

3GPP TSG-RAN Rel-18 workshop

RWS-210542

Electronic Meeting, June 28 - July 2, 2021

Agenda item: 4.1

Source: Sharp

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

1 Introduction

This document is intended to capture questions and comments raised from interested companies regarding Sharp's contributions to Rel-18 Workshop on agenda item 4.1, and provide answers to those questions and comments. Your feedback is very much appreciated.

This discussion covers the following documents.

Table 1: List of Sharp's contributions for agenda item 4.1

RWS-210219	Views on Rel-18 Flexible Duplex
RWS-210220	Views on Rel-18 Coverage Enhancement

2 General

2.1 General comments

Feedback Form 1: General comments

2.2 Answers to general comments

[Answer table to be added by Moderator]

3 Flexible duplex (RWS-210219)

3.1 Round 1 questions

Feedback Form 2: Round 1 questions on flexible duplex

1 – CATT

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

Q1: For comparison between CA-based solution on page 3 and full duplex based solution on page 4:

- 1) From UE RF chain perspective, what is the difference between two the two solutions if the total operating bandwidth is the same?
- 2) What's the difference between the frequency diversity gain if the whole bandwidth are used for transmission?

Q2: UE-specific TDD UL/DL configuration and proper gNB scheduling can already achieve the configuration illustrated on page 4? What is the expected specification work?

2 – LG Electronics Inc.

Thanks for the contribution. In Rel-17, Coverage Enhancement (CE) WI is ongoing for specification based on the study result which is that the UL coverage enhancement (CE) can be achieved by PUSCH repetition. Even if DL centric TDD configuration (e.g., DDDSU), the CE can be obtained.

Furthermore, if more time occasions for UL are provided from full duplex for unpaired spectrum, we may simply think further coverage enhancement can be achieved by more time occasions.

Q1) Do you think what is different point/work scope between coverage enhancement in Rel-17 and coverage enhancement by full duplex.

3 – Intel Corporation (UK) Ltd

Thanks for the contribution. We have a couple of questions:

Q1. Given that basic feasibility of FD @ gNB needs to be determined by RAN4 as a first step, what is your view on managing the studies across RAN1 and RAN4? Specifically, under what assumptions should RAN1 proceed with for their study w/o information on isolation and self-, adjacent channel interference effects, etc. that would need RAN4 expertise?

Q2. Have you considered the impact from inter-cell/inter-operator interference, need for guard bands within a CC as well as coexistence with legacy cells in your comparison against other options for UL coverage and capacity trade-offs?

4 – Nokia Corporation

Would see that BS-2-BS CLI would be good area for studies as part of the proposed studies from gNB perspective?

3.2 Round 1 answers

Thank you very much for providing questions. Please find answers to the provided questions. Your further comment/question in the 2nd round would be higher appreciated.

Answer to CATT

Q1:

1) In CA-based solution, the UE RF needs to have two RF chains (one for CC#0 and another for CC#1). On the other hand, in proposed flexible duplex solution, one RF chain with enhanced out-of-band emission requirement. For example, in occasion#1, out-of-band emission requirement is defined for uplink bandwidth which is narrower than the bandwidth of CC#0 to reduce CLI for DL reception by other UEs. In occasion#2, out-of-band emission requirement is defined for the bandwidth of CC#0 to transmit in the whole bandwidth.

2) In CA-based solution, frequency diversity gain is limited to the CC bandwidth. In the proposed flexible duplex solution, wider bandwidth can be utilized to exploit frequency diversity.

Q2:

As described in the above, out-of-band emission requirement should be enhanced from the current specification. In our view, RAN1/4 work could be required.

Answer to LG

When DL centric TDD configuration is used, joint channel estimation for multi-slot PUSCH cannot be applied. Further, total uplink power the UE can transmit reduces when the time resource for uplink is reduced. Those are motivation to have flexible duplex for uplink coverage.

Full duplex may be optimal for uplink coverage as well as system throughput. On the other hand, self-interference due to full duplex (either by in-band full duplex or sub-band full duplex) is severe for UE device such as smartphones since the sufficient antenna isolation may not be obtained with such a small device.

Q1:

Out-of-band emission requirement should be enhanced from the current specification. In our view, RAN1/4 work could be required. This is because, in the proposed flexible duplex solution, dynamic change of out-of-band emission requirement may occur. Please also refer to the answer comment to CATT above.

Answer to Intel

Q1:

RAN1 can study potential gain (in terms of UL coverage, cell throughput, etc.) while RAN4 study on self-interference may occur simultaneously.

Q2:

Impact from inter-cell/inter-operator interference

Impact from inter-cell/inter-operator interference should be the major concern for flexible duplex. On the other hand, given the UL/DL configuration in adjacent carrier with different operators is aligned not to increase interference in some countries, one possible application for the flexible duplex is to align UL/DL configuration in the edge of carrier and the operator can apply desired UL/DL configuration in the carrier center.

Need for guard bands within a CC

We think guard band is necessary to reduce self-interference at gNB and cross-link interference at UE.

Coexistence with legacy cells

We think gNB can avoid DL/UL collision of legacy and Rel-18 UE by scheduling. Considering multiple benefits like UL coverage, DL/UL larger throughput, the proposed flexible duplex solution could be worth to study in Rel-18, which benefits over CA, SUL or carrier switching. On the other hand, we are open to other solutions to study.

Answer to Nokia

We also think that gNB-to-gNB CLI would be a good area to be studied.

3.3 Round 2 questions

Feedback Form 3: Round 2 questions on flexible duplex

--

3.4 Round 2 answers

No questions are raised in round 2 discussion.

4 Coverage enhancement (RWS-210220)

4.1 Round 1 questions

Feedback Form 4: Round 1 questions on coverage enhancement

--

1 – EURECOM

We interested in continuing to work on coverage enhancements. Especially, further enhanced PUCCH transmission formats.

2 – Intel Corporation (UK) Ltd

Thanks for the contribution. We have the following questions:

Q1. During CovEnh SI phase, the main focus for PUCCH coverage enhancement is for long PUCCH format. Further, during Rel-17 feMIMO, beam cycling on short PUCCH format was supported. Can you please clarify the motivation to study sequence based short PUCCH in Rel-18?

Q2: If PRACH format B4 was not identified as bottleneck during CovEnh SI phase, can you please clarify the motivation to further enhance it for coverage?

3 – ZTE Corporation

We also think sequence based PUCCH is helpful for improving PUCCH coverage based on the evaluation proceeded in Rel-17 CE SI. Except for PUCCH format 2, what's your view on applying sequence based approach for long PUCCH format?

4 – InterDigital Communications

We are supportive of coverage enhancements for PUCCH. What is the reason for specifically targeting PUCCH format 2 for this?

5 – Samsung Electronics Co.

Q1. For PRACH enhancement, what would be the considered number of repetitions? Would you consider also PRACH transmission using multiple beams?

4.2 Round 1 answers

Thank you very much for providing questions. Please find answers to the provided questions. Your further comment/question in the 2nd round would be higher appreciated.

Answer to EUROCOM

Thanks for the comment.

Answer to Intel

Thanks for the question. We would answer as the following:

A1: In our view, Rel-17 CovEnh focused on PUSCH repetition type A but PUSCH repetition type B was deprioritized, because people assumed that special slots were used for SRS and PUCCH. It means there is a demand for short PUCCH in TDD operation. For this reason, we think short PUCCH format needs to be enhanced for utilizing special slots, at least for TDD with single-TRP.

A2: The motivation is that PRACH format B4 was identified as bottleneck during CovEnh SI phase. See the conclusion in TR38.830.

Answer to ZTE

Thanks for the question. We think applying sequence based approach for long PUCCH format is also helpful for improving PUCCH coverage because PAPR is reduced and SNR is improved by advanced receiver for sequence-based PUCCH.

Answer to Interdigital

Thanks for the question. In our view, Rel-17 CovEnh focused on PUSCH repetition type A but PUSCH repetition type B was deprioritized, because people assumed that special slots were used for SRS and PUCCH. It means there is a demand for short PUCCH in TDD operation. For this reason, we think short PUCCH format needs to be enhanced for utilizing special slots. However, we think studying long PUCCH format is also helpful for improving PUCCH coverage.

Answer to Samsung

Thanks for the question. We consider some potential enhancements such as higher repetition number, multiple ROs, and multiple beams. The exact number of repetitions should be studied further.

4.3 Round 2 questions

Feedback Form 5: Round 2 questions on coverage enhancement

--

4.4 Round 2 answers

No questions are raised in round 2 discussion.

5 Email discussion summary

In the round 1 of the email discussion, we received comments from 4 companies regarding RWS-210219 and from 5 companies regarding RWS-210220. Corresponding answers from Sharp Corp. are provided in 3.2 and 4.2 respectively.

In the round 2 of the email discussion, we haven't received comments from any companies.