

RAN-R18-WS-eMBB-InterDigital - Version 0.0.3

RAN

3GPP TSG RAN Rel-18 Workshop

RWS-210528

Electronic Meeting, June 28 - July 2, 2021

Agenda Item: 4.1

Source: InterDigital

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

Document for: Information

1 Introduction

This document is the report from the email discussion prior to the Rel-18 Workshop of the contributions submitted by InterDigital to agenda item 4.1 'eMBB-driven Functional Evolution'. As instructed by the chair [RWS-210002], the purpose of the pre workshop email discussions is to provide an opportunity for questions and answers to help better understanding of the proposals among companies.

InterDigital submitted the following tdocs to the agenda item 4.1:

RWS-210424 Views on NR MIMO for Rel-18

RWS-210425 Enhancements for higher frequencies for Real-18

2 General questions/comments

In addition to the 2 tdocs submitted to AI 4.1, InterDigital submitted an overview of Red-18 to AI 4 [RWS-210422] which includes some additional eMBB-driven functional evolution aspects. General questions/comments to InterDigital related to eMBB-driven functional evolution can be raised in this section

2.1 Round 1 Questions

Feedback Form 1: General questions/comments related to eMBB-driven functional evolution

1 – Intel

For RWS-210424:

Could you clarify more on how power efficient beam management is envisioned from a specification perspective?

2.2 Round 1 Answers

Answers to Intel:

The question is answered in Section 3.2 as the same question raised in that section

2.3 Round 2 Questions

Please let us know if you have any follow-up question

Feedback Form 2: General questions/comments related to eMBB-driven functional evolution

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2.4 Round 2 Answers

3 Rel-18 MIMO enhancement

Questions related to RWS-210424 'Views on NR MIMO for Rel-18' can be raised in this section

3.1 Round 1 Questions

Feedback Form 3: Questions related to RWS-210424 'Views on NR MIMO for Rel-18'

1 – Intel Could you clarify more on how power efficient beam management is envisioned from a specification perspective? (duplicate question from general, put the question in the wrong section above by mistake)
2 – Samsung Research America Re UL FS precoding, should it include designing new codebook (e.g. two-stage $W1 \times W2$) that can reduce DL signaling (TPMI) overhead, or is it based on Rel-15 CB?
3 – Beijing Xiaomi Mobile Software For the enh. for the scenarios of asyc. M-TRP operations, more discussion is needed. Joint discussion can be held together with Coherent –Joint Transmission for further clarification.
4 – MediaTek Inc. Q1. For power efficient beam management, it would be great if you can elaborate more about how PDCCH monitoring adapt to beam change can achieve power saving.

5 – NTT DOCOMO INC.

For UL selective precoding, did you conduct simulations and how large the performance gain is (in which scenario)? For asynchronous network mTRP operation, in addition to multiple TAs, is there any additional spec. impact needed in your mind?

6 – HuaWei Technologies Co.

Thanks for the contribution, we have the following questions:

1. We share similar view that number of DMRS ports could be enhanced in Rel-18. Then, for the proposal "increasing the number of ports and interference aspects", could you clarify on the interference aspects?
2. On Page 3: While power consumption can certainly be improved in FR2, what is the relation between "reduction of PDCCH monitoring" and "narrow-beam changes"?

7 – CATT

Proposal 3: Is there any numerical evaluation on the probability of a UE in inter-TRP operation observing larger than CP timing difference from coordinating TRPs? From past CoMP study in LTE, it was observed that UE RSRP to both TRP are usually not too far apart, implying similar distance to TRPs and similar propagation delay. It is also questionable if two TRPs involved in inter-TRP coordination cannot maintain time synchronization is a typical case.

8 – Beijing Lenovo Software Ltd.

Q1: To improve the power efficiency for beam management, do you have any quantitative measure for UE power consumption for beam management?

Q2: For R17, RAN1 has already agrees to use unified TCI framework for inter-cell. What additional change do you have in mind for inter-cell?

9 – Sony Europe B.V.

Thank you for the contribution.

We are supportive of considering higher order modulation.

Is a higher resolution for CSI both in time and frequency necessary to achieve high resolution precoding?

3.2 Round 1 Answers

Answers to Intel:

It targets mainly for stationary RedCap UEs (e.g., industrial sensor, video surveillance) if that use case is covered under MIMO WI. As those UEs are stationary and possible rotation with a predefined pattern, beam measurement, reporting, and BFR could be simplified to reduce some power consumption. Also, monitoring PDCCH search space can be also optimized by allowing PDCCH monitoring skipping if its associated beam is blocked (e.g., beam quality is lower than a threshold).

Answers to Samsung:

Our preference is to re-use Rel-15 CB, and at least for now, limit the focus of this work to efficient signaling of Rel-15 TPMIs. Two-stage W1W2 precoding can be considered, but we don't see a necessity for introduction of a new set of codebooks.

Answers to Xiaomi:

We are open to further discussion on this topic.

Answers to MediaTek:

It is actually similar answer to the Intel. One possibility we provided as an example is defining PDCCH skipping criteria based on the associated beam quality.

Answers to NTT DOCOMO:

5.1- At this time, we don't have simulation results that we could share. However, we understand that the observed gain for frequency-selective precoding would be subjective to various operational conditions, such as; deployment set up, scheduled bandwidth, mobility condition, SNR, etc. Therefore, to prevent excessive specification efforts, our preference is to re-use Rel-15 CB and only focus on efficient DL signaling of multiple TPMIs.

5.2- As for the question related to M-TRP, first we need to discuss if there is really an interest for this scenario or not. If the answer is yes, then we need to proceed to discuss whether the burden of synchronization enhancement should be on the NW, UE or both. Then, we could have a better understanding about the level of impact on the specifications.

Answers to Huawei:

6.1- If we understand the question correctly, we could consider both orthogonal and non-orthogonal DMRS design. Clearly, each solution would have a different impact on resource utilization, interference, etc. In our view, either approach can/should be considered for further evaluation.

6.2 - Assuming that a hierarchical beam structure is used (e.g., broad beam for common search space and narrower beam for a UE-specific search space), a PDCCH monitoring skipping of a UE-specific search space can be considered when its associated beam quality below a threshold.

Answers to CATT:

We agree with your comments and observations, as long as we consider FR1 operation with SCS=15KHz. For FR2 and small SCS values, within CP reception becomes very difficult, as CP size and even symbol length becomes comparable to accuracy of the timing of the network. We provided an analysis of the problem and involved challenges in our contribution R1-2100065 (Synchronization Analysis for M-TRP Inter-cell Operation and RRC Config).

Answers to Lenovo:

Regarding Q1) we don't have any quantitative measure but it is well known issue for the FR2 and it becomes more problematic for a specific UE type (e.g., RedCap)

Regarding Q2) in Rel-17, the mTRP inter-cell operation is based on Rel-15/16 beam management. Therefore, we think the unified TCI framework could be extended to support mTRP inter-cell operation in Rel-18

Answers to Sony:

In our view, the main shortcoming is not about the resolution of the CB, but is about the use of WB precoding instead of frequency-selective precoding. As long as we use a WB precoder, resolution enhancement of the CB

itself will not be effective.

3.3 Round 2 Questions

Please let us know if you have any follow-up question to RWS-210424

Feedback Form 4: Questions related to RWS-210424 'Views on NR MIMO for Rel-18'

<p>1 – Samsung Research America</p> <p>Slide 3: What enhancements do you envision for Rel-18 to reduce power consumption of beam management. In Rel-15, there is already some flexibility in configuring the periodicity and offset of CSI resources.</p>
<p>2 – HuaWei Technologies Co.</p> <p>For further question: For your proposal of DMRS enhancement, do you consider it for DL, UL or both?</p>

3.4 Round 2 Answers

Answers to Samsung:

Thanks for your question. In our view, the key enhancement for reducing power consumption of beam management is by performing a more intelligent PDCCH monitoring process. For example, given a configured CSI configuration for beam measurement, we can skip PDCCH monitoring of UEs whose beam quality is below a threshold.

Answers to Huawei:

Thanks for the follow up question. In our view, DMRS capability could be further enhanced for both UL and DL MIMO. However, the priority may be decided based on other decisions. For example, if an increase of UL MIMO layers is not agreed for R18, then obviously the UL DMRS enhancement may become a low priority at this time.

4 Rel-18 Higher Frequency

Question related to RWS-210425 'Enhancements for higher frequencies for Related-18'

4.1 Round 1 Question

Feedback Form 5: Questions related to RWS-210425 'Rel-18 Higher Frequencies'

<p>1 – Guangdong OPPO Mobile Telecom.</p> <p>Thanks for the contribution. Would you like to elaborate a bit more on the benefit of "hierarchical beam measurement/reporting" when compared to legacy beam measurement/reporting?</p>
<p>2 – NTT DOCOMO INC.</p> <p>Thanks for the proposal. We have the same question as OPPO. We are also very happy if you could share a bit more detail on "partial BFR" and what is its exact motivation.</p>
<p>3 – Motorola Mobility Germany GmbH</p> <p>[Lenovo, Motorola Mobility]:</p> <hr/> <p>-</p> <p>What are your views on two parallel items in Rel-18 including further enhancements for B52.6-71 GHz and extension beyond 71GHz and corresponding timeline?</p> <hr/> <p>-</p> <p>Do you envision specific enhancements are needed to deal with the issue of frequent beam blockages for B52.6-71 GHz?</p>
<p>4 – Samsung Electronics Co.</p> <p>What do you think of beam enhancement for 52.6 114.25GHz in MIMO rather than study beam enhancement for 71-114.25GHz here?</p>
<p>5 – MediaTek Inc.</p> <p>For the SI on extending NR to 71 – 114.25 GHz, have you investigated whether current 3GPP channel model is suitable for the study ?</p>
<p>6 – Apple Benelux B.V.</p> <p>1. Beam management is proposed in the enhancement in 52.6 GHz to 71 GHz, in the extension to 71 GHz - 114 GHz and as mentioned by Samsung possibly in MIMO. Do you have a preference of where it should be studied ? Should it wait till the 71 GHz SI (with possibly new waveforms etc) to be studied ? and as asked in an earlier question, do you plan on having parallel efforts in the 52.6 - 71 GHz and > 71 GHz ?</p>
<p>7 – LG Electronics Inc.</p> <p>Q) Do you consider DFT-s-OFDM for DL as a candidate of new waveform for frequency range from 71 GHz to 100 GHz?</p>
<p>8 – CATT</p> <p>Can you please give an example of the "new waveform with low PAPR, PA compensation and out-of-band leakage" you envisioned ? Why this is the most important for 71 114.25GHz ?</p>

4.2 Round 1 Answers

Answers to Oppo:

Thanks for the question. In “hierarchical beam measurement/reporting”, we believe that association of beam information between FR2-1 and FR2-2 is beneficial to increase beam measurement/reporting efficiency by reducing RS overhead and measuring latency. Given increased number of beams considering narrow beamwidth in FR2-2, measuring whole narrow beams require excessive overhead and latency. However, for example, if UE can search a set of beams associated with the optimized beam in FR2-1, required measurement, RS overhead and latency will be significantly reduced.

Answers to NTT DOCOMO:

Thanks for the question. For “hierarchical beam measurement/reporting”, please check the response for OPPO. Our motivation is to introduce more reliability for beam failure recovery. In higher frequency, probability to successfully recover beam failure should be low considering narrow beamwidth. Given that, we believe that initiating recovery procedure before having failure of all beams and providing more than one new candidate beams would be beneficial for higher frequency.

Answers to Motorola Mobility:

In our view, having two parallel items in Rel-18 for both 52.6-71 GHz and beyond 71 GHz is beneficial if RAN1 TU allows. As clarified in the above, we believe that providing more reliable beam recovery procedure would be beneficial.

Answers to Samsung:

If MIMO work item can focus on 52.6-114.25 GHz as well as existing FR2-1 and FR1 and RAN agrees to discuss it within MIMO WI, it would be acceptable for us. However, in our view, scope of MIMO enhancement already includes various enhancements which require huge workload, so we prefer to include beam related enhancement in higher frequency related WI.

Answers to MediaTek:

Current TR38.901 covers up to 100 GHz, therefore, frequency range needs to be discussed is only from 100 – 114.25 GHz. Given that, in our view, the SI can mainly focus on up to 100 GHz based on the existing channel model while the SI is simultaneously investigating whether additional update of the channel model and specification supports are needed for 100-114.25 GHz.

Answers to Apple:

As we responded to Samsung, we prefer to have it in higher frequency related WI, however, if RAN agrees to enhance relevant beam management in MIMO, we can accept it.

Answers to LG Electronics:

Yes. We are considering all possible new waveforms including DFT-s-OFDM for >71GHz.

Answers to CATT:

As LGE mentioned, DFT-s-OFDM can be an example of the new waveform with low PAPR, PA compensation and out-of-band leakage. We don't say this is “the most important” for 71-114.25 GHz, however, it is still important for practical implementation considering extremely high power consumption of RF chain including PA and even higher pathloss than 52.6-71GHz in 71-114.25 GHz.

4.3 Round 2 Questions

Please let know if you have any follow-up question to RWS-210425

**Feedback Form 6: Questions related to RWS-210425 'Rel-18
Higher Frequencies'**

1 – Huawei Tech.(UK) Co.. Ltd

Thank you for the contribution. You mentioned BM enhancements for both 52.6-71 GHz and above 71 GHz. Do you see a difference in terms of BM enhancements for these two ranges of frequencies, or should the BM enhancements be commonly studied and specified?

4.4 Round 2 Answers

Answers to Huawei:

Thanks for the question. We believe that BM enhancements can be commonly studied and specified, however, motivation to introduce BM enhancements can be higher in above 71 GHz considering even higher pathloss and narrower beamwidths. In addition, if above 71 GHz WI introduces new waveform for DL, it can be an additional point to consider for above 71 GHz.