**RAN-R18-WS-crossFunc-CMCC - Version 0.0.2**
**RAN**

3GPP TSG RAN Rel-18 workshop RWS-210614

Electronic Meeting, June 28 - July 2, 2021

Agenda Item: 4.3

Source: CMCC

Title: Email discussion summary for [RAN-R18-WS-crossFunc-CMCC]

# 1 Introduction

This document is used for email discussion before the workshop to collect comments/questions from companies regarding CMCC's contributions under agenda item 4.3 and to provide answers.

This email discussion summary covers the following documents, including one overview [1] and five seperate topics (Topic#1-Full duplex[2][3], Topic#2-UE aggregation[4][5], Topic#3-AI enabled RAN (RAN3)[6], Topic#4-AI enabled RAN (PHY)[7][8], Topic#5-Network energy saving[9]):

-[1] RWS-210351 CMCC views on Rel-18 Cross-Functionalities for both eMBB and Non-eMBB Evolution

-[2] RWS-210353 Motivation of study for full duplex in NR

-[3] RWS-210352 New study on full duplex for NR

-[4] RWS-210355 Motivation of study for UE Aggregation

-[5] RWS-210354 New SID on UE Aggregation

-[6] RWS-210359 Motivation for support of AI-enabled NG-RAN

-[7] RWS-210357 Motivation of study for evaluation methodology of AI enabled physical layer enhancement

-[8] RWS-210356 New SID on evaluation methodology of AI enabled physical layer enhancement

-[9] RWS-210358 Network energy saving

The following sections are structrued as following:

-Section 2 is used for collecting comments/questions in 1st round emaill discussion, in which section 2.1 is to collect the general comments, and section 2.2 is used to collect comments/questions regarding topic#1 (full duplex [2][3]), and section 2.3 is used to collect comments/questions regarding topic#2 (UE aggregation[4][5]), and section 2.4 is used to collect comments/questions regarding topic#3 (AI enabled RAN (RAN3)[6]), and section 2.5 is used to collect comments/questions regarding topic#4 (AI enabled RAN (PHY)[7][8]), and section 2.6 is used to collect comments/questions regarding topic#5 (Network energy saving[9]).

-Section 3 is used for providing answers to the comments/questions in 1st round.

-Section 4 is used for collecting comments/questions in 2nd round, similar as in section 2.

-Section 5 is used for providing answers to the comments/questions in 2nd round, similar as in section 3.

Timeline for the email discussion is:

-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

# 2 [1st Round] Comments/Questions

## 2.1 General Comments

**Feedback Form 1: General comments in 1st round**

**1 – Rakuten Mobile**

We can support RAN3 WI which targets use of AI/ML for energy saving, traffic steering, load balancing etc.

## 2.2 Comments on Topic#1(Full Duplex [2][3])

**Feedback Form 2: Commens/Questions on Full Duplex [2][3]**

**1 – CATT**

Thanks for the contribution and we have following comments/questions for clarification:

C1: Agree the observation that for type-2 FD, we can first focus on isolated scenario and small cells with limited Tx power and limited number of antennas.

Q2: On page 4, why would DL/UL symbol misalignment have impact on the inter-cell CLI management? Is it based on certain assumption of CLI mitigation scheme?

**2 – ZTE Corporation**

Thanks for the contribution and the thorough analysis of interference occurred in different full duplex modes.

According to the analysis in the P4/P5 in RWS-210353, it seems the inter-cell CLI at gNB/UE side is more challenging in both duplex modes due to the misalignment of the DL/UL symbol boundary in multiple cells. However, the suggested SI objectives focus on the self-interference, without considering CLI. Would you mind to clarify the discrepancy?

**3 – vivo Communication Technology**

Thanks CMCC for the proposal. We have following questions and comments

1. To our understanding, the proposal focusedon full duplex at gNB side, assumption at the UE side is still half-duplex as in Rel-17. Is this the correct understanding?

2. For Type-2 FD, what is CMCC's view on how to handle the adjacent channel CLI issue in case multiple operators share the same TDD band?

3. For the handling of intra-cell UE-to-UE CLI, the scheduling restriction method was mentioned, do you think either type-1 or type-2 FD potentially requires more stringent UE RF requirement to handle the intra-cell UE-to-UE interference? From our perspective, it would be very important to avoid UE hardware change for the full duplex study in Rel-18.

4. What frequency band does CMCC consider for gNB side full duplex, is it for TDD band only, or also include low band FDD?

**4 – Lenovo (Beijing) Ltd**

Thanks CMCC for the nice contributions for FD.

From the 3rd sub-bullet (i.e., duplex mode) of the first proposed objective, it seems you are open to study full duplex in UE side in Rel.18, is it correct understanding? We see that only RAN1 is listed in the study, while maybe RAN4 should be involved as well, which is especially vital to determine the scope. Generally, it would be good to settle down the scope for FD at the first stage since it is expected that much more standard impact might be needed to support both UE and gNB FD than to support gNB FD only.

**5 – Rakuten Mobile**

Thanks CMCC for Contribution.

We support Type1 FD ( Sub Band wise Full duplex ) for Rel18 ,since this topic will cover most aspects & Type 2 FD can be consider for future releases.

**6 – China Unicom**

Thanks for the contribution from CMCC, and we have the following questions for clarification:

Q1. Taking into account antenna configuration and other factors, what is difference if supporting Full duplex in TDD and FDD bands?

Q2. What is the potential solution to solve self-interference in R18?

Q3. Need clarifications on the '**deployment**' in " Requirement of self-interference cancellation capabilities for different **deployments** [RAN1/RAN4]". Is it related with deployment scenario for two types of FD gNB?

**7 – Guangdong OPPO Mobile Telecom.**

Thanks for interesting paper. In general we are open to study sort of full duplex. Here are some questions and comments:

Q1: for type-1 FD case, can we limit the case where slot frame structure is aligned among cells in the study?

Q2: for both type-1 FD and type-2 FD, can we assume they are only applicable for gNB but not UE i.e. from UE perspective, UE will only transmit or receive in one slot but not simultaneously?

Q3: for both type-1 FD and type-2 FD, can we assume no extra RF and demodulation core requirement wil l be added for UE compared to Rel17?

Q4: can we assume only TDD bands will be addressed in this study? what is typical bands in your mind?

C1: We think for type-2 FD, isolated case is good start. but still feasibility study is necessary, especially on self-cancellation performance.

C2: We think co-existence with legacy UE is important to be discussed in this study

C3: RAN4 should be also involved in the work ”Techniques of self-interference cancellation”

C4: Type-1 FD is prioritized to get a manageable scope based on the maturity of the technologies

**8 – Spreadtrum Communications**

Thanks for the well-written contribution, we have a question for subband full duplex. As shown in Figure 1(a) 1(c), three examples are given. We notice that in the three examples, there is no common DL slot in all the subbands. Will you consider the case that all the subbands has common DL slots/symbols? Which one is your first priority among the three examples?

**9 – MediaTek Inc.**

Thanks for the contribution. Some questions as below.

Q1: What’s the regulation status to enable fullduplex in TDD bands in China?

Q2: What is the impact of gNB FD support onto NR legacy UEs from R15/16/17 due to UE-UE CLI? How can these terminals be protected from UE-UE CLI? Legacy UEs cannot implement any CLI mitigation techniques or CLI-related measurements.

Q3: What is the impact on legacy gNB because of gNB-gNB CLI?

Q4: Is there any expected RF specification tightening for future R18 Half Duplex UEs (ACLR, ACS, in-band blocking, etc) to operate with a SSFD or SBFD-capable gNB?

Q5: Is there a significant power consumption impact onto FD-capable gNBs?

Q6: Is there any significant difference between FR1 and FR2 to minimise UE-UE CLI and gNB-gNB CLI.

Q7: A huge amount of effort will be needed in RAN4, which is already overloaded. Do you believe the RAN4 effort be prioritised on FR2 over FR1?

Q8: What is the specific mechanism for CLI measurement report in a dynamic scheduling situation where different unknown UEs may be interfering one another at different times?

Q9: UE-UE intra-cell and inter-cell CLI for case 1 is ”manageable” via scheduling restriction. However, the performance loss due to scheduling restriction may eat up the performance gain obtained by full duplex. Do you think the trade-off is worthy?

**10 – LG Electronics Inc.**

We think the potential study objectives for full duplex in page 6 is reasonable. We have small question for our clarification regarding the evaluation methodology and performance metrics.

Q1) Regarding the ’coverage’ among the performance metrics (e.g., spectrum efficiency, user perceived throughput, latency, coverage, etc.), do you think what is performance metric to measure coverage?

Q2) Also, in Rel-17, specification work for coverage enhancement is ongoing. Do you think what is different point/scope for coverage enhancement in Rel-17 and coverage study for full duplex operation?

**11 – Intel Corporation (UK) Ltd**

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

1. Given that basic feasibility of FD @ gNB needs to be determined by RAN4 as a first step, what is your view on managing the studies across RAN1 and RAN4? Specifically, under what assumptions should

RAN1 proceed with their study w/o information on isolation and self-, adjacent channel, intermodulation interference effects that would need RAN4 expertise?

2. Following further on the above question, could you elaborate how RAN1 and not RAN4 would be better suited to study self-interference and adjacent channel interference techniques (as suggested in the proposed objective)?

3. One of the objectives mentions studying FD at UE side. For FD at UE, have you considered practical feasibility and challenges for the isolation and interference filtering/cancelation methods, even for "partial self-interference cancelation" and it's effectiveness considering (1) form-factor limitations; (2) # of antennas/antenna elements/panels, e.g., to realize isolation or to realize nulling at another UE while still effectively steering a strong-enough beam to the gNB; (3) device complexity, etc.?

4. Any views on applicable bands? TDD only or are you considering FDD bands as well?

**12 – Huawei Tech.(UK) Co.. Ltd**

Shouldn't RAN4 lead the study on the feasibility of self-interference cancellation to enable full duplex, rather than RAN1? This seems very much related to RF hardware.

Should the study include considerations on the cross-link interference? The CLI is different from what has been done during R16 because CLI occurs between UEs in the same cell. For BS-BS CLI interference, we think that some advanced solutions are needed to mitigate the BS-BS interference.

**13 – Nokia Corporation**

What kind of performance impacts especially in DL performance do you foresee if UEs do not support full duplex? How about handling and DL performance of legacy UEs? Are you considering the earlier RAN4 co-existence studies for dynamic TDD as starting point to avoid repeating the same studies?

**14 – Qualcomm Incorporated**

Thanks for the contribution and the discussion on both types of FD operation. We have couple of questions for clarification:
Q1) For macro deployment with high power gNB, in your views which type of FD is more feasible for FR1 and FR2?
Q2) Rel-18 study on full duplex gNB can be considered/extended to other scenarios as IAB node. What are your views on extension of the study to full duplex deployment of IAB in addition to Rel-17 IAB enhancement?

**15 – Samsung Electronics Polska**

Thanks you the paper. It is mentioned that inter-cell CLI may be challengeable for XDD and FD, if timing is not well-aligned between cells. Do you think we have to consider both time aligned and mis-aligned scenario in Rel-18, or only consider time aligned scenario in Rel-18, and consider mis-aligned scenario in later release ?

**16 – Fraunhofer HHI**

Thank you very much for the paper, which highlights the expected gains very well. The proposed scope on slide 6 reads well structured for a study. We would appreciate if you could elaborate further on the aspect of coexistance among different operators:

Q1: Are you considering coexistence among multiple operators using FD capabilities in their network or rather a scenario where one Operator is using FD techniques while another remains at traditional TDD w/o FD capabilities in the gNB?

Q2: Do you expect different performance levels for Adjacent channel interference than in subband-wise FD operation when configured similarily?

**17 – Xiaomi Communications**

Thanks CMCC for Contributions.

We support Type1 FD ( Sub Band wise Full duplex ) has priority for Rel18 , Type 2 FD can be consider for future releases. Is it still half-duplex at the UE side in Rel-18 study?

**18 – Spark NZ Ltd**

There will be very significant operational problems when any kind of FD is introduced.. For clarity this item is discussing full duplex simultaneously in time and frequency.

This differs from conventional full duplex methods where TDD or FDD used. TDD is FD in frequency but not time. FDD is FD is time but not frequency.

Multiple operators in the same band will need to follow the same protocol and should be synchronised. otherwise there is inter operator interference.. Even in TDD systems unless they are synchronised there is potential for interference and large guard bands are needed. we would like to point you to ITU R 5D work on TDD synchronisation.

Even when the band is say hypothetically all allocated to one operator, there is Tx into receive interference that may be able to be mitigated at the base station but not easily at the handset as this will pose computation overhead to mitigate sensitivity degradation unless the handset is conventional TDD.

the gains of this work item are questionable!

## 2.3 Comments on Topic#2(UE Aggregation [4][5])

**Feedback Form 3: Commens/Questions on UE Aggregation [4][5]**

**1 – Xiaomi Communications**

This is an interesting topic in Rel-18. We have the following questions for clarification:

Question 1: How are the two devices connected with each other (e.g. via cable/3GPP Uu/3GPP sidelink/WiFi/Blue-Tooth)?

Question 2: We are wondering whether the enhancements on IAB/Sidelink Relay/LTE-like L3 relay station/LTE-like LWA can acheive the same purpose.

**2 – China Unicom**

Q1: If different types of service (i.e. eMBB and URLLC) are aggregated to transmit, how to guarantee service quality during the scheduling or transmssion?

Q2: Is one UE could be connected to single UE in one pair or to multiple UEs for transmission diversity?

**3 – ZTE Corporation**

We share similar views that UE aggregation can be used as one way to boost UL transmission power. We have two clarification questions.

1) In addition to power domain, do you intend to explore other potential benefits, e.g., spatial domain for multi-path transmission from the aggregated UEs?

2) How are the aggregated UEs connected, e.g., by Uu, SL or others? Do you intend to specify/enhance the connections among aggregated UEs in the proposed SID?

**4 – HuaWei Technologies Co.**

For UE aggregation, we share similar view. Do you think there is any difference with using sidelink L2 relay supporting multi-path (i.e., direct and indirect) ? In our understanding the standards scope/impact are quite similar.

**5 – vivo Mobile Communication Co.**

Thank you for the contribution. We are quite interesting about this use case. It is similar with our case3.2 in our Tdoc RWS-210172(PIOT).

How to connect two UEs in CMCC mind?

**6 – CATT**

This seems an interesting topic to further discuss. A few questions for a better understanding of the proposed stuides/work.

1. First of all we'd like to clarify whether it is correct understanding that the intended study/work actually does not have extra requirement for the link btw UE, i.e., it is either SL or other type wired line, etc.?

2. Then we'd like to understand the main drive force, i.e., is it for higher data rate, or also for reliability?

3. Also it would be good to roughly understand the amount of work required for SA, as it seems RAN would need to know the relationship of the UEs based on some info provided by CN?

**7 – Apple Portugal**

Q1: What's the assumption of the link between two UEs, including the link type (e.g. WIFI, BT, SL), the requirement on the link (i.e. delay, throughput)?

Q2: How can NW identify that the two UEs are associated for the same user or same service's transmission?

**8 – Intel Corporation (UK) Ltd**

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

1. Is it possible to clarify the use case of UAV for data aggregation? Is it aggregation of different UAV's UL data towards NG-RAN?

**9 – Lenovo Mobile Com. Technology**

Thanks for the interesting porposals! we have following questions for further understanding

1. whether aggregate UE is treated as two UEs or one UE from gNB point of view?
2. Does aggregate UE share the same RRC layer and SDAP layer?
3. the split L2 architecture is only for UL or for both DL and UL?

**10 – Qualcomm Technologies Int**

1. Does the proposed framework for UE aggregation allow for autonomous UE discovery and association, or the network directly manages sidelink communications between UEs, or all UEs are physically collocated and the connection is wired?

2. If all UEs are collocated, what differentiate the proposed approach from the SA-2 based solution for dual UE?

**11 – Asia Pacific Telecom co. Ltd**

Thanks for sharing the interesting ideas.

1. We would like to clarify more on the terminology of the aggregated terminals. The aggregated terminals are belong to a single UE or they were two independent UEs, physically. From the gNB's perspective, does the gNB treat the aggregated terminals as two independent UE before aggregation, and the two independent UEs are aggregated by gNB's configuration? Is any discovery or pairing procedure needed for aggregating the two UEs?

2. Furthermore, is there any data link between the PDCP/RLC/MAC of each aggregated terminals?

**12 – Asia Pacific Telecom co. Ltd**

One more question.

3. It seems improving UL throughput is the main target here, since it is proposed to avoid data duplication. Is it possible to also allow data duplication to ensure reliability when it cannot be ensured by a single device?

## 2.4 Comments on Topic#3(AI enabled RAN (RAN3 part)) [6]

**Feedback Form 4: Commens/Questions on AI enabled RAN (RAN3 part) [6]**

**1 – CATT**

Thank you for the contribution. We have one question on the second bullet of the Rel-18 work. Here, only enhancement on network interface is indicated, I am wondering whether we could also consider information driven from UE if benefits are justified.

**2 – ZTE Corporation**

Thanks for the contributions. We share the same view of the Rel-18 Objectives. We also think Rel-18 need to focu on the normative work of prioritized use cases first.

**3 – LG Electronics France**

Q1) Is there other use cases to be considered except the three prioritized ones in RAN3?

Q2) On P1, i.e., in the Rel-18 follow-up WI, it should be the same assumption as the current on-going SI, i.e., focus on the current NG-RAN architecture and interfaces?

**4 – Futurewei Technologies**

We support the idea that the R17 RAN3 SI should progress further and identified specs impact may be turned into WI in R-18. We also share the view that new use cases, such as AI for air interface, should be studied.
In addition, as AI/ML approach is data-driven, we suggest considering using common datasets for at least testing identified use cases, using a common evaluation methodology, as discussed in RWS-210038.

**5 – Intel Corporation (UK) Ltd**

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

1. What is your assumption on training (e.g., whether it is performed at each NW node or in a coordinated manner) and frequency of adaptation for load balancing/traffic management?

**6 – Samsung Electronics Polska**

We agree to study on other use case. What is the benefits and drawbacks for three ways: extend existing one, set-up a new one, combine with other SI?

**7 – MediaTek Inc.**

Thanks for the contribution. Some questions for clarification:

1) What does CMCC think about RAN1/RAN2's involvement in this work?

2) What is CMCC's stand on the AI for air interface?

**8 – NEC Corporation**

NEC supports having WI in RAN3 as continuation of the current RAN3 SI and having a new SI as continuation of the current RAN3 SI covering wider scope and use cases.

## 2.5 Comments on Topic#4(AI enabled RAN (PHY part) [7][8])

**Feedback Form 5: Comments/Questions on AI enabled RAN (PHY part) [7][8]**

**1 – Rakuten Mobile**

We support use of AI/ML in RAN1 for enhancement on physical layer.

**2 – Intel Corporation (UK) Ltd**

1. In the context of air-interface - what is envisioned as a common data-set? Is it a deployment scenario/channel model and related parameters ?

**3 – Futurewei Technologies**

FUTUREWEI supports the view on identifying candidate AI/ML-based PHY layer use cases and studying common evaluation methodologies for AI/ML-based functionalities, which include common datasets and performance evaluation metrics as explained in RWS-210038, https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_A 210038.zip.

However, regarding the study of typical AI models for ”each” use case, we believe this is not needed at this stage for the following reasons:

1. Many use cases may not involve direct model offloading to UE or other nodes.

2. Even if there is use case that desires transferring AI/ML model to other entities, it has to be studied on a case by case basis to evaluate different options and their feasibilities before we start to study typical AI model architecture. Feel free to share your view at: https://nwm-trial.etsi.org/#/documents/4751

**4 – CATT**

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

Q1: On page 2/3, what is the role of typical AI model? Is it to be specified in specification?

Q2: Regarding common dataset, it is 3GPP that develops a common dataset for each use case, and each individual company can use the common dataset to train and validate their own AI module. Is it correct understanding?

**5 – Sony Corporation**

Thanks for the contribution. We have two questions.

- Could you clarify the “*common*” of common dataset mean?
- Who use the common dataset for training, gNB, UEs or both?

**6 – Lenovo (Beijing) Ltd**

Thanks for the contribution, we also support to firstly study the evaluation methodology of AI based physical layer enhancements, as the same as our proposals (RWS-210260).

One question is what do you mean ‘typical AI model’ and ‘common parts of different AI models’?

**7 – Qualcomm Incorporated**

What is typical AI model and what is its usage? Will it have spec impact?

**8 – MediaTek Inc.**

Thanks for the contribution. Some questions for clarification:

1) What are the prioritized use cases to be studied?

2) Does CMCC think it is useful to establish the ”test data set” (repository)?

**9 – HUAWEI TECHNOLOGIES Co. Ltd.**

Thank you very much for the contribution. We have one question for clarification as below:

Q1. In our understanding, the bullet ”Study the typical AI models for each use case” is only for evaluation, i.e. the study on the AI models is to align the AI models to be used to evaluate whether a use case is beneficial or not, right? Otherwise, in general detailed AI/ML algorithms and models shall be left for implementation.

## 2.6 Comments on Topic#5(Network energy saving [9])

**Feedback Form 6: Comments/Questions on Network energy saving [9]**

**1 – MediaTek Inc.**

Thanks for the quality contribution on network energy saving. Below please find our comments/questions:

- It is understood the target of network energy saving is to reduce operator OPEX. On the other hand, **user experience should not be compromised in order to avoid impact to user subscription**. In this regard, it will be important ensure minimum impact to legacy UEs (R15/R16/R17) in the aspects of coverage, mobility, packet throughput/latency and UE power consumption.

- Answer to the above question can base on system-level evaluation with UE metrics included. Since system-level evaluation assumptions for UE power consumption has been developed in TR38.840, it is possible to leverage and extend the methodology to further include network power models and operations so as to optimize overall system energy efficiency. In this regard, an dedicated SI/WI for comprehensive investigation is suggested.

- Enabling dynamic gNB/TRP power saving will be a key enhancement for better system energy efficiency. Since, for gNB/TRP power saving, potential UE UL activity will also prevent gNB/TRP to enter deeper sleep, it is suggested to take both gNB/TRP and UE into account for developing the most effective solutions.

**2 – CATT**

Thanks for sharing your view and desire in network energy saving. The network energy saving had been studied in Rel-10 LTE. The study results in Rel-10 showed the most network energy saving solutions would be network implementation solution. It is also known that network energy saving would have potential impact to the UE service and coverage. Do you have any targets or requirements of NR network energy saving study in Rel-18?

**3 – BBC**

**Sustainability**

The BBC supports measures to improve the sustainability of the 5G RAN.

In particular we're keen to see a realistic and standardised methodology for the measurement and modelling of power consumption in networks to help operators to reduce their impact. In addition, as a content provider, the BBC would like the ability to better understand the impact of our content being consumed over these networks to also drive down our impact.

**4 – Intel Corporation (UK) Ltd**

Thank you for the contribution.

1. Can you please clarify a bit more on multi-RAT/multi-carrier synergy for energy saving? Do you mean adaptation of carriers based on UE assistance info?

**5 – Qualcomm communications-France**

Could you please clarify how ”Multi-RAT/multi-carrier synergy energy savings mechanisms” enable network power savings? An example would be great

**6 – ZTE Corporation**

Thanks for the contribution.

We also observe that the 5G BS energy consumption contributes a lot in OPEX due to the increased bandwidth, number of RX chains,etc. We agree that network power saving techniques should be considered to develop a green and sustainable 5G.

We also believe that the awareness of traffic or UE behavior are helpful to network power saving. Besides, we think other techniques such as dynamic antenna/beam on-off operation and network coordination can be also considered.

Moreover, would you mind to clarify (1) how to define “different energy saving modes” and (2) how to implement “Traffic/UE behavior/user experience aware energy saving mechanisms”?

**7 – LG Electronics Polska**

In potential objectives, you mentioned ”definition of different energy saving modes and network signaling support to enable energy saving”. Would you clarify why different energy saving modes should be considered?

**8 – HUAWEI TECHNOLOGIES Co. Ltd.**

Thank you very much for the contribution. Please find one question for clarification as below:

Q1. Could you explain a little bit more on multi-RAT/multi-carrier synergy for energy saving?

**9 – Beijing Lenovo Software Ltd.**

Thanks for the contribution, our concerning is whether this network power saving needs the UE assistant information. Maybe, lots of information could be known by network implementation, an efficient and simple reporting is desired from the view of UE power saving, which should be identified based on the potential mechanism in the future discussion.

# 3 [1st Round] Answers

## 3.1 Answers to the general comments

## 3.2 Answers for Topic#1(Full Duplex [2][3])

The objectives were updated based on comments/questions as following:

**-General study on different variants of full duplex operation in TDD bands [RAN1, RAN4]**

-Deployment scenarios (e.g., Isolated, Indoor, Urban, Rural) [RAN1]

-Frequency range and regulation (e.g., FR1, FR2) [RAN1, RAN4]

-Duplex mode at gNB (e.g., Sub-band wise FD, Frequency fully overlapped FD) assuming UE does not support simultaneous transmission and reception [RAN1, RAN4]

-Antenna configuration (e.g., Single-/multi-panel, Co-located/distributed antennas, antenna scale) [RAN1]

**-Study on the feasibility of self-interference/cross-link interference cancellation to enable full duplex [RAN4, RAN1]**

-Techniques of self-interference/cross-link interference cancellation and corresponding capabilities [RAN4, RAN1]

-Requirement of self-interference cancellation capabilities for different deployment scenarios [RAN1, RAN4]

**-Evaluate the performance of full duplex [RAN1]**

-Evaluation methodology and performance metrics (e.g., spectrum efficiency, user perceived throughput, latency, etc.)

**-Study on coexistence among different operators in adjacent channels [RAN4]**

**-Study on coexistence with legacy UE [RAN1, RAN4]**

**-Identify the potential standardization impact to support full duplex operation [RAN1, RAN2, RAN4]**

-Note 1: The UE hardware impact should be minimized.

-Note 2: For frequency fully overlapped full duplex, focus on isolated scenario.

The questions/comments in the 1st round and corresponding answers are categorized as follows:

### 3.2.1 Consideration on frequency band

[vivo]What frequency band does CMCC consider for gNB side full duplex, is it for TDD band only, or also include low band FDD?

[OPPO] can we assume only TDD bands will be addressed in this study? what is typical bands in your mind?

[Intel] Any views on applicable bands? TDD only or are you considering FDD bands as well?

**[Answer]: We mainly consider gNB side full duplex for TDD bands for both FR1 and FR2. We can make it clear in the 1st objective to focus on TDD bands in this study.**

### 3.2.2 Regulation status

[MTK] What's the regulation status to enable fullduplex in TDD bands in China?

**[Answer]: For TDD bands, there is no regulation to prevent full duplex operation in China.**

### 3.2.3 Deployment scenarios

[Qualcomm]Q1) For macro deployment with high power gNB, in your views which type of FD is more feasible for FR1 and FR2? Q2) Rel-18 study on full duplex gNB can be considered/extended to other scenarios as IAB node. What are your views on extension of the study to full duplex deployment of IAB in addition to Rel-17 IAB enhancement?

**[Answer]: Regarding Q1, in our view, for macro deployment with high power gNB, type-1 FD (i.e., Sub-band wise FD) is more feasible for FR1, while for FR2 it may need more study. Regarding Q2, we are open to consider the extension of the study to full duplex deployment of IAB in addition to Rel-17 IAB enhancement.**

### 3.2.4 Whether UE supports full duplex or not

[vivo] To our understanding, the proposal focused on full duplex at gNB side, assumption at the UE side is still half-duplex as in Rel-17. Is this the correct understanding?

[Lenovo] From the 3rd sub-bullet (i.e., duplex mode) of the first proposed objective, it seems you are open to study full duplex in UE side in Rel.18, is it correct understanding? We see that only RAN1 is listed in the study, while maybe RAN4 should be involved as well, which is especially vital to determine the scope. Generally, it would be good to settle down the scope for FD at the first stage since it is expected that much more standard impact might be needed to support both UE and gNB FD than to support gNB FD only.

[OPPO] for both type-1 FD and type-2 FD, can we assume they are only applicable for gNB but not UE i.e. from UE perspective, UE will only transmit or receive in one slot but not simultaneously?

[Intel] One of the objectives mentions studying FD at UE side. For FD at UE, have you considered practical feasibility and challenges for the isolation and interference filtering/cancelation methods, even for "partial self-interference cancelation" and it's effectiveness considering (1) form-factor limitations; (2) # of antennas/antenna elements/panels, e.g., to realize isolation or to realize nulling at another UE while still effectively steering a strong-enough beam to the gNB; (3) device complexity, etc.?

[Xiaomi] Is it still half-duplex at the UE side in Rel-18 study?

**[Answer]: We agree that it is challenging for UE to support simultaneous transmission and reception considering the various practical limitations and complexity. We can make it clear to assume UE does not support simultaneous transmission and reception in this study. We updated the 3rd sub-bullet (i.e., duplex mode) of the first proposed objective to reflect this and also added RAN4 for this objective.**

### 3.2.5 Whether require more stringent UE RF requirement or not

[vivo] For the handling of intra-cell UE-to-UE CLI, the scheduling restriction method was mentioned, do you think either type-1 or type-2 FD potentially requires more stringent UE RF requirement to handle the intra-cell UE-to-UE interference? From our perspective, it would be very important to avoid UE hardware change for the full duplex study in Rel-18.

[OPPO] for both type-1 FD and type-2 FD, can we assume no extra RF and demodulation core requirement will be added for UE compared to Rel17?

[MTK] Is there any expected RF specification tightening for future R18 Half Duplex UEs (ACLR, ACS, in-band blocking, etc) to operate with a SSFD or SBFD-capable gNB?

**[Answer]: From our perspective, it would be better to not introduce more stringent UE RF requirement. We can add a note to minimize the UE hardware impact.**

### 3.2.6 Prioritization of scenarios of type-1 FD and type-2 FD

[CATT] Agree the observation that for type-2 FD, we can first focus on isolated scenario and small cells with limited Tx power and limited number of antennas.

[Rakuten Mobile] We support Type1 FD (Sub Band wise Full duplex) for Rel18, since this topic will cover most aspects & Type 2 FD can be consider for future releases.

[OPPO] for type-1 FD case, can we limit the case where slot frame structure is aligned among cells in the study?

[OPPO]We think for type-2 FD, isolated case is good start. but still feasibility study is necessary, especially on self-cancellation performance.

[OPPO] Type-1 FD is prioritized to get a manageable scope based on the maturity of the technologies

[Xiaomi] We support Type1 FD (Sub Band wise Full duplex) has priority for Rel18 , Type 2 FD can be consider for future releases.

**[Answer]: For type-1 FD (sub-band wise full duplex), there are two cases: case 1 is that the same UL/DL time-frequency resource partitioning pattern is used in neighboring cells; case 2 is that different UL/DL time-frequency resource partitioning patterns are used in neighboring cells.**

**For type-2 FD (frequency fully overlapped full duplex), there are two kinds of scenarios: isolated scenario and multi-cell scenario.**

**We are open to limit the scope to some of the cases (e.g., case 1 for type-1 FD and isolated scenario for type-2 FD) when determining the study scope, or first have a thorough study for all the cases and then narrow down the scope to some of the cases based on observations when go to WI. I added a note to clarify to focus on isolated scenario at least for type-2 FD.**

[Samsung]It is mentioned that inter-cell CLI may be challengeable for XDD and FD, if timing is not well-aligned between cells. Do you think we have to consider both time aligned and mis-aligned scenario in

Rel-18, or only consider time aligned scenario in Rel-18, and consider mis-aligned scenario in later release?

**[Answer]: The inter-cell CLI is more severe for case 2 of type-1 FD and multi-cell scenario of type-2 FD. We are fine to consider the mis-aligned scenario either in Rel-18 or in later release.**

[Spreadtrum] As shown in Figure 1(a) 1(c), three examples are given. We notice that in the three examples, there is no common DL slot in all the subbands. Will you consider the case that all the subbands has common DL slots/symbols? Which one is your first priority among the three examples?

**[Answer]: We are open to also consider the case that all the sub-bands have common DL slots/symbols. For the three examples, we are also open regarding whether or not to prioritize some of them(e.g., example 2 considering the coexistence among different operators), and the prioritization if needed can be further discussed.**

### 3.2.7 Questions/comments on self-interference

[China Unicom] What is the potential solution to solve self-interference in R18?

**[Answer]: For Type-2 FD, the methods of self-interference cancellation in antenna/spatial domain, RF domain and digital domain can be used. For Type-1 FD, UL and DL in different sub-bands can provide additional frequency separation.**

### 3.2.8 Questions/comments on cross-link interference

[ZTE]According to the analysis in the P4/P5 in RWS-210353, it seems the inter-cell CLI at gNB/UE side is more challenging in both duplex modes due to the misalignment of the DL/UL symbol boundary in multiple cells. However, the suggested SI objectives focus on the self-interference, without considering CLI. Would you mind to clarify the discrepancy?

[Huawei] Should the study include considerations on the cross-link interference? The CLI is different from what has been done during R16 because CLI occurs between UEs in the same cell. For BS-BS CLI interference, we think that some advanced solutions are needed to mitigate the BS-BS interference.

**[Answer]: Our consideration is as following. The self-interference is a totally new study point for full duplex operation, while for inter-cell CLI we have studied and discussed some solutions during Rel-14/Rel-16 CLI. The solutions can be taken as baseline for inter-cell CLI in scenarios of full duplex.**

**For type-1 FD (sub-band wise full duplex), if we only focus on case 1, the inter-cell CLI is less severe since they are from different sub-bands, but if we also consider case 2, the inter-cell CLI is more severe since they are from the same frequency. For type-2 FD (frequency fully overlapped full duplex), if we only focus on the isolated scenario, there is no inter-cell CLI, but if we also consider multi-cell scenario, the inter-cell CLI is more severe since they are from the same frequency.**

**As we explained above, we are open to limit the scope to some of the cases (e.g., case 1 for type-1 FD and isolated scenario for type-2 FD) when determining the study scope, or first have a thorough study for all the cases and then narrow down the scope to some of the cases based on observations when go to WI.**

**Even only considering case 1 for type-1 FD and isolated scenario for type-2 FD, the inter-cell CLI at gNB side and intra-/inter-cell CLI at UE side from different sub-bands for case 1 of type-1 FD, as well as intra-cell CLI at UE side for isolated scenario of type-2 FD, also need to be studied and handled, so we are fine to add the study for cross-link interference in the second objective for clarification.**

[MTK] What is the specific mechanism for CLI measurement report in a dynamic scheduling situation where different unknown UEs may be interfering one another at different times?

**[Answer]: The concrete CLI measurement/report schemes can be studied during the study phase. In our understanding, current CSI measurement/report and CLI measurement/report schemes can be used as baseline for evaluation.**

[MTK] UE-UE intra-cell and inter-cell CLI for case 1 is ”manageable” via scheduling restriction. However, the performance loss due to scheduling restriction may eat up the performance gain obtained by full duplex. Do you think the trade-off is worthy?

**[Answer]: This needs more performance evaluation during the study phase. We expect the performance loss induced by scheduling restriction is less than the performance gain brought by full duplex operation.**

[CATT] On page 4, why would DL/UL symbol misalignment have impact on the inter-cell CLI management? Is it based on certain assumption of CLI mitigation scheme?

**[Answer]: If we consider SCS 30kHz, the CP length is about 1.855us, that means if the distance between the serving gNB and the neighboring gNB is more than 550m, then the DL interference from the neighboring gNB will be out of the CP of uplink signal at serving gNB side. We think this kind of UL/DL misalignment may further complicate the inter-cell CLI mitigation at gNB side.**

### 3.2.9 Objective management across RAN1 and RAN4

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

[Intel] Following further on the above question, could you elaborate how RAN1 and not RAN4 would be better suited to study self-interference and adjacent channel interference techniques (as suggested in the proposed objective)?

[Huawei] Shouldn’t RAN4 lead the study on the feasibility of self-interference cancellation to enable full duplex, rather than RAN1? This seems very much related to RF hardware.

[OPPO] RAN4 should be also involved in the work ”Techniques of self-interference cancellation”

**[Answer]: We are open on which objectives should be led by RAN4 and which should be led by RAN1, and how to manage the studies across RAN1 and RAN4.**

**In our view, we think RAN1 can study the general aspects of potential techniques for SI/CLI cancellation and study the required SI cancellation capabilities for different deployment scenarios in**

**order to harvest desired performance gain, while RAN4 can study the concrete techniques and corresponding capabilities for SI/CLI cancellation and confirm whether it is feasible to achieve the required SI cancellation capabilities using the potential techniques.**

**Our initial consideration is that, during the study, w/o information on isolation and SI cancellation capabilities from RAN4, RAN1 can first perform evaluation based on its analyses of required SI cancellation capabilities for different deployment scenarios (e.g., RAN1 can assume some typical SI cancellation capabilities for performance evaluation), and RAN4 confirms whether it is feasible to achieve the required SI cancellation capabilities later based on RAN4's study.**

**Based on these questions and comments, I put RAN4 as the leading WG for the study on the feasibility of self-interference/cross-link interference cancellation to enable full duplex, and I also restructured the objective of evaluation of the performance of full duplex.**

### 3.2.10 Coexistence among different operators in adjacent channels

[vivo]For Type-2 FD, what is CMCC's view on how to handle the adjacent channel CLI issue in case multiple operators share the same TDD band?

**[Answer]: For Type-2 FD, we think we can focus on the isolated scenario and assume only one operator exists (e.g., for some indoor scenarios, factories).**

[Fraunhofer] Are you considering coexistence among multiple operators using FD capabilities in their network or rather a scenario where one Operator is using FD techniques while another remains at traditional TDD w/o FD capabilities in the gNB?

**[Answer]: When considering the coexistence among different operators, we think it would be more feasible to place the uplink sub-band in the middle part of TDD band (i.e., example 2 of type-1 FD). We are open to study the two kinds of scenarios of coexistence among different operators mentioned by you. We think at least the scenario where one operator is using FD techniques while another remains at traditional TDD w/o FD capabilities in the gNB should be studied. For the scenario where multiple operators using type-1 FD capabilities with same UL/DL time-frequency resource partitioning pattern in their network (e.g., using same pattern as example 2 of type-1 FD), the coexistence issue may be less severe.**

[Fraunhofer] Do you expect different performance levels for Adjacent channel interference than in subband-wise FD operation when configured similarly?

**[Answer]: In our understanding, when the uplink sub-band is placed in the middle part of TDD band (i.e., example 2 of type-1 FD), the adjacent channel interference from another operator is less severe than the interference from the different sub-bands in the same band.**

### 3.2.11 Questions/comments related to legacy UE

[OPPO]We think co-existence with legacy UE is important to be discussed in this study

[MTK] What is the impact of gNB FD support onto NR legacy UEs from R15/16/17 due to UE-UE CLI? How can these terminals be protected from UE-UE CLI? Legacy UEs cannot implement any CLI mitigation

techniques or CLI-related measurements.

**[Answer]: I added a new objective to study the coexistence with legacy UE. For NR legacy UEs from R15/16/17, on the one hand, gNB can try to schedule the legacy UEs in frequency resources that are less impacted by the UE-UE CLI. On the other hand, the legacy CSI measurement/report can also be utilized by gNB to perform scheduling restriction (e.g., gNB try to schedule UEs in less spatially corelated beams simultaneously for DL and UL, and avoid scheduling UEs in the same or adjacent beams simultaneously for DL and UL).**

### 3.2.12 Questions/comments related to FR1 and FR2

[MTK] Is there any significant difference between FR1 and FR2 to minimize UE-UE CLI and gNB-gNB CLI.

**[Answer]: Maybe. There is significant difference on pathloss, antenna configuration and analog beams between FR1 and FR2, which may have impact on UE-UE CLI and gNB-gNB CLI mitigation.**

[MTK] A huge amount of effort will be needed in RAN4, which is already overloaded. Do you believe the RAN4 effort be prioritised on FR2 over FR1?

**[Answer]: We are open to put equal effort on FR1 and FR2 or prioritize one of them.**

### 3.2.13 Questions/comments related to evaluation

[LG]Regarding the 'coverage' among the performance metrics (e.g., spectrum efficiency, user perceived throughput, latency, coverage, etc.), do you think what is performance metric to measure coverage?

**[Answer]: For measure of coverage, usually we can use 5% spectrum efficiency for full buffer traffic, or use 5% UPT for burst traffic, or use link budget for simple calculation. Considering both spectrum efficiency and UPT have already been mentioned here, we can also remove coverage in the objective.**

[LG] Also, in Rel-17, specification work for coverage enhancement is ongoing. Do you think what is different point/scope for coverage enhancement in Rel-17 and coverage study for full duplex operation?

**[Answer]: The intention here is just to express that full duplex is beneficial for coverage performance since more uplink time slots are available. I think the methods discussed in the coverage enhancement in Rel-17 can also be used for full duplex.**

### 3.2.14 Questions/comments related to FDD bands

[China Unicom] Taking into account antenna configuration and other factors, what is difference if supporting Full duplex in TDD and FDD bands?

**[Answer]: I think there are similarity and also difference. For example, if we consider full duplex in**

**FDD bands (e.g., part of the UL spectrum is used as DL for FDD) and assume UE does not support simultaneous Tx/Rx in the UL spectrum of FDD band, then the UE behavior becomes a TDD-like behavior (e.g., if UE perform downlink reception in some part of the UL spectrum for FDD, then UE cannot transmit at the same time) and it may result latency degradation compared to FDD. From this point of view, for FDD bands, it may be more reasonable to consider to use some of the time domain resources (e.g., some slots) as DL in the UL spectrum, i.e., use the UL spectrum of FDD band in a TDD manner.**

### 3.2.15 Impacts on DL performance

[Nokia] What kind of performance impacts especially in DL performance do you foresee if UEs do not support full duplex? How about handling and DL performance of legacy UEs? Are you considering the earlier RAN4 co-existence studies for dynamic TDD as starting point to avoid repeating the same studies?

**[Answer]: In our understanding, if gNB supports full duplex and UEs do not support full duplex, different UEs can be configured with different TDD-UL-DL-configurations based on their UL/DL traffic and related requirements even if they are in the same cell. The concrete impact on the DL performance needs further evaluation during the study. For legacy UEs, they can be configured to work on a sub-band with TDD manner or they can be scheduled to perform DL and UL on corresponding sub-band resources to minimize the impact. We think earlier RAN4 co-existence studies for dynamic TDD can be taken as starting point to avoid repeating the same studies.**

### 3.2.16 Others

[China Unicom] Need clarifications on the ’deployment’ in ”Requirement of self-interference cancellation capabilities for different deployments [RAN1/RAN4]”. Is it related with deployment scenario for two types of FD gNB?

**[Answer]: I updated ‘’deployments’ to ‘deployment scenarios’ for clarification, since in different deployment scenarios, the gNB may have different level of transmission power classes and noise figures, so the required self-interference cancellation capability may be different in order to get desired performance gain.**

[MTK]What is the impact on legacy gNB because of gNB-gNB CLI?

**[Answer]: This can be resolved or avoided by updating all the gNBs to avoid both legacy gNB and new gNB are mixed deployed in the same area.**

[MTK] Is there a significant power consumption impact onto FD-capable gNBs?

**[Answer]: We haven’t evaluated the power consumption impact on FD-capable gNBs**

## 3.3 Answers for Topic#2(UE Aggregation [4][5])

**Xiaomi Communications**

# 1

This is an interesting topic in Rel-18. We have the following questions for clarification:

Question 1: How are the two devices connected with each other (e.g. via cable/3GPP Uu/3GPP sidelink/WiFi/BlueTooth)?

Question 2: We are wondering whether the enhancements on IAB/Sidelink Relay/LTE-like L3 relay station/LTE-like LWA can acheive the same purpose.

**Answer:**

For Q1, regarding the selected communication technology applied to the interface between the two device, we are open on this, which can be cable/3GPP Uu/3GPP sidelink/WiFi/BlueTooth.

For Q2, the IAB and LTE-like L3 RN are network nodes, and our intention is to address the issue of the shortage of UL UE transmission power resulting from the requirement of UL big bandwidth in 5G. Meanwhile, side link relay requires the involved UE to be additionally support of PC5, while we pursue not to add such kind of limitation.

**China Unicom**

# 2

Q1: If different types of service (i.e. eMBB and URLLC) are aggregated to transmit, how to guarantee service quality during the scheduling or transmssion?

Q2: Is one UE could be connected to single UE in one pair or to multiple UEs for transmission diversity?

**Answer:**

For Q1, in our understanding, it is possible that the DRB1 corresponding to service 1 transmitting in UE1, while the DRB2 corresponding to service 2 transmitting in UE2; Meanwhile, it is possible the different or same packets of DRB1 corresponding to service 1 split in the UE1 and UE2. There will be a common logical layer to guarantee the service quality and continuity in gNB and UE side for the DL and UL respectively.

For Q2, there is no limitation on the aggregation UE number, which depends on the scenario in implementation.

**ZTE Corporation**

# 3

We share similar views that UE aggregation can be used as one way to boost UL transmission power. We have two clarification questions.

1) In addition to power domain, do you intend to explore other potential benefits, e.g., spatial domain for multi-path transmission from the aggregated UEs?

2) How are the aggregated UEs connected, e.g., by Uu, SL or others? Do you intend to specify/enhance the connections among aggregated UEs in the proposed SID?

**Answer:**

For Q1, we are open on the specific aggregation approach.

For Q2, regarding the selected communication technology applied to the interface between the two device, we are open on this, which can be cable/3GPP Uu/3GPP sidelink/WiFi/BlueTooth.

**HuaWei Technologies Co., Ltd**

# 4

For UE aggregation, we share similar view. Do you think there is any difference with using sidelink L2 relay supporting multi-path (i.e., direct and indirect) ? In our understanding the standards scope/impact are quite similar.

**Answer:**

Since side link relay requires the involved UE to be additionally support of PC5, we pursue not to add such kind of limitation.

**vivo Mobile Communication Co.,**

# 5

Thank you for the contribution. We are quite interesting about this use case. It is similar with our case3.2 in our Tdoc RWS-210172(PIOT).

How to connect two UEs in CMCC mind?

**Answer:**

For PIOT, the two UEs are separate without co-ordination on one service data reception/transmission between the two UEs, especially for UL. And most of the PIOT scenarios, the two UEs are not work simultaneously.

**CATT**

# 6

This seems an interesting topic to further discuss. A few questions for a better understanding of the proposed stuides/work.

1. First of all we'd like to clarify whether it is correct understanding that the intended study/work actually does not have extra requirement for the link btw UE, i.e., it is either SL or other type wired line, etc.?

2. Then we'd like to understand the main drive force, i.e., is it for higher data rate, or also for reliability?

3. Also it would be good to roughly understand the amount of work required for SA, as it seems RAN would need to know the relationship of the UEs based on some info provided by CN?

**Answer:**

For Q1, it is correct.

For Q2, our intention is to improve the situation that the bottleneck of supporting the applications with wide UL bandwidth on 5G terminals is the limited UL UE transmission power. Naturally, it can be used to meet the target high reliability as well.

For Q3, we assume for the UE aggregation, one way is to involve SA2, e.g. establishment of two separate PDU session for two individual UEs; But we sort out a more efficient way is that just let RAN to be aware of the relationship of the aggregated UEs with the association of UE's IDs, e.g. C-RNTI.

**Apple Portugal**

# 7

Q1: What's the assumption of the link between two UEs, including the link type (e.g. WIFI, BT, SL), the requirement on the link (i.e. delay, throughput)?

Q2: How can NW identify that the two UEs are associated for the same user or same service's transmission?

**Answer:**

For Q1, regarding the selected communication technology applied to the interface between the two device, we are open on this, which can be cable/3GPP Uu/3GPP sidelink/WiFi/BlueTooth.

For Q2, we assume for the UE aggregation, one way is to involve SA2, e.g. establishment of two separate PDU session for two individual UEs marked with the aggregation relationship; But we sort out a more efficient way is that just let RAN to be aware of the relationship of the aggregated UEs with the association of UE's IDs, e.g. C-RNTI.

**Intel Corporation (UK) Ltd**

# 8

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

Is it possible to clarify the use case of UAV for data aggregation? Is it aggregation of different UAV's UL data towards NG-RAN?

**Answer:**

For example, in 5G, UAV can take role of live video transmission, which requires wide UL bandwidth. The aggregated UEs are located in the same UAV, e.g. transmitting different packets of a given video service.

**Lenovo Mobile Com. Technology**

# 9

Thanks for the interesting porposals! we have following questions for further understanding

1. whether aggregate UE is treated as two UEs or one UE from gNB point of view?

2. Does aggregate UE share the same RRC layer and SDAP layer?

3. The split L2 architecture is only for UL or for both DL and UL?

**Answer:**

For Q1, in our understanding, the simple way is that aggregate UE is treated as two UEs from gNB.

For Q2, we assume for the UE aggregation, the RRC layer and SDAP layer is either same or different can work, which depending on the down-selection on the specific approaches. However, we sort out that common PDCP may be the path forward with least residence.

For Q3, both.

**Qualcomm Technologies Int**

# 10

1. Does the proposed framework for UE aggregation allow for autonomous UE discovery and association, or the network directly manages sidelink communications between UEs, or all UEs are physically collocated and the connection is wired?

2. If all UEs are collocated, what differentiate the proposed approach from the SA-2 based solution for dual UE?

**Answer:**

For Q1, as mentioned above, regarding the selected communication technology applied to the interface between the two devices, we are open on this, which can be cable/3GPP Uu/3GPP sidelink/WiFi/BlueTooth.

For Q2, the approach brought up in SA2 is two separate end-to-end tunnel, including separate RANs and separate CNs. In our understanding, the UE aggregation can be realized with one single GTP-U tunnel and two Radio bearers legs.

**Asia Pacific Telecom co. Ltd**

# 11

Thanks for sharing the interesting ideas.

1. We would like to clarify more on the terminology of the aggregated terminals. The aggregated terminals are belong to a single UE or they were two independent UEs, physically. From the gNB's perspective, does the gNB treat the aggregated terminals as two independent UE before aggregation, and the two independent UEs are aggregated by gNB's configuration? Is any discovery or pairing procedure needed for aggregating the two UEs?

2. Furthermore, is there any data link between the PDCP/RLC/MAC of each aggregated terminals?

3. It seems improving UL throughput is the main target here, since it is proposed to avoid data duplication. Is it possible to also allow data duplication to ensure reliability when it cannot be ensured by a single device?

**Answer:**

For Q1, They can be two independent UEs, physically. From the gNB's perspective, the gNB can treat the aggregated terminals as two independent UE before and during aggregation, and the two independent UEs are aggregated by gNB's configuration or requested by the UE. There is no mandatory demand on the discovery or pairing procedure needed of the UEs.

For Q2, we assume there is a data link between the PDCP/RLC/MAC of each aggregated terminals, but there is no limitation on the specific communication technology applied to the interface between the two devices.

For Q3, Yes, although our intention is to improve the situation that the bottleneck of supporting the applications with wide UL bandwidth on 5G terminals is the limited UL UE transmission power, naturally, it can be used to meet the target high reliability as well.

## 3.4 Answers for Topic#3(AI enabled RAN (RAN3 part) [6])

CATT

Q: Thank you for the contribution. We have one question on the second bullet of the Rel-18 work. Here, only enhancement on network interface is indicated, I am wondering whether we could also consider information driven from UE if benefits are justified.

A: Thanks for the comments, yes, you are right, the impact on the UE side is also need to be considered. It depends on the outcome of the SI. If some UE impacts are identified, RAN2 objectives can be added in the WI phase.

ZTE Corporation

# 2

Thanks for the contributions. We share the same view of the Rel-18 Objectives. We also think Rel-18 need to focus on the normative work of prioritized use cases first.

A: We are on the same page.

LG Electronics France

# 3

Q1) Is there other use cases to be considered except the three prioritized ones in RAN3?

Q2) On P1, i.e., in the Rel-18 follow-up WI, it should be the same assumption as the current on-going SI, i.e., focus on the current NG-RAN architecture and interfaces?

A:

Yes, studies on other use cases are not precluded, it is contribution driven.

We think so, normally WI should follow the principles and recommendations of SI.

Futurewei Technologies

# 4

We support the idea that the R17 RAN3 SI should progress further and identified specs impact may be turned into WI in R-18. We also share the view that new use cases, such as AI for air interface, should be studied.

In addition, as AI/ML approach is data-driven, we suggest considering using common datasets for at least testing identified use cases, using a common evaluation methodology, as discussed in RWS-210038.

A: We are on the same page.

Intel Corporation (UK) Ltd

Thank you for the contribution. Please see our question below

What is your assumption on training (e.g., whether it is performed at each NW node or in a coordinated manner) and frequency of adaptation for load balancing/traffic management?

A: These questions are actullay what the enhancement of data collection SI. The assumption on training are agreed to be discussed on a per-use case basis and the frequency of adaptation for load balancing is a stage 3 details. In our view, it could be at least the same level as current load reporting.

Samsung Electronics Polska

We agree to study on other use case. What is the benefits and drawbacks for three ways: extend existing one, set-up a new one, combine with other SI?

A: We would rather not call it benefits and drawbacks, it is just how RAN would like to organize the whole work on AI, including the higher layer part and the air interface part. No matter what option is selected, in our view, the principle should be AI work in RAN is under a common framework for Rel-18 and beyond.

MediaTek Inc.

Thanks for the contribution. Some questions for clarification:

1) What does CMCC think about RAN1/RAN2's involvement in this work?

2) What is CMCC's stand on the AI for air interface?

A:

For the RAN3 leading SI/WI, whether to involve RAN1/RAN2 depends on if we identify any impacts on the Uu interface. If some impacts are found, for sure, we could add RAN1/RAN2 objectives during the WID drafting phase

We are interested in the AI for air interface, but in Rel-18 we would like to start with evaluation methodologies rather than detailed specification impacts. Details can be found in our dedicated paper for physical layer AI.

NEC Corporation

NEC supports having WI in RAN3 as continuation of the current RAN3 SI and having a new SI as continuation of the current RAN3 SI covering wider scope and use cases.

A: Thanks for sharing your views, this can be discussed at later stage.

## 3.5 Answers for Topic#4(AI enabled RAN (PHY part) [7][8])

Based on companies' comments/questions, some clarifications:

**Common data set**: We expect that 3GPP can provide a common dataset for each use case, and companies can use the common dataset for training and validation (CATT's understanding is correct). The "common" means each individual company can use the same dataset. The common dataset can be used by gNB, or UE, or both. It depends on who could involve in the training.

**Typical AI model**

For each use case, companies could use different AI models, but some common parts of these AI models may be identified, and the common parts play the most important role in the performance. It is expected that the typical AI model can ensure the basic performance. The gNB or UE can directly use the typical AI model to achieve a basic performance. Or, a modified AI model based on the typical model can be used to achieve a better performance.

In some use cases, the model offloading from gNB to UE may be necessary. For these use cases, the typical AI model should be specified.

Regarding MTK's questions:

-We think at least CSI feedback and AI based positioning can be studied.

-In our view, the common dataset includes two parts, the training data and test data. Companies use the two parts for model training and model test , respectively.

## 3.6 Answers for Topic#5(Network energy saving [9])

First, we echo MTK's statement of "user experience should not be compromised in order to avoid impact to user subscription", actually, network energy saving should not sacrifice the network capacity and user experience is our principle in our 4G/5G network operation. Extend the methodology now at UE side to network side seems an interesting idea.

For the question of any targets or requirements of NR network energy saving study in Rel-18.

A: Most of network energy saving solutions now is relying on network implementation, but it seems not work well in the practical network, so some standard solutions are needed. We are also fine not to have a dedicated WI for this, but we should consider network efficiency in every WI.

The potential aspect in our mind is:

-Definition of different energy saving modes and network signalling support to enable energy saving.

-Multi-RAT/Multi-carrier synergy energy saving mechanisms

-Traffic/UE behavior/user experience aware energy saving mechanisms

For the question of Multi-RAT/multi-carrier synergy energy savings mechanisms

A: The idea is to consider energy saving from system point of view, e.g., within a certain area, multi-RAT/multi-carrier network is deployed, the network should decide intelligently which carrier or RAT will be put in energy saving mode considering the UE traffic, number of UEs, etc. Some assistance information from UE may be needed.

Some examples:

-Investigate the 4G/5G energy saving solutions based on traffic characteristics on 4G and 5G

-Investigate the energy saving solutions for hetnet and different frequencies

For the question of different energy saving mode

A: In the current spec, only cell on and off is defined. But in practical, there are different levels of energy saving mode. These energy saving modes are not aware among different network nodes. If different cell status is conveyed to neighboring node, it could be utilized by the receiving node to make better RRM decision, e.g, whether to HO the user to the cell.

For questions of Traffic/UE behavior/user experience aware energy saving mechanisms

A: We can rely on AI-like mechanism to implement the Traffic/UE behavior/user experience aware energy saving mechanisms, e.g., if we can predict when the cell will have less traffic under the coverage, the cell could be switched to energy saving mode more efficiently. In the current implementation, the network makes

the energy saving decision mainly considering the tide effects based on statistical data, which is not efficient and accurate.

# 4 [2nd Round] Comments/Questions

## 4.1 Comments on Topic#1(Full Duplex [2][3])

**Feedback Form 7: Commens/Questions on Full Duplex [2][3]**

**1 – Xiaomi Communications**

Thanks for the contributions and response.
For frequency domain partition of DL and UL in Type-1 FD, do you think semi-static partition is sufficient? Does it need guard PRBs between DL and UL in Type-1 FD?

**2 – ZTE Corporation**

Thanks for the detailed clarifications in the 1st round reply. Regarding the potential standardization impact to support full duplex operation, we think network coordination to exchange information for interference cancellation/suppression is also one possible solution. Hence, we think RAN3 should also be involved.

Besides, one clarification about the "Antenna configuration", is it referred to UE antenna configuration or gNB antenna configuration, or both UE and gNB?

**3 – Huawei Tech.(UK) Co.. Ltd**

Thank you for the responses in round 1. We think that to study the gain of type2-FD, isolated cell may not be enough. Type 2 FD should be within network because the gain of type 2 FD would have to heavily rely on the suppression of the inter-cell CLI.

**4 – CATT**

Thanks for the response and the updated objectives. Regarding the study of duplexing mode at gNB (subband wise FD and fully overlapped FD), what is the expected study other than feasiblity of self/cross-link interference mangement?

**5 – Spreadtrum Communications**

Thanks for the detailed response. Just one point for identification: Are all the slots configured flexible for legacy UEs in case 1 for type-1 FD? And no TDD subband□

**6 – China Unicom**

Thanks for your response and updated scope. We think the scenarios and scope are well prepared. However one question is that current scope include different scenarios, frequency band, dulplex type and related solutions, do you think all RAN1 and RAN4 work can be completed in R18? If not, do you have priority list or preference?

**7 – VODAFONE Group Plc**

We are supportive of work on energy saving. As we anticipate that LTE IoT devices (e.g. eCall over VoLTE) will have to be supported for long periods, will you include DSS in your 'multi-RAT' scenarios?

**8 – LG Electronics Inc.**

Thanks for good answer.

We are also thinking techniques for CE in Rel-17 can be applied in Rel-18. But, as we know, main drawback of CE in Rel-17 is that latency is increased due to PUSCH/PUCCH repetition using multiple slots which are timely longer period. If full duplex is introduced, it is allowable for UE to transmit PUSCH/PUCCH at consecutive uplink time slots. Hence, we can enjoy latency reduction compared with that of Rel-17 CE. That is what we want to point out.

We have two questions.

Q1) For type-2 FD (frequency fully overlapped full duplex), it is allowable to use narrower bandwidth for UL transmission/reception than that for DL transmission/reception.

Regarding co-existence among different operators in adjacent channels, it was explained that 'In our understanding, when the uplink sub-band is placed in the middle part of TDD band (i.e., example 2 of type-1 FD), the adjacent channel interference from another operator is less severe than the interference from the different sub-bands in the same band.'

Similar with above observation, if narrower bandwidth in a carrier is used for UL transmission/reception for type-2 FD (frequency fully overlapped full duplex) case, we can expect 'less severe level of adjacent channel interference form another operators'. Do you open to use narrower frequency resource for UL for type-2 FD case?

Q2) For type-2 FD (frequency fully overlapped full duplex), it is allowable to use lower DL transmission power than DL tx power for half duplex. That has a benefit to reduce SI level and gNB2gNB CLI level. That is a good trade-off between throughput and interference handling. Do you open to study DL power control for SI / gNB2gNB CLI reduction?

## 4.2 Comments on Topic#2(UE Aggregation [4][5])

**Feedback Form 8: Comments/Questions on UE Aggregation [4][5]**

**1 – HuaWei Technologies Co.**

Thanks for your answer. To clarify, our intention is not to limit it to PC5 only, our intention is to say the standards impact is mainly the same, and thus we think such aggregation can consider multi-path including both Uu interface and PC5 interface, do you agree?

**2 – ZTE Corporation**

Thanks for the response which is indeed helpful to understand more about the benefits of the proposals. Here is one further clarification from us after reviewing the discussion in the first round: Is your preference is to share the same PDCP layer among aggregated UEs, and define a mapping of the C-RNTI among aggregated UEs for identification of the aggregated UEs?

**3 – CATT**

Thanks for your response to us in round 1.

Regarding the 1st and 2nd question we now understand your intention.

Regarding 3rd question, we need more time to think about the possible impact, but at this stage we are open to discuss if there is any ran based way to identify the relationship of UEs.

Then we noticed some companies are discussing the protocal stack already, that we are also open and maybe that could be discuss in a later stage after the requirements are clear.

**4 – Qualcomm Technologies Int**

Thank you for your responses in round 1. Here are some follow up questions for round 2.

1. If two UEs can be aggregated using a wireless link, should the study also include aggregation of non-collocated UEs that belong to different users?

2. How does the charging work? Is there an ”anchor UE” whose credentials are used for billing, or each UE is billed separately, or aggregation is allowed only among UEs that belong to the same user?

## 4.3 Comments on Topic#3(AI enabled RAN (RAN3 part)) [6]

**Feedback Form 9: Comments/Questions on AI enabled RAN (RAN3 part)) [6]**

**1 – MediaTek Inc.**

Thanks for the answers. Just following,

1) Does CMCC have any priority among the use cases mentioned?

2) Does CMCC think it is useful to establish the “common and test data set” (repository)?

## 4.4 Comments on Topic#4(AI enabled RAN (PHY part) [7][8])

**Feedback Form 10: Comments/Questions on AI enabled RAN (PHY part) [7][8]**

**1 – ZTE Corporation**

You mention in your slide that AI model should be studied. We are wondering to what extent the study should be performed. Does the spec need to specify the detailed structure of the AI models, e.g., nubmer of layers, dimension of each layer, activation function, etc.? Or the study is just for evaluation purpose?

**2 – CATT**

Thanks for the response. Regarding typical AI model, does model offloading from gNB to UE means that gNB provides the entire AI model to be used to UE? If this is the case, then what is to be specified? the format of input and output, or anything else?

**3 – Samsung Electronics Polska**

Q1: Could you give more description or example about typical model in the 3rd bullet of potential study objectives? Identifying typical AI model from different AI models used by different companies seems to be difficult if different AI/ML algorithms are applied(Some companies say that AI/ML algorithms can be different). How typical AI model can be identified when AI/ML algorithms are different?

Q2: Agree to study on other use case. What is the benefits and drawbacks for three ways: extend existing

one, set-up a new one, combine with other SI?

## 4.5 Comments on Topic#5(Network energy saving [9])

**Feedback Form 11: Comments/Questions on Network energy saving [9]**

**1 – ZTE Corporation**

Thanks for the detailed clarifications. In this 1st round reply, you mentioned that UE assistance information can be considered for network power saving. Would you mind to provide some examples of the assistance information?

# 5 [2nd Round] Answers

## 5.1 Answers for Topic#1(Full Duplex [2][3])

The objectives were updated based on comments/questions in 2nd round as following:

**-Identify the scenarios for different variants of full duplex operation in TDD bands [RAN1]**

-Deployment scenarios (e.g., Isolated, Indoor, Urban, Rural)

-Frequency range and regulation (e.g., FR1, FR2)

-Duplex mode at gNB (e.g., Sub-band wise FD, Frequency fully overlapped FD) assuming UE does not support simultaneous transmission and reception

-Antenna configuration (e.g., Single-/multi-panel, Co-located/distributed antennas, antenna scale)

**-Study on the feasibility of interference cancellation to enable full duplex [RAN4, RAN1]**

-Techniques of self-interference/cross-link interference cancellation and corresponding capabilities [RAN4, RAN1]

-Requirement of self-interference cancellation capabilities for different deployment scenarios [RAN1, RAN4]

**-Study on coexistence among different operators in adjacent channels [RAN4]**

**-Study on coexistence with legacy UE [RAN1, RAN4]**

**-Evaluate the performance of full duplex [RAN1]**

-Evaluation methodology and performance metrics (e.g., spectrum efficiency, user perceived throughput, latency, etc.)

**-Identify the potential standardization impact to support full duplex operation [RAN1, RAN2, RAN3, RAN4]**

-Note 1: The UE hardware impact should be minimized.

-Note 2: For frequency fully overlapped full duplex, focus on isolated scenario.

The questions/comments in the 2nd round and corresponding answers are as follows:

[Xiaomi] Thanks for the contributions and response. For frequency domain partition of DL and UL in Type-1 FD, do you think semi-static partition is sufficient? Does it need guard PRBs between DL and UL in Type-1 FD?

**[Answer]: In our view, we can first focus on semi-static DL and UL frequency domain partition, and the feasibility of dynamic partition can also be studied. In addition, we think guard PRBs may be needed between DL and UL in type-1 FD for better separation, but it needs further study how many PRBs are needed.**

[ZTE] Thanks for the detailed clarifications in the 1st round reply. Regarding the potential standardization impact to support full duplex operation, we think network coordination to exchange information for interference cancellation/suppression is also one possible solution. Hence, we think RAN3 should also be involved.

Besides, one clarification about the "Antenna configuration", is it referred to UE antenna configuration or gNB antenna configuration, or both UE and gNB?

**[Answer]: I added RAN3 in the last objective. Besides, the "Antenna configuration" refers to gNB antenna configuration.**

[Huawei] Thank you for the responses in round 1. We think that to study the gain of type2-FD, isolated cell may not be enough. Type 2 FD should be within network because the gain of type 2 FD would have to heavily rely on the suppression of the inter-cell CLI.

**[Answer]: Companies have diverse views on this, we are open to narrow the scope at the beginning or after we have a thorough study. More discussion may be needed on this.**

[CATT] Thanks for the response and the updated objectives. Regarding the study of duplexing mode at gNB (subband wise FD and fully overlapped FD), what is the expected study other than feasibility of self/cross-link interference management?

**[Answer]: I think you are referring to the duplex mode in the 1st objective. In our view, during the study, we need to first identify the scenarios for different variants of full duplex operation, that includes which kinds of duplex mode we need to consider at gNB side, etc. Then, we need to study the feasibility to enable full duplex, including the feasibility of interference cancellation/mitigation, performance evaluation. I updated the 1st objective to make it clear.**

[Spreadtrum] Thanks for the detailed response. Just one point for identification: Are all the slots configured

flexible for legacy UEs in case 1 for type-1 FD? And no TDD subband□

**[Answer]: In our view, regarding case 1 for type-1 FD, there could be TDD subband, but different cells have aligned TDD UL-DL configuration for the TDD subband.**

[China Unicom] Thanks for your response and updated scope. We think the scenarios and scope are well prepared. However one question is that current scope include different scenarios, frequency band, duplex type and related solutions, do you think all RAN1 and RAN4 work can be completed in R18? If not, do you have priority list or preference?

**[Answer]: The concrete priorities of different scenarios can be further discussed during the study phase, and we are open to it. Generally, we think type-1 FD and type-2 FD with isolated scenario can be prioritized.**

[LG Electronics] We are also thinking techniques for CE in Rel-17 can be applied in Rel-18. But, as we know, main drawback of CE in Rel-17 is that latency is increased due to PUSCH/PUCCH repetition using multiple slots which are timely longer period. If full duplex is introduced, it is allowable for UE to transmit PUSCH/PUCCH at consecutive uplink time slots. Hence, we can enjoy latency reduction compared with that of Rel-17 CE. That is what we want to point out.

We have two questions.

Q1) For type-2 FD (frequency fully overlapped full duplex), it is allowable to use narrower bandwidth for UL transmission/reception than that for DL transmission/reception.

Regarding co-existence among different operators in adjacent channels, it was explained that 'In our understanding, when the uplink sub-band is placed in the middle part of TDD band (i.e., example 2 of type-1 FD), the adjacent channel interference from another operator is less severe than the interference from the different sub-bands in the same band.'

Similar with above observation, if narrower bandwidth in a carrier is used for UL transmission/reception for type-2 FD (frequency fully overlapped full duplex) case, we can expect 'less severe level of adjacent channel interference form another operators'. Do you open to use narrower frequency resource for UL for type-2 FD case?

**[Answer]: Yes, we also think it is possible to use narrower UL frequency resource for type-2 FD, and we are open to it.**

Q2) For type-2 FD (frequency fully overlapped full duplex), it is allowable to use lower DL transmission power than DL tx power for half duplex. That has a benefit to reduce SI level and gNB2gNB CLI level. That is a good trade-off between throughput and interference handling. Do you open to study DL power control for SI / gNB2gNB CLI reduction?

**[Answer]: Yes, we are open to it. If we decide to also consider multi-cell scenario for type-2 FD in the study, we think lower DL transmission power is a useful method to reduce the gNB-to-gNB CLI and improve throughput at the same time.**

## 5.2 Answers for Topic#2(UE Aggregation [4][5])

**HuaWei Technologies Co., Ltd**

# 1

Thanks for your answer. To clarify, our intention is not to limit it to PC5 only, our intention is to say the standards impact is mainly the same, and thus we think such aggregation can consider multi-path including both Uu interface and PC5 interface, do you agree?

**Answer:**

As we mentioned before, regarding the selected communication technology applied to the interface between the two devices, we are open on this, which can be cable/3GPP Uu/3GPP sidelink/WiFi/BlueTooth.

**ZTE Corporation**

# 2

Thanks for the response which is indeed helpful to understand more about the benefits of the proposals. Here is one further clarification from us after reviewing the discussion in the first round: Is your preference is to share the same PDCP layer among aggregated UEs, and define a mapping of the C-RNTI among aggregated UEs for identification of the aggregated UEs?

**Answer:**

We currently are open on the solution part. However, from our perspective, the common PDCP layer or SDAP-like L2 layer may be more efficient way that just let RAN to be aware of the relationship of the aggregated UEs with the association of UE's IDs, e.g. C-RNTI, without CN involved.

**CATT**

# 3

Thanks for your response to us in round 1.

Regarding the 1st and 2nd question we now understand your intention.

Regarding 3rd question, we need more time to think about the possible impact, but at this stage we are open to discuss if there is any ran based way to identify the relationship of UEs.

Then we noticed some companies are discussing the protocal stack already, that we are also open and maybe that could be discuss in a later stage after the requirements are clear.

**Answer:**

Yes, we share your view, and we are open on the approach part as well. And the protocol stack design is too detail to be discussed in this phase.

**Qualcomm Technologies Int**

# 4

Thank you for your responses in round 1. Here are some follow up questions for round 2.

1. If two UEs can be aggregated using a wireless link, should the study also include aggregation of non-collocated UEs that belong to different users?

2. How does the charging work? Is there an ”anchor UE” whose credentials are used for billing, or each UE is billed separately, or aggregation is allowed only among UEs that belong to the same user?

**Answer:**

Currently, our requirement focus on the UEs for the same user same purpose in this topic. For the aggregation of non-collocated UEs that belong to different users, we can further discuss it.

It is indeed a good question. Not only charging but also the connection to the RAN node, whether an “anchor UE” is needed both can be studied. Of course, the billing is out of the scope of RAN, which is mainly SA5’s field.

## 5.3 Answers for Topic#3(AI enabled RAN (RAN3 part) [6])

**MediaTek:**

**Q:** Thanks for the answers. Just following,

1) Does CMCC have any priority among the use cases mentioned?

2) Does CMCC think it is useful to establish the “common and test data set” (repository)?

**A:**

Among the three use cases now under study in the TR 37.817, i.e., AI for mobility enhancement, load balancing, and energy saving, we think all of them are important.

We noticed that you have asked the same question in the section of AI for physical layer, our answer is yes for that one, since the common and test data set can be used for training and validation. But for the high-layer part, considering normally no simulation and evaluation will be performed, so may be no common and test data set will be provided. Nevertheless, the overall functional AI framework defined now in the TR considers Data Collection function which provides input data to Model training and Model inference functions. Examples of input data may include measurements from UEs or different network entities, performance feedback, AI/ML model output, etc.

## 5.4 Answers for Topic#4(AI enabled RAN (PHY part) [7][8])

Answer to ZTE:

In our view, for evaluation, the detailed structure of the AI model should be reported by companies. For some

AI use cases, a joint inference between UE and gNB is needed. For these use cases, gNB can transmit the typical AI model to UE. The UE can directly use the typical AI model to achieve a basic performance, or use a modified AI model based on the typical model to achieve a better performance. Hence, for these use cases, the detailed structure of the typical AI models should be specified.

Answer to CATT:

How to specify the typical AI model is part of the study. At present, we think at least the input, output, and the structure of the typical AI model should be specified.

Answer to Samsung:

A1: We agree that different AI/ML algorithms can be used, but some core parts of the AI model may be similar or same. The typical AI model can be identified based on the common/similar parts of different AI models, and these parts can ensure the basic performance.

A2: The question is already answered in our reply of AI enabled RAN (RAN3 part).

## 5.5 Answers for Topic#5(Network energy saving [9])

ZTE:

Q: Thanks for the detailed clarifications. In this 1st round reply, you mentioned that UE assistance information can be considered for network power saving. Would you mind to provide some examples of the assistance information?

A: The assistance information from UE depends on the energy saving scenarios, I could give some examples, one example is to enable more efficient gNB switching on from dormant state, imagine a cell/carrier/beam is switched to sleep state due to less or no traffic, when some UEs moves to the cell or the number of UEs increases or the traffic load increases within the coverage, how to efficiently to wake up the cell needs to be studied. Notification from UE could be one of the viable solution. Another example, UE could provide some trajectory or traffic prediction information to gNB to help the network make proper and timely energy saving decision.

# 6 References

[1] RWS-210351 CMCC views on Rel-18 Cross-Functionalities for both eMBB and Non-eMBB Evolution

[2] RWS-210353 Motivation of study for full duplex in NR

[3] RWS-210352 New study on full duplex for NR

[4] RWS-210355 Motivation of study for UE Aggregation

[5] RWS-210354 New SID on UE Aggregation

[6] RWS-210359 Motivation for support of AI-enabled NG-RAN

[7] RWS-210357 Motivation of study for evaluation methodology of AI enabled physical layer enhancement

[8] RWS-210356 New SID on evaluation methodology of AI enabled physical layer enhancement

[9] RWS-210358 Network energy saving