for rank>1 should take it into account. At least non-coherent codebook subset with rank>1 can preserve PAPR. If Rel-15 UL MIMO is considered, for example in 2Tx case, due to 3dB lower output power in rank=1 transmission, probability of rank=2 transmission without increasing PAPR is higher.
MediaTek	Thank you very much for further question. Yes, DL measurement cannot be entirely removed. To expedite handover, for example, in FR2, the UE performs SRS beam sweeping to replace blind measurement on target cells. Based on the UL measurement, the network could indicate UE to either initiate handover procedure in target cell or possibly further measure DL signals with specific reciprocal beams of UL transmission. Based on the UL transmission, the DL measurement can be more focused on possible beams for a target cell.
ZTE	Thank you very much for further comments. Yes, we can further discuss.

Qualcomm	Thank you very much for further questions. A1: application scenario can be discussed, for example in indoor scenario it could be possible with existing RAN4 requirements for MIMO. In Macro, Micro deployment scenario, larger TAE can be considered. A2: yes, distributed TRPs can share same clock/PLL, which is feasible at least in scenarios where TRPs are geographically separated but not too far away.
Huawei	Thank you very much for further question. We are open to discuss any potential enhancement to facilitate channel prediction at gNB with relatively lower overhead.
LG	Thank you very much for further question. In some sense, it is true the NW can predict/estimate CSI based on SRS, to support high speed scenario SRS gNB need to configure with small periodicity which will cause large overhead. We are thinking about potential SRS enhancement for CSI prediction at gNB with smaller overhead, and open for any potential solution.

2.4 Enhancement on IRC receiver performance (RWS-210163)

Motivations

• Rel-17 RAN4 WI is limited on demodulation performance considering slot based operation and overlappingDMRS symbols

• Interference due to with slot based and non-slot based multi-user scheduling

• Interference due to uncoordinated neighboring cell scheduling

• Interference in UL due to new scenarios such as flexible duplex, full duplex operations at gNB

Potential enhancement

• RAN1 based enhancement of IRC receiver performance including signaling and RS design, e.g. blank REs

2.4.1 1st Round-Questions

Feedback Form 7: 1st round of questions and comments to RWS-210163

1 – Spreadtrum Communications

Generally we are interested in this topic. We have some questions below on this t-doc:

Q1: Is the potential enhancement in P5 to handle inter-cell interference, or intra-cell MU-MIMO interference, or both?

Q2: The evaluation results in P3/P4 show that the simulation assumption on UE's antenna configuration is 4T4R. Given that the typical commercial configuration for UE is 2T4R, if there are related evaluations on 2T4R, could they be shared?

2 – China Mobile Com. Corporation

This is a very interesting topic, and the performance evaluation for different scenarios are important for identifying the potential benefits. We think during the study we can also consider more scenarios, e.g., with more cells and UEs.

3 – Intel Corporation (UK) Ltd

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

1. Do you have evaluation results for MMSE-IRC receiver when Ryy is measured directly from PDSCH? Based on MMSE-IRC study for LTE, in the scenarios with high interference level, this approach may provide accurate measurements and address the issues raised in the document.

2. For the results in Slide 3, what is the reason for substantial performance difference between Case 2 and Case 3? Why interference estimation does not work well for Case 2, while works for Case 3?

4 – ZTE Corporation

Thank you so much for sharing this interesting contribution. From our perspective, the MMSE-IRC is much relevant to UE DL receiver based on RAN4 discussion. For this contribution, you want to handle this issue for both DL and UL, right? Meanwhile, we wonder whether you can provide further thoughts or simulation results related to Case2 in Page3 by using Blank RE.

2.4.2 1st Round-Answers

Table 6:

Respond to	Answers
Spreadtrum	Thank you very much for questions, please find answers below A1: Yes, potential enhancement include MU-MIMO especially for DL and inter-cell scenario. It could also be beneficial for full duplex case at gNB, if supported in Rel-18. A2: In the simulations, for simplicity 4 Tx at gNB and 4Rx at UE or vice versa is considered. The performance of MMSE-IRC is mainly subject to the receiver antenna number and the cross-correlation of channel between signal and interference. The transmitter antenna number has little impact especially for Rank=1 which is assumed in our simulation. More evaluation considering different assumptions can be done in future.

CMCC	Thank you very much for question, please find answers below yes IRC receiver performance is directly related to PDSCH/PUSCH performance. Further study/evaluation considering different scenarios is needed.
Intel	Thank you very much for questions, please find answers below A1: To some extent, interference estimation directly based on received signals can also achieve effective whitening filter only in case of high interference level rather than low or medium interference level. Furthermore, when UE is not aware of the irregularly overlapped PDSCH scheduling patterns from intra-cell MU-MIMO or neighbor cells, it is preferred more conservative measurement granularity for statistical interference covariance matrix should be adopted, e.g. Ryy is measured by averaging the received signals on the subcarriers within 1 PRB together within 1 OFDM symbol. Since whitening filter need inversion of matrix, the complexity of implementation for UE is huge. A2: Firstly, we would clarify UE1 from cell1 is assumed as target UE and UE2 from cell2 is assumed as interference UE in slide3, so the performance in right figure proves the performance of UE1 in different case. Regarding the difference between case 2 and case 3, after checking simulation details only one front-loaded DMRS symbol is configured and UE1 estimates the interference auto-correlation matrix only based on front-loaded DMRS symbol without interference estimation data symbols. Sorry for confusion. In case 2, the DMRS of UE1 cannot estimate the interference while the DMRS of UE1 can estimate the interference in case 3. Hence the performance in case 3 is better than case 2.
ZTE	Thank you much for question, please find answers below yes in our view both PDSCH and PUSCH reception performance can be enhanced with enhanced IRC receiver. Further study/evaluation is needed to identify potential solution considering balance between overhead and gain, for example blank REs can be configured on each symbol of scheduled PDSCH/PUSCH.

2.4.3 2nd Round-Questions

Feedback Form 8: 2nd round of questions and comments for Enhancement on IRC receiver performance (RWS-210163)

1 – Huawei Tech.(UK) Co.. Ltd

Thank you for the contribution. We share the same view that RAN1 based enhancement for IRC receiver is needed such as signaling. Is there any starting point for the signaling? Considering the stability of traffic (and thus scheduling) and signaling overhead on network assistance, it seems the enhancement is more suitable for more stationary scenarios, such as FWA. But the mechanism can be common for both eMBB and FWA.

2.4.4 2nd Round-Answers

Table 7:

Respond to	Answers
Huawei	Thank you very much for further question. We are open to discuss potential enhancement in any scenario. Signaling could be just to support such a feature or it could also involve assistance information for DL. However, we should be careful not to complicate the design as in NAICS receiver in LTE!

2.5 Enhanced support for XR services (RWS-210164)

In this contribution, it is proposed to study/specify the following enhancements to NR to better support XR services

Power saving enhancements

1. Dynamic adaptive DRX behaviors

2. Tackling for jitter impact

3. UL and DL alignment

Capacity enhancements

1. Dynamic adaptive CG/SPS transmission

2. UE assisted transmission

3. Traffic aware transmission

4. UL triggered DL reception

5. CSI enhancement

2.5.1 1st Round-Questions

Feedback Form 9: 1st round of Questions and Comments to RWS-210164

1 – Spreadtrum Communications

The HARQ feedback of DL data could be indicated to UE via K-offset, so the UL and DL alignment may be an implementation.

Which layer is responsible to generate the scheduling assistant information?

2 – Classon Consulting

[for FUTUREWEI]

We also think application oriented transmission control is important. Please see RWS-210040 on enhancements for low/bounded latency high throughput transmission. NWM https://nwm-trial.etsi.org/#/documents/4751 .

3 – CATT

Thanks for sharing the idea of NR enhancement for XR. The proposed schemes of capacity enhancement with enhancement of SPS and CG, power saving technique of dynamic adaptive DRX and traffic awareness transmission are quite interesting. However, we believe the aspects of NR enhancements should be discussed in the working group first with conclusion in the XR study before further discussion of the scope of XR work item.

4 – Apple Europe Limited

Thanks for your contribution. On dynamic adaptive DRX, what is your view on that with multiple data flows? especially two flows with ”odd” periodicities, e.g. one with 60 fps, another with 100 packets per second. In our view, tackling jitter impact and handling time-varying packet size can be supported by a unified solution. As for UL and DL alignment, it seems the case you cite is for VR, could you elaborate what enhancements are needed to achieve UL and DL alignment (presumably alignment can be already achieved by good gNB implementation). On dynamic CG/SPS transmission, we seem to share similar views. for packet discarding (slide 10 in your presentation), if multiple SDUs with different delay budgets are contained in the same MAC PDU, then how do you deal with that? From DL/UL alignment, it seems your goal to minimize UE’s footprint (of ”On” time). the motivation for UL triggered DL reception (slide 12) is not so clear: assume XR traffic flows are quasi-periodic, does gNB need further prompt from the UE? On CSI enhancements, we believe two aspects should be handled: 1) faithful interference measurement, 2) UE power consumption. You are welcome to check details at https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_AHs/2021_06_RAN_Rel18_WS/Docs/RWS-210500.zip

5 – Guangdong OPPO Mobile Telecom.

Thanks for the contribution. Some questions for clarification from our side:

Q1: UL and DL alignment can be implemented by reasonable scheduling, what the spec impact from UL and DL alignment? How to solve latency due to alignment?

Q2: For UL triggered DL reception, DL repection is PDCCH or PDSCH? **Q3:** What’s difference between CSI enhancement and R17 urllc csi enhancement?

6 – LG Electronics Inc.

Regarding traffic aware transmission in slide 11, what do you mean by ”traffic flow”? Is it a QoS flow? DRB? or RLC leg?

In addition, which layer do you think is suitable for packet inspection?

By the way, the proposal is similar to our proposal on TCP boosting (RWS-210226), where we propose to identify TCP ACK within a TCP stream and prioritize the TCP ACK transmission. Do you only consider I/P frame for traffic aware transmission? or open for other packets like TCP ACK?

7 – Sony Europe B.V.

Regarding GC/SPS, do you have any specific features or functionality in mind that needs to be specified to support dynamic CG and SPS transmission?

8 – Intel Corporation (UK) Ltd

1) Could you provide more details on the UL triggered DL reception enhancement including which problem is this targeting to solve?

9 – ZTE Corporation

1)The UL pose period is 4ms, in case the UL triggering is supported, how does the UE identify which is the corresponding DL occasion for the frame at e.g. 60fps whose periodicity is 16.67ms.

2)About the traffic awareness transmision, could you explain how to introduce DPI in RAN and the RAN3 impacts.

10 – MediaTek Inc.

Thanks for the good contribution. We have some questions below to know more about the enhancements.

For enhanced SPS and CG to match XR DL/UL periodicity, dynamic grant should be sufficient for DL (low overhead and high efficiency). UL traffic can also utilize flexible CG type-2. What are the expected additional enhancement and benefit?

For Enhanced CDRX to match XR frame rate, DCI-based power saving is able to achieve the best dynamic and fine-granularity power saving. What is expected addition enhancement w.r.t. R17 PDCCH monitoring reduction and benefit, considering very dense UL (Ex. 4ms) in XR assumed in SA4?

For jitter handling to achieve power saving, DCI-based power saving is able to achieve the best dynamic and fine-granularity power saving. What is expected addition enhancement w.r.t. R17 PDCCH monitoring reduction and benefit?

For Alignment of UL and DL transmission, dependency in DL and UL traffics should be first agreed in SA4 and RAN1. Then, it can be evaluated for checking the power saving issue and identify the solution(s). Is it planned to check with SA4 first?

For cross-layer enhancement, RAN1 can first conclude the benefit of RAN awareness of application and application awareness of RAN first (Ex. packet dropping, packet prioritization), and then the work can be led by SA4 since QoS requirements are currently under study in SA4. How is it planned to progress the work in SA4 and RAN for RAN awareness of application and application awareness of RAN?

For UE assistant information reporting, UAI is not expected to be frequent (overhead consideration), and how slow UAI can help fast adaptation? Does the UAI information comes from application?

For the enhanced timely CSI measurement and reporting, given less stringent reliability requirement than URLLC and it has already studied in R17 URLLC WI, would the need of further/new CSI enhancements be justified first?

11 – Qualcomm Incorporated

1) How would UL triggered DL reception interact with CDRX? In UL triggered DL, does vivo assumes reduced UL pose transmission frequency such as the DL frame rate?

2) Can vivo provide more details on this set of proposals ”Timely CSI measurement and reporting and reducing CSI computation”?

12 – LG Electronics Inc.

We have the following additional questions.

Q) In your paper (RWS-210164), you proposed to study and specify features to support UL triggered DL reception. And as a motivation, you mentioned the case of a large amount of data triggered by the pose/control information in UL. We expect the typical DL traffic requiring a large amount of resource in response to the pose/control in UL is typically a video traffic which has a certain periodicity based on the frame rate. If you agree on this, can we assume that your proposal is mainly to reduce the turn-around time of the first video frame, rather than consistently reducing e.g., the pose-to-motion latency? Or, if you don’t, then could you further elaborate the XR scenarios that you have in mind in relation to this proposal?

13 – Sony Europe B.V.

Thank you for the contribution.

On enhanced CSI measurements:

Operation at higher frequencies such as FR2 may also require an increase in CSI granularity to ‘achieve timely and accurate CSI reports’. Is this at odds with reducing CSI computation?

2.5.2 1st Round-Answers

Table 8:

Respond to	Answers

Spreadtrum	Thanks for the comment and question. Please find the answer to the question as follow. **A1**: Although HARQ-ACK for dynamic scheduled PDSCH transmission can be aligned with DL reception via gNB scheduling, but at the point of time when DL grant is sent, gNB may not have the decision on PUSCH scheduling, so HARQ-ACK for PDSCH may not be time aligned with PUSCH transmission. Moreover, SPS HARQ-ACK timing is configured/indicated by activation DCI semi-statically. In order to align with DL reception, mechanisms e.g. deferring the HARQ-ACK feedback to the closest DL occasion can be considered. In addition, UL data/CSI report can also be considered to align with DL reception, e.g. reducing UL pose transmission frequency and aligning with the DL frame rate can be considered. We think study and specify the mechanisms to support UL and DL alignment for power saving will be beneficial for XR traffic but we are open to the solutions **A2**: Scheduling assistant information can be generated by L2 or upper layer(s) or application layer. For example, UL data burst related information can be collected in L2 or upper layer(s). For DL scheduling recommend information, it may also be collected by L2, or upper layer(s).
Futurewei	Thanks for the comment. We fully agree with your point of view. Furthermore, cross-layer design between application layer and CN/RAN might be needed.

Apple	Thanks for the comment and question. **A1**: Dynamic adaptive DRX can be applicable to single or multiple data flows. For multiple data flows as you mentioned, they can be well organized by other mechanisms, e.g. traffic awareness transmission. **A2**: Regarding jitter tackling, the preparation of DL monitoring at UE to cover the jitter will cause increased power consumption since the traffic arrival timing with jitter is non-predictable beforehand. So enhanced solutions should be identified to tackle jitter impact with low UE power consumption, as an example, lower power wake-up signal can be considered. For time-varying frame size, if frame size can be known at RAN e.g. by traffic awareness transmission mechanism, dynamic adaptive DRX for UE can be managed by gNB. Therefore, how to study jitter and time-varying packet size can be studied separately and we are open to discuss whether and how to combine different power saving techniques. **A3**: Although HARQ-ACK for dynamic scheduled PDSCH transmission can be aligned with DL reception via gNB scheduling, but at the point of time when DL grant is sent, gNB may not have the decision on PUSCH scheduling, so HARQ-ACK for PDSCH may not be time aligned with PUSCH transmission. Moreover, SPS HARQ-ACK timing is configured/indicated by activation DCI semi-statically. In order to align with DL reception, mechanisms e.g. deferring the HARQ-ACK feedback to the closest DL occasion can be considered. In addition, UL data/CSI report can also be considered to align with DL reception, e.g. reducing UL pose transmission frequency and aligning with the DL frame rate can be considered. We think study and specify the mechanisms to support UL and DL alignment for power saving will be beneficial for XR traffic but we are open to the solutions **A4**: Regarding the packet discarding, for example, dropping the ”too late” packets can be considered in PDCP such that only packets with sufficient remaining delay budget will be delivered to the lower layer for transmission. In this case, the packets that may be multiplexed in a PDU have the sufficient delay budget. Currently there is no such dropping mechanism based on delay budget at RAN. Therefore, how to handle packet dropping in lower layer can be further studied in RAN. We are open to discuss the other mechanism for packet discarding. **A5**: Regarding UL triggering DL, the motivation of UL triggering DL is to reduce the latency for DL reception, since for XR if the pose or control information is sent in UL a large amount of DL data may need to be delivered to XR device subsequently. UL Tx (e.g. SR) can trigger the DL reception to reduce the turn-around time of the first video frame, thus reducing the latency

OPPO	Thanks for the comment and question. **A1**: Although HARQ-ACK for dynamic scheduled PDSCH transmission can be aligned with DL reception via gNB scheduling, but at the point of time when DL grant is sent, gNB may not have the decision on PUSCH scheduling, so HARQ-ACK for PDSCH may not be time aligned with PUSCH transmission. Moreover, SPS HARQ-ACK timing is configured/indicated by activation DCI semi-statically. In order to align with DL reception, mechanisms e.g. deferring the HARQ-ACK feedback to the closest DL occasion can be considered. In addition, UL data/CSI report can also be considered to align with DL reception, e.g. reducing UL pose transmission frequency and aligning with the DL frame rate can be considered. We think study and specify the mechanisms to support UL and DL alignment for power saving will be beneficial for XR traffic but we are open to the solutions **A2**: For UL triggering DL reception, either PDCCH monitoring or PDSCH reception can be considered. The motivation is to reduce latency **A3**: We think the requirements for XR use case are different from those for URLLC use case, such as high data-rate and quasi-periodicity traffic characteristics. And from the simulation, system capacity is limited for XR due to the high data rate and high reliability and low latency requirements. Timely and accurate CSI report is beneficial to improve capacity and spectrum efficiency. For XR, reducing CSI measurement and reporting latency, as well as reducing CSI computation effort, can be considered to facilitate timely CSI reporting. Certainly, it will depend on the outcome of CSI enhancement discussion in Rel-17 URLLC WI.

LG	Thanks for the comment and question. A1: Traffic flow denotes the data stream from application layer, e.g. I/P frames, video/audio, frames for basic/enhanced layers, frames of FOV/non-FOV, frames of left/right eyes, pose, control, etc. We are open for the definition of traffic flows for traffic awareness transmission and how they are identified in CN or RAN. A2: Regarding the packet identification, we think both RAN and CN can be considered, e.g. by PDCP in gNB or DPI(Deep Packet Inspection)/DFI(Deep/Dynamic Flow Inspection) in CN. We are open to study and discuss it. A3: For TCP ACK, we haven't considered but can look in to it.
Sony	Thanks for the comment and question. We think at least we can consider adaptive CG and SPS periodicity configuration to resolve the mismatch of SPS/CG periodicity and traffic interval of XR, and adaptive transmission parameters adjustment for CG and SPS to resolve the variable packet size of XR traffic. Other enhancement for CG and SPS can also be considered.
Intel	Thanks for the comment and question. The motivation of UL triggering DL is to reduce the latency for DL reception, since for XR if the pose or control information is sent in UL a large amount of DL data may need to be delivered to XR device subsequently. UL Tx (e.g. SR) can trigger the DL reception to reduce the turn-around time of the first video frame, thus reducing the latency,.

ZTE	Thanks for the comment and question. **A1**: The motivation of UL triggering DL is to reduce the latency for DL reception, since for XR if the pose or control information is sent in UL a large amount of DL data may need to be delivered to XR device subsequently. **A2**: For DPI(Deep Packet Inspection)/DFI(Deep/Dynamic Flow Inspection), it will be implemented in CN. Therefore SA2/CT1 need be involved for related work. The data from application will be divided into one or multiple traffic flows in CN. Each of flow may have individual characteristics and requirements and it will be inspected and delivered between different network nodes. The potential RAN3 impact includes transferring the packet inspection results between different network nodes, potentially along with necessary interface information. For example, for video flow, frame based processing in RAN is beneficial by inspecting the boundary of a video frame in CN, wherein the mapping between IP packets and video frames is desirable. These information including the frame based information and the mapping related information need to be delivered from CN to gNB as the interface information, along with the corresponding IP packets, thus RAN3 impact is needed.

MediaTek	Thanks for the comment and question. **A1**: For XR traffic with periodic characteristic, SPS and CG can be beneficial to save control overhead and thus improve the resource utilization and reduce the power consumption. In addition, latency reduction may also be achieved at the same time. However, currently CG(Configured Grant) and SPS(Semi-persistent Scheduling) transmission(s) with semi-statically configured integer periodicity and fixed TB size are not suitable for XR traffic with the characteristics of non-integer periodicity and variable packet size. Hence, further enhancements on dynamic adaptive CG and SPS transmissions are needed, e.g. adaptive CG and SPS periodicity configuration to resolve the mismatch of SPS/CG periodicity and traffic interval of XR, and adaptive transmission parameters adjustment for CG and SPS to resolve the variable packet size of XR traffic. **A2**: What enhancements on dynamic adaptive DRX behavior are needed for XR will be dependent on the outcome of Rel-17 power saving WI. For XR, in order to achieve further power saving gain, reducing UL pose transmission frequency and aligning with the DL frame rate can be considered. Since jitter is unpredictable, DCI-based PDCCH cannot solve this issue, which also can lead capacity loss. Further study is required to make tradeoff between capacity and power consumption. The motivation is to minimize capacity impact while maximize power saving gain. **A3**: Although HARQ-ACK for dynamic scheduled PDSCH transmission can be aligned with DL reception via gNB scheduling, but at the point of time when DL grant is sent, gNB may not have the decision on PUSCH scheduling, so HARQ-ACK for PDSCH may not be time aligned with PUSCH transmission. Moreover, SPS HARQ-ACK timing is configured/indicated by activation DCI semi-statically. In order to align with DL reception, mechanisms e.g. deferring the HARQ-ACK feedback to the closest DL occasion can be considered. In addition, UL data/CSI report can also be considered to align with DL reception, e.g. reducing UL pose transmission frequency and aligning with the DL frame rate can be considered. We think study and specify the mechanisms to support UL and DL alignment for power saving will be beneficial for XR traffic but we are open to the solutions On the other hand, due to the dependency in UL and DL for XR, e.g. the UL pose/control with pose update is sent to request a certain frame to refresh the viewport, UL triggering DL to reduce the latency for DL reception can be considered. If needed, SA4 can be involved for related work. **A4**: For cross-layer enhancement, good question.

Qualcomm	Thanks for the comment and question. **A1**: The interaction between UL triggered DL reception and DRX can be further studied, for example, the UL triggered DL reception only happens during DRX active time, or potentially be allowed even outside DRX active time. UL pose transmission frequency maybe reduced in order to align with DL frame rate, to save power, but that would also increase the delay. **A2**: We think the requirements for XR use case are different from those for URLLC use case, such as high data-rate and quasi-periodicity traffic characteristics. And from the simulation, system capacity is limited for XR due to the high data rate and high reliability and low latency requirements. Timely and accurate CSI report to improve capacity and spectrum efficiency can be considered, e.g. CSI reporting aligned with XR traffic arrival. On the other hand, reducing CSI measurement and reporting latency, as well as reducing CSI computation effort, can be considered to facilitate timely CSI reporting. Certainly, it will depend on the outcome of CSI enhancement discussion in Rel-17 URLLC WI.
LG2	Thanks for the comment and question. We have the similar view as you that UL triggering DL reception can be beneficial to reduce the turn-around time of the first video frame, thus reducing the latency, e.g. the UL pose/control with pose update is sent to request a certain frame to refresh the viewport.
Sony	Thanks for the comment and question. Finer CSI granularity would increase CSI computation complexity thus longer feedback latency, there is a tradeoff between accuracy and delay.

2.5.3 2nd Round-Questions

Feedback Form 10: 2nd round of questions and comments for Enhanced support for XR services (RWS-210164)

1 – MediaTek Inc.

Thanks for the detailed reply.

For the jitter issue, it is unpredictable, but to our understanding NW should be able to know the timing

when a new frame arrives from application. Hence, would setting a small PDCCH skipping period from NW when the next frame is close (with jitter ranged considered) be a possible solution?

For reducing UL pose transmission frequency and aligning with the DL frame rate (16.7ms period), it may violate the current assumption in SA4 (4ms periodic control for UL with PDB=10ms). Would this be confirmed with SA4?

2.5.4 2nd Round-Answers

Table 9:

Respond to	Answers
MediaTek	**A1**: Indeed, jitter is unpredictable but the possible range of jitter can be estimated by NW, e.g. by statistics of frame arrival time. We think it could be possible that a time period for is indicated by NW before the next frame by considering the jitter range. **A2**: We think the UL pose can have different transmission intervals, depending on the application type. Actually, for VR/AR or CG, the pose information is sampled and packetized in the XR device, by the sensors equipped in the XR device e.g. gyroscope and gravity sensor. Once the pose information is sampled and processed by the XR device, the pose information will be delivered to the XR or game server. In general, the sampling rates are controlled by the application for which the pose information is applied. The more frequently the pose information is captured, the more accurate the rendered scenes and gaming control are. The interval for delivering the pose information is dependent on the transmission resources in UL and the delay tolerance requirements of application, e.g. as described in S4-210614. Although according to TR 26.928, in order to always be able to respond to the latest XR Viewer Pose, tracking needs to be done frequently and the minimum update rates should be 1000Hz and beyond, the transmission frequency of UL pose may be reduced considering the transmission resources in UL and the potential power consumption at XR device. We are open to further study the feasibility.

2.6 Further CA/DC enhancements (RWS-210165)

In this contribution, it is proposed to consider the following for Rel-18 CA/DC enhancements

Improved multi-carrier operation

1. Study SUL-like initial Access for non-co-location deployment for idle UE

2. Study to introduce anchor carrier to Scattered narrow band usage in NR for idle UE.

3. Study, and if agreed specify PDCCH of P(S)Cell/SCell scheduling PDSCH/PUSCH on multiple cells using a single DCI for FR1 and FR2

Fast SN switching/activation

1. Study Fast SN switching/activation when Multi-SN can be configured for the UE

2. Note1: Only two TX transmissions are allowed at same time

2.6.1 1st Round-Questions

Feedback Form 11: 1st round of questions and comments to RWS-210165

1 – ZTE Corporation

For multi-cell scheduling:

For the 1st bullet, from our perspective, it seems the main motivation of co-located SUL is coverage enhancement. For non-co-located case, could you clarify a little bit the detailed motivation?

For the 2nd bullet (i.e., Scattered narrow band), could you clarify a little bit the detailed motivation & scenario?

2 – LG Electronics Inc.

Thank you for the proposals.

Q: Regarding the improved multi-CC operation, do you consider paring of SUL+NUL over inter-band? and also consider UE-common anchor CC (i.e., Pcell) for multiple scattered CCs?

3 – MediaTek Inc.

Thanks for the quality contribution. In general, we are supportive to further CA and DC enhancements in Rel-18. Below please find our specific comments/questions:

For CA enhancements:

- **Item 1** looks to improve the coverage of initial access, but is RACH an issue for FR1 coverage?
- For **item 2**, more clarification on the need of specific anchor carrier is needed. Currently, UE can already receive SI and paging in IDLE mode from a single serving cell.
- For **item 3**, we support the enhancement and think it is also fundamental for enable full CA scheduling flexibility at reduced UE blind decoding complexity

For DC enhancement:

-

If keeping data continuity is the the main target, enabling fast SCG to MCG data switching can already keep data continuity when SCG blockage/failure. It is not very clear why configuring multiple SCG is needed.

4 – Beijing Xiaomi Mobile Software

Thanks for the proposal.

We are interested in this aggregation for Multiple carrier. We have some questions:

1) For P1: ”SUL-Like Coverage enhancement for Non co-location deployment should be studied.” So you want this aggregation for Multiple carrier for Non co-location deployment? Is it for Coverage enhancement or for throughput boosting?

2) For P2: Does Multiple carrier belong to the same gNB?

3)For P4: Is Fast SN Switching/activation the physical signaling?

5 – Apple Portugal

For Fast SN switching/activation, how many Rx chains do you assume during the transmission, e.g. from MCG, source SCG and target SCG simultaneously or only two of them?

6 – Intel Corporation (UK) Ltd

1) Are the scattered narrow bands treated as one carrier or multiple carriers?

7 – Intel Corporation (UK) Ltd

2) Regarding non-collocation deployment between high/low frequencies, how does enhancements in initial access benefit the system, especially compared to enhancements in idle/connected mode? Do you consider the enhancement of having the same low frequency uplink among different non-collocated downlinks?

8 – Lenovo Mobile Com. Technology

Similar question as Apple, how many Rx chains are assumed for SN fast switching/activation? two?

9 – Qualcomm Incorporated

Regarding “Study to introduce anchor carrier to Scattered narrow band usage in NR for idle UE”, is it correct understanding that the target is to enable aggregating narrowband carrier(s) that cannot accommodate broadcast/SSB together with an anchor carrier that accommodates broadcast/SSB? If so, what bandwidth is such narrowband carrier(s) supposed to have?

10 – China Mobile Com. Corporation

For SUL-like initial Access for non-co-location deployment for idle UE, when SUL is non-co-located with DL, Msg.2 will be transmitted on a different located DL carrier from the SUL carrier, how the different located gNB connected to each other? And what is the assumption for beam correspondence of UL and DL?

For Study to introduce anchor carrier to Scattered narrow band usage in NR for idle UE, we also have similar poposal for this, system overhead can be reduced for narrow band.

11 – Nokia Corporation

Q1: The proposal on SUL seems to just allow what is already there, and SUL has not been widely deployed currently so the motivation doesn't seem very strong. What is there to study (or specify) for SUL anymore?

2.6.2 1st Round-Answers

Table 10:

Respond to	Answers
ZTE	Thanks for the comments and questions. For bullet1, non-co-located case is still for coverage enhancements. In our figure case2, the UE can camp in carrier 2 (FR2) and use carrier 1 (FR1) for UL coverage extension for initial access. However, carrier 2(FR2) is non-co-located with carrier1(FR1). For bullet2, we see that it is not efficient if every narrow band (e.g. TDD 2010M-2025M) still broadcasts SIBX/paging for idle UE, if these kind bands also serve the idle UEs. NW can only broadcast SIBx/-paging in some anchor carriers, and allow UE initial access in another carrier, it can reduce the resource overhead for SIBx/paging from system aspect.
LG	Thanks for the comments and questions. Yes, for idle UE, we would like to study the possibility, i.e., paring of SUL+NUL over inter-band even for non-co-location case and UE-common anchor CC (i.e., Pcell) for multiple scattered CCs (still only SIBX for idle UE).

MTK	Thanks for the comments and questions. For CA enhancement Item1: we assume that FR2 has some coverage issues, in our figure case2, the UE can camp in carrier 2 (FR2) and use carrier 1 (FR1) for UL coverage extension for initial access. However, carrier 2(FR2) is non-co-located with carrier1(FR1). Item2: we see that it is not efficient if every narrow band (e.g. TDD 2010M-2025M) still broadcasts SIBX/paging for idle UE, if these kind bands also serve the idle UEs. NW can only broadcast SIBx/-paging in some anchor carriers, and allow UE initial access in another carrier, it can reduce the resource overhead for SIBx/paging from system aspect. Item3: we also ok to study this part in R18. For DC enhancement We assume that SCG is for data throughput, MCG is for coverage/mobility. In this assumption, fast SCG switching/activation can give good balance between throughput and mobility.
Xiaomi	Thanks for the comments and questions. For P1, non-co-located case is still for coverage enhancements. In our figure case2, the UE can camp in carrier 2 (FR2) and use carrier 1 (FR1) for UL coverage extension for initial access. However, carrier 2(FR2) is non-co-located with carrier1(FR1). For P2, Multiple carrier can belong to the same gNB or different gNB. For P3, We can discuss further if it is PHY signaling or MAC signaling.
Apple	Thanks for the comments and questions. Two or more Rx chains can be considered for reception in UE side. Tx chain for simultaneous transmission in UE side should be limited to two.
Intel	Thanks for the comments and questions. We would like to treat scattered narrow bands as multiple carriers. We also see some companies want scattered narrow bands as one Cell. However, we think it modelling issue, we can discuss it further. For non-collocation deployment, we assume that FR2 will be deployed like this in future. SUL-Like benefit can also be gotten for non-collocation deployment. In our figure case2, the UE can camp in carrier 2 (FR2) and use carrier 1 (FR1) for UL coverage extension for initial access. However, carrier 2(FR2) is non-co-located with carrier1(FR1).

Lenovo	Thanks for the comments and questions. Two or more Rx chains can be considered for reception in UE side. Tx chain for simultaneous transmission in UE side should be limited to two.
Qualcomm	Thanks for the comments and questions. Yes, your understanding is correct. The narrowband carrier could still be able to accommodate SSB/SIB/-paging but we see that it is not efficient if every narrow band (e.g. TDD 2010M-2025M) still broadcasts SIBX/paging for idle UE, if these kind bands also serve the idle UEs. NW can only broadcast SIBx/-paging in some anchor carriers, and allow UE initial access in another carrier, it can reduce the resource overhead for SIBx/paging from system aspect.
China mobile	Thanks for the comments and questions. We assume that ideal backhaul still be suitable for the different located gNB connection to each other. Some DL transmission pairing with non-collocation SUL (beam correspondence) can be further studied.
Nokia	Thanks for the comments and questions. We assume that the market will deploy more FR2 cell (co-location and non-co-location) in future, and coverage for FR2 cells are not expected to be large. Existing SUL is for co-location case, in our figure case2, the UE can camp in carrier 2 (FR2) and use carrier 1 (FR1) for UL coverage extension for initial access. However, carrier 2(FR2) is non-co-located with carrier1(FR1).

2.6.3 2nd Round-Questions

Feedback Form 12: 2nd Round of questions and comments to Further CA/DC enhancements (RWS-210165)

1 – ZTE Corporation

Q1: Thanks for the response. Regarding the "SUL-like initial Access for non-co-location deployment for idle UE", if the intention is for coverage enhancements, then it seems we can deploy Pico cell at the cell edge, which can serve the same purpose and without any spec impact and implementation impact. What's your view on this?

Q2: Thanks for the response. Regarding the scattered band utilization, if the intention is to reduce the common resources (e.g., SSB), we also proposed a flexible association of DL and UL carriers solution in our tdoc RWS-210479 (https://nwm-trial.etsi.org/#/documents/4776), i.e., a DL carrier shared by multiple UL carriers via CA framework can achieve the same goal. Do you agree that both your scheme proposed in your tdoc and CA based scheme in our contribution can achieve the same goal?

2 – QUALCOMM JAPAN LLC.

On the carrier(s)/band(s) with sufficient bandwidth for SSB/SIB/paging (e.g., 5MHz, 10MHz), if SSB/SIB/paging is not transmitted, the carrier(s)/band(s) becomes inaccessible by legacy UEs (and by UEs not supporting this feature). While the overhead reduction of SSB/SIB/paging could be a potential gain, we are wondering if this could offer actual performance improvement given the load across carrier(s)/band(s) would be unbalanced.

One further essential question is: whether the proposal is to enable initial/random access on a UL carrier based on SSB/SIB/paging reception on a DL carrier that is not paired/linked with the UL carrier in the band definition. For any possible linkage, REFSENS, MSD and other requirements still need to be derived and specified per pairing. Once it is done, how is the pairing really different from simply defining it as an FDD band? Also, in such pairings, the possible DL BW and UL BW combinations and frequency offsets would still need to be defined, which again would make it not much different from simply defining it as an FDD band.

2.6.4 2nd Round-Answers

Table 11:

Respond to	Answers
ZTE	Thank you for further questions For Q1: The SUL-like initial access for non-co-location is for coverage enhancement. More Pico cell deployment in macro cell edge is one option, however our understanding is that real network deployment is complexity, it is not easy to deploy enough picos in cell edge. For Q2: Yes, we confirm that we are on same page on this goal.
Qualcomm	Thank you for further questions For Q1: We confirm that legacy idle UEs cannot access the carrier that SSB/SIB/paging is not transmitted. For load balance issue we think the there is no issue if more advance UEs go into the markets in future with legacy UE reduction. For Q2: We agree that some DL carrier paired/linked with the UL carrier in the band definition need to be discussed and RAN4 should be involved. However, if Multiple-CCs or Multiple-BWP modeling can be discussed further. We do not expect to increase new band combinations if legacy band combinations can be reused.

TBD

2.7 Further enhancements to IAB (RWS-210166)

In this contribution, it is proposed to consider the following areas for Rel-18

Mobile IAB

Smart repeater

2.7.1 1st Round-Questions

Feedback Form 13: 1st round of questions and comments to RWS-210166

1 – Intel Corporation (UK) Ltd [Mobile IAB] 1. For Mobile IAB, seems there's no impact to the RRC-INACTIVE and RRC-IDLE UEs within the mobile IAB coverage. What are the considered measurements and solutions for those UEs' mobility? [Smart repeater] 2. What is the structure and L1/L2/L3 functionalities expected to smart repeater? More IAB like or simple repeater like? 3. What are the cost advantages of smart repeaters with L1/L2 support over IAB?
2 – Lenovo (Beijing) Ltd We also support vehicle mounted IAB, which is a scenario for mobile IAB. For smarter repeater, my understanding is L1 relay. What is the association between L2 IAB and L1 smarter repeater?
3 – LG Electronics Inc. Thanks for the contribution. Regarding mobile IAB, we think that Rel-18 IAB can support more dynamic mobility and it is important to reduce interruption and interference by mobility to provide stable backhaul performance. What kind of enhancement on mobile IAB do you consider? Do you think that enhancements to reduce interruption and interference by mobility are needed?
4 – ZTE Corporation Thanks for the contribution. We are interested to the mobile relay scenario and submit a paper "RWS-210475 Support of Mobile IAB for 5G Advanced" to address this issue. In addition to the objectives mentioned in this contribution, we think local service support in the high speed vehicle is also important . It is suggested to consider this.
5 – NTT DOCOMO INC. Thanks for the nice contribution. For ***mobile IAB***, we would like to understand more on the intention of enhancement on "RRC-INACTIVE/IDLE UE" mobility

For ***smart repeater***, we would like to understand what kind of signaling do you have in mind to transmit the control information between gNB and smart repeater, for example, is any new interface needed between gNB and smart repeater.

2.7.2 1st Round-Answers

Table 12:

Respond to	Answers
Intel	Thanks for the comments and questions. A1: We mean there may be frequent unnecessary measurement for a UE camping at mobile IAB cell due to frequent neighboring cell change, which means power consumption. Also, there could be related enhancement so that the network can track and quickly reach these UEs when necessary. A2: We think it is more close to repeater. The L1/L2/L3 functionalities depends on how smart we want it to be. Our current thinking is that there should be no L3 function, limited MAC functionality for beam and power control and RF for controlled repeating. A3:We think the major cost reduction comes from the baseband processor and ADC/DAC avoidance in both MT and DU part.
Lenovo	Thanks for the comments and questions. In our view, repeater aims at low cost coverage extension compared to IAB. Repeater and IAB node can be complementary in network deployment.
LG	Thanks for the comments and questions. We share the view that the mobility should be further enhancement, the signaling storm, PCI collision and tracking of UEs and mobile IABs can be considered. We agree that interruption reduction and interference mitigation should be considered as well.
ZTE	Thanks for the comments and questions. For local service support, we are still not so sure if it is specific for IAB network or not. We agree that the motivation to have local service support can be stronger with IAB than without. We are wondering that if we should study this issue in a wider scenario, including both IAB and non-IAB case.

NTT DOCOMO	Thanks for the comments and questions. We mean there may be frequent unnecessary measurement for a UE camping at mobile IAB cell due to frequent neighboring cell change, which means power consumption. Also, there could be related enhancement so that the network can track and quickly reach these UEs when necessary. we prefer to use L1 signal to convey beam/power control and on-off command, other signaling can be also OK if necessary. It is fine to reuse Uu interface rather than new interfaces for control signaling convey, to save the work load.

2.7.3 2nd Round-Questions

Feedback Form 14: 2nd round of comments and questions to Further enhancements to IAB(RWS-210166)

1 – ZTE Corporation

We agree with you that local service support is useful for both IAB and non-IAB scenarios. For VMR scenario, it has requirements to support the local service. So the local service support may start from IAB scenario and then extend to other scenario. However, the current L2 architecture in IAB seems hard to support the local Uu traffic forwarding between UEs, since the mobile IAB may only have DU part deployed on the vehicle. In this case, may be L3 IAB architecture or the sidelink traffic relaying via IAB node may be considered.

2.7.4 2nd Round-Answers

Table 13:

Respond to	Answers
ZTE	Thanks for your further comment. We are not sure if the support of local service is considered in the VMR use cases (TR 22.839 V1.0.0), but we are open to discuss the specific issues (if any) on supporting local service in IAB scenarios. Between the options “L3 IAB architecture” and “the sidelink traffic relaying via IAB node” to support local service, our preference would be the latter one, as this method seems to be off-the-shelf and can be applied directly in the IAB scenarios (where the IAB-node functions as a L2-relay node to support the UE-to-UE traffics, no further enhancement seems needed).

3 Summary

The discussions are summarized as the following:

Mobility enhancements (RWS-210161)

Comments/questions received from 11 companies in 1st round of email discussion, the questions raised on the following points.

-The potential impacts on specification and RAN1/RAN2

-The use case and scenario

UL signal design, transmission, and measurement

-The procedure for UL-based mobility

-How to save network power consumption based on UL signal

-The benefit for the UL-based mobility comparing to legacy HO and CHO

Further comments/questions from 2 companies received in 2nd round of email discussion in response to 1st round email discussion or new questions/comments

-The motivation for UL-based mobility in Rel-18

-Further clarification on the design of SFN-SSB

Further MIMO enhancements (RWS-210162)

Comments/questions received from 14 companies in 1st round of email discussion, the questions raised on the following points.

-More dynamic UL waveform switching

-Higher rank transmission for DFT-s-OFDM waveform in UL

-Distributed MIMO

-UL centric mobility

-SRS for CSI prediction

Further comments/questions from 7 companies received in 2nd round of email discussion in response to 1st round email discussion

-Further clarification on more dynamic UL waveform switching

-Further clarification higher rank for DFT-s-OFDM waveform in UL

-Further clarification SRS for CSI prediction

-Further clarification on SRS transmission in UL centric mobility

-Further clarification on distributed MIMO

Enhancement on IRC receiver performance (RWS-210163)

Comments/questions received from 4 companies in 1st round of email discussion, the questions raised on the following points.

-Applicable scenarios, e.g. intra-cell MU MIMO, inter-cell interference

-Performance of potential enhancement schemes, evaluation assumption e.g. number of Tx/Rx antennas

-Whether to estimate interference on data symbols can work well

Further comments/questions from 1 company received in 2nd round of email discussion in response to 1st round email discussion

-Further clarification on applicable scenario and potential signaling

Enhanced support for XR services (RWS-210164):

Comments/questions received from 11 companies in 1st round of email discussion, the questions raised on the following points.

-Potential enhancement and spec impact for UL and DL alignment

-Motivation and potential enhancement for UL triggered DL reception

-Traffic awareness transmission

-Generation of UE assistant information

-Adaptive DRX & jitter handling

-Potential SPS/CG enhancement

-Clarification on packet discarding

-CSI enhancement

Further comments/questions from 1 company received in 2nd round of email discussion in response to 1st round email discussion

-Further clarification on jitter handling

-Further clarification on UL and DL alignment

Further CA/DC enhancements(RWS-210165):

Comments/questions received from 11 companies in 1st round of email discussion, the questions raised on the following points.

-If motivation for UL-like initial access for non-co-location is enough considering SUL deployment

-How DL/UL beam is related if it is non-co-location between DL and UL

-How many RX and TX chain for fast SN switching and activation

-Is Fast SN Switching/activation the physical signaling

-Enabling fast SCG to MCG data switching may already keep data continuity when SCG blockage/failure.

-Detailed motivation & scenario for Scattered narrow band

Further comments/questions from 2 companies received in 2nd round of email discussion in response to 1st round email discussion

-it seems we can deploy Pico cell at the cell edge for coverage enhancement.

-How load balance is considered for anchor carrier case.

-Need for defining more new band

Further enhancements to IAB (RWS-210166)

Comments/questions received from 5 companies in 1st round of email discussion, the questions raised on the following points.

-Measurements and solutions for those UEs' mobility

-Structure and L1/L2/L3 functionalities expected to smart repeater

-Scenario for mobile IAB.

-Enhancements to reduce interruption and interference by mobility

-Local service support in the high speed vehicle

-Interface needed between gNB and smart repeater

Further comments/questions from 1 companies received in 2nd round of email discussion in response to 1st round email discussion

-L2 or L3 architecture for local service