

3GPP TSG RAN Rel-18 workshop RWS-210544

Electronic Meeting, June 28 - July 2, 2021

Agenda Item: **4.1**

Source: **Sony**

Title: **NWM discussion on Sony eMBB contributions**

Document for: **Discussion**

1 Introduction

This document is used for the email discussion for the Sony contributions on eMBB evolution for Release-18. Sony submitted the following contributions to the Release-18 workshop on eMBB evolution:

RWS-210303: MIMO Enhancements for Rel-18

RWS-210305: Advanced Modulation for 5G-Advanced

This document is structured as follows:

Section 2: General comments on Sony documents for eMBB evolution.

Section 3: Questions, comments and answers on RWS-210303 (MIMO Enhancements for Rel-18).

Section 4: Questions, comments and answers on RWS-210305 (Advanced Modulation for 5G-Advanced).

Section 5: Summary of the NWM discussion on Sony documents submitted under AI4.1.

2 General comments on Sony documents on eMBB evolution

This section is for general comments, questions and answers on the Sony documents for eMBB evolution (RWS-210303, RWS-210305).

2.1 Round 1: Questions and comments on Sony documents for eMBB evolution

There were no general comments nor questions on the Sony contributions on eMBB functionality in Round 1.

2.2 Round 2: Further general questions and comments on Sony documents for eMBB evolution

There were no general comments nor questions on the Sony contributions on eMBB functionality in Round 2.

3 (MIMO Enhancements for Rel-18)

This section is for comments, questions and answers on the Sony document RWS-210303 (MIMO Enhancements for Rel-18).

RWS-210303 made the following proposals.

Beam management

- Support UE-initiated/triggered beam management

. For the use cases of MPE (maximum permissible exposure) avoidance and L1/L2-centric inter-cell mobility, UE can be the first one to identify such event(s) which requires NW-initiated UE reporting. To conduct time-sensitive reporting in the most recent occasion, UE should be able to initiate reporting.

Multi-TRP/panel

- Extend unified beam indication mechanism to multi-TRP/panel operation

. Unified TCI states for either joint or separate DL/UL beam indication was defined in Rel-17 for single-TRP operation. To avoid NW configuring UEs with two parallel beam indication mechanisms, it should be extended to Multi-TRP/panel operation in Rel-18.

3.1 Round 1: RWS-210303: questions and comments

Questions / comments are invited on the above proposals or on other aspects of the document RWS-210303.

Feedback Form 1: Round 1: Questions and comments on RWS-210303 (MIMO Enhancements)

1 – Samsung Research America
We agree that the two areas pointed out above are indeed natural areas for enhancement over Rel-17 FeMIMO.
2 – Beijing Xiaomi Mobile Software
Why not to support NW configuring UEs with two parallel beam indication mechanisms, especially in Multi-DCI scenario?
3 – Intel Corporation (UK) Ltd
What kind of benefits are expected by supporting new TCI framework for mTRP scenario? It seems the existing beam indication framework works well for mTRP including URLLC cases.

4 – MediaTek Inc.

Q1. For UE-initiated/triggered beam management in your example, what’s the difference between Rel-17 SSBRI/CRI reporting for MPE mitigation (if supported in Rel-17)?

3.2 Round 1: RWS-210303: Sony answers to questions / comments

This section provides answers and responses to questions and comments that were received in Round 1.

Table 1: Round1 answers to questions and comments on RWS-210303 (MIMO Enhancements)

Question/Comment	SONY answer
<p><u>Samsung Research America</u> We agree that the two areas pointed out above are indeed natural areas for enhancement over Rel-17 FeMIMO.</p>	<p>Thank you for the comments. Glad that on this point we are aligned.</p>
<p><u>Beijing Xiaomi Mobile Software</u> Why not to support NW configuring UEs with two parallel beam indication mechanisms, especially in Multi-DCI scenario?</p>	<p>Thanks for the good observation. In our view, we tend to agree that two parallel beam indication mechanisms (one based on Rel.15/16 TCI states and the other based on Rel.17 unified TCI states) can work at least for m-DCI multi-TRP. We would like to support both for multi-TRP scenario.</p> <p>If Rel.17 unified TCI states cannot be supported for multi-TRP, there could be some costs and flexibility issues that we would not be happy to see.</p> <p>Firstly, the UE has to store and maintain two types of TCI states with additional memory, but their functions are basically the same.</p> <p>Secondly, in RAN1#105e, a conclusion was made that only RRC signaling can configure joint TCI states or separate TCI states. So, it seems too optimistic to predict Rel.15/16 TCI states and Rel.17 unified TCI states can be configured to the UE simultaneously for the same BWP per CC as well.</p>

<p><u>Intel Corporation (UK) Ltd</u> What kind of benefits are expected by supporting new TCI framework for mTRP scenario? It seems the existing beam indication framework works well for mTRP including URLLC cases.</p>	<p>Thank you for the good question. In our understanding, multi-TRP operations should be able to fallback to single-TRP operation whose beam indication may be based on (new) Rel.17 unified TCI states. The first benefit of supporting this new TCI framework for mTRP would be saving UE memory cost by configuring UE only with unified TCI states. In addition, we could extend the benefits of unified TCI state over Rel.15/16 TCI states from single-TRP to multi-TRP. For instance, joint TCI state indication (in Rel.17) for DL and UL beams seems to consume less signaling overhead compared with separate TCI state indication (for DL) and spatial relation (for UL) in Rel.15/16 when beam correspondence holds.</p>
<p><u>MediaTek Inc.</u> Q1. For UE-initiated/triggered beam management in your example, what's the difference between Rel-17 SSBRI/CRI reporting for MPE mitigation (if supported in Rel-17)?</p>	<p>Thanks for the question on beam management. Short answer: no difference. On the reporting content related to MPE, we do hope RAN1 can handle and finalize it within Rel.17. As you may also know, we think Opt 2A (SSBRI(s)/CRI(s) and/or panel indication + L1-RSRP [L1-SINR] or modified version that accounts MPE effect) is a good candidate. What we would like to propose for Rel.18 BM is whether UE can trigger such reporting. Given the fact that for some use cases, UE is the first one to identify some events, e.g. MPE or L1/L2 inter-cell mobility.</p>

3.3 Round 2: RWS-210303: further questions and comments

In the feedback form in this section, we invite responses to the answers that we provided to the Round 1 questions and comments. We also invite further new comments and questions on RWS-210303.

Feedback Form 2: Round 2: Questions and comments on RWS-210303 (MIMO Enhancements)

1 – HuaWei Technologies Co.

Is the proposed "UE-initiated BM" for MPE and L1/L2 inter-cell mobility only? Or it is also proposed to be applied to general intra-cell DL/UL BM? And by "BM", does it intend to include beam switching only, or it extends to beam measurement and reporting?

3.4 Round 2: RWS-210303: Sony answers to questions / comments

This section provides answers and responses to questions and comments that were received in Round 2.

Table 2: Round2 answers to questions and comments on RWS-210303 (MIMO Enhancements)

Questions/Comments	Sony Answer
<p>HuaWei Technologies Co., Ltd Is the proposed "UE-initiated BM" for MPE and L1/L2 inter-cell mobility only? Or it is also proposed to be applied to general intra-cell DL/UL BM? And by "BM", does it intend to include beam switching only, or it extends to beam measurement and reporting?</p>	<p>Thank you for the well-structured questions. Regarding the first and second question, we believe MPE and L1/L2 inter-cell mobility are two promising use cases of UE-initiated BM. Currently, we are open to discuss and study whether/how UE-initiated BM can be applied to other use cases in Rel.18, e.g. the intra-cell DL/UL BM in your 2nd question. In our understanding, the MPE issue also falls into the category of intra-cell BM, if UE impacted by MPE does not switch UL beam to another TRP with different PCI from its serving cell. Regarding the third question, we think UE-initiated BM at least includes beam reporting (if not supported in Rel.17) and beam switching (e.g. for the use case of NTN with predictable trajectory). To avoid Tx-Rx beam pair misalignment at NW and UE side, we also think there should be certain mechanism to keep NW and UE on the same page on which beam pair(s) is(are) applied or to be applied.</p>

4 (Advanced Modulation for 5G-Advanced)

This section is for comments, questions and answers on the Sony document RWS-210305 (Advanced Modulation for 5G-Advanced).

RWS-210305 made the following proposals.

Study advanced modulation techniques and their usefulness with attention to the following aspects:

- **High throughput**
- **Decoding in lower SINR than current modulations**
- **New forms of CSI to support decoding of these modulation**

4.1 Round 1: RWS-210305: questions and comments

Questions / comments are invited on the above proposals or on other aspects of the document RWS-210305.

**Feedback Form 3: Round 1: Questions and comments on
RWS-210305 (Advanced Modulations)**

<p>1 – NTT DOCOMO INC.</p> <p>Thank you for the proposal. On ”Decoding in lower SINR than current modulations”, is it your intention that the same modulation order as the modulation scheme supported in NR already with optimized constellation will be studied?</p>
<p>2 – Intel Corporation (UK) Ltd</p> <p>Do you consider constellation enhancements for DL or UL or both?</p>
<p>3 – Nokia Corporation</p> <p>Thank you for the interesting contribution. Is the new modulation only intended for above 52.6 GHz range? What kind of modulation order are you considering?</p>

4.2 Round 1: RWS-210305: Sony answers to questions / comments

This section provides answers and responses to questions and comments that were received in Round 1.

Table 3: Round1 answers to questions and comments on RWS-210305 (Advanced Modulations)

Question/Comments	SONY answer
<p><u>Docomo</u> Thank you for the proposal. On ”Decoding in lower SINR than current modulations”, is it your intention that the same modulation order as the modulation scheme supported in NR already with optimized constellation will be studied?</p>	<p>Thank you for your question. Our intention is to study optimized constellations for any new high order modulations that may have to be introduced. The largest order constellation in Rel16 is 256QAM. Whilst there is good shaping gain for non-uniform 256QAM and below, it is known that shaping gain increases with the order of the constellation. Optimizing new 1024QAM and/or 4096QAM constellations can provide more significant shaping gain.</p>
<p><u>Intel</u> Do you consider constellation enhancements for DL or UL or both?</p>	<p>Thank you for your question. We consider that optimized constellations should be studied for both UL and DL. We also recognize that in a normative phase, the maximum order of constellation adopted may differ between the UL and DL.</p>
<p><u>Nokia</u> Thank you for the interesting contribution. Is the new modulation only intended for above 52.6 GHz range? What kind of modulation order are you considering?</p>	<p>Thank you for your question. We think that advanced modulation schemes will bring benefits for all frequency bands: Modulation orders: up to 4096QAM depending on achievable SINR.</p>

4.3 Round 2: RWS-210305: further questions and comments

In the feedback form in this section, we invite responses to the answers that we provided to the round 1 comments. We also invite further new comments and questions on RWS-210305.

Feedback Form 4: Round 2: Questions and comments on RWS-210305 (Advanced Modulations)

1 – Huawei Tech.(UK) Co.. Ltd

Thank you for the contribution. Could you clarify what is mixed constellation? Are you proposing to signal multiple MCS for a PDSCH in different PRBs?

4.4 Round 2: RWS-210305: Sony answers to questions / comments

This section provides answers and responses to questions and comments that were received in Round 2.

Table 4: Round2 answers to questions and comments on RWS-210305 (Advanced Modulations)

Questions/comments	Sony answers
Huawei Tech.(UK) Co.. Ltd Thank you for the contribution. Could you clarify what is mixed constellation? Are you proposing to signal multiple MCS for a PDSCH in different PRBs?	Thank you for the question. Mixed modulation would indeed allow to use different constellations on the different PRBs of a PDSCH depending on the SINR of each PRB. This brings throughput gain in frequency selective channels or channels suffering from narrow band interference. We are open to further studying and discussion on how to signal the modulation per PRB or PRB group.

5 Summary of email discussion

This section will contain a summary of the overall email discussion in this NWM.

The email discussion was based on the following Sony input documents:

RWS-210303: MIMO Enhancement for Rel-18

RWS-210305: Advanced Modulation for 5G-Advanced

RWS-210303. MIMO Enhancement in Rel-18. We received comments from five companies. Three companies were interested or had questions on extending the unified TCI states defined in Rel.17 to multi-TRP operation in Rel.18. The other two companies enquired about technical details of UE-initiated beam management (BM), including beam measurement, reporting and switching. We responded to all these questions and look forward to further discussions.

RWS-210305. Advanced Modulation for 5G-Advanced. We received comments/questions from 4 companies across the two rounds. Questions related to the frequency bands for advanced modulation, largest

enhanced constellations for both UL and DL, clarification on mixed modulation and how it is signaled; and whether constellation enhancement will also be applied to existing constellations. We responded to all the questions and look forward to further discussions.