RAN-R18-WS-non-eMBB-ZTE - Version 0.0.4
RAN

3GPP TSG RAN Rel-18 workshop RWS-210605

e-Meeting, June 28th - July 2nd, 2021

Source: **ZTE**

Title: **Email discussion summary for [RAN-R18-WS-non-eMBB-ZTE]**

Agenda Item: **4.2**

Document for: **Discussion**

1 Introduction

This document summarizes the discussion on ZTE contributions [1-11] submitted to the agenda item 4.2.

[1] RWS-210467, Evolution of massive NR based IoTs for 5G Advanced, *ZTE, Sanechips*

[2] RWS-210468, Enhancements on NTN for 5G Advanced, *ZTE, Sanechips*

[3] RWS-210469, Discussion on Working Areas of XR for 5G Advanced, *ZTE, Sanechips*

[4] RWS-210470, Further enhancement for Sidelink, *ZTE, Sanechips*

[5] RWS-210471, Evolution of NR positioning in Rel-18, *ZTE, Sanechips*

[6] RWS-210472, Mesh based NR LAN, *ZTE, Sanechips*

[7] RWS-210473, MBS Enhancement for 5G Advanced, *ZTE, Sanechips*

[8] RWS-210474, Support of UAV for 5G Advanced, *ZTE, Sanechips*

[9] RWS-210475, Support of Mobile IAB for 5G Advanced, *ZTE, Sanechips*

[10] RWS-210476, Rel-18 NR RedCap evolution, *ZTE, Sanechips*

[11] RWS-210477, Support of ATG for 5G Advanced, *ZTE, Sanechips*

The following is the timeline of the discussion:

Round 1 Q&A:

- Questions: June 14 08:00 UTC – June 17 8:00 UTC;

- Answers: June 17 8:00 UTC – June 18 23:59 UTC

Round 2 Q&A:

- Questions: June 21 08:00 UTC – June 23 8:00 UTC;

- Answers: June 23 8:00 UTC – June 24 18:00 UTC

Before June 25 18:00 UTC, email discussion summary is to be uploaded.

2 General Comments

This section is to collect general comments on the contributions [1-11]. No general comments have been received.

3 Summary of Q&A and comments on contributions

3.1 RWS-210467 Evolution of massive NR based IoTs for 5G Advanced

In RWS-210467, we present our views on the evolution of NR based massive IoT for 5G-Advanced. Basically we think the transmission efficiency could be further improved for some mMTC applications like wide area sensor monitoring and event driven alarms. And some other IoT applications like advanced smart metering and factories of the future require both high connection density and high reliability, which may not be fulfilled well by the current NB-IoT or RedCap. In addition, we found that for NTN scenario the user density for connected mode UE is quite limited due to the large cell size, and thus the number of configurable resources and proper idle/inactive UE distribution can be further studied. Given the above motivation and some preliminary evaluations provided in the appendix, the following enhancements are proposed.

For Rel-18, transmission efficiency and connection density can be further enhanced, e.g.

- Small data transmission through RACH or pre-allocated resources from idle state directly

- Support more flexible UE distribution for high user density in IDLE/INACTIVE modes

- Extend the number of configurable resources (e.g. preambles and RNTIs) to support huge amount of UEs in an extremely large cell size e.g. for NTN. Study the gap and identify the potential enhancements.

- Enhancements on integration of preamble and DMRS functionality *(and therefore some resources can be saved to support more connections especially in small cell scenarios)*

- Enhancements on PRACH/preamble including perspectives of capacity and latency *(considering differentiation of many services e.g. CovEnh, RedCap, SDT which may rely on PRACH/preamble)*

- Support of multiple layer MsgA PUSCH for more efficient small data transmission

- Sensing based small data transmission *(e.g. LBT applied for CG-SDT)*

Note: the first two Rel-18 objectives can be considered in this item or another separate item dedicated for enhancements on IDLE/INACTIVE (RWS-210485) under agenda item 4.3.

3.1.1 Questions/Comments (Round1)

Feedback Form 1: Questions/comments on the aspects discussed in RWS-210467 (Round 1)

1 – Asia Pacific Telecom co. Ltd

We wonder whether the current EDT (if supported in Rel-17 IoT over NTN) can support small data transmission.

2 – China Telecommunications

We have a question for page 4. Rel-14 FeMTC introduced the data rate improvements in order to address a wider range of use cases for Cat-M UEs with peak rates more than 1Mbps(Cat-M2 has a UE bandwidth of 5 MHz). So is there some use case overlapping between these Rel-14 Cat-M UEs and low data rate RedCapUEs with data rate 1 10Mbps?

3 – Intel Corporation (UK) Ltd

Q1: Could you please provide some background (beyond R14 targets) to establish the urgency for support of very high connection density, beyond solutions offered by LPWA and existing NR solutions?

Q2: What specification-based solutions are envisioned for ”more flexible UE distribution” for UEs in Idle mode?

4 – InterDigital Communications

In slide 7, LBT applied for small data transmission is listed as potential enhancements. Can you elaborate more on why such enhancement is needed and what will be the objective to achieve?

3.1.2 Response (Round 1)

Feedback Form 2: Response to questions/comments for RWS-210467 (Round 1)

1 – ZTE Corporation

Questions/comments from Asia Pacific Telecom #1:

We wonder whether the current EDT (if supported in Rel-17 IoT over NTN) can support small data transmission.

Response to questions/comments from Asia Pacific Telecom #1:

Thanks for the question. This is actually in line with our first objective ”small data transmission through RACH or pre-allocated resources from idle state directly” listed as above. We think the pre-allocated resources can be either UE-specific (similar to CG/EDT) or common to a group of UEs (similar to RACH) to further increase the transmission efficiency and spectral efficiency.

2 – ZTE Corporation

Questions/comments from China Telecommunications #2:

We have a question for page 4. Rel-14 FeMTC introduced the data rate improvements in order to address a wider range of use cases for Cat-M UEs with peak rates more than 1Mbps(Cat-M2 has a UE bandwidth

of 5 MHz). So is there some use case overlapping between these Rel-14 Cat-M UEs and low data rate RedCapUEs with data rate 1 10Mbps?

Response to China Telecommunications #2:

Thanks for the question. Compared with Cat-M2 UEs, NR RedCap UEs can potentially have better performance e.g. in terms of URLLC. As mentioned in our tdoc, massive IoT use cases with URLLC requirements can be supported by NR RedCap UEs. Therefore, the use cases for Cat-M2 UEs and low data RedCap UEs can be different.

3 – ZTE Corporation

Questions/comments from Intel #3:

Q1: Could you please provide some background (beyond R14 targets) to establish the urgency for support of very high connection density, beyond solutions offered by LPWA and existing NR solutions?

Q2: What specification-based solutions are envisioned for "more flexible UE distribution" for UEs in Idle mode?

Response to Intel #3:

Thanks for the questions.

To Q1: The KPI for connection density itself could be similar to R14 target, e.g. 1 million/km2. However, we found that there are more applications requires combination of KPIs in different dimensions. For example, the wide area sensor monitoring and event driven alarms [TR 22.891, 5.20] requires massive connections in an efficient manner (i.e. efficient data transmission with limited resource and signalling usage); Advanced smart metering for smart grid [TR 22.867] and Factories of the Future (from TR22.804) requires the support of massive connections considering certain URLLC requirements. In addition, for NTN, the cell size could much larger than that of the terrestrial cell, user density for connected mode UE is quite limited and therefore needs further enhancements.

To Q2: The following solutions can be considered for UE distribution for idle and inactive mode. More details can be found in our paper RWS-210485.

Enhanced cell reselection with redistribution factor (similar as LTE), with which the UE can be distributed to different cells by cell reselection. Each candidate redistribution target (cell/frequency) configured with redistribution factor and UE chooses redistribution target based on UE ID. Some NR specific features, e.g. SSB/slice/NPN/SDT should also be considered when we design the redistribution factor based mechanism in NR.

Inter-cell fast initial access (i.e. fast initial access from camped cells to other cells). The UE will acquire the initial access configuration for other cells through the SIB of camped cell, and can switch to the target cell and initiate the access procedure immediately to avoid the load triggered HO or redirection of UE.

4 – ZTE Corporation

Questions/comments from InterDigital #4:

In slide 7, LBT applied for small data transmission is listed as potential enhancements. Can you elaborate more on why such enhancement is needed and what will be the objective to achieve?

Response to InterDigital #4:

Thanks for the question. We think in order to support high connection density with enhanced transmission efficiency, pre-allocated resources that are shared by a group of UEs (or even all UEs performing SDT) would be necessary, which would result in contention-based transmission among the UEs. In such case, LBT can be applied to alleviate the collision and thus provides capacity gain (see the preliminary results in slide#13 in our contribution). Regarding the potential objective, we think reusing the existing LBT procedure (LBE or FBE) for unlicensed band can be the starting point.

3.1.3 Questions/Comments (Round 2)

Feedback Form 3: Further questions/comments on RWS-210467 (Round 2)

1 – China Unicom

Thanks for your contribution.

Q1: In slide 9, could you please clarify the gain from integrated preamble and DMRS functionality comparing with preamble only and DMRS only functionalities and what the reason that you point out the small cell scenarios in terms of more resources saved.

Q2: Would you please elaborate more about how to integrate preamble and DMRS functionality and the target scenario for that?

3.1.4 Response (Round 2)

Feedback Form 4: Response to questions/comments for RWS-210467 (Round 2)

1 – ZTE Corporation

Questions/comments from China Unicom #1:

Thanks for your contribution.

Q1: In slide 9, could you please clarify the gain from integrated preamble and DMRS functionality comparing with preamble only and DMRS only functionalities and what the reason that you point out the small cell scenarios in terms of more resources saved.

Q2: Would you please elaborate more about how to integrate preamble and DMRS functionality and the target scenario for that?

Response to China Unicom #1:

Response to Q1:

To clarify, we did not compare the integrated preamble and DMRS with preamble only or DMRS only here. Actually we consider the preamble only (or DMRS only) as a special case of integrated preamble and DMRS since the preamble (or DMRS) will do both TA estimation and channel estimation. The results show that in some cases we can save the resource overhead of preamble (or DMRS) without performance degradation compared to the baseline 'preamble+DMRS'. Small cell is suitable for DMRS only structure, since the UEs can be considered as synchronized and therefore TA estimation and adjustment may not be necessary.

Response to Q2:

For the example of small cell as above, if we consider DMRS only channel structure (i.e. resource for preamble is saved), in this case the capacity of DMRS resources still needs to be improved (e.g. to support more sequences or cyclic shifts) to alleviate the potential collision issue for 2-step RACH or SDT, which brings the idea of integrated preamble and DMRS. This is just an example, and we are open for various approaches to achieve the purpose.

3.2 RWS-210468 Enhancements on NTN for 5G Advanced

In RWS-210468, our views on potential enhancements for NTN in 5G Advanced are provided with the following consideration:

Architecture

- Considering the re-generative payload (e.g., gNB on-board/CU-DU) at satellite/HAPS side to reduce scheduling latency and enable more applications.

Assumptions-Use case

- Supports on the GNSS incapable UE or poor GNSS case

- Optimized cooperation between TN and NTN side as stepping stone for integrated network

Performance improvement

- Enhancement to improve the supported UE density (only 400 UE/km^2 is assumed for IoT-NTN in Rel-17), e.g., PRACH capacity improvement

- Enhancement on mobility/RLF/paging/transmission, e.g., in case of discontinuous service

- Enhancement on power efficiency with usage of GNSS for synchronization

- Enhancement on UL performance to enable the direct linkage between satellite and smart phone

- Enhancement on DL performance to improve the system capability including

o Optimized DM-RS configuration to harvest LoS-based channel condition

o Optimized CSI feedback to deal with CSI aging (e.g., by enabling the prediction at UE side).

o Optimized Beam management to reduce the overhead and ensure the service quality (pending for Rel-17)

- Enabling DC or PHY-based solution based on multiple-satellites to improve the service continuity

New functionality

- Enabling NR-NTN network based positioning as potential area

3.2.1 Questions/Comments (Round 1)

Feedback Form 5: Questions/comments on the aspects discussed in RWS-210468 (Round 1)

1 – Asia Pacific Telecom co. Ltd

We share the same view that supports on the GNSS incapable UE or poor GNSS case shall be considered. We wonder whether NR-NTN network-based positioning shall have priority or UE with GNSS but without

UL timing/freq. pre-compensation shall be done first.

2 – Lenovo (Beijing) Ltd

We agree that without GNSS UE should be supported in R18. We agree that DC between different satellites is beneficial for service continuity and we also prefer CA between same/different satellite for performance improvement. We agree that NTN based positioning is a potential area.

3 – Guangdong OPPO Mobile Telecom.

For NTN based positioning, is the intention to use NR positioning as a baseline and aims for a similar use case, e.g. indoor positioning?

4 – MediaTek Inc.

On NTN IoT:

Q1. Rel-17 NTN IoT could not conclude there was issue for PRACH capacity requiring enhancements. What would be the scope of enhancements?

Q2. What is the gap from R17 Coverage Enhancements (assuming up to 32 slot aggregation / repetitions), the justification, need, and use case?

Q3. What is the use case and scope of enhancement for GNSS incapable UE or poor GNSS case and impact on specifications?

On NTN NR:

Q1: What is the gap from R17 Coverage Enhancements (assuming up to 32 slot aggregation / repetitions), the justification, need, and use case for Enhancement on UL performance to enable the direct linkage between satellite and smart phone? The expected data rates?

Q2: What is the use case and scenarios for DL performance to improve the system capability, expected benefits and gains of Beam Managements compare to re-using Rel-15 NR / Rel-17 NTN NR solutions, would impact of new DM RS configuration and CSI feedback on specification and implementation be justified by the gains?

Q3: What is the use case and scenarios for service continuity. Is DC asynchronous or synchronous? What is the scope of PHY based solutions and impact on specifications?

Q4: Is network-based positioning for LEO or GEO? For GEO this may not be possible as standalone without use of GNSS due to not enough GEO satellite in coverage; for LEO, the measurements can take x10s or x100s of seconds based on our understanding of legacy LEO satellites-based positiong methods. What is the expected benefits, scenarios and use case?

5 – THALES

We agree that DC combined with CA between different satellites is beneficial for performance improvement. We also agree that NTN based positioning is an important feature for reliable UE location.

How to support both types of UE, with and without GNSS capability ?

6 – Intel Corporation (UK) Ltd

Q: Enabling NR NTN without GNSS at the UE will lead to decreased system performance due to larger PRACH reception window (especially for GEO) and frequent PRACH transmission (especially for LEO). Do you expect that significant part of connections will correspond to UEs without GNSS?

7 – CATT

Generally, we're pretty much aligned in several topics for the scope of NR NTN Rel-18.

A few questions for clarification:

1. for the "NR-NTN network based positioning", this is linked to the use case "Supports on the GNSS incapable UE or poor GNSS case"?

2.For the discontinuous coverage scenario, NR NTN just follow the discussion from IoT NTN? Or any additional enhancement is expected?

8 – Samsung Electronics Co.

1) For CSI prediction, what could be the benefit of the prediction at UE side compared to the prediction at gNB/satellite side?

2) What does "Optimized cooperation between TN and NTN" mean? Is it mobility between TN and NTN or something else?

3) What would be an example of enhacement on transmission in case of discontinuous service?

9 – China Unicom

Thanks for this contribution.

We share the same view of the re-generative payload. One question for clarification, what is the difference between satellite and HAPS?

3.2.2 Response (Round 1)

Feedback Form 6: Response to questions/comments for RWS-210468 (Round 1)

1 – ZTE Corporation

Questions/comments from Asia Pacific Telecom #1:

We share the same view that supports on the GNSS incapable UE or poor GNSS case shall be considered. We wonder whether NR-NTN network-based positioning shall have priority or UE with GNSS but without UL timing/freq. pre-compensation shall be done first.

Response to Asia Pacific Telecom #1:

Thanks for your question. The motivation of these two aspects are partially coupled. Whether both of them should be supported or any priority can be further discussed according to the needs. For example, if the momentum is to extend the market, maybe the GNSS-incapable issue should be done firstly. Otherwise, to satisfy the regulation issue, we can work on positioning. The overall load for this topic also matters.

2 – ZTE Corporation

Questions/comments from Lenovo #2:

We agree that without GNSS UE should be supported in R18. We agree that DC between different satellites is beneficial for service continuity and we also prefer CA between same/different satellite for performance improvement. We agree that NTN based positioning is a potential area.

Response to Lenovo #2:

Thanks for your support.

3 – ZTE Corporation

Questions/comments from OPPO #3:

For NTN based positioning, is the intention to use NR positioning as a baseline and aims for a similar use case, e.g. indoor positioning?

Response to OPPO #3:

Thanks for your question. The intention for NTN based positioning has some differences compared to TN based. The outdoor part should be the prioritized scenarios and further enhancement on the indoor can be considered once the link budget is sufficient.

W.r.t the solution, the traditional solution can be the reference, but we need think more on the LEO case that all satellites are moving with shorter service duration.

4 – ZTE Corporation

Questions/comments from MediaTek #4: On NTN IoT

Q1. Rel-17 NTN IoT could not conclude there was issue for PRACH capacity requiring enhancements. What would be the scope of enhancements?

Q2. What is the gap from R17 Coverage Enhancements (assuming up to 32 slot aggregation / repetitions), the justification, need, and use case?

Q3. What is the use case and scope of enhancement for GNSS incapable UE or poor GNSS case and impact on specifications?

Response to MediaTek #4: On NTN IoT

A1: For Rel-17, the baseline assumption is only 400 UE per km^2, which is much lower than the requirement for the typical IoT case as captured in TR 36.763. Moreover, the potential congestion on the initial access is also discussed. This issue is not concluded as essential issue due to the limited time for R17. We can improve it in R18.

A2: This question may be for NR-NTN. The issue is related to the assumption on the effective antenna gain for smart phone. In the previous discussion, lower antenna gain as -5dB is proposed by some companies, in this way, the smart phone is unable to reach satellite service, e.g., for Voice and multi-media.

A3: The intention is to support the GNSS-incapable UE for covering more potential use case, e.g., indoor. Moreover, additional mechanism is helpful to alleviate the requirement at UE side for pre-compensation. W.r.t the spec impact, we can start with optimization on the RACH design.

Questions/comments from MediaTek #4: On NTN NR

Q1: What is the gap from R17 Coverage Enhancements (assuming up to 32 slot aggregation / repetitions), the justification, need, and use case for Enhancement on UL performance to enable the direct linkage between satellite and smart phone? The expected data rates?

Q2: What is the use case and scenarios for DL performance to improve the system capability, expected benefits and gains of Beam Managements compare to re-using Rel-15 NR / Rel-17 NTN NR solutions, would impact of new DM RS configuration and CSI feedback on specification and implementation be justified by the gains?

Q3: What is the use case and scenarios for service continuity. Is DC asynchronous or synchronous? What is the scope of PHY based solutions and impact on specifications?

Q4: Is network-based positioning for LEO or GEO? For GEO this may not be possible as standalone without use of GNSS due to not enough GEO satellite in coverage; for LEO, the measurements can take

x10s or x100s of seconds based on our understanding of legacy LEO satellites-based positiong methods. What is the expected benefits, scenarios and use case?

Response to MediaTek #4: On NTN NR

A1: Please refer to A2 for NTN-IoT above.

A2:

- For BM management part, it can be leftover of R17 NTN discussion. Comparing to the legacy mechanism, additional solution to reduce signalling overhead along with saving on the measurement can be support for the case, especially with FRF>1.
- For CSI feedback, additional content for CSI feedback can be considered based on prediction from UE side to alleviate the impact of CSI aging.
- For new DM-RS configuration, it's mainly based on LoS dominated channel condition and overhead for DM-RS can be reduced with sparse configuration.

A3: The continuous service can refer to the connectivity between TN and NTN or satellites. For the DC part, it's preferred to be synchronous for satellite over same orbit type. But in case of cross-orbit, asynchronous assumption may be more realistic.

A4: We prefer to study the possibility based on LEO satellite. For the usage of positioning, it's mainly to satisfy the regulation needs to avoid fake position report and provide standalone service, which is decoupled from non-3GPP solution.

5 – ZTE Corporation

Questions/comments from Thales #5:

We agree that DC combined with CA between different satellites is beneficial for performance improvement. We also agree that NTN based positioning is an important feature for reliable UE location.

How to support both types of UE, with and without GNSS capability ?

Response to Thales #5:

Thanks for your question. For the DC part, we can further refine the scope with certain priority, e.g., cross orbit or same type of satellite.

W.r.t the support on the GNSS and non-GNSS based UE, in our view, additional configuration should be defined to provide guidance on the UE's behavior. Normally, the UE with GNSS can still reuse the resource for GNSS incapable UE during the initial access.

6 – ZTE Corporation

Questions/comments from Intel #6:

Q: Enabling NR NTN without GNSS at the UE will lead to decreased system performance due to larger PRACH reception window (especially for GEO) and frequent PRACH transmission (especially for LEO). Do you expect that significant part of connections will correspond to UEs without GNSS?

Response to Intel #6:

Thanks for your question. The support on the UE without GNSS is just to further boost the application case of NTN service. Moreover, with additional mechanism, the requirement on the UE can be reduced, it's also friendly to low-RANK device with potential connection to NTN.

7 – ZTE Corporation

Questions/comments from CATT #7:

Generally, we're pretty much aligned in several topics for the scope of NR NTN Rel-18.

A few questions for clarification:

Q1. for the "NR-NTN network based positioning", this is linked to the use case "Supports on the GNSS incapable UE or poor GNSS case"?

Q2.For the discontinuous coverage scenario, NR NTN just follow the discussion from IoT NTN? Or any additional enhancement is expected?

Response to CATT #7:

Thanks for your question.

A1: there are two motivations behind this proposal. And the major reason is to satisfy the regulation requirement to avoid the potential report on the fake location from UE side.

Then second one is to improve the synchronization/transmission for the UE without GNSS or poor GNSS.

A2: In our views, the discussion for IoT-NTN can be the baseline. But since the connectivity duration for NR UE is much longer than the IoT case with sporadic traffic, additional consideration to ensure the service and traffic continuity is also needed from PHY perspective.

8 – ZTE Corporation

Questions/comments from Samsung #8:

Q1) For CSI prediction, what could be the benefit of the prediction at UE side compared to the prediction at gNB/satellite side?

Q2) What does "Optimized cooperation between TN and NTN" mean? Is it mobility between TN and NTN or something else?

Q3) What would be an example of enhacement on transmission in case of discontinuous service?

Response to Samsung #8:

A1: Based on the current mechanism, the gNB/satellite will get the CSI mainly based on the feedback or UL measurement. However, due to quantization error and unaligned interference at UE/BS side, the accuracy for prediction at gNB will be limited, especially for the case with poor UL link budget. Then, the UE side solution is more preferred with benefits on performance and overhead reduction for feedback.

A2: Yes, mobility between TN and NTN is the major one and potential DC is also possible.

A3: The main work is related to RAN2 as discussion in IoT-NTN for set 4. But similar situation can also be considered for NR-NTN to deal with coverage hole for initial constellation. From RAN1 perspective, additional behavior as postponed transmission can also be possible to reduce UE power consumption.

9 – ZTE Corporation

Questions/comments from China Unicom #9:

Thanks for this contribution.

We share the same view of the re-generative payload. One question for clarification, what is the difference between satellite and HAPS?

Response to China Unicom #9:

Thanks for your question. As the baseline assumption for Rel-17 discussion, the HAPS can be supported with solution defined for NTN. Based on the discussion, the main different is due to deployment assumption

including the usage of frequency band. For example, if the shared spectrum is used for both TN and HAPS based network, more works on handling the co-channel or cross-link interference is needed and dual-connectivity between TN and HPAS can be further optimized. Moreover, RAN4 discussion will be independent.

3.2.3 Questions/Comments (Round 2)

Feedback Form 7: Further questions/comments on RWS-210468 (Round 2)

1 – Beijing Xiaomi Mobile Software

Thanks for the proposal. We share the same view on many areas. One clarification question is on the performance improvement, enhancement on the PRACH capacity to support denser UE distribution, what do you think of enhancements on other channels such as paging capacity.

The other one question is on the coverage enhancement. What's your view on the target service when we evaluate the coverage performance.

2 – Guangdong OPPO Mobile Telecom.

Thanks for the answers. A follow-up question is that if the intention is to prioritize outdoor positioning, is it also an intention to target the UE without GNSS capability?

3 – Samsung Electronics Co.

Q2: For mobility between TN/NTN, do you assume here that TN and NTN are owned by one single operator?

3.2.4 Response (Round 2)

Feedback Form 8: Response to questions/comments for RWS-210468 (Round 2)

1 – ZTE Corporation

Questions/comments from Xiaomi #1:

Thanks for the proposal. We share the same view on many areas. One clarification question is on the performance improvement, enhancement on the PRACH capacity to support denser UE distribution, what you think of enhancements on other channels such as paging capacity.

The other one question is on the coverage enhancement. What's your view on the target service when we evaluate the coverage performance?

Response to Xiaomi #1:

Thanks for your questions.

For the paging capacity issue, according to the study in R16 SI, we have agreed that "The paging capacity should also be considered together with the cell's capacity to support UEs accessing the cell." Then, it's more reasonable to start with PRACH enhancement and we can further jointly improve paging.

2 – ZTE Corporation

Questions/comments from OPPO #2:

Thanks for the answers. A follow-up question is that if the intention is to prioritize outdoor positioning, is it also an intention to target the UE without GNSS capability?

Response to OPPO #2:

Thanks for your question. In general, there are two motivations for positioning and one of them is for the UE without GNSS capability. But the major reason is to satisfy the regulation requirement to avoid any potential report on fake location from UE side.

3 – ZTE Corporation

Questions/comments from Samsung #3:

Q2: For mobility between TN/NTN, do you assume here that TN and NTN are owned by one single operator?

Response to *Samsung* #3:

Thanks for your question. This is mainly related to the deployment. But if the infrastructure (e.g. core network and RAN part for TN and NTN) can be shared among operators, the corresponding performance can still be ensured.

3.3 RWS-210469 Discussion on Working Areas of XR for 5G Advanced

RWS-210469 synthesizes the RAN1 evaluation results for the ongoing Rel-17 XR SI. Consequently, from power and capacity perspectives, challenges are identified and the proposed working areas for enhancement are listed below:

A work item with study phase can be considered:

- Specify enhancements on dynamic grant including link adaptation techniques for (Re-)Tx, pre-emption /cancellation under DL/UL concurrent transmission, network coding [RAN1, RAN2]

o Enhanced CQI measurement/report for better Tx efficiency

o Pre-emption/Cancellation based on QoS parameter/traffic characteristic difference, e.g. importance/PDB/PER, among different data streams

o NW coding to exploit link diversity, RAN protocol stack adaptation for application layer traffic characteristic and requirements

- Support of Inter-cell Interference Coordination [RAN3, RAN1]

o Interface/Signaling to facilitate interference related information exchange

o Mechanism to mitigate interference of neighbor cell to aide scheduling

- Study and if needed, specify the 5QI aspects and relevant pre-emption/cancellation mechanism to enable efficient delivery of (concurrent) XR services [SA4, RAN1]

o Further study the potential spec. impact in interaction with ADU (Application Data Unit), differentiation

on 5QI PDB requirement differentiation within a single stream

o Adaptive Tx for multiple streams including priority based pre-emption/cancellation

- Specify enhancements on dynamic grant including eCDRX(Enhancements of CDRX) [RAN2, RAN1]

o Dynamically change DRX parameters to align the DRX cycle and traffic cycle. e.g., change the start time of DRX ON Duration or change DRX cycle according to fixed patterns or indication by DCI

- Study and if needed, specify power saving schemes jointly considering UL and DL traffic, modified R16/R17 power saving schemes, UE assistance information [RAN1,RAN2]

o Mechanism to ensure DL and UL alignment

o Study and specify whether cross-slot scheduling, WUS, PDCCH skipping/search space set group switching are modified.

o Dropping of some consecutive UL transmissions

3.3.1 Questions/Comments (Round 1)

Feedback Form 9: Questions/comments on the aspects discussed in RWS-210469 (Round 1)

1 – CATT Thanks for sharing the idea of NR enhancement for XR. The proposals Link adaptation techniques for (Re-)Tx Pre-emption/Cancellation under DL/UL Concurrent Transmission, Network coding, Enhancements related to Delay-Aware Scheduler, Inter-cell Interference Coordination, and Adaptive Txfor multiple streams with priority based pre-emption/cancellation 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.
2 – DOCOMO Communications Lab. Thanks for sharing the ideas on enhancements for XR. Regarding ”Pre-emption/Cancellation based on QoS parameter/traffic characteristic difference, e.g. importance/PDB/PER, among different data streams,” what RAN1 impacts are you expecting? In our understanding, the proposed finer granularity is one of them. Any other views for the pre-emption/cancellation enhancements at RAN1 especially from the perspective of ”based on QoS parameter/traffic characteristic”?
3 – Sony Europe B.V. Thanks for your paper. For CDRX and Power save, do you think that CDRX enhancements are separate from Power saving enhancements, where the CDRX enhancements should be specified, while other UE power save enhancements should only be studied. Would you regard C-DRX as higher priority? And do you see any difference in prioritization between potential UL and DL enhancements ,e.g. in case of more DL heavy VR applications, or more UL related AR traffic scenarios.

4 – Nokia Corporation

Thank you for your contribution.

1) Regarding the link adaptation techniques, do you have some specific new aspects to evaluate? There has been many evaluations in the past.

2) What is the difference between the ”Pre-emption/Cancellation under DL/UL Concurrent Transmission” and ”Adaptive Tx for multiple streams with priority based pre-emption/cancellation” ?

5 – MediaTek Inc.

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

- 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 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 the 5QI enhancement, how is it planned to progress the work in SA and RAN for QoS perspective?
- For Link adaptation for (Re-) Tx by report of CQI, what additional study of enhancements on top of Rel-17 uRLLC/IIoT is needed?
- For inter-cell interference coordination, m-TRP is a possible NR solution for interference and transmission coordination. What is the expected benefit over existing m-TRP solution?

6 – LG Electronics Inc.

Thanks for the contribution.

Q1) In your paper (RWS-210469), you proposed the network coding as one of the enhancement techniques on dynamic grant. As the discussion on network coding is not new in 3GPP, we would like to understand the aspects that are more relevant for XR scenario or traffic.

7 – China Mobile International Ltd

Could you calrify the the difference of XR with other services in terms of the following objective:

- Support of Inter-cell Interference Coordination [RAN3, RAN1]

o Interface/Signaling to facilitate interference related information exchange

  o Mechanism to mitigate interference of neighbor cell to aide scheduling

3.3.2 Response (Round 1)

Feedback Form 10: Response to questions/comments for RWS-210469 (Round 1)

1 – ZTE Corporation

Questions/comments from CATT #1:

Thanks for sharing the idea of NR enhancement for XR. The proposals Link adaptation techniques for (Re-)Tx

Pre-emption/Cancellation under DL/UL Concurrent Transmission, Network coding, Enhancements related to Delay-Aware Scheduler, Inter-cell Interference Coordination, and Adaptive Txfor multiple streams with priority based pre-emption/cancellation 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.

Response to CATT #1:

Thanks for the good comments! So far, traffic model for single/multi stream and evaluation methodologies are finalized/discussed in the Rel-17 XR SI. Thus our understanding is that proponents shall try to justify the relevant enhancements through simulations or analysis based on the agreed traffic/evaluation methodology. In case some enhancements are deemed feasible and beneficial, it can be pursued in Rel-18 WI though not necessarily in the dedicated WI for XR. Specifically, the traffic aware DRX adaptation seems to have already evaluated and proposed by quite some companies and closely related to XR Traffic. We also believe enhancement addressing co-existence of XR traffic with other traffic is worth investigating to ensure the commercial viability.

2 – ZTE Corporation

Questions/comments from DOCOMO Communications Lab #2:

Thanks for sharing the idea of NR enhancement for XR. The proposals Link adaptation techniques for (Re-)Tx

Pre-emption/Cancellation under DL/UL Concurrent Transmission, Network coding, Enhancements related to Delay-Aware Scheduler, Inter-cell Interference Coordination, and Adaptive Txfor multiple streams with priority based pre-emption/cancellation 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.

Response to DOCOMO Communications Lab #2:

Thanks for your attention on our proposal. First of all, a finer granularity for pre-emption/cancellation, as you said, is one of the expected RAN1 impacts. Then, new indicator in DCI and indication method are also foreseeable RAN1 impacts to that end. For other views on pre-emption/cancellation, it works under the premise that RAN1 is capable of knowing the QoS (e.g. PER and PDB) and the "importance" parameter of different data streams or different users. As a result, application awareness at RAN1 should be considered. And RAN1 has identified different data streams through 5QI so far. However, the identification capability of current 5QI for different QoSs or priorities for XR service consisting of multiple streams is limit. Hence, improvement of 5QI is needed and cooperation among RAN1, SA2 and SA4 is required for proceeding the improvement.

3 – ZTE Corporation

Questions/comments from Sony #3:

Thanks for your paper. For CDRX and Power save, do you think that CDRX enhancements are separate from Power saving enhancements, where the CDRX enhancements should be specified, while other UE

power save enhancements should only be studied. Would you regard C-DRX as higher priority? And do you see any difference in prioritization between potential UL and DL enhancements ,e.g. in case of more DL heavy VR applications, or more UL related AR traffic scenarios.

Response to Sony #3:

Thanks for your attention on our proposal.

For the first and the second question, up to RAN1#105-e, companies have submitted abundant evaluation results for CDRX, while evaluation results for other power saving scheme are limited. CDRX enhancement indeed has a higher priority to be studied and specified. However, some proposed eCDRX (enhanced CDRX) still cause large capacity loss owing to the tradeoff between power consumption and capacity, according to companies' simulation results. As a result, eCDRX should be further studied to minimize the impacts on capacity.

For the third question, according to the simulation results of companies in RAN1#105e, it can be observed that DL is the performance bottleneck, thus should be prioritized in terms of enhancement.

4 – ZTE Corporation

Questions/comments from Nokia #4:

Thank you for your contribution.

1) Regarding the link adaptation techniques, do you have some specific new aspects to evaluate? There has been many evaluations in the past.

2) What is the difference between the "Pre-emption/Cancellation under DL/UL Concurrent Transmission" and "Adaptive Tx for multiple streams with priority based pre-emption/cancellation" ?

Response to Nokia #4:

Thanks for your attention on our proposal.

For Question 1, our answer is that CBG-based re-transmission together with the simplified HARQ ACK reporting and delta CQI reporting are the link adaptation techniques for XR enhancement from our perspective. According to our evaluations, we have found that performance gain can be obtained compared to baseline capacity by using these two techniques.

For Question 2, our answer is that the difference is that Pre-emption/Cancellation is capable of dealing with the collision both in single-stream traffic model and multiple-stream traffic model. From the perspective of "Pre-emption/Cancellation under DL/UL Concurrent Transmission" (i.e., each UE transmits single data stream), we mainly focus on solving the collision problems among UEs with different priorities. From the perspective of "Adaptive Tx for multiple streams with priority based pre-emption/cancellation" (i.e., UEs may transmit multiple stream), we focus on solving the collision problems among different data streams with different QoS and different priorities.

5 – ZTE Corporation

Questions/comments from MediaTek #5:

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

- *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 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 the 5QI enhancement, how is it planned to progress the work in SA and RAN for QoS perspective?*

- *For Link adaptation for (Re-) Tx by report of CQI, what additional study of enhancements on top of Rel-17 uRLLC/IIoT is needed?*

- *For inter-cell interference coordination, m-TRP is a possible NR solution for interference and transmission coordination. What is the expected benefit over existing m-TRP solution?*

Response to MediaTek #5:

Thanks for the questions.

- Considering the dense UL traffic, we think one potential enhancement is to align the DL and UL traffic to reduce the UE energy caused by frequent UL transmission. Meanwhile, as the data arrival is unpredictable due to some factors such as jittering effect and the stringent PDB requirement, another power saving solution is enhanced/dynamic DRX.

- We agree SA input is needed.

- We think RAN1 should try to agree on some observations on the potential benefit of QoS refinement, then SA involvement is needed to incorporate the information in the current 5QI that could be beneficial from RAN1 perspective.

- The study/discussion in Rel-17 uRLLC can be used as starting point.

- m-TRP based transmission can be one of the solutions to mitigate interference to some extent. Moreover, due to the misalignment of the DL/UL transmission in adjacent cells, it would incur inter-cell UE-UE interference, etc., which would finally degrade transmission reliability. Hence, more enhancements should be considered with regard to Rel-16 CLI WI. The details can be found in our Tdoc RWS-210487.

6 – ZTE Corporation

Questions/comments from LGE #6:

Thanks for the contribution.

Q1) In your paper (RWS-210469), you proposed the network coding as one of the enhancement techniques on dynamic grant. As the discussion on network coding is not new in 3GPP, we would like to understand the aspects that are more relevant for XR scenario or traffic.

Response to LGE #6:

Thanks for your question. XR traffic is featured by high data rate, stringent latency and reliability requirement. Network coding can be useful in the sense that one shot transmission with high reliability can be pursued at the cost of reasonable redundancy/duplication.

7 – ZTE Corporation

Questions/comments from China Mobile #7:

Could you calrify the the difference of XR with other services in terms of the following objective:

- Support of Inter-cell Interference Coordination [RAN3, RAN1]

o Interface/Signaling to facilitate interference related information exchange

o Mechanism to mitigate interference of neighbor cell to aide scheduling

Response to China Mobile #7:

Thanks for your question. The inter-cell interference would impact the CSI measurement accuracy, scheduling strategies (e.g.,MCS), and the transmission reliability. And XR service is known for the high data rate and stringent PDB requirement. The negative impact of inter-cell interference on XR traffic would be tougher to relieve compared with other eMBB services. Hence, improving the XR transmission performance is one of the motivation to further enhance the CLI. More details can be found in our Tdoc RWS-210487.

3.3.3 Questions/Comments (Round 2)

Feedback Form 11: Further questions/comments on RWS-210469 (Round 2)

1 – DOCOMO Communications Lab.

Thanks for your kind response. We have two follow-up questions as below:

Q1: We understand that you prefer to enhance the 5QI. Would you prefer to enhance the priority levels at PHY layer in addition to the 5QI? Or, only enhancements of 5QI is in your mind?

Q2: Is the awareness of ”importance” of different data streams only for gNB or for both gNB and UE? In other words, from UE perspective, the ”importance” is determined by UE itself or according to gNB indication?

2 – vivo Communication Technology

Thanks for your contribution. We have following questions:

Q1: We agree that improvement of QoS parameters is needed. Regarding Pre-emption/Cancellation based on QoS parameter, it seems to us that there may be prioritization or cancellation for the flows/packets with different ”importance”, e.g. packets with lower importance may be deprioritized, or the packets exceeding delay bound may be cancelled. Is that the understanding? If not, could you elaborate more what is Pre-emption/Cancellation based on QoS parameter/traffic characteristic difference and how it works with the enhanced QoS parameter? In addition, which layer(s) would ZTE expect that the Pre-emption/Cancellation based on QoS parameter will apply to?

Q2: regarding the power saving schemes, could you explain more about the motivation for Dropping of some consecutive UL transmissions and how it works?

3 – 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 aligning the DL and UL traffic to reduce the UE energy, it may violate the current assumption in SA4 (4ms periodic control for UL with PDB=10ms). Would this be confirmed with SA4?

3.3.4 Response (Round 2)

Feedback Form 12: Response to questions/comments for RWS-210469 (Round 2)

1 – ZTE Corporation

Questions/comments from NTT DOCOMO #1:

Thanks for your kind response. We have two follow-up questions as below:

Q1: We understand that you prefer to enhance the 5QI. Would you prefer to enhance the priority levels at PHY layer in addition to the 5QI? Or, only enhancements of 5QI is in your mind?

Q2: Is the awareness of "importance" of different data streams only for gNB or for both gNB and UE? In other words, from UE perspective, the "importance" is determined by UE itself or according to gNB indication?

Response to NTT DOCOMO #1:

Thanks for your further questions.

For Q1: We are open to PHY layer enhancement using the new information incorporated in 5QI, e.g. preemption/cancellation operation based on 5QI

For Q2: We think some "importance" information may be indicated by the gNB, e.g. the priority level related information of a certain packet.

2 – ZTE Corporation

Questions/comments from vivo #2:

Thanks for your contribution. We have following questions:

Q1: We agree that improvement of QoS parameters is needed. Regarding Pre-emption/Cancellation based on QoS parameter, it seems to us that there may be prioritization or cancellation for the flows/packets with different "importance", e.g. packets with lower importance may be deprioritized, or the packets exceeding delay bound may be cancelled. Is that the understanding? If not, could you elaborate more what is Pre-emption/Cancellation based on QoS parameter/traffic characteristic difference and how it works with the enhanced QoS parameter? In addition, which layer(s) would ZTE expect that the Pre-emption/Cancellation based on QoS parameter will apply to?

Q2: regarding the power saving schemes, could you explain more about the motivation for Dropping of some consecutive UL transmissions and how it works?

Response to vivo #2:

Thanks for your further questions.

For Q1, your understanding is correct in terms of using priority to guide the preemption operation. We think PHY layer may be involved given some priority related information may be indicated to the UE.

For Q2, our intention is in the context of ADU, for power saving purpose, in case some of the preceding packets within an ADU are degraded, the following packets can be dropped for power saving purpose.

3 – ZTE Corporation

Questions/comments from MediaTek #3:

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 aligning the DL and UL traffic to reduce the UE energy, it may violate the current assumption in SA4 (4ms periodic control for UL with PDB=10ms). Would this be confirmed with SA4?

Response to MediaTek #3:

For the jittering issue, we think the proposed solution may work.

For the DL/UL alignment part, we have similar confusion as you as to how to handle the periodicity difference for alignment.

3.4 RWS-210470 Further enhancement for Sidelink

Due to the work load and limited time, Rel-16/Rel-17 sidelink only focuses on limited functionalities. For example, only single carrier operation is supported in Rel-16/17 NR V2X. It is difficult to support some advanced services which requires high data rate (up to 1Gbps) and 99.999% of reliability. To solve this problem, it is suggested in RWS-210470 to support the following enhancements in Rel-18:

- Multi-carrier and carrier aggregation, e.g. synchronization on multiple carriers, packet duplication, handling limited TX/RX capability and carrier selection.

- Slots aggregation

- Sidelink operation on FR2 and beam management on FR2

- Enhance the reliability of mode 2

In addition to the above scope, it is suggested in this contribution to extend the sidelink to unlicensed spectrum to support more vertical services. With unlicensed spectrum, higher data rate can be supported and more services can be operated. With collaboration or traffic balance between the licensed spectrum and unlicensed spectrum, it can provide better services and user experience. In a sum, it is proposed to support sidelink operation on unlicensed band, considering in-network coverage, out-of-network coverage, and partial network coverage. The following objectives can be further considered for Rel-18:

- Specify mechanisms for LBT related procedures in NR-U, including LBT procedures for different SL physical channels, and NR-U should be a starting point. (RAN1, RAN2)

- Specify the physical layer channels and signals and related procedures.(RAN1)

- Enhancements to Mode 1 and Mode 2 resource allocation mechanisms.(RAN1, RAN2)

- Specify the L2/L3 protocols and signaling.(RAN2, RAN3)

- UE Tx and Rx RF requirement(RAN4)

o OCB and PSD requirements should be met on unlicensed band. OCB and PSD requirements should be met on unlicensed band.

3.4.1 Questions/Comments (Round 1)

Feedback Form 13: Questions/comments on the aspects discussed in RWS-210470 (Round 1)

1 – Classon Consulting FUTUREWEI also supports sidelink FR2 and unlicensed enhancements, see RWS-210039 and https://nwm-trial.etsi.org/#/documents/4714 . Do you feel that the sidelink enhancements for FR2 should include work on CSI feedback?
2 – LG Electronics Inc. Q1: Related to Proposal 2, can you elaborate on the reason why SCS is impacted by the introduction of multiple BWP/carrier?
3 – Samsung Electronics Co. Q1: The proposal of sidelink operation on unlicensed band is for FR1 only (i.e., 5/6 GHz unlicensed band) or for both FR1 and 52.6-71 GHz?
4 – Guangdong OPPO Mobile Telecom. On slot aggregation, how to understand it, is it for a single TB spanning across multiple slots or a same TB transmitted via multiple slots by multiple times?
5 – Huawei Tech.(UK) Co.. Ltd Is there a band to prioritize for SL unlicensed, e.g. 60 GHz?
6 – Fraunhofer HHI What enhancements do you have in mind for Mode 1 and Mode 2 resource allocation to facilitate SL-unlicensed? Would they use NR-U or NR-SL as the baseline?
7 – CATT Do you consider unlicensed sidelink as a separate WI , instead of having this topic combined with other sidelink enhancements?
8 – MediaTek Inc. Thanks for the contribution. For slot aggregation in case of multiple carriers with different numerology, is there any need/use case to support the different numerology for SL CA?

9 – Samsung Electronics Co.

Q: The proposal of sidelink operation on unlicensed band is for FR1 only (i.e., 5/6 GHz unlicensed band) or for both FR1 and FR2x?

3.4.2 Response (Round 1)

Feedback Form 14: Response to questions/comments for RWS-2104670 (Round 1)

1 – ZTE Corporation

Questions/comments from FUTUREWEI #1:

FUTUREWEI also supports sidelink FR2 and unlicensed enhancements, see RWS-210039 and https://nwm-trial.etsi.org/#/documents/4714 . Do you feel that the sidelink enhancements for FR2 should include work on CSI feedback?

Response to FUTUREWEI #1:

Thanks for the question. Yes, we think it depends on the assumption of antenna deployment(e.g. more than 2Tx antennas or DAS is supported).

2 – ZTE Corporation

Questions/comments from LGE #2:

Q1: Related to Proposal 2, can you elaborate on the reason why SCS is impacted by the introduction of multiple BWP/carrier?

Response to LGE #2:

Thanks for the question. If sidelink is operating on multiple BWPs/carriers which are in a same band, the signal transmission duration should be aligned on time domain to avoid AGC issue in receiver side. For example, if the transmissions are performed on two carriers with difference SCSs, the slot duration with large SCS is shorter than the slot with small SCS. To avoid AGC issue, multiple slots with large SCS could be aggregated to align a slot with small SCS.

3 – ZTE Corporation

Questions/comments from Samsung #3:

Q1: The proposal of sidelink operation on unlicensed band is for FR1 only (i.e., 5/6 GHz unlicensed band) or for both FR1 and 52.6-71 GHz?

Response to Samsung #3:

Thanks for the question. Considering that in Rel-16/17 that beam management has not been specified and the enhancements on FR2/FR2x is expected to be within the scope of further sidelink enhancement in Rel-18, we prefer to work on only FR1 for sidelink operation on unlicensed band in first phase. For sidelink operation on FR2/FR2x unlicensed band, it can be specified in later phase.

4 – ZTE Corporation

Questions/comments from OPPO #4:

On slot aggregation, how to understand it, is it for a single TB spanning across multiple slots or a same TB transmitted via multiple slots by multiple times?

Response to OPPO #4:

Thanks for the question. Slot aggregation is introduced for supporting multiple BWPs/carriers while avoiding AGC issues. We are open for the solutions of slot aggregation. In our opinion, both two options mentioned above seem to have their own advantages.

5 – ZTE Corporation

Questions/comments from Huawei #5:

Is there a band to prioritize for SL unlicensed, e.g. 60 GHz?

Response to Huawei #5:

Thanks for the question. As replied to Samsung, we think in first phase, we can focus on FR1 only.

6 – ZTE Corporation

Questions/comments from Fraunhofer HHI #6:

What enhancements do you have in mind for Mode 1 and Mode 2 resource allocation to facilitate SL-unlicensed? Would they use NR-U or NR-SL as the baseline?

Response to Fraunhofer HHI #6:

Thanks for the question. We share similar views. The enhancements should be based on NR-U and NR-SL. The enhancements for Mode 1 and Mode 2 should enable the resource for SL transmissions on unlicensed bands both scheduling by Uu and selecting by UE itself, considering the regulations on the use of unlicensed bands and coexistence with other wireless systems(e.g. WIFI). The enhancements, such as LBT, sensing on unlicensed bands, resource reservation HARQ, resource scheduling by Uu, are expected.

7 – ZTE Corporation

Questions/comments from CATT #7:

Do you consider unlicensed sidelink as a separate WI , instead of having this topic combined with other sidelink enhancements?

Response to CATT #7:

Thanks for the question. If the work load of the WI of other sidelink enhancements is large enough, we think unlicensed sidelink could be a separate WI.

8 – ZTE Corporation

Questions/comments from MediaTek #8:

Thanks for the contribution. For slot aggregation in case of multiple carriers with different numerology, is there any need/use case to support the different numerology for SL CA?

Response to MediaTek #8:

Thanks for the question. The UL SCS of multiple carriers could be configured different, and as we concluded in Rel-16, the SCS for sidelink should be the same as UL SCS on the same carrier. In this case, different numerology for SL CA should be considered.

3.4.3 Questions/Comments (Round 2)

Feedback Form 15: Further questions/comments on RWS-210470 (Round 2)

1 – Huawei Tech.(UK) Co.. Ltd

Thanks for the response. Do you think that FR1-only will be enough to support multi-Gbps services such as interactive XR ? We are concerned it may not be.

3.4.4 Response (Round 2)

Feedback Form 16: Response to questions/comments for RWS-210470 (Round 2)

1 – ZTE Corporation

Questions/comments from Huawei #1:

Thanks for the response. Do you think that FR1-only will be enough to support multi-Gbps services such as interactive XR ? We are concerned it may not be.

Response to Huawei #1:

Thanks for your question. We think the spec work of SL-U should take two steps. The first step is to specify the solutions for FR1 and the second step is to consider FR2. Regarding the unlicensed spectrum in FR1, e.g. in China, there are three candidate bands, 5150MHz -5350MHz, 5470MHz -5725MHz, 5725MHz -5825MHz, the total bandwidth is up to 555MHz (200MHz+255MHz,100MHz). It provides a pretty good possibility to support various kinds of traffics. Suppose the evaluation of SL unlicensed in FR1 shows that the multi-Gbps services could not be supported, the support of FR2 in second phase can be further studied.

3.5 RWS-210471 Evolution of NR positioning in Rel-18

In RWS-210471, we suggest a WI with study phase for Rel-18 positioning. The potential enhancement aspects include:

- Aggregation of multiple frequency layers or carriers for PRS/SRS transmission/receptions

- Extend positioning integrity for more positioning methods

- Sidelink positioning to support both absolute and relative positioning in both Out-of-coverage and in-coverage scenarios

3.5.1 Questions/Comments (Round 1)

Feedback Form 17: Questions/comments on the aspects discussed in RWS-210471 (Round 1)

1 – CATT

CATT shares the similar view that the aggregation of DL PRS/UL SRS resources in multiple carriers can be studied in R18.

2 – vivo Mobile Communication Co.

Thanks for your effort on this. We share the view that sidelink positioning is important aspects for positioning related enhancement.

For aggregation of multiple frequency layers or carriers for PRS/SRS transmission/receptions, which WG should starts the work first? Would evaluation methodology and hardware impairements for PRS/SRS over multiple carriers need to be established first?

3 – Guangdong OPPO Mobile Telecom.

Regarding the coherent reception / transmission of multiple PFLs for DL PRS or PRS, R17 has a lot of discussions. The main concern from UE vendor and gNB vendor is the feasibility. Thus, its feasibility should be justified by RAN4 before we can determine to specify something.

4 – Huawei Tech.(UK) Co.. Ltd

Q1: For PRS PFL aggregation, is the intention to support non-contiguous aggregation?

Q2: In the right-handed figure to show the evaluation resutls, for 50MHz+50MHz with 50MHz gap, is the phase continuity assumed within the overall 150MHz bandwidth?

Q3: What do you mean by reducing latency of SL positioning, since there is no baseline SL positioning latency to start from. Is there a requirement on this?

5 – Beijing Xiaomi Mobile Software

- Q1: Do you think the commercial and public safety use cases and requirements identified in SA1 Ranging WI(TR22.855/TS22.261) should be taken into account?
- Q2: According to the definition and the KPI requirements of relative positioning and ranging in TS22.261(see below), do you agree that relative positioning and ranging are different, i.e. relative positioning requires to acquire the 2D/3D coordinates(e.g. the horizontal accuracy of relative positioning set requirements on both distance accuracy and angle accuracy) while Ranging requires to acquire only one component of 2D/3D coordinates(either distance or angle) and thereby only set requirements on one component(either distance or angle)?
  - Relative positioning: relative positioning is to estimate position relatively to other network elements or relatively to other UEs.
  - Ranging: refers to the determination of the distance between two UEs and/or the direction of one UE from the other one via direct communication connection.
- Q3: Do you think unlicensed band should be considered? If so, what frequency range is considered (e.g. 60GHz)?
- Q4: Do you think Redcap UE should be taken into account?

6 – MediaTek Inc.

Q1: For SL positioning, what do you mean by ”**reuse** Uu-like positioning solutions and RS”, Do you mean to actually to reuse the ”principles/concepts” used when designing SL positioning? Or to actually use DL-PRS?

3.5.2 Response (Round 1)

Feedback Form 18: Response to questions/comments for RWS-210471 (Round 1)

1 – ZTE Corporation

Questions/comments from CATT #1:

CATT shares the similar view that the aggregation of DL PRS/UL SRS resources in multiple carriers can be studied in R18.

Response to CATT #1:

Thanks for sharing your view.

2 – ZTE Corporation

Questions/comments from vivo #2:

Thanks for your effort on this. We share the view that sidelink positioning is important aspects for positioning related enhancement.

For aggregation of multiple frequency layers or carriers for PRS/SRS transmission/receptions, which WG should starts the work first? Would evaluation methodology and hardware impairements for PRS/SRS over multiple carriers need to be established first?

Response to vivo #2:

For multiple FLs/carriers aggregation for PRS/SRS, our opinion is that RAN1 and RAN4 can work in parallel for the sake of efficient discussion. At the beginning of Rel-18, from RAN1 side, some high level directions can be discussed, e.g. whether the aggregation should be done only within intra-band or inter-bands, whether only for contiguous carriers, etc. Meanwhile, RAN4 can provide some critical information, such as inter-carrier phase error, inter-carrier timing error etc. to help RAN1 evaluation.

3 – ZTE Corporation

Questions/comments from OPPO #3:

Regarding the coherent reception / transmission of multiple PFLs for DL PRS or PRS, R17 has a lot of discussions. The main concern from UE vendor and gNB vendor is the feasibility. Thus, its feasibility should be justified by RAN4 before we can determine to specify something.

Response to OPPO #3:

For multiple FLs/carriers aggregation for PRS/SRS, yes we had a lot of discussion. We believe this solution is very beneficial at least for the contiguous carriers within the same band. We are also open to get some information/justification from RAN4 at the very beginning of Rel-18.

4 – ZTE Corporation

Questions/comments from Huawei #4:

Q1: For PRS PFL aggregation, is the intention to support non-contiguous aggregation?

Q2: In the right-handed figure to show the evaluation resutls, for 50MHz+50MHz with 50MHz gap, is the phase continuity assumed within the overall 150MHz bandwidth?

Q3: What do you mean by reducing latency of SL positioning, since there is no baseline SL positioning latency to start from. Is there a requirement on this?

Response to Huawei #4:

For Q1, we believe multiple FLs/carriers should be supported at least for the contiguous carriers. We also support non-contiguous aggregation, but open to further discuss.

For Q2, Yes, the total bandwidth is 150MHz including 50MHz gap. The phase continuity is assumed since this is a preliminary evaluation. We can further study what's the impact on positioning accuracy when phase continuity cannot be satisfied.

For Q3, Thanks for the good point. Our intention was to consider latency as we discussed in Rel-17 Uu positioning. We think the requirement for sidelink positioning can refer to the outcome of the ongoing RAN SI. So it is OK for us to further discuss if there is no baseline.

5 – ZTE Corporation

Questions/comments from Xiaomi #5:

- *Q1: Do you think the commercial and public safety use cases and requirements identified in SA1 Ranging WI(TR22.855/TS22.261) should be taken into account?*
- *Q2: According to the definition and the KPI requirements of relative positioning and ranging in TS22.261(see below), do you agree that relative positioning and ranging are different, i.e. relative positioning requires to acquire the 2D/3D coordinates(e.g. the horizontal accuracy of relative positioning set requirements on both distance accuracy and angle accuracy) while Ranging requires to acquire only one component of 2D/3D coordinates(either distance or angle) and thereby only set requirements on one component(either distance or angle)?*
  - *Relative positioning: relative positioning is to estimate position relatively to other network elements or relatively to other UEs.*
  - *Ranging: refers to the determination of the distance between two UEs and/or the direction of one UE from the other one via direct communication connection.*
- *Q3: Do you think unlicensed band should be considered? If so, what frequency range is considered (e.g. 60GHz)?*
- *Q4: Do you think Redcap UE should be taken into account?*

Response to Xiaomi #5:

For Q1, We are OK to also consider the use cases and requirements of ranging and sidelink in the same SI/WI.

For Q2, Yes, we see some difference. But we think the unified enhancement should be pursued in the normative work of Rel-18, e.g. different types of location measurements can be configured for ranging and relative location in the unified enhanced structure/procedure,

For Q3, Since unlicensed band is not supported for regular sidelink in Rel-17, we prefer to focus on licensed band for sidelink positioning in Rel-18. Perhaps, Rel-19 can further consider unlicensed band for sidelink positioning which can rely on the outcome of Rel-18 V2X.

For Q4, Yes, we think RedCap UEs should be considered for positioning enhancement. Actually, we provided the related proposal in our RedCap tdoc RWS-210476 as shown in section 3.10 below. Since this enhancement is more related with RedCap UE processing/complexity, we think it is more suitable to put the discussion there.

6 – ZTE Corporation

Questions/comments from MediaTek #6:

Q1: For SL positioning, what do you mean by "**reuse** Uu-like positioning solutions and RS", Do you mean to actually to reuse the "principles/concepts" used when designing SL positioning? Or to actually use DL-PRS?

Response to MediaTek #6:

Our intension is to reuse Rel-16/17 PRS pattern, positioning solutions including TDOA, RTT, AOD/AOA, etc.. Then, there is no need to design/discuss new PRS patterns and new positioning solutions dedicated for sidelink positioning. Definitely, the signaling and procedures should be redesigned since most signaling for sidelink positioning should be through PC5 instead of Uu interface.

3.5.3 Questions/Comments (Round 2)

Feedback Form 19: Further questions/comments on RWS-210471 (Round 2)

1 – Huawei Tech.(UK) Co.. Ltd

Follow-up question for our Q2 regarding discontinuous aggregation: We also did some evaluation in Rel-17, which shows performance gain of non-contiguous over contiguous aggregation. We wonder if there is any special handling in the ZTE evaluation on the detection of the first path by taking into account the spectrum shaping?

2 – Apple France

For (Uu) accuracy enhancements using aggregated SRSs, in the right hand figure, do you assume same PSD for all three scenarios or same Tx power? Since it is assumed the phase continuity is kept for the case of 50MHz gap, is the latter (same Tx power, reduced PSD) the reason why 50+50+gap is doing worse than 50+50 contagious?

3 – Qualcomm Incorporated

Thanks for the paper and the discussion in the 1st round. With regards to PRS/SRS aggregation, we are also supportive of the feature to be within scope of rel-18. We are also open to consider both intraband contiguous and non-contiguous scenarios, and we also think that the work in RAN1 can start in parallel

to RAN4 work. One question with regards to phase continuity assumption: have you considered partially overlapped PFLs in frequency, to enable the receiver to estimate any amplitude/phase jump between the different PFLs by using the common subband between the 2 PFLs?

4 – Apple GmbH

Thanks for the paper and 1st round discussion. I have two related questions:

1. Regarding the proposed work on ”Extend integrity for more positioning methods”, do you feel any urgency of this work? In other words, how do you compare this to your other objectives (SL positioning and accuracy enhancements) in regards of prioritization? I consider that the positioning integrity falls into the domain of system reliability work rather than the reliability of communication itself. So, there are various ways to address it in 3GPP or out of 3GPP. I am not yet convinced that it is essential or critical to extend this to non-GNSS methods.

2. For the in-coverage SL positioning scenario, do you consider the combined approach to use both Uu-based signals and SL-based signals for relative/absolute positioning?

5 – vivo Mobile Communication Co.

Thanks for further sharing your views.

For the case with non-contiguous positioning RS aggregation, if the phase offset is independent, would there be performance gain?

6 – MediaTek Inc.

1, For aggregation of FPL, the TAE (timing alignment error) is a crucial issue. We want to check with ZTE’s view that, whether the further tougher requirement on TAE is needed, or there are solutions without mandating NW side to reduce TAE?

2, For aggregation of FPL, now we actually can get larger BW for each carrier, for example, in C band. So, what is the potential use case for aggregation of FPL? It seems to us that it could only be used for regulatory use case

7 – CATT

Q1: We noticed that ZTE proposed to extend integrity for more positioning methods, such as RAT-dependent positioning methods and RAT-independent positioning methods. We are open to discuss this enhancement in Rel-18.

What’s ZTE’s view on potential work load and specs impacts on RAN1 group, if we try to specify the positioning integrity for RAT-dependent positioning methods, such as DL-TDOA, UL-TDOA, DL-AoD, UL-AoA and Multi-RTT?

8 – LG Electronics Inc.

Thank you for contribution.

Q1: Regarding multiple PFLs for DL PRS transmission & reception, it seems that you think non-continuous PFLs would be considered for joint estimation. Could you explain more details of the related procedure for a clear understanding?

3.5.4 Response (Round 2)

Feedback Form 20: Response to questions/comments for RWS-210471 (Round 2)

1 – ZTE Corporation

Questions/comments from Huawei #1:

Follow-up question for our Q2 regarding discontinuous aggregation: We also did some evaluation in Rel-17, which shows performance gain of non-contiguous over contiguous aggregation. We wonder if there is any special handling in the ZTE evaluation on the detection of the first path by taking into account the spectrum shaping?

Response to Huawei #1:

At least the common part of our simulation results is that FL aggregation can introduce performance improvement over non-aggregation. We can do some further evaluation including aligning our simulation assumption in Rel-18 normative work phase.

In our initial evaluation, we didn't observe performance gain of non-contiguous over contiguous aggregation. Probably, that is because two contiguous aggregated PFLs normally share similar channel characteristics so that the PFLs can be coherently combined. Regarding how to detect the first path, we simply use a large FFT size to cover aggregated PFLs and assume zero powers in the gap. After that, MUSIC algorithm is applied.

2 – ZTE Corporation

Questions/comments from Apple #2:

For (Uu) accuracy enhancements using aggregated SRSs, in the right hand figure, do you assume same PSD for all three scenarios or same Tx power? Since it is assumed the phase continuity is kept for the case of 50MHz gap, is the latter (same Tx power, reduced PSD) the reason why 50+50+gap is doing worse than 50+50 contagious?

Response to Apple #2:

Yes, we assumed the same Tx power for all scenarios. In our initial thought, the reason why 50+50+gap is doing worse than 50+50 contiguous is that two contiguous aggregated carriers normally share similar channel characteristics so that the carriers can be coherently combined.

3 – ZTE Corporation

Questions/comments from Qualcomm #3:

Thanks for the paper and the discussion in the 1st round. With regards to PRS/SRS aggregation, we are also supportive of the feature to be within scope of rel-18. We are also open to consider both intraband contiguous and non-contiguous scenarios, and we also think that the work in RAN1 can start in parallel to RAN4 work. One question with regards to phase continuity assumption: have you considered partially overlapped PFLs in frequency, to enable the receiver to estimate any amplitude/phase jump between the different PFLs by using the common subband between the 2 PFLs?

Response to Qualcomm #3:

Thanks for sharing the similar views. We haven't considered partially overlapped PFLs in frequency yet. But we are open to further study if the benefits can be identified when we conduct evaluations in Rel-18 work phase.

4 – ZTE Corporation

Questions/comments from Apple GmbH #4:

Thanks for the paper and 1st round discussion. I have two related questions:

1. Regarding the proposed work on "Extend integrity for more positioning methods", do you feel any urgency of this work? In other words, how do you compare this to your other objectives (SL positioning and accuracy enhancements) in regards of prioritization? I consider that the positioning integrity falls into the domain of system reliability work rather than the reliability of communication itself. So, there are various ways to address it in 3GPP or out of 3GPP. I am not yet convinced that it is essential or critical to extend this to non-GNSS methods.

2. For the in-coverage SL positioning scenario, do you consider the combined approach to use both Uu-based signals and SL-based signals for relative/absolute positioning?

Response to Apple GmbH #4:

For the integrity issue, based on the feedback from market and some operators, the high accuracy positioning without integrity info is not acceptable to verticals. And that is why we think the feature is urgent for the commercial use case. Moreover, based on our understanding and RAN2 SI outcome, integrity can help system detect the standard deviation of positioning results. So this should be as essential as the accuracy of positioning result. Thus, we think at least extending integrity for RAN-dependent positioning shares the same priority level with the other topics.

Further, we think the situation of RAN-dependent integrity is quite similar to GNSS. Though GNSS has its own way to handle the integrity without any assistance from 3GPP system, RAN2 is still specifying the positioning integrity for GNSS in Rel-17. As defined in the TR38.857, the positioning integrity should also consider the UE feared event and LMF feared event which only happens in 3GPP system. So it is valuable to extend the positioning integrity for other positioning methods in Rel-18.

5 – ZTE Corporation

Questions/comments from vivo #5:

Thanks for further sharing your views.

For the case with non-contiguous positioning RS aggregation, if the phase offset is independent, would there be performance gain?

Response to vivo #5:

We agree phase offset between FLs will impact the performance which depends how much phase offset exists. That's why we think RAN4 should be involved to provide some justification or new requirement.

6 – ZTE Corporation

Questions/comments from MediaTek #6:

1, For aggregation of FPL, the TAE (timing alignment error) is a crucial issue. We want to check with ZTE's view that, whether the further tougher requirement on TAE is needed, or there are solutions without mandating NW side to reduce TAE?

2, For aggregation of FPL, now we actually can get larger BW for each carrier, for example, in C band. So, what is the potential use case for aggregation of FPL? It seems to us that it could only be used for regulatory use case

Response to MediaTek #6:

1, We share the similar view that TAE/phase offset is a crucial issue, and we are open to further discuss whether tougher requirement is needed or not. It is better to let RAN4 handle this issue at the beginning of Rel-18. Meanwhile, RAN1 can discuss if there are some solutions without tougher TAE/phase offset requirement. For now, we have no specific solutions.

2, We think aggregation of FPL can be used for any use cases which are without large BWP but have multiple carriers/bands for CA. Even for large BW, using aggregation can further improve the resolution of timing measurement for positioning.

7 – ZTE Corporation

Questions/comments from CATT #7:

Q1: We noticed that ZTE proposed to extend integrity for more positioning methods, such as RAT-dependent positioning methods and RAT-independent positioning methods. We are open to discuss this enhancement in Rel-18.

What's ZTE's view on potential work load and specs impacts on RAN1 group, if we try to specify the positioning integrity for RAT-dependent positioning methods, such as DL-TDOA, UL-TDOA, DL-AoD, UL-AoA and Multi-RTT?

Response to CATT #7:

Yes, our thinking is to specify the positioning integrity for RAT-dependent positioning methods as you said. We expect only minor spec effort is needed. The structure defined for GNSS integrity can be reused or can be the baseline. Some difference with GNSS integrity should be identified in Rel-18, e.g. error source.

8 – ZTE Corporation

Questions/comments from LG Electronics #8:

Thank you for contribution.

Q1: Regarding multiple PFLs for DL PRS transmission & reception, it seems that you think non-continuous PFLs would be considered for joint estimation. Could you explain more details of the related procedure for a clear understanding?

Response to LG Electronics #8:

We are open to support non-continuous PFLs. From specification perspective, we think there is not much difference between continuous aggregation and non-aggregations, e.g. some PFLs should be associated by signaling which implies that UE has to do measurement on aggregated PFLs. The new UE capability, processing capability, etc. for aggregation should be discussed as well.

3.6 RWS-210472 Mesh based NR LAN

In RWS-210472, mesh based NR LAN is introduced to support the communication within the industrial automation environment. The UEs, DUs, CUs, gNBs and IAB nodes jointly form a mesh network. The SL traffic between UEs within a specific private group can be delivered directly via sidelink communication or forwarded via one or multiple gNB/DU/CU(s) within the mesh based NR LAN.

Compared with traditional PDU session based network transmission, the network based forwarding of sidelink traffic between two UEs has following advantages:

Latency reduction

The data traffic between two UEs forwarded by network node does not traverse 5GC. For the intra-CU based data forwarding, the latency between CU and DU can also be removed.

Enhanced security

The security of sidelink traffic can be established at PDCP layer in an end-to-end manner between UE pairs.

Network node such as gNB/DU/CU/IAB node only forwards the SL PDCP traffic without performing PDCP encryption/decryption again. On the other hand, the mesh based NR LAN only support restricted set of UEs to communicate amongst each other. For devices not join the private group, the mesh based NR LAN communication is not supported.

Compared with UE-to-UE relay, the network based forwarding of sidelink traffic between two UEs has following advantages:

Extended transmission range of sidelink traffic

The sidelink traffic can be delivered via the network based on the multi-hop Uu forwarding of gNB/DU/CU/IAB node. It can meet both small and large local area requirement of industrial environment. On the other hand, the network node based relay is stationary in nature and is assumed to be more reliable than UE based relay.

High throughput

The eMBB techniques for the large data rate support in Uu, such as MIMO, DC/CA, NR-U, wide and high spectrum, can be reused between UE and network node to support high throughput sidelink traffic forwarding for industrial automation environment.

In summary, a new work item is proposed in RWS-210472 to support the mesh based NR LAN. The detailed objectives are listed as follows:

- Specify mechanisms for proximity discovery and routing path detection between UEs with specific group for network based L2 forwarding [RAN2, RAN3]

- Specify mechanisms for control plane and user plane protocol stack design [RAN2]

- Specify mechanism for control plane procedure, e.g., connection management of relayed connection, bearer mapping and E2E QoS management [RAN2, RAN3]

- Specify mechanisms for routing path selection and service continuity during routing path switch [RAN2, RAN3]

- Specify mechanism for UE authorization for network based L2 forwarding [RAN3]

3.6.1 Questions/Comments (Round 1)

Feedback Form 21: Questions/comments on the aspects discussed in RWS-210472 (Round 1)

1 – China Unicom

Thanks for this contibution. Our comments are below.

Q1.For the routing path detection, routing path selection and service continuity during routing path switch, what is the potential impacts on standard?

2 – Intel Corporation (UK) Ltd

for the scenario, why not consider a meshed IAB network with sidelink UEs? Introducing the interface between DU-DU may have a significant spec impact. Also it require wireline connection between DU and DU.

3 – Lenovo (Beijing) Ltd

Thanks for your paper.

Routing is realized in adaptation layer and BAP in sidelink relay and IAB respectively. According to the description, the combination of the sidelink communication and network (Uu) based data forwarding is supported in the integrated multi-hop mesh network. Which layer (AS layer or uppler layer) is suitable for routing in the mesh network?

4 – Huawei Tech.(UK) Co.. Ltd

Thank you for the contribution.

What is the different between the proposal and SL Relay?

What is the relation between the proposal and a mesh network, which per definition a dynamic topology adaptation?.

Which node is responsible for the configuration of the Uu protocol stacks under Adaptation layer? In our understanding they should be under gNB control, but in your proposed protocol stack it seems it should be controlled by UE?

5 – MediaTek Inc.

Thank you for the contribution. We have a few questions for clarification below, referring to figure 2 in the contribution for the examples of different paths.

- Do you foresee UE impact for path establishment/selection? E.g., it seems that path 7 would require UE3 and UE6 to negotiate an upper layer configuration (at least for end-to-end security) before data can be sent using this path, and the example protocol stack in figure 3 looks aligned with this.
- There is a mix of paths going via CU (path 4) and via DU (path 5, path 7). Do the CU and the DU need to terminate different layers with the participating UEs, or is it intended that the network maintains the path in a way that is transparent to the UEs? (We understand that it would be network implementation to determine which path is used in a particular scenario.)
- What is assumed about the inter-DU connection used in path 7? Is it a proprietary link or does something need to be specified?

6 – Qualcomm Incorporated

Q1: For industrial use case with sidelink, what type of traffic is targeted. Is it URLLC traffic also?

Q2: What spectrum is expected to be used on sidelink? Is it co-channel with Uu, or a separate band?

7 – vivo Mobile Communication Co.

Thanks for this contribution. We have some comments for clarification:

-

is there any significant difference compared to SL relay?

- Are you considering a standardized DU-DU interface? If is not not, the interface would lack inter-vendor support.

- If the DU-DU interface would be standardized, would the interface also support CP-UP separation function?

3.6.2 Response (Round 1)

Feedback Form 22: Response to questions/comments for RWS-210472 (Round 1)

1 – ZTE Corporation

Response to common questions from Intel #2/MediaTek #5/Vivo #7 on inter-DU interface:

Thanks for your question. Our idea is to support various network architectures in mesh based NR LAN, such as non CU/DU split, CU/DU split and IAB network. For the CU/DU split scenario without IAB node, all the CUs and DUs have wireline connection. If the DU-DU connection is supported, it may further reduce data packet forwarding latency. Here the DU-DU connection is a candidate solution for the mesh network. Whether new interface is defined or only a tunnel is supported can be further discussed. Actually, during the RAN3#112-e meeting, it is agreed to further evaluate a tunnel between source Donor-DU and target Donor-DU to address the source IP filtering issue during inter-Donor-DU re-routing. So it is possible that the inter-DU tunnel would be supported in R17. With regard to the IAB network, only the donor DU has wireline connection while the IAB node may connect with each other via Uu interface. In this case, the inter-DU forwarding via Uu interface may be considered.

2 – ZTE Corporation

Questions/comments from China Unicom #1:

Thanks for this contibution. Our comments are below.

Q1.For the routing path detection, routing path selection and service continuity during routing path switch, what is the potential impacts on standard?

Response to China Unicom #1:

Thanks for your questions. Our understanding with the potential standard impacts are listed as follows:

Routing path detection: RAN node (e.g. gNB/CU) need to be aware of the potential path between UE pairs, for example, direct PC5 link, intra-gNB, inter-gNB, intra-DU, inter-DU, inter-donor DU and inter-CU routing path. In this case, UE or 5GC may provide some assistance info to notify gNB/CU of the potential routing path between UE pairs.

Routing Path selection: Multiple routing paths may be available for the traffic delivery for a given UE pair within the mesh based NR LAN. Which routing path to select can be based on the location, traffic load, channel status and network deployment. In this case, UE report may be necessary to aid the gNB/CU to select the routing path. After the routing path selection, gNB/CU also need to configure the RLC channel/GTP-U tunnels for the SL traffic forwarding.

Service continuity: The routing path for SL traffic may be switched with the mobility of UE pairs. In case of RLF or congestion, the packet re-routing or routing path switch should also be considered. The control

plane procedures for the path switch need to be specified and the user plane need to be studied to ensure lossless packet delivery

3 – ZTE Corporation

Questions/comments from Lenovo #3:

Thanks for your paper.

Routing is realized in adaptation layer and BAP in sidelink relay and IAB respectively. According to the description, the combination of the sidelink communication and network (Uu) based data forwarding is supported in the integrated multi-hop mesh network. Which layer (AS layer or uppler layer) is suitable for routing in the mesh network?

Response to Lenovo #3:

Thanks for the question. In our understanding, the adaptation layer is added/removed by UEs while the BAP header is added/removed by access IAB node/donor DU. It means that the BAP header only exist for IAB network. To be specific, the usage of BAP header/adaptation layer can be divided into the following cases:

1) For the non CU/DU split and CU/DU split without IAB scenario, the adaptation layer is used by the gNB/DU/CU to perform routing.

2) For the IAB network, the following cases can be considered:

a) if the intra-DU forwarding is configured, the DU of access IAB node may forward the packet to destination UE based on adaptation layer. It is not necessary to add BAP header to the packet.

b) If inter-DU forwarding is configured, the BAP header shall be added to the data packet at access IAB node and is used for the routing between IAB nodes and donor DU with UL forwarding as an example.

c) if inter-CU forwarding is configured, the adaptation layer is used by CU to perform routing.

In summary, for the routing between IAB nodes and donor DU, the BAP header shall be used. For the routing within a specific DU or across CUs, the adaptation layer shall be used.

4 – ZTE Corporation

Questions/comments from Huawei #4:

Thank you for the contribution.

What is the different between the proposal and SL Relay?

What is the relation between the proposal and a mesh network, which per definition a dynamic topology adaptation?.

Which node is responsible for the configuration of the Uu protocol stacks under Adaptation layer? In our understanding they should be under gNB control, but in your proposed protocol stack it seems it should be controlled by UE?

Response to Huawei #4:

Thanks for your question. It helps to clarify the scenario. The mesh network proposed in this paper can be regarded as a special form of UE-to-UE relay. Compared with traditional UE-to-UE relay, the relay node in our proposal is performed by network node, such as gNB/DU/CU. Compared with traditional PDU session based transmission, the data traffic between UE does not need to traverse 5GC.

In our opinion, different network nodes can be exploited to forward the local traffic between UEs. Multiple path and multi-hop forwarding can be configured to support the flexible local traffic forwarding. For example, direct PC5 link, intra-gNB, inter-gNB, intra-DU, inter-DU, inter-donor DU and inter-CU routing path can be considered. In this sense, it can be regarded as a mesh network.

We share the same view with you that gNB/CU shall be responsible for the SDAP/PDCP/adaptation layer configuration. gNB/DU shall be responsible for the RLC channel configuration. It is not controlled by UE.

5 – ZTE Corporation

Questions/comments from MediaTek #5:

Thank you for the contribution. We have a few questions for clarification below, referring to figure 2 in the contribution for the examples of different paths.

- *Do you foresee UE impact for path establishment/selection? E.g., it seems that path 7 would require UE3 and UE6 to negotiate an upper layer configuration (at least for end-to-end security) before data can be sent using this path, and the example protocol stack in figure 3 looks aligned with this.*

- *There is a mix of paths going via CU (path 4) and via DU (path 5, path 7). Do the CU and the DU need to terminate different layers with the participating UEs, or is it intended that the network maintains the path in a way that is transparent to the UEs? (We understand that it would be network implementation to determine which path is used in a particular scenario.)*

- *What is assumed about the inter-DU connection used in path 7? Is it a proprietary link or does something need to be specified?*

Response to MediaTek #5:

Thanks for your insightful question. The following is our considerations on your questions:

1) You are right that UEs need to negotiate the upper layer configuration(PC5-S) and establish the PC5 connection before the SL traffic forwarding via network node. This procedure is actually similar to the UE-to-Network scenario. Before the remote UE's Uu traffic could be forwarded by relay UE, the Uu connection needs to be established first. The SRB0/1/2 signalling may be delivered between remote UE and gNB via remote UE's forwarding. When it comes to the network based forwarding of SL traffic, we think the PC5-S/PC5-RRC signalling might be delivered between UEs via direct PC5 link or via network node's forwarding.

2) In our understanding, the UE only knows whether PC5 link or Uu is used for the first hop transmission of SL traffic. For the Uu based forwarding, which CU/DU/IAB nodes shall be involved in the routing path is transparent to UE.

3) Please refer to the response to common questions for inter-DU support.

6 – ZTE Corporation

Questions/comments from Qualcomm #6:

Q1: For industrial use case with sidelink, what type of traffic is targeted. Is it URLLC traffic also?

Q2: What spectrum is expected to be used on sidelink? Is it co-channel with Uu, or a separate band?

Response to Qualcomm #6:

Thanks for your question. We think URLLC traffic should be considered for industry automation scenario. According to TS 22.891, the services for industrial automation may require very low latency, such as 1ms delay.

Our main idea is network based forwarding of SL traffic. So the SL traffic is actually transmitted via Uu interface. With regard to the sidelink transmission, it can follow the spec in R16/17, i.e. both shared and dedicated spectrum could be considered.

7 – ZTE Corporation

Questions/comments from vivo #7:

Thanks for this contribution. We have some comments for clarification:

- is there any significant difference compared to SL relay?

- Are you considering a standardized DU-DU interface? If is not not, the interface would lack inter-vendor support.

- If the DU-DU interface would be standardized, would the interface also support CP-UP separation function?

Response to vivo #7:

Thanks for your question. The following is our consideration:

1) Compared with traditional UE-to-UE SL relay, the relay node in our proposal is performed by network node, such as gNB/DU/CU. It means that the protocol stack (SL over Uu) is different from traditional SL relay(Uu over SL in U2N relay). The routing path detection, routing path selection and control plane configuration by gNB/CU should also be newly designed. However, we think these deign efforts are worthwhile. The network based forwarding of SL traffic extends the transmission range of sidelink traffic. One hop Uu forwarding may be equivalent to two to more sidelink hops. In addition, the network node based relay is stationary in nature and is assumed to be more reliable than UE based relay. Moreover, the eMBB techniques for the large data rate support in Uu, such as MIMO, DC/CA, NR-U, can be reused between UE and network node to support high throughput sidelink traffic forwarding for industrial automation environment.

2) Please refer to the response to the common question on inter-DU support.

3) We haven't considered the combination of CP-UP separation and inter-DU interface. We are open to further discuss it.

8 – VODAFONE Group Plc

Thank you for your contribution, we have a few question:

1-What frequency band do you envisage meshing all the radio interfaces?

2- How do you envisage resolving the inter-channel frequency interferences?

3- Have you considered the Signalling Load on the Core network for providing a mesh solution?

3.6.3 Questions/Comments (Round 2)

Feedback Form 23: Further questions/comments on RWS-210472 (Round 2)

1 – China Unicom

If the DU is act as a relay node, is the signalling establishment and bearer establishment procedure different with the normal procedure?

3.6.4 Response (Round 2)

Feedback Form 24: Response to questions/comments for RWS-210472 (Round 2)

1 – ZTE Corporation

Questions/comments from China Unicom #1:

If the DU is act as a relay node, is the signalling establishment and bearer establishment procedure different with the normal procedure?

Response to China Unicom #1:

Thanks for your question. To support SL traffic forwarding via DU, Uu RLC channel needs to be configured for UE. The Uu RLC channel configuration is similar to the Uu RLC channel configured for relay UE in UE-to-Network Relay, which is not associated with any Uu DRB and PDU session and is only used for data forwarding. In addition, the bearer mapping rule may be configured for UE.

3.7 RWS-210473 MBS Enhancement for 5G Advanced

In RWS-210473, we provide our analysis and views for Rel-18 MBS enhancement with the following proposals. It has been observed that in Rel-17 some of the important features, including the ones with explicit requirements from verticals like MCPTT support for Multicast reception in RRC states other than RRC_CONNECTED) had been de-prioritized, due to the low productivity of electric meeting. Those features including MBS (especially Multicast) reception in non RRC_CONNECTED states, flexible MBS deployments in RAN architecture other than stand-alone, are suggested to be supported in later Releases, e.g, Rel-18, to provide an MBS solution for diverse scenarios and requirements.

Layer 1 centric enhancements:

- Support feedback for RRC_IDLE/INACTIVE UEs (RAN1, RAN2)

- Support carrier aggregation for RRC_IDLE/INACTIVE UEs (RAN1, RAN2)

- Flexible CFR configuration for RRC_IDLE/INACTIVE UEs (RAN1, RAN2)

- Enable reception of unicast and MBSFN based MBS Simultaneously (RAN1, RAN2)

- Support Partial Beam Sweeping in desired beam directions (RAN1, RAN2)

Architectural enhancements:

- Flexible MBS deployment in NRDC, or in Multiple cells (RAN3, RAN2)

- Multicast reception support in RRC_INACTIVE states (RAN2, RAN3)

- Advanced and lossless HO support for Multicast services (RAN3, RAN2)

- Other enhancements on Broadcast services, e.g., power efficiency enhancement, area specific PTM configuration, MBSFN (RAN3, RAN2)

3.7.1 Questions/Comments (Round 1)

Feedback Form 25: Questions/comments on the aspects discussed in RWS-210473 (Round 1)

1 – Classon Consulting

[for FUTUREWEI]

SFN is interesting. What is your intent for numerology/CP?

2 – Lenovo (Beijing) Ltd

Thanks for the contribution. I have some questions for clarification:

(1) For CA for idle/inactive UEs, how can gNB know the reception UEs are CA capable?

(2) In Slide 9, as mentioned, ”HARQ-ACK feedback scheme (e.g., DAI/Feedback resource determination) for partial beam sweeping”, do you propose Type-2 HARQ-ACK codebook for idle/inactive UEs?

3 – HUAWEI TECHNOLOGIES Co. Ltd.

[Huawei, HiSilicon] Thank you for the paper. We have some questions. Q1. For the support of CSI/best SSB feedback in RRC *IDLE/INACTIVE, does it mean that the UE has specific resources for this report in RRC* IDLE/INACTIVE?

Q2. For CFR enhancement for RRC_IDLE/INACTIVE, does mentioning Redcap UE intend to define a CFR smaller than 20M for Redcap in Rel-18?

Q3. For partial beam sweeping, does ”dynamic selection of MO/CORESET” mean up to UE dynamic selection? Does HARQ-ACK feedback scheme for partial beam sweeping mean feedback resources might be different for different downlink beam or does it mean something else (and what, in case)?

4 – BBC

BBC supports the evolution of NR MBS under Rel-18 and generally the topics you propose seem relevant to us as potential enhancements for NR MBS.

Questions:

We have the following questions/comments from the following topics listed in your contribution:

- Layer 1 centric enhancements: Enable reception of unicast and MBSFN based MBS Simultaneously (RAN1, RAN2)
  - Are you considering changes in sub-carrier spacing and/or CP?
    - We have concerns that significant changes in UEs may hinder the deployment of the feature. As stated in our contribution [RWS-210133] and being discussed under [RAN-R18-WS-crossFunc-BBC] in NWM we believe widespread feature support in handsets is essential. Specially for UEs in RRC_IDLE/INACTIVE that may not be able to signal back to the gNB the capability, enhancements that force significant changes in the UEs may limit the reach of Multicast and Broadcast.

- Considerations should be taken in whether simulcasting two signals (with different CPs) would be overall beneficial to the system spectral efficiency.
- Another aspect to consider is whether the reference signals frequency sampling (assuming are unchanged) can cope with the additional channel selectivity from deployments with larger ISDs and therefore extended CPs.

5 – Sony Europe B.V.

Would all UEs support of two BWPs for enabling simultaneous configuration of unicast PDSCH and MBSFN-based MBS PDSCH?

6 – Guangdong OPPO Mobile Telecom.

1. Does "reception of unicast and MBSFN based MBS Simultaneously" imply that UE needs to support multiple active BWPs with different numerologies?

2. Beam sweeping has been supported for broadcast, and gNB can divide UEs into different groups if they located in different directions, given that what's the rationale to support partial beam sweeping?

7 – Intel Corporation (UK) Ltd

1) Regarding [1-1]: How to enable UE feedback for IDLE/INACTIVE UEs of different operators?

2) Regarding [1-3]: What is motivation for supporting multiple overlapping CFRs?

8 – Apple Computer Trading Co. Ltd

Thanks for the contribution. questions for clarificaiton.

1. supporting CA for IDLE UE, how the gNB differentiate the UE receiving MBS service with CA or single carrier.

2. Enable reception of unicast and MBSFN based MBS simultaneously, is this objective to propose different SCS/CP for unicast and multicast?

9 – CATT

Thanks for the good paper, of which many of the aspects we believe are good points for further discussions.

A few questions for clarification.

1) for inactive/idle UE, in order to allow feedback/carrier aggregation, what are the extra requirements to UE? e.g., control channel monitoring, feedback, etc.

2) for 'enable reception of unicast and MBSFN based MBS Simultaneously', maybe it could be further clarified what is the extra requirement from NW and/or UE side. can it be left to implementation or how is it?

3) for mobility enh., what extra requirement needed on top of R16/17 mechanism for unicast?

10 – Qualcomm Incorporated

In our understanding, the proposals include supporting CA (as well as HARQ-ACK/CSI etc.) for IDLE/INACTIVE. Does this mean the UE is required to receive MBS data from multiple CCs? If so, the NW has to make sure that the multiple CCs are receivable everywhere and the energy saving benefit of IDLE/INACTIVE states may not be achievable.

11 – LG Electronics Polska

1. For Advanced and lossless HO support for Multicast services, can we understand it is the data forwarding scheme that is under debating in RAN3? Or some other enhancement?
2. For Other enhancements on Broadcast services, would you clarify area specific PTM configuration?

12 – MediaTek Inc.

Thanks for the proposal. When you list the bullet "Enable reception of unicast and MBSFN based MBS Simultaneously (RAN1, RAN2)", do you intend to support the superposition based coding between unicast and MBS?

3.7.2 Response (Round 1)

Feedback Form 26: Response to questions/comments for RWS-210473 (Round 1)

1 – ZTE Corporation

Questions/comments from FUTUREWEI #1:

SFN is interesting. What is your intent for numerology/CP?

Response to FUTUREWEI #1:

MBSFN requires longer CP. Our intention is to address the issue that different SCS/CP is required by unicast and MBSFN. One possibility is that the current SCS set can be reused, or maybe we need to support ECP for more SCSs, e.g., 15KHz. Overall, if SFN is included in the WID, we may need to perform evaluation to determine whether any new SCS/CP is needed or not.

2 – ZTE Corporation

Common question from Lenovo #2 Q1 and Apple #8 Q1:

Lenovo: For CA for idle/inactive UEs, how can gNB know the reception UEs are CA capable?

Apple: supporting CA for IDLE UE, how the gNB differentiate the UE receiving MBS service with CA or single carrier.

Response to Lenovo #2 Q1 and Apple #8 Q1:

From our perspective, network doesn't need to know whether UEs are capable of CA or not.

With the booming of broadcast industry, different MBS services are emerging. It will be impossible/difficult for network to configure all MBS service in one cell. In this sense, network may configure different MBS services on different carriers for IDLE/INACTIVE UEs. If UE is capable of CA in IDLE/INACTIVE, then this UE can receive all these different MBS services on different carriers simultaneously. If not, then UE can only receive MBS service from one carrier based on its interest.

Another possible scenario is that, network may configure the same MBS service on different carriers. If UE receives all the data from different carriers, UE can support higher quality MBS service (e.g., 4K video). However, if UE only receives data from one carrier, then it can only supports lower quality MBS service.

3 – ZTE Corporation

Questions/comments from Lenovo #2 Q2:

Q2 In Slide 9, as mentioned, "HARQ-ACK feedback scheme (e.g., DAI/Feedback resource determination) for partial beam sweeping", do you propose Type-2 HARQ-ACK codebook for idle/inactive UEs?

Response to Lenovo #2 Q2:

The feedback for partial beam sweeping is mainly for RRC_CONNECTED UEs from our perspective.

4 – ZTE Corporation

Questions/comments from Apple #8 Q2:

Q2: Enable reception of unicast and MBSFN based MBS simultaneously, is this objective to propose different SCS/CP for unicast and multicast?

Response to Apple #8 Q2:

Our understanding is that, compared with unicast, longer CP length is needed for MBSFN. Network can configure different SCS for unicast and MBSFN, e.g., 15KHz for MBSFN and 30KHz for unicast. Besides, network can also configure different CP length for unicast and MBSFN, e.g., new longer CP length for MBSFN and the legacy CP length for unicast.

Overall, this may need further simulation analysis in the WI phase if MBSFN is introduced in the WID.

5 – ZTE Corporation

Questions/comments from Huawei #3:

[Huawei, HiSilicon] Thank you for the paper. We have some questions. Q1. For the support of CSI/best SSB feedback in RRC IDLE/INACTIVE, does it mean that the UE has specific resources for this report in RRC IDLE/INACTIVE?

Q2. For CFR enhancement for RRC_IDLE/INACTIVE, does mentioning Redcap UE intend to define a CFR smaller than 20M for Redcap in Rel-18?

Q3. For partial beam sweeping, does "dynamic selection of MO/CORESET" mean up to UE dynamic selection? Does HARQ-ACK feedback scheme for partial beam sweeping mean feedback resources might be different for different downlink beam or does it mean something else (and what, in case)?

Response to Huawei #3:

A1: From our perspective, both common resource and UE specific resource can be considered. If the resource for CSI/best SSB feedback is shared among UEs, similar mechanism as NACK-only based HARQ feedback.

A2: If the question is to ask whether network can **configure (**instead of **"define")** a CFR smaller than 20M for Redcap UE, from our perspective, if the legacy CFR restriction can be relaxed or removed, then it is totally possible to configure a smaller CFR (e.g., smaller than 20M) for Redcap UE in Rel-18.

A3: Yes, UE can dynamically select the MO/CORESET corresponding to each beam.

Regarding the "feedback resources", currently, we don't have a strong view on this. Different feedback resources or the same feedback resource can be configured for different beam. This can be further discussed.

6 – ZTE Corporation

Questions/comments from BBC #4:

We have the following questions/comments from the following topics listed in your contribution:

- Layer 1 centric enhancements: Enable reception of unicast and MBSFN based MBS Simultaneously (RAN1, RAN2)
  - Are you considering changes in sub-carrier spacing and/or CP?
    - We have concerns that significant changes in UEs may hinder the deployment of the feature. As stated in our contribution [RWS-210133] and being discussed under [RAN-R18-WS-crossFunc-BBC] in NWM we believe widespread feature support in handsets is essential. Specially for UEs in RRC_IDLE/INACTIVE that may not be able to signal back to the gNB the capability, enhancements that force significant changes in the UEs may limit the reach of Multicast and Broadcast.
    - Considerations should be taken in whether simulcasting two signals (with different CPs) would be overall beneficial to the system spectral efficiency.
    - Another aspect to consider is whether the reference signals frequency sampling (assuming are unchanged) can cope with the additional channel selectivity from deployments with larger ISDs and therefore extended CPs.

Response to BBC #4:

We share similar view that it is better to keep the changes on UE side (especially for the hardware change) as minimal as possible. Thus, our thinking is that, maybe the current SCS set can be reused, or maybe network needs to support ECP for more SCSs, e.g., 15KHz. Another way is that, we don't need to introduce any new SCS or CP, we just reuse the existing SCS and CP for unicast and MBSFN. Then the third issue mentioned in your comments doesn't exist.

From our perspective, supporting both unicast and MBSFN can increase the system spectral efficiency because unicast can provide high throughput for individual UE and MBSFN can apply the same time-frequency resource for a large number UEs. Network can use unicast and MBSFN dynamically and simultaneously to accommodate different traffic.

Overall, if SFN is included in the WID, we may need to perform simulation to determine whether any new SCS/CP is needed or not. The spectrum efficiency and reference signals frequency sampling issue can also be taken into account in the simulation.

7 – ZTE Corporation

Common question from Sony #5 and OPPO #6 Q1:

Sony: Would all UEs support of two BWPs for enabling simultaneous configuration of unicast PDSCH and MBSFN-based MBS PDSCH?

OPPO: Does "reception of unicast and MBSFN based MBS Simultaneously" imply that UE needs to support multiple active BWPs with different numerologies?

Response to Sony #5 and OPPO #6 Q1:

MBSFN requires longer CP. Our intention is to address the issue that different SCS/CP is required by unicast and MBSFN. From our perspective, one possible way is to support two BWPs for enabling simultaneous reception of unicast PDSCH and MBSFN-based MBS PDSCH. This can be an optional UE feature. If UE supports this UE feature, then UE can support FDM-ed unicast PDSCH and MBSFN-based MBS PDSCH reception. If not, then UE may only support TDM-ed unicast PDSCH and MBSFN-based MBS PDSCH reception. We are also open to consider other solutions to address this issue.

8 – ZTE Corporation

Questions/comments from OPPO #6 Q2:

Q2. Beam sweeping has been supported for broadcast, and gNB can divide UEs into different groups if they located in different directions, given that what's the rationale to support partial beam sweeping?

Response to OPPO #6 Q2*:*

If gNB divides UEs into different groups based on the beam direction, then if the beam direction of one UE updates, then network has to configure another set of CORESETs/SSs for this UE. Because the CORESETs/SSs are shared among different UEs, it is not possible for UE to update the beam of each CORESET unless the beam of all the UEs in this group has been changed. Updating CORESET/SS configuration is a RRC level process that requires large latency. Thus, we propose to address this issue by partial beam sweeping, where multiple CORESETs/SSs of different beams can be configured for UEs and UE can select based on their beam direction.

9 – ZTE Corporation

Questions/comments from Intel #7:

Q1) Regarding [1-1]: How to enable UE feedback for IDLE/INACTIVE UEs of different operators?

Q2) Regarding [1-3]: What is motivation for supporting multiple overlapping CFRs?

Response to Intel #7*:*

A1) From our perspective, a common resource can be configured for these UEs by the network providing broadcast. We are also open to discuss whether/how to introduce some rules to activate/deactivate UE feedback.

A2) Our intention is not to introduce overlapping CFRs. If the current constraints of CFR are removed or relaxed, then network can configure non-overlapping CFRs for different UEs or for different services.

In some cases, there may be overlapping CFRs. Some UEs may only support a small size of bandwidth, e.g., Redcap UE. Multiple overlapping CFRs can help to accommodate UEs with different bandwidth capability. For example, a 100M CFR can be configured for regular UE and a 20M CFR can be configured for Redcap UE. The 20M CFR and 100M CFR may be overlapping.

10 – ZTE Corporation

Questions/comments from CATT #9:

Thanks for the good paper, of which many of the aspects we believe are good points for further discussions.

A few questions for clarification.

Q1) for inactive/idle UE, in order to allow feedback/carrier aggregation, what are the extra requirements to UE? e.g., control channel monitoring, feedback, etc.

Q2) for 'enable reception of unicast and MBSFN based MBS Simultaneously', maybe it could be further clarified what is the extra requirement from NW and/or UE side. can it be left to implementation or how is it?

Q3) for mobility enh., what extra requirement needed on top of R16/17 mechanism for unicast?

Response to CATT #9*:*

A1) Regarding feedback, the extra requirement is that UE needs to support HARQ/CSI/SSB feedback in IDLE/INACTIVE, which is similar as what we have for CONNECTED UEs.

Regarding carrier aggregation, currently, we think the similar requirements of support CA may be required for IDLE/INACTIVE UE to support CA.

A2) The extra requirement is mainly from UE side.

MBSFN requires longer CP. Our intention is to address the issue that different SCS/CP is required by unicast and MBSFN. Currently, the spec doesn't support simultaneous reception of downlink transmission with different numerologies. Thus, we need to address this issue in specification. For example, UE may need to support two BWPs for enabling simultaneous reception of unicast PDSCH and MBSFN-based MBS PDSCH. If UE supports this UE feature, then UE can support FDM-ed unicast PDSCH and MBSFN-based MBS PDSCH reception. If not, then UE may only support TDM-ed unicast PDSCH and MBSFN-based MBS PDSCH reception.

We are also open to consider other solutions to address this issue.

A3) HO mechanism for unicast in Rel-16/17 shall be baseline, and study on whether any enhancement is needed can be taken. (if some of the features on advanced HO for MBS is not touched in Rel-17)

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11 – ZTE Corporation

Questions/comments from Qualcomm #10:

In our understanding, the proposals include supporting CA (as well as HARQ-ACK/CSI etc.) for IDLE/INACTIVE. Does this mean the UE is required to receive MBS data from multiple CCs? If so, the NW has to make sure that the multiple CCs are receivable everywhere and the energy saving benefit of IDLE/INACTIVE states may not be achievable.

Response to Qualcomm #10*:*

With the booming of broadcast industry, different MBS services are emerging. It will be impossible/difficult for network to configure all MBS service in one cell. In this sense, network may configure different MBS services on different carriers for IDLE/INACTIVE UEs. If UE is capable of CA in IDLE/INACTIVE, then this UE can receive all these different MBS services on different carriers simultaneously. If not, then UE can only receive MBS service from one carrier based on its interest.

Regarding how to guarantee "receivable everywhere", different carriers may be with different coverage. From our perspective, UE only needs to receive data from the CCs that are receivable and doesn't need to receive data from the CCs that are out of coverage.

Regarding the energy saving issue, supporting CA in IDLE may still consumes less power than supporting CA with the same number of carriers in CONNECTED. Besides, if a UE prioritizes power saving, then this UE doesn't need to support CA in IDLE. Maybe more study or simulation is needed for this issue.

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12 – ZTE Corporation

Questions/comments from LGE #11:

Q1. For Advanced and lossless HO support for Multicast services, can we understand it is the data forwarding scheme that is under debating in RAN3? Or some other enhancement?

Q2. For Other enhancements on Broadcast services, would you clarify area specific PTM configuration?

Response to *LGE* #11*:*

A1. Data forwarding is already agreed in Rel-17 in both RAN2 and RAN3. It is lossless feature that is being debated in RAN3.

Advanced HO including Rel-16 HO features like DAPS and CHO, and those advanced features for now are de-prioritized in RAN3.

A2. A general definition to the "area specific PTM configuration" is that the PTM configuration for MBS PTM transmission is common and shared in more than one cells, therefore UE won't need to update the configuration after HO or cell re-selection. The service interruption can be minimized to the greatest extent following such design.

13 – ZTE Corporation

Questions/comments from MediaTek #12:

Thanks for the proposal. When you list the bullet "Enable reception of unicast and MBSFN based MBS Simultaneously (RAN1, RAN2)", do you intend to support the superposition based coding between unicast and MBS?

Response to MediaTek #12*:*

Our intention is as below. If UE supports two BWPs, then UE can support FDM-ed unicast PDSCH and MBSFN-based MBS PDSCH reception. If not, then UE may only support TDM-ed unicast PDSCH and MBSFN-based MBS PDSCH reception. But we are open to discuss superposition based coding between unicast and MBS.

3.7.3 Questions/Comments (Round 2)

Feedback Form 27: Further questions/comments on RWS-210473 (Round 2)

1 – Lenovo (Beijing) Ltd

Thank ZTE for the elaboration. Further comments from my side for better understanding your proposal:

Further comments to Q1: As you described, the proposal seems more like multiple carrier operation where different carriers for transmitting same or different MBS service and transparent from RAN1's perspective are working independently. If we use the term of "CA", it implies the network configures multiple carriers to a UE via dedicated RRC signaling. Is it better wording to use "multiple carrier operation" than "CA"?

Further comments to Q2: If HARQ-ACK feedback scheme (e.g., DAI/Feedback resource determination) for partial beam sweeping is applied for connected UEs, considering Rel-17 MBS is specifying Type-2 HARQ-ACK codebook determination for MBS, could you elaborate it a bit more what is the specific issue needs to be enhanced for Type-2 HARQ-ACK codebook for partial beam sweeping?

2 – BBC

Thank you for your responses. Given the range of views on SFN first a consensus view should be formed on whether or not take this work further. A pragmatic next step may be to study whether there is any benefit in enhancing SFN, and to assess any requirements for changes to SCS/CP and any corresponding implications for UEs etc.

3 – HUAWEI TECHNOLOGIES Co. Ltd.

[Huawei, HiSilicon] In the response to Lenovo #2 Q1 and Apple #8 Q1, you mention two scenarios for supporting CA in IDLE/INACTIVE for MBS:

1. Configuring different MBS services on different carriers for IDLE/INACTIVE UEs

2. Configuring the same MBS service on different carriers. If UE receives all the data from different carriers, UE can support higher quality MBS service (e.g., 4K video).

Fore scenario 1 – is there anything that needs to be specified in order to support this scenario, in addition to what will be supported for broadcast in Rel-17?

For scenario 2 – how can this be made possible from higher layer's perspective? I.e. is it really so that receiving part of data allows the UE to receive the video with lower definition while combining it with additional packets allows it to get 4K video? If so, what needs to be specified?

3.7.4 Response (Round 2)

Feedback Form 28: Response to questions/comments for RWS-210473 (Round 2)

1 – ZTE Corporation

Questions/comments from Lenovo #1:

Thank ZTE for the elaboration. Further comments from my side for better understanding your proposal:

Further comments to Q1: As you described, the proposal seems more like multiple carrier operation where different carriers for transmitting same or different MBS service and transparent from RAN1's perspective are working independently. If we use the term of "CA", it implies the network configures multiple carriers to a UE via dedicated RRC signaling. Is it better wording to use "multiple carrier operation" than "CA"?

Further comments to Q2: If HARQ-ACK feedback scheme (e.g., DAI/Feedback resource determination) for partial beam sweeping is applied for connected UEs, considering Rel-17 MBS is specifying Type-2 HARQ-ACK codebook determination for MBS, could you elaborate it a bit more what is the specific issue needs to be enhanced for Type-2 HARQ-ACK codebook for partial beam sweeping?

Response to Lenovo #1:

Regarding Q1: Currently, UE is not required to receive data from more than one carriers in IDLE/INACTIVE. If UE supports the enhancements we mentioned in Rel-18, UE needs to support data reception from multiple carriers IDLE/INACTIVE. Also, network may need to define one anchor cell (PCell) so that UE can perform legacy cell reselection, measurements based on this anchor cell. From this perspective, it is more like the legacy CA framework. That's why we can call it as "IDLE/INACTIVE CA".

In addition, network may need to provide some information in SIB/MCCH to let UE know the detailed information of these carriers with MBS service, e.g., CFR, CORESET/SS.

Regarding Q2: If gNB divides UEs into different groups based on the beam direction, then if the beam direction of one UE updates, then network has to configure another set of CORESETs/SSs for this UE. Because the CORESETs/SSs are shared among different UEs, it is not possible for UE to update the beam of each CORESET unless the beam of all the UEs in this group has been changed. Updating CORESET/SS configuration is a RRC level process that requires large latency. Thus, we propose to address this issue by partial beam sweeping, where multiple CORESETs/SSs of different beams can be configured for UEs and UE can select among them based on their beam direction. In this case, the same TB will be transmitted multiple times corresponding to different beams. One of the potential issues is how to count the DAI here.

2 – ZTE Corporation

Questions/comments from BBC #2:

Thank you for your responses. Given the range of views on SFN first a consensus view should be formed on whether or not take this work further. A pragmatic next step may be to study whether there is any benefit in enhancing SFN, and to assess any requirements for changes to SCS/CP and any corresponding implications for UEs etc.

Response to BBC #2:

Based on the preliminary simulation results in our contribution (RWS-210473), MBSFN provides performance gains. If SFN is included in the WID, we are open to further discuss the simulation details.

3 – ZTE Corporation

Questions/comments from Huawei, HiSilicon #3:

[Huawei, HiSilicon] In the response to Lenovo #2 Q1 and Apple #8 Q1, you mention two scenarios for supporting CA in IDLE/INACTIVE for MBS:

1. Configuring different MBS services on different carriers for IDLE/INACTIVE UEs

2. Configuring the same MBS service on different carriers. If UE receives all the data from different carriers, UE can support higher quality MBS service (e.g., 4K video).

Fore scenario 1 – is there anything that needs to be specified in order to support this scenario, in addition to what will be supported for broadcast in Rel-17?

For scenario 2 – how can this be made possible from higher layer's perspective? I.e. is it really so that receiving part of data allows the UE to receive the video with lower definition while combining it with additional packets allows it to get 4K video? If so, what needs to be specified?

Response to *Huawei, HiSilicon* #3:

Regarding Scenario 1, network may need to provide some information in SIB/MCCH to let UE know the detailed information of these carriers with MBS service, e.g., CFR, CORESET/SS. You can also refer to our response to Lenovo#1 in this round.

Regarding Scenario 2, our thinking is that, if UE only supports receiving MBS in one carrier, it can only support lower QoS. But if it can support two carriers, it can support higher QoS for this MBS service. Regarding the specification impact, it is similar to what we mentioned above in scenario.

3.8 RWS-210474 Support of UAV for 5G Advanced

In RWS-210474, the motivation and benefits to enable the UAV for 5G Advanced are provided with consideration on following aspects:

- UAV identification and control, which is mainly for security issue

- DL enhancement to ensure continuous service, which is to address the degradation of network performance

- DL enhancement to ensure continuous service, which is to address the degradation of network performance

- UL performance improvement, mainly target for interference mitigation, e.g.,

  - o Co-channel interference cross UE within same and different cell.

  - o Cross-link interference cross UE within different cells

- Additionally, we can also consider the potential use case to take Drone as BS.

For addressing the identified issue above, the following objectives are proposed for normative work:

- Study the cross-link interference condition [RAN1]

Specify enhancements on performance:

- Power control for random access (RAN1)

- The height-dependent BM mechanism for both FR1/FR2(RAN1)

- Specify side-link enhancements for UAV, e.g., broadcast of identifiers (RAN1/2)

- Specify enhancements on access control, e.g., regulation indication (RAN2/3)

- Specify enhancements on mobility (RAN2):

  o Report mechanisms, e.g., new event to reduce the report overhead.

  o Conditional HO, e.g., based on location information, UE's airborne status, flight path plan, etc.

- Specify subscription and identification(RAN2/3)

- Specify RF and RRM core requirements for gNB and UE (if new UE type/BS type is identified)

3.8.1 Questions/Comments (Round 1)

Feedback Form 29: Questions/comments on the aspects discussed in RWS-210474 (Round 1)

1 – Lenovo Mobile Com. Technology Thanks for the proposals, we also interest in UAV topic and we have some clarification questions for further understanding consider following objectives: 1. power control for RA: we would like understand more the motivation of this objective, it there observed problem for UAV random access? Or why limited to RA only? 2. beam management: whether UE needs to know the location of gNB in your perspective? 3. access control: is this target to enhance UAC? 4. report mechanism: In LTE, multi-cell measurement was introduced and can reduce the measurement overhead to some extent. Do you think it is not enough and some enhancements are still needed especially for mobility purpose?
2 – HUAWEI TECHNOLOGIES Co. Ltd. [Huawei, HiSilicon] In general we should focus on what is really necessary. Some questions: 1) What is the motivation for power control enhancements for RA? 2) What is the motivation for access control enhancements? 3) When the Drone acts as BS, what's the baseline? IAB?

3 – Ericsson LM

We are interested to know what you are trying to address with this bullet: •Specify enhancements on access control, e.g., regulation indication (RAN2/3) ?

4 – Qualcomm Incorporated

Thank you for the contribution. Some comments/questions:

- CLI was Rel-16 WI. Do you consider anything more is needed for Drones?
- For the case of sidelink enhancements, do you consider any other use case apart from ”broadcast of identifiers” (remote ID)?
- New UE type/ BS type/ UAV as BS are separate issues. We are not sure if those should be included here.

5 – Intel Corporation (UK) Ltd

Q: For beam management enhancements for FR1, do you consider multiple beams generated by analog beamforming at the gNB or at the UAV?

3.8.2 Response (Round 1)

Feedback Form 30: Response to questions/comments for RWS-210474 (Round 1)

1 – ZTE Corporation

Questions/comments from Lenovo #1:

Thanks for the proposals, we also interest in UAV topic and we have some clarification questions for further understanding consider following objectives:

Q1. power control for RA: we would like understand more the motivation of this objective, it there observed problem for UAV random access? Or why limited to RA only?

Q2. beam management: whether UE needs to know the location of gNB in your perspective?

Q3. access control: is this target to enhance UAC?

Q4. report mechanism: In LTE, multi-cell measurement was introduced and can reduce the measurement overhead to some extent. Do you think it is not enough and some enhancements are still needed especially for mobility purpose?

Response to Lenovo #1*:*

Thanks for your questions.

A1: The intention of this proposal to improve the potential interference congestion on UL channel. For the case during the RRC connected state, the parameters can be optimized by UE-specific configuration as defined in R15.

A2: For only support the height-dependent mechanism, the UE is not needed to get the information of gNB's location. The simple way is to enable different beam configuration for UE per height range.

A3: UAV is one way to achieve this goal and potential PHY based solution during the initial access stage can also be considered.

A4: The LTE based solution will still be the baseline for NR. We can further consideration on the optimization in PHY level to reduce the higher layer activity, and it's will be more efficient.

2 – ZTE Corporation

Questions/comments from Huawei #2:

[Huawei, HiSilicon] In general we should focus on what is really necessary. Some questions: 1) What is the motivation for power control enhancements for RA? 2) What is the motivation for access control enhancements? 3) When the Drone acts as BS, what's the baseline? IAB?

Response to Huawei #2*:*

Thanks for your questions.

For Q1: The intention of this proposal to improve the potential interference congestion on the UL channel. For the case during the RRC connected state, the parameters can be optimized by UE-specific configuration as defined in R15.

For Q2: the mechanism for access control is to avoid the congestion for the normal cell and also enable the functionality to define the non-fly zone.

For Q3: It's still open. With consideration on different type of Drone, it can be either IAB, DU or full gNB.

3 – ZTE Corporation

Questions/comments from Ericsson #3:

We are interested to know what you are trying to address with this bullet: •Specify enhancements on access control, e.g., regulation indication (RAN2/3) ?

Response to Ericsson #3*:*

Thanks for your question The mechanism for access control is to avoid the congestion for the normal cell and also enable the functionality to define the non-fly zone.

4 – ZTE Corporation

Questions/comments from Qualcomm #4:

Thank you for the contribution. Some comments/questions:

- *CLI was Rel-16 WI. Do you consider anything more is needed for Drones?*
- *For the case of sidelink enhancements, do you consider any other use case apart from "broadcast of identifiers" (remote ID)?*
- *New UE type/ BS type/ UAV as BS are separate issues. We are not sure if those should be included here.*

Response to Qualcomm #4*:*

- Compared to CLI discussed in R16, the impact of CLI is expected be more dynamic for UAV. More flexible solution should be considered.
- At initial stage, the usage of sidelink is mainly for UE identification in case of platoon communication. Further consideration to enable the centralized control can be one way for future.
- Yes, it's up to the group's decision. As we know, there is need to enable drone based BS. Whether it can be covered in same item or not can be further checked.
5 – ZTE Corporation ***Questions/comments from Intel #5:*** *For beam management enhancements for FR1, do you consider multiple beams generated by analog beam-forming at the gNB or at the UAV?* **Response to Intel #5*:*** Thanks for your question. Yes, based on the study in R15, the performance (UL, also can mitigate the interference to other cell) can be improved once the UE is more powerful on beamforming. These beams can be generated as analog beam by panel or directional antenna.

3.9 RWS-210475 Support of Mobile IAB for 5G Advanced

In RWS-210475, it is suggested to support mobile IAB scenario. To be specific, the IAB node is installed in a vehicle and move along with the vehicle. The IAB node mounted in the vehicle provides wireless access to UEs and connects to parent IAB node or IAB donor node with backhaul link. For the mobile IAB scenario, handover of UEs may lead to signaling storm if individual UE handover procedure is used. In addition, there would be packet loss due to the frequent handover of mobile IAB node. So the enhancements to group mobility and service continuity should be considered. In addition, it is suggested to support the local service to save the backhaul link radio resources and reduce the burden of the CN. The enhancements from predicted mobility information may be considered. In a sum, a work item with the following objectives is proposed in RWS-210475:

- Specification of procedures for inter-donor IAB-node full migration including enhancements to reduce signalling load. [RAN3, RAN2]

- Specification of enhancements to reduce service interruption due to IAB-node migration. [RAN3, RAN2]

- Specification of functionalities, procedures, signaling, etc. to support local service. [RAN3, RAN2]

- Specification of enhancements to neighboring cell management of mobile IAB node. [RAN3, RAN2]

- Specification of functionalities, procedures, signaling, etc. to support power saving for mobile IAB node/UE or parent IAB node/IAB donor node. [RAN3, RAN2]

3.9.1 Questions/Comments (Round 1)

Feedback Form 31: Questions/comments on the aspects discussed in RWS-210475 (Round 1)

1 – Lenovo (Beijing) Ltd

For vehicle mounted relay, we also support it (see RWS-210255). Furthermore, drone mounted relay also can be supported.

For local service case, we have interest in it. New routing mechanism is needed for local routing. Do you want to enhance the current BAP? In addition, all IAB node including node1, node2 and donor node in the figure for local service forwords the data for the pair of UE1-UE2. Do you mean three IAB nodes will forward the data at the same time for UE1-UE2?

SON for mobile IAB is proposed for Rel-18. My understanding is that SON for mobile IAB can be discussed after completing mobile IAB. We support to have SON for IAB, which have been specificed in Rel-16 and Rel-17.

2 – Intel Corporation (UK) Ltd

• to support local service, how to solve the security aspect between UE1 and UE2? IAB node does not have functionality of PDCP.

• "For mobile IAB node/UE: measurement configuration according to the mobile IAB node's movement trace or location." For mobile IAB node, what additional measurement configuration can be used for movement trace compared with normal UE? From our understanding, there's not much difference.

3 – LG Electronics Inc.

Thanks for the contribution. We also think that Rel-18 IAB can support more dynamic mobility and it is important to reduce interruption and service discontinuity by mobility.

Regarding "Specification of enhancements to reduce service interruption due to IAB-node migration.", it seems quite broad to us. Could you elaborate more on this? For example, is this include to enhance mobility mechanism to reduce interruption time? Do you consider routing enhancement or packet duplication to prevent packet loss/drop?

4 – Samsung Electronics Co.

Q: The IAB node only has DU part, how to support the localized UPF at IAB node?

5 – vivo Mobile Communication Co.

Thanks for the contribution. We also support to have mobile IAB. Is local service support a special feature for IAB or a common one for gNB?

Additionally, we think there may be some new challenges that may need to considered in case mobile IAB, for example:

```
What do you think about the signaling storm due to tracking area
   update of IAB and the served UEs?
Is there any other UE impact due IAB moving that we should consider?
Is it still possible to keep UE transparent to mobile IAB?
```

3.9.2 Response (Round 1)

Feedback Form 32: Response to questions/comments for RWS-210475 (Round 1)

1 – ZTE Corporation

Response to common questions from Lenovo #1/ Intel #2 / Samsung #4 / vivo #5 on supporting local service in IAB:

Thanks for your questions. Regarding local service, we think the following two methods could be considered:

1) Sidelink traffic between UEs are relayed via IAB node/IAB donor, please see RWS-210472 for more detail. In this method, new routing mechanism is needed considering that sidelink traffic is locally routed within mobile IAB node, e.g. IAB node DU need to determine the destination UE and then forward the packet via appropriate Uu RLC channel with the destination UE. And end-to-end PDCP is terminated at UEs, which could provide security protection for UE traffic.

Cellular traffic between UE and 5GC is relayed via IAB node/IAB donor. As we know, layer-2 relay and CU/DU split architecture is considered in R16/R17 IAB. In this situation, IAB node only has MT and DU functionality. Localized UPF co-located in the IAB donor CU instead of IAB node could be considered to support local service. In this method, UE's cellular traffic may go through IAB donor CU without going through the core network. And end-to-end PDCP is terminated at UE and IAB donor CU to provide security protection. In our view, in case that layer-3 relay and non CU/DU split architecture is considered in R18, local service could be supported via localized UPF co-located in the IAB node.

2 – ZTE Corporation

Questions/comments from Lenovo #1:

For vehicle mounted relay, we also support it (see RWS-210255). Furthermore, drone mounted relay also can be supported.

For local service case, we have interest in it. New routing mechanism is needed for local routing. Do you want to enhance the current BAP? In addition, all IAB node including node1, node2 and donor node in the figure for local service forwords the data for the pair of UE1-UE2. Do you mean three IAB nodes will forward the data at the same time for UE1-UE2?

SON for mobile IAB is proposed for Rel-18. My understanding is that SON for mobile IAB can be discussed after completing mobile IAB. We support to have SON for IAB, which have been specificed in Rel-16 and Rel-17.

Response to Lenovo #1*:*

Thanks for your questions. Regarding local service, please refer to the answer to common questions for local service. In our understanding, IAB donor could determine the relaying path and there is no need to forward the data via multiple paths at the same time.

3 – ZTE Corporation

Questions/comments from Intel #2:

• to support local service, how to solve the security aspect between UE1 and UE2? IAB node does not have functionality of PDCP.

• "For mobile IAB node/UE: measurement configuration according to the mobile IAB node's movement trace or location."

For mobile IAB node, what additional measurement configuration can be used for movement trace compared with normal UE? From our understanding, there's not much difference.

Response to Intel #2*:*

Thanks for your questions. Regarding local service, please refer to the answer to common questions for local service. For measurement configuration, we share the same view with you that there's no additional measurement configuration for mobile IAB node

4 – ZTE Corporation

Questions/comments from LGE #3:

Thanks for the contribution. We also think that Rel-18 IAB can support more dynamic mobility and it is important to reduce interruption and service discontinuity by mobility.

Regarding "Specification of enhancements to reduce service interruption due to IAB-node migration.", it seems quite broad to us. Could you elaborate more on this? For example, is this include to enhance mobility mechanism to reduce interruption time? Do you consider routing enhancement or packet duplication to prevent packet loss/drop?

Response to LGE #3*:*

Thanks for your questions. In our view, enhanced mobility mechanism could be considered to reduce interruption time, e.g. DAPS, CHO, etc. In addition, enhancement to reduce UL packet loss needs further investigation in the case that all involved devices are migrated to target donor in a short time period, i.e. full migration is used and there is no intermediate stage.

5 – ZTE Corporation

Questions/comments from Samsung #4:

Q: The IAB node only has DU part, how to support the localized UPF at IAB node?

Response to Samsung #4*:*

Sorry for the misleading, we think the localized UPF could be collocated in the IAB donor instead of IAB node to support local service. Please refer to the answer to common questions for local service for more detail.

6 – ZTE Corporation

Questions/comments from vivo #5:

Thanks for the contribution. We also support to have mobile IAB. Is local service support a special feature for IAB or a common one for gNB?

Additionally, we think there may be some new challenges that may need to considered in case mobile IAB, for example:

What do you think about the signaling storm due to tracking area update of IAB and the served UEs? Is there any other UE impact due IAB moving that we should consider? Is it still possible to keep UE transparent to mobile IAB?

Response to vivo #5*:*

Thanks for your questions. In our view, local service support could be considered as a common feature for gNB to accommodate various use cases involving IAB and non-IAB deployment.

For mobile IAB, we have the following considerations regarding your questions:

1.In our view, to avoid signaling storm of IAB/UE TAU, one possible solution is that a dedicated TA is configured for mobile IAB node. The TAI list configured to UE should also contain the dedicated TA of the mobile IAB node. In addition, the TAI broadcast by the mobile IAB node is known by the connected CU so that the paging message could be delivered to UE correctly. There are other potential solutions and we may further discuss it.

2.During mobile IAB node movement, IAB DU cell configuration may need to change, e.g. PCI, NCGI, frequency, radio resources, etc. The UE impact due to cell configuration update during mobile IAB node movement needs to be further considered.

3. Actually, we are not sure whether mobile IAB could be kept transparent to UE, it depends whether mobile IAB could be supported without UE impact, e.g. IAB DU cell configuration change (e.g. PCI) as mentioned above is supported without UE impact.

3.10 RWS-210476 Rel-18 NR RedCap evolution

In RWS-210476, considerations on Rel-18 NR RedCap evolution are discussed. Considering that the DL and UL peak data rate for 5 MHz channel bandwidth (15 kHz SCS) is around 20 Mbps, it can meet data rate requirement of industrial wireless sensors and some of the low-end video surveillance applications. Reducing FR1 RedCap maximum UE bandwidth to 5 MHz can further reduce the cost of NR RedCap UEs. Besides, to meet the application requirements of RedCap UEs, enhanced power saving, positioning and broadcast/multicast solutions need to be studied for NR RedCap UEs. We recommend to consider following objectives for Rel-18 NR RedCap evolution.

FR1 RedCap UE with 5 MHz bandwidth

- Study and specify FR1 RedCap UE with 5 MHz bandwidth solutions

Enhanced power saving for RedCap UEs

- Study and evaluate whether enhanced power saving solutions are needed for RedCap

Positioning for RedCap UEs

- Define positioning requirement/capability for RedCap

- Evaluate positioning performance for RedCap and study whether new positioning solution is needed

Broadcast/Multicast services for RedCap UEs

- Study how to effectively support broadcast/multicast IoT applications for RedCap

Improvements to co-existence with non-RedCap UEs

- e.g., reduce negative impacts on non-RedCap UEs

3.10.1 Questions/Comments (Round 1)

Feedback Form 33: Questions/comments on the aspects discussed in RWS-210476 (Round 1)

1 – Classon Consulting

FUTUREWEI supports studying redcap positioning, but should be in positioning not redcap
A Rel-17 RedCap UE should be able to optionally indicate Rel-17 MBS feature support. Is there an alignment issue to resolve?

2 – vivo Communication Technology

Thanks ZTE for the contribution on Rel-18 eRedCap.

Regarding cost reduction, do you think reducing UE RF BW to 5MHz is a must for cost reduction, or we can potentially keep 20MHz RF BW but reduce the baseband capability by TBS/RB restriction, etc for cost reduction. By this way, we would not suffer from many performance degradation issues(frequency diversity, scheduling flexibility, resource fragment) ?

For the improvement of co-existence with normal UEs, what enhancement do you have in mind?

3 – MediaTek Inc.

Thank you for sharing your views. We share your view that accurate positioning should be supported by RedCap. However, we prefer that this topic is discussed in an associated positioning work item to have all the relevant experts in the same room.

We also have the following questions:

Q1: As highlighted by 3GPP in the Rel-17 discussions, economies of scale is an important factor for reducing cost. Has the impact of market fragmentation been taken into consideration when suggesting lower bandwidth operation? Also have the limited cost benefits associated with lower bandwidths as outlined in RWS-210313 and RWS-210409 been considered?

Q2: Do you have any further details on the type of power saving enhancements needed?

Q3: What RedCap use cases do you foresee using multicast? Also, do you foresee any gaps with respect to supporting multicast as defined in R17 for RedCap?

4 – Guangdong OPPO Mobile Telecom.

Q1, For the 5MHz RedCap UE, if the restriction of 15 MHz is to make small impact of spec, the application frequency band would be very limited. What is the range of frequency for that kind of device you are targeting for.

Q2: For the coexistence issue, what is the standard can be improved for better of non-redcap UEs?

5 – Huawei Tech.(UK) Co.. Ltd

We also think coexistence between RedCap and non-RedCap UEs is important. In R17 it is already discussed. What are the further issues needing improvement, and why can't they be solved in Rel-17?

6 – Ericsson LM

Regarding further reduced UE bandwidth (RWS-210476), we would like to ask you to provide further details on your analysis of the potential UE cost reduction you expect from reduction from 20 MHz to 5 MHz, since according to the estimates from CATT (RWS-210409) and Ericsson (RWS-210313), which we believe are based on the established cost evaluation methodology (TR 38.875), there may not be a very significant further cost reduction compared to 20 MHz.

7 – Intel Corporation (UK) Ltd

Q1: What exact enhancements on UE power savings are being considered that would not be repetitive of R17 discussions?

Q2: What nature of enhancements are envisioned for enhanced co-ex with non-RedCap UEs?

Q3:'- Could you clarify what enhancements are needed specific to broadcast/multicast services e.g. is this due to the support of BR operation?

8 – Xiaomi Communications

[Xiaomi]: Thank you for the contribution. We have the following questions for your proposals

(1) : What is the motivation or application scenrio for broadcast and multicast

(2): For the positioning, what is your consideration for the requirement for the RedCap, define new requirement or reuse the existing requirement defined for non-RedCap

9 – Beijing Lenovo Software Ltd.

Thanks for consideration on RedCap evolution. For the point of enhanced power saving solutions, the eDRX and relaxed RRM measurement have been discussed in R17 RedCap, is there any other consideration on this point, or is it just an enhancement to eDRX or relaxed RRM measurement in RedCap?

10 – CATT

Thanks for the contribution. We have the following comments/questions.

1. For the evaluation of further cost reduction from 20MHz to 5MHz, it seems that your result is much higher than ours in RWS-210409. Can you please elaborate how 20% is derived?

2. If the UE BW is reduced to 5MHz, SSB with 30kHz SCS cannot be accommodated within 5MHz BW. Then there will be big spec/implementation impact. Otherwise if 30kHz SCS SSB is not supported, the usefulness in the real deployment is quite limited.

3. We support RedCap positioning in Rel-18 which can be included in the positioning item.

4. By default, RedCap UE supports all non-RedCap UE features except those due to reduced L1 capability. What additional enhancements do you have in mind for RedCap UE to support MBS?

5. What enhancements do you have in mind for coexistence enhancement?

11 – LG Electronics Inc.

Thanks for the contribution.

Q1) We agree that coexistence b/w RedCap UEs and non-RedCap UEs should always be taken into account. Regarding whether the coexistence should be an objective in the WID, do you see it necessary to have the coexistence as an WID objective, rather than kind of a note or a baseline assumption for Rel-18?

12 – NTT DOCOMO INC.

What kind of improvement do you see for coexistence with non-RedCap UEs in terms of technical features?

13 – Sony Europe B.V.

- positioning: Would you consider accuracy enhancements to compensate the reduced bandwidth (which may degrade the accuracy)?
- Do you have any enhanced power saving schemes in mind? Other companies have discussed lower power WUS as one avenue towards lower power consumption

3.10.2 Response (Round 1)

Feedback Form 34: Response to questions/comments for RWS-210476 (Round 1)

1 – ZTE Corporation

Response to common questions from FUTUREWEI #1/ MediaTek #3/ CATT #10 regarding positioning issue:

A1: For RedCap positioning, we think it is better to consider the new requirement/improvement supported by Rel-18 RedCap UEs. Putting it in RedCap agenda can avoid collision between two topics. In addition, we think most spec impact for RedCap positioning is on UE buffer/processing/complexity design which is more related with RedCap topics. Further, due to the limitation of redcap UE bandwidth, some RedCap dedicated solutions (e.g. frequency hopping) will affect the unicast transmission and scheduling, channel measurement and CSI feedback of Redcap UEs. Such impact on the regular RedCap features should be discussed in RedCap agenda. Even though that, our motivation is to support enhancement for RedCap positioning in Rel-18, we would be open to further discuss which agenda should be used.

2 – ZTE Corporation

Response to common questions from FUTUREWEI #1/ MediaTek #3/Intel #7/Xiaomi #8/CATT #10 regarding multicast issue:

A2: Due to the limitation of RedCap UE bandwidth, if multicast and unicast are still transmitted within one BWP, the peak rate of unicast and multicast may be limited. For multicast, we should study if specific multicast enhancement is needed for RedCap UEs.

3 – ZTE Corporation

Response to common questions from vivo #2/ OPPO #4/Huawei #5/Intel #7/CATT #10/ NTT DOCOMO #12 regarding co-existence issue:

A3: Due of limited TU in Rel-17, there may have some leftovers on co-existence. In addition, for better co-existence, there is a need to study multicast enhancement dedicated for RedCap UEs to avoid negative impacts on non-RedCap UEs. For improvement of co-existence with normal UEs, we consider to handle Rel-17 leftovers and study multicast enhancement for better co-existence performance.

4 – ZTE Corporation

Response to common questions from MediaTek #3/Ericsson #6 /CATT #10 regarding cost saving evaluation issue:

A4: If we take 100 MHz non-RedCap UE as reference, the cost saving of 5 MHz FDD RedCap UE is 33.5%. Since cost saving of 20 MHz FDD RedCap UE is 28%, further reducing UE bandwidth to 5 MHz can have additional 5.5 % cost saving gain (if we take 20 MHz RedCap UE as reference, the cost saving gain of further reducing UE bandwidth to 5 MHz is about 20%).

5 – ZTE Corporation

Response to common questions from OPPO #4/CATT #10 regarding application band issue for 5 MHz RedCap UE:

A5: We can use these devices in low frequency bands supporting 15 kHz SCS SSB. These bands have better coverage. These devices can also be used bands only supporting 30 kHz SCS SSB if UE implementation related solution is considered.

6 – ZTE Corporation

Response to common questions from Intel #7/ Lenovo #9 regarding power saving issue:

A6: We are open to any power saving solutions. We think it is necessary to evaluate the impact of system capacity and energy saving performance.

7 – ZTE Corporation

Questions/comments from vivo #2:

Regarding cost reduction, do you think reducing UE RF BW to 5MHz is a must for cost reduction, or we can potentially keep 20MHz RF BW but reduce the baseband capability by TBS/RB restriction, etc for cost reduction. By this way, we would not suffer from many performance degradation issues(frequency diversity, scheduling flexibility, resource fragment) ?

For the improvement of co-existence with normal UEs, what enhancement do you have in mind?

Response to vivo #2*:*

By bandwidth reduction, the cost of FFT and post FFT module can be further reduced. We are open to study and evaluate other complexity reduction method for cost saving. Please refer to A3 for the question related to co-existence with normal UEs.

8 – ZTE Corporation

Questions/comments from MediaTek #3:

Thank you for sharing your views. We share your view that accurate positioning should be supported by RedCap. However, we prefer that this topic is discussed in an associated positioning work item to have all the relevant experts in the same room.

We also have the following questions:

Q1: As highlighted by 3GPP in the Rel-17 discussions, economies of scale is an important factor for reducing cost. Has the impact of market fragmentation been taken into consideration when suggesting lower bandwidth operation? Also have the limited cost benefits associated with lower bandwidths as outlined in RWS-210313 and RWS-210409 been considered?

Q2: Do you have any further details on the type of power saving enhancements needed?

Q3: What RedCap use cases do you foresee using multicast? Also, do you foresee any gaps with respect to supporting multicast as defined in R17 for RedCap?

Response to MediaTek #3*:*

For Q1: We think RedCap UE with much lower cost is beneficial for RedCap ecosystem if it can significantly extend 5G applications in vertical domains.

For Q2: We are open to study and evaluate different types of power saving solutions.

For Q3: We think there a need to study efficient multicast solutions for RedCap UEs. Please refer to above common question A2.

9 – ZTE Corporation

Questions/comments from Xiaomi #8:

[Xiaomi]: Thank you for the contribution. We have the following questions for your proposals

(1) : What is the motivation or application scenrio for broadcast and multicast

(2): For the positioning, what is your consideration for the requirement for the RedCap, define new requirement or reuse the existing requirement defined for non-RedCap

Response to Xiaomi #8*:*

For (1): The motivation is to study efficient multicast solutions for RedCap UEs. Please refer to A2.

For (2): We think it is better to reuse the existing requirement as much as possible. However, there is a need to study whether the new positioning requirement is needed for RedCap UEs, e.g. the new UE processing capability/requirement for PRS measurement.

10 – ZTE Corporation

Questions/comments from Lenovo #9:

Thanks for consideration on RedCap evolution. For the point of enhanced power saving solutions, the eDRX and relaxed RRM measurement have been discussed in R17 RedCap, is there any other consideration on this point, or is it just an enhancement to eDRX or relaxed RRM measurement in RedCap?

Response to Lenovo #9*:*

It is not clear to us to consider further eDRX and relaxed RRM measurement in Rel-18. For other views on power saving, please refer to response A6 to common questions.

11 – ZTE Corporation

Questions/comments from LGE #11:

Q1) We agree that coexistence b/w RedCap UEs and non-RedCap UEs should always be taken into account. Regarding whether the coexistence should be an objective in the WID, do you see it necessary to have the coexistence as an WID objective, rather than kind of a note or a baseline assumption for Rel-18?

Response to LGE #11*:*

The coexistence enhancement between RedCap UEs and non-RedCap UEs is for specific cases, it is preferred to have an WID objective.

12 – ZTE Corporation

Questions/comments from Sony #13:

- positioning: Would you consider accuracy enhancements to compensate the reduced bandwidth (which may degrade the accuracy)?
- Do you have any enhanced power saving schemes in mind? Other companies have discussed lower power WUS as one avenue towards lower power consumption

Response to Sony #13*:*

- Regarding positioning, we are open to study accuracy enhancement.
- For enhanced power saving schemes, we are open to study and evaluate different types of power saving solutions including lower power WUS.

3.10.3 Questions/Comments (Round 2)

Feedback Form 35: Further questions/comments on RWS-210476 (Round 2)

1 – vivo Communication Technology

Thanks for your reply. In addition to BW reduction, we wonder what is your view on the following potential areas for Rel-18 eRedCap?

1) Lower UE power class
2) UE Processing time relaxation (data, CSI)
3) Reduced number of HARQ processes
4) serving cell RRM relaxation for stationary devices
5) Coverage recovery

2 – Sierra Wireless

WRT a 5MHz RedCap device - We are not supportive of creating another device type, for many reasons. The Cat-M2 5 MHz device type has never been commercialized as there is no market - CAT-M1 and CAT1Bis are enough. Using the already available ScalingFactor=0.4 can bring peak rate of Rel17 Redcap down to 34mbps which is close enough to Cat1Bis. A 5MHz Redcap device will further fragment the Redcap and NB-IOT/CAT-M1 market. The industry has shown that reducing bandwidth is not a good way to reduce cost and will certainly not yield a 20% cost reduction. A 5MHz Redcap device can only operate with SCS=15MHz unless massive standard changes are implemented.

3 – Spreadtrum Communications

We have some questions for co-existence issue as listed below:

1. What does the non-RedCap UE refers to? eMBB UE? URLLC UE? or both of them? Perhaps, co-existence with different UE may have different issues.

2. If we reuse the current multicast mechanism, what are the possible negative impacts on normal UEs? In our understanding, all the scheduling is up to gNB implementation, how the enhanced multicast can improve the co-existence performance?

4 – Huawei Tech.(UK) Co.. Ltd

Thanks for the reply. You indicated that there is a need to study multicast enhancement dedicated to RedCap UEs to avoid negative impacts on non-RedCap UEs. Could you please further clarify what is the particular issues for RedCap multicast?

5 – Ericsson LM

In our cost analysis for further reduced UE bandwidth from 20 MHz to 5 MHz (RWS-210313), we followed the established cost evaluation methodology (TR 38.875), and according to our result there was a very small further cost reduction: <10% if the baseline is Rel-17 RedCap (equivalent to <4% if the baseline is the Rel-15 NR reference UE). This result is in line with CATT (RWS-210409) and several companies have agreed with this result in their replies in NWM (DoCoMo, Intel, Lenovo, Sharp). Do you get different results using the same methodology?

6 – Guangdong OPPO Mobile Telecom.

For the co-exsitence evaluation, we expect some evluation methodolgy should be developed for the candidate solutions, e.g. multi-cast schemes and so on. What is the evaluation in your perspective?

7 – Intel Corporation (UK) Ltd

Follow-up to round #1: *On MBS enhancements for RedCap (A2 and A3), since the requirements for MBS are defined 'per service', if a session can be delivered to RedCap UE, it would work for non-RedCap as well. Also, the impact on combined peak rate between MBS and unicast would naturally follow from the BW restrictions for RedCap. Thus, it still is unclear what kind of enhancements related to co-existence are being envisioned here.*

3.10.4 Response (Round 2)

Feedback Form 36: Response to questions/comments for RWS-210476 (Round 2)

1 – ZTE Corporation

Questions/comments from vivo #1:

Thanks for your reply. In addition to BW reduction, we wonder what is your view on the following potential areas for Rel-18 eRedCap?

1) Lower UE power class

2) UE Processing time relaxation (data, CSI)

3) Reduced number of HARQ processes

4) serving cell RRM relaxation for stationary devices

5) Coverage recovery

Response to vivo #1:

1) Lower UE power class: We are open to study lower UE power class.

2) UE Processing time relaxation (data, CSI): We are open to further study relaxed UE processing time in terms of N1 and N2.

3) Reduced number of HARQ processes: We are open to study reduced number of HARQ processes

4) serving cell RRM relaxation for stationary devices

For serving cell measurement relaxation in RRC_IDLE/INACTIVE state, we understand it was excluded from Rel-17 because companies haven't identified effective serving cell RRM relaxation method without impacting IDLE/INACTIVE behaviour (e.g. Paging). On the other hand, the quality of serving cell measurement is used in "stationary criterion" evaluation. If serving cell measurement relaxation is applied, the transition from "relaxed mode" to "normal mode" may be delayed and affects mobility performance. So, we are afraid serving cell measurement relaxation cannot bring benefit as expected.

5) Coverage recovery

We are open to study coverage recovery solutions if coverage recovery requirement is identified for RedCap UEs.

2 – ZTE Corporation

Questions/comments from Sierra Wireless #2:

WRT a 5MHz RedCap device - We are not supportive of creating another device type, for many reasons. The Cat-M2 5 MHz device type has never been commercialized as there is no market - CAT-M1 and CAT1Bis are enough. Using the already available ScalingFactor=0.4 can bring peak rate of Rel17 Redcap down to 34mbps which is close enough to Cat1Bis. A 5MHz Redcap device will further fragment the Redcap and

NB-IOT/CAT-M1 market. The industry has shown that reducing bandwidth is not a good way to reduce cost and will certainly not yield a 20% cost reduction. A 5MHz Redcap device can only operate with SCS=15MHz unless massive standard changes are implemented.

Response to Sierra Wireless #2:

Considering that NB-IoT and Cat-M1 UEs are targeted for poor coverage scenario and delay tolerant service, 5 MHz RedCap device would not fragment NB-IoT/Cat-M1 market. 5 MHz RedCap device has much better latency performance and would be deployed for 5G vertical domains. For vertical applications, using 5 MHz RedCap UE instead of Cat-1bis for low-end applications can avoid maintaining two systems (5G based and LTE based).

3 – ZTE Corporation

Questions/comments from Spreadtrum #3:

We have some questions for co-existence issue as listed below:

1. What does the non-RedCap UE refers to? eMBB UE? URLLC UE? or both of them? Perhaps, co-existence with different UE may have different issues.

2. If we reuse the current multicast mechanism, what are the possible negative impacts on normal UEs? In our understanding, all the scheduling is up to gNB implementation, how the enhanced multicast can improve the co-existence performance?

Response to Spreadtrum #3:

Thanks for the questions.

Response to 1: Non-RedCap UE refers to legacy NR UE including eMBB UE and URLLC UE. For potential different co-existence issues, we can consider different solutions.

Response to 2: If RedCap and non-RedCap UE share the same multicast transmission, the TBS scheduled is limited and multicast data should be scheduled within 20 MHz bandwidth in FR1. It may have negative impact on the transmission efficiency of non-RedCap UEs.

4 – ZTE Corporation

Questions/comments from Huawei #4:

Thanks for the reply. You indicated that there is a need to study multicast enhancement dedicated to RedCap UEs to avoid negative impacts on non-RedCap UEs. Could you please further clarify what is the particular issues for RedCap multicast?

Response to Huawei #4:

Due to bandwidth reduction for RedCap UEs, the peak rate of multicast for RedCap would be limited. If multicast transmission is shared for RedCap and non-RedCap, the transmission efficiency for non-RedCap would be impacted.

5 – ZTE Corporation

Questions/comments from Ericsson #5:

In our cost analysis for further reduced UE bandwidth from 20 MHz to 5 MHz (RWS-210313), we followed the established cost evaluation methodology (TR 38.875), and according to our result there was a very small further cost reduction: <10% if the baseline is Rel-17 RedCap (equivalent to <4% if the baseline is the Rel-15 NR reference UE). This result is in line with CATT (RWS-210409) and several companies have agreed with this result in their replies in NWM (DoCoMo, Intel, Lenovo, Sharp). Do you get different results using the same methodology?

Response to *Ericsson #5:*

Regarding bandwidth reduction to 5 MHz, for baseband, besides ADC/DAC and FFT/IFFT, the cost of post FFT buffering and LDPC decoding would be reduced. If the baseline is the Rel-15 NR reference UE, further bandwidth reduction to 5 MHz would have 5.5% additional cost reduction gain.

6 – ZTE Corporation

Questions/comments from OPPO #6:

For the co-exsitence evaluation, we expect some evluation methodolgy should be developed for the candidate solutions, e.g. multi-cast schemes and so on. What is the evaluation in your perspective?

Response to OPPO #6:

Regarding evaluation, we think the peak data rate and spectral efficiency performance can be considered.

7 – ZTE Corporation

Questions/comments from Intel # 7:

Follow-up to round #1: On MBS enhancements for RedCap (A2 and A3), since the requirements for MBS are defined 'per service', if a session can be delivered to RedCap UE, it would work for non-RedCap as well. Also, the impact on combined peak rate between MBS and unicast would naturally follow from the BW restrictions for RedCap. Thus, it still is unclear what kind of enhancements related to co-existence are being envisioned here.

Response to Intel #7:

If a multi-cast session is shared for RedCap and non-RedCap, the peak data rate and transmission efficiency for non-RedCap would be restricted. A session delivered to only non-RedCap UE can be scheduled in a wider bandwidth. Therefore, multicast transmission dedicated to RedCap UEs and corresponding enhancement can be considered.

3.11 RWS-210477 Support of ATG for 5G Advanced

In RWS-210477, we elaborate more on ATG usage from different perspectives, e.g. market demand from several regional commercial or trial test, the online service that ATG could provide on the airplane, the basic functionality of ATG BS to support airplane traffic, additional benefit of ATG system compared with satellite system and also foreseen Rel-17 RAN4 workload. Based on the all considerations above, we made the following proposal:

- Proposal 1: It's very essential to start this ATG work as soon as possible. If ATG cannot be accommodated in Rel-17 time frame, then ATG WID should be considered in Rel-18 time frame at least.

3.11.1 Questions/Comments (Round 1)

Feedback Form 37: Questions/comments on the aspects discussed in RWS-210477 (Round 1)

1 – Intel Corporation (UK) Ltd

1) What are candidate RF bands for ATG operation?

2) Does the proposal focus on co-channel or adjacent channel deployment with terrestrial networks?

3) What is the target UE power class (including antenna gain)?

2 – Beijing Xiaomi Mobile Software

Considering the ATG work was proposed for a long time and market demands is clear, we support to start this ATG work in R18.

3 – Lenovo (Beijing) Ltd

The scope of ATG is clear and the commercial demand is insistent. This WI should be completed no late than R18.

4 – China Mobile Group Device Co.

The existing Rel-17 NTN WI does not specify the RF requirements of ATG, in order to avoid confusion and overloading of the NTN WI and the low dependency between RAN1-3 work and RAN4 work for ATG, it is proposed that the ATG RAN4 work is performed within the context of the ATG WI. The proposal to split off RAN4 work is exceptional for the NTN work due to the large and complex scope of covering quite different types of system and low dependency on RAN1-3. Considerting that the ATG WID is very satble, CMCC support the ATG WI led by RAN4 in Rel-18.

5 – China Telecommunications

We would like to echo the urgency and importance of ATG for operators' 5G development. From our side, we already have ATG trials for several domestic routes. Candidate RF band for us includes n78.

We really appreciate if ATG can be considered in Rel-18 at the latest.

6 – vivo Communication Technology

We support to do ATG work in Rel-18, and suggest to consider it as high priority.

7 – VODAFONE Group Plc

Thank you for your contribution, we have a question:

1- there are a few proprietary solutions being trialled around the world and Europe, how would you differentiate your proposal from other proposed solutions., what aspect of this can be standardised? More clarity would be useful !

3.11.2 Response (Round 1)

Feedback Form 38: Response to questions/comments for RWS-210477 (Round 1)

1 – ZTE Corporation

Response to Beijing Xiaomi Mobile Software#2/ Lenovo (Beijing) Ltd#3/ China Mobile Group Device Co.#4/ China Telecommunications#5/Vivo#6

We fully agree that ATG work needs to be completed no later than Rel-18.

2 – ZTE Corporation

Response to Intel#1:

1) We are open for operating band for ATG and this should mainly depend on operators' request;

2) Co-channel operating with Terrestrial network, meanwhile coexistence between ATG+terrestrial network and terrestrial network should be evaluated.

3) Start with Power class 26dBm and antenna gain 20dBi, dual polarization;

3 – ZTE Corporation

Response to Vodafone#3:

RAN1/RAN2/RAN3 aspects of standardization work are generic for Satellite, HAPS and ATG. They have been already considered and standardized in Rel-17 NTN WI. In RWS-210477, we mainly discussed RAN4 aspects of ATG which have different consideration on requirements compared to Satellite/HAPS. We think it is important to setup RAN4 requirements so that ATG deployment can follow.

4 Summary

Two rounds of discussion have been done on the following 11 contributions submitted to agenda item 4.2 non-eMBB driven evolution. The numbers of comments and companies involved in the discussion are listed as below:

- *RWS-210467 Evolution of massive NR based IoTs for 5G Advanced* : 5 comments from 5 companies:

- *RWS-210468 Enhancements on NTN for 5G Advanced* : 12 comments from 10 companies;

- *RWS-210469 Discussion on Working Areas of XR for 5G Advanced* : 10 comments from 8 companies;

- *RWS-210470 Further enhancement for Sidelink* : 10 comments from 9 companies;

- *RWS-210471 Evolution of NR positioning in Rel-18* : 14 comments from 9 companies;

- *RWS-210472 Mesh based NR LAN* : 8 comments from 7 companies;

- *RWS-210473 MBS Enhancement for 5G Advanced* : 15 comments from 12 companies;

- *RWS-210474 Support of UAV for 5G Advanced* : 5 comments from 5 companies;

- *RWS-210475 Support of Mobile IAB for 5G Advanced* : 5 comments from 5 companies;

- *RWS-210476 Rel-18 NR RedCap evolution* : 20 comments from 15 companies;

- *RWS-210477 Support of ATG for 5G Advanced* : 7 comments from 7 companies.

The responses to the received questions/comments have been provided in this document.