

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

3GPP TSG RAN Rel-18 workshop

RWS-210586

Electronic Meeting, June 28 - July 2, 2021

Agenda Item: 4.2

Source: NTT DOCOMO, INC.

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

1 Introduction

This email discussion summary covers the following documents:

[1] RWS-210269: Evolution of reduced capability for Rel-18

[2] RWS-210270: Study on HAPS with relay-like architecture for Rel-18

2 General Q&A

2.1 Round 1

2.1.1 General comments/questions

Feedback Form 1: Round 1 general comments/questions

2.1.2 Answers to general comments/questions

Void

2.2 Round 2

2.2.1 General comments/questions

Feedback Form 2: Round 2 general comments/questions

2.2.2 Answers to general comments/questions

Void

3 eRedCap [1]

3.1 Round 1

3.1.1 Comments/questions on eRedCap

Feedback Form 3: Round 1 comments/questions on eRedCap

1 – KDDI Corporation

Let me ask questions below, with regard to BW reduction

<Q1>

With this BW reduction, are you trying to address the market where now LTE cat1 UEs are covering?

<Q2>

Are you assuming “FDD” or “FDD□TDD”? If you assume FDD, customers seem to be not so motivated to use RedCap Rel-18 and maybe prefer LTE cat1 UEs, since cheaper and more stable. If you assume TDD, we are not sure whether operators can provide enough coverage and uplink through put. What do you think about that?

2 – vivo Communication Technology

Thanks for the contribution on eRedCap. We would like to ask some questions about further UE BW reduction in Rel-18

1. Regarding further BW reduction to 5 10MHz, how much cost reduction do you expect, compared to the 20MHz BW capable UEs with potential TBS/RB restriction?

2. Assuming redcap UEs only capable of 5MHz BW is to be specified, what is your view about the loss of frequency diversity and the potential resource fragmentation issue when co-exists with non-redcap UEs. Does it mean that a 5MHz BW capable UE has to implement a faster BW switching capability or coverage recovery solutions to compensate the loss?

3 – China Telecommunications

[China Telecom] Thanks for your contribution. We also think that RedCap evolution should be considered in Rel-18. With the development of RedCap market, we are expected to see RedCap evolution with better performance and lower cost.

1) For further UE complexity reduction, we think it should be careful to leave room for further BW reduction and reduced peak data rate. 5MHz and 10Mbps DL data rate for FR1, if there are any use cases for this requirement? How to avoid overlapping with LTE eMTC/NB-IoT?

2) For power saving, we agree that it should be based on Rel-17 RedCap outcome. Take compatibility and coexistence into consideration, when deciding the scope for eRedCap WI in Rel-18.

3) For minimum impact on current NW, we have the same view that it should ensure coexistence with non-RedCap UEs and Rel-17 RedCap UEs. We are not expected large impact on current network. In addition, do you expect how to handle initial BWP congestion (RACH/Paging)? Reusing the techniques in Rel-17 with some necessary improvement or other technical direction?

4 – Sony Europe B.V.

Slide 5: Complexity: The R17 study determined that 20MHz BW was a sweetspot for UE redcap bandwidth capability. What percentage further complexity reduction do you expect with a 5/10MHz UE bandwidth? Are there other motivations for supporting a narrower bandwidth?

Slide 5: Power saving: what power saving adaptations are you considering based on a reduced max BW?

5 – Intel Corporation (UK) Ltd

<Intel>

Q1. Could you provide some justifications (e.g., market demands) to motivate the urgency for enhancements for support of high RedCap UE density?

6 – Ericsson LM

Regarding handling of PDCCH blocking (RWS-210269), we would like to ask whether you think that there might be a need to do something to improve PDCCH blocking also for non-RedCap UEs, or only for RedCap UEs?

Regarding further reduced UE bandwidth (RWS-210269), we would like to ask what potential UE cost reduction you expect from reduction from 20 MHz to 5-10 MHz? The estimates from CATT (RWS-210409) and Ericsson (RWS-210313) indicate that according to the established cost evaluation methodology (TR 38.875), there may not be a very significant further cost reduction compared to 20 MHz.

7 – ZTE Corporation

Thanks for the proposals on RedCap evolution. We show similar view to further consider 5 MHz maximum UE bandwidth for cost saving as we proposed in RWS-210476. For clarification, do you consider other complexity reduction features since '10Mbps DL data rate' is lower than the peak data rate that 5 MHz bandwidth can achieve?

8 – LG Electronics Inc.

Thanks for the contribution.

Regarding the power saving and minimum impact on current NW (support high UE density) in your suggested WI scope, it is not clear for us what it means by "applicable both to Rel-17 RedCap UEs and Rel-18 eRedCap UEs. Can you elaborate further on your idea?

9 – Samsung Electronics Co.

In Rel-17, there have been no specific schemes introduced for coverage recovery in RedCap. But, it was noted in WID that UL coverage enhancements in NR coverage enhancement WI shall be assumed to be available to RedCap UE by default. So, we don't think some coverage recovery is needed for at least UL. In this sense, could you elaborate your proposal "potential coverage recovery for same coverage as non-RedCap and Rel-17 RedCap UEs"?

Feedback Form 4: Round 1 answers on eRedCap

1 – NTT DOCOMO INC.

Thank you very much for the comments/questions! We would like to provide our answers per feature as follows:

2 – NTT DOCOMO INC.

UE complexity reduction:

[KDDI#1] With this BW reduction, are you trying to address the market where now LTE cat1 UEs are covering?

From use case perspective (i.e., up to 10Mbps DL data rate), the eRedCap UEs with max 5MHz BW can cover the market where LTE Cat1 UEs now covering, for sure. However, we don't think it is the only case where the eRedCap UEs can cover. NR UE capability framework has quite high degrees of freedom to support a variety of use cases and it is quite useful to further extending NR-IoT market, which is not covered by LTE Cat1 UEs.

[KDDI#2] Are you assuming "FDD or "FDD□TDD"? If you assume FDD, customers seem to be not so motivated to use RedCap Rel-18 and maybe prefer LTE cat1 UEs, since cheaper and more stable. If you assume TDD, we are not sure whether operators can provide enough coverage and uplink through put. What do you think about that?

As we mentioned in RWS-210269, Rel-15 SSB should be reused for eRedCap UEs with max 5MHz BW at least 15kHz SCS to minimize specification and NW impacts, and we are open to further discuss for 30/60kHz SCS. In that sense, low-bands for FDD are our main focus in Rel-18. As we answered in [KDDI#1], we don't think replacing LTE Cat1 UEs is the only case where the eRedCap UEs can cover.

[vivo#1] Regarding further BW reduction to 5 10MHz, how much cost reduction do you expect, compared to the 20MHz BW capable UEs with potential TBS/RB restriction?

Based on TR38.875, we expect 10% additional cost reduction gain from max 20MHz BW to max 5MHz BW, which seems aligned with the average of evaluations in RWS-210313 from Ericsson, RWS-210409 from CATT, and RWS-210476 from ZTE. We haven't taken TBS/RB restriction into account. We think it is quite important to provide the low-end NR platform, which does not overlap with LTE eMTC/NB-IoT, to further extending NR-IoT market.

[vivo#2] Assuming redcap UEs only capable of 5MHz BW is to be specified, what is your view about the loss of frequency diversity and the potential resource fragmentation issue when co-exists with non-redcap UEs. Does it mean that a 5MHz BW capable UE has to implement a faster BW switching capability or coverage recovery solutions to compensate the loss?

We expect some loss of frequency diversity due to 5MHz BW and we propose to support coverage recovery solutions for same coverage as non-RedCap UEs and Rel-17 RedCap UEs as in RWS-210269.

Regarding resource fragmentation issue, we think it should be avoided as being discussed in RAN1 for Rel-17 RedCap UEs, and it should be the starting point for further discussion.

[China Telecom#1] For further UE complexity reduction, we think it should be careful to leave room for further BW reduction and reduced peak data rate. 5MHz and 10Mbps DL data rate for FR1, if there are any use cases for this requirement? How to avoid overlapping with LTE eMTC/NB-IoT?

As answered in [KDDI#1], the eRedCap UEs with max 5MHz BW can cover the market where LTE Cat1 UEs now covering, for sure. NR UE capability framework has quite high degrees of freedom to support a variety of use cases and it is quite useful to further extending NR-IoT market, which is not covered by LTE Cat1 UEs. From requirement perspective, there is still a gap between Rel-17 RedCap UEs (up to 150Mbps DL data rate) and LTE CatM2 (up to 4Mbps DL data rate) as shown in RWS-210269. Given that, we think max 5MHz BW can minimize the NR device cost while minimizing specification/NW impacts, and up to 10Mbps DL data rate can avoid overlap with LTE eMTC/NB-IoT.

[Sony#1] The R17 study determined that 20MHz BW was a sweetspot for UE redcap bandwidth capability. What percentage further complexity reduction do you expect with a 5/10MHz UE bandwidth? Are there other motivations for supporting a narrower bandwidth?

Please see our answers to [vivo#1] and [China Telecom#1].

[Ericsson#2] Regarding further reduced UE bandwidth (RWS-210269), we would like to ask what potential UE cost reduction you expect from reduction from 20 MHz to 5-10 MHz? The estimates from CATT (RWS-210409) and Ericsson (RWS-210313) indicate that according to the established cost evaluation methodology (TR 38.875), there may not be a very significant further cost reduction compared to 20 MHz.

Please see our answer to [vivo#1].

[ZTE#1] We show similar view to further consider 5 MHz maximum UE bandwidth for cost saving as we proposed in RWS-210476. For clarification, do you consider other complexity reduction features since '10Mbps DL data rate' is lower than the peak data rate that 5 MHz bandwidth can achieve?

Our calculation for 10Mbps DL data rate is based on the assumption with 5MHz BW and 16QAM for FR1 FDD. We can consider relaxed max modulation order to 16QAM for further complexity reduction feature, while the complexity reduction gain from 64QAM to 16QAM is marginal (2%) based on TR38.875.

3 – NTT DOCOMO INC.

Power saving:

[China Telecom#2] For power saving, we agree that it should be based on Rel-17 RedCap outcome. Take compatibility and coexistence into consideration, when deciding the scope for eRedCap WI in Rel-18.

Thanks for the comments. We also agree that the compatibility and coexistence with Rel-17 UEs should be taken into account. Detailed description on the scope will be further discussed.

[Sony#2] what power saving adaptations are you considering based on a reduced max BW?

Thanks for the question. Generally, our intention is to study what is impacted on in terms of power consumption and where there is room for additional power saving, assuming Rel-17 reduced capability. Although a reduced max BW is just an example among them and we do not intend to stick to it, for instance one potential impact by a reduced max BW is following: non-RedCap UE can perform various types of power saving adaptation by BWP switching with BW adaptation. However, BW adaptation would not be needed for RedCap UE with a reduced max BW especially for FR1, and then various power saving adaptation based on BWP switching might not be best way for RedCap UE. Considering this impact, some potential enhancement can be considered.

[LGE#1] Regarding the power saving and minimum impact on current NW (support high UE density) in your suggested WI scope, it is not clear for us what it means by “applicable both to Rel-17 RedCap UEs and Rel-18 eRedCap UEs. Can you elaborate further on your idea?

Thanks for pointing this out. Our intention is that these features are applicable to following UEs:

1. RedCap UEs with max 20MHz BW for FR1 specified in Rel-17
2. RedCap UEs with max 100MHz BW for FR2 specified in Rel-17
3. eRedCap UEs with max 5MHz BW for FR1 to be specified in Rel-18

4 – NTT DOCOMO INC.

Minimum impact on current NW:

[China Telecom#3] For minimum impact on current NW, we have the same view that it should ensure co-existence with non-RedCap UEs and Rel-17 RedCap UEs. We are not expected large impact on current network. In addition, do you expect how to handle initial BWP congestion (RACH/Paging)? Reusing the techniques in Rel-17 with some necessary improvement or other technical direction?

We have the same understanding that impact on current NW is limited if Rel-15 SSB can be reused.

Regarding handling of initial BWP congestion (RACH/Paging), we think Rel-17 solutions, which are under discussion in RAN1, should be the starting point. Some enhancements from Rel-17 solutions may be necessary depending on the outcome from Rel-17.

[Intel#1] Could you provide some justifications (e.g., market demands) to motivate the urgency for enhancements for support of high RedCap UE density?

We think it is quite important to provide the low-end NR platform as it is well known that the number of IoT terminals will increase significantly toward the second half of 2020s. IoT devices will last up to 10 years and hence, it is necessary to specify the features for handling high UE density as early release as possible. Otherwise, such resource-hungry devices degrade the network efficiency significantly.

[Ericsson#1] Regarding handling of PDCCH blocking (RWS-210269), we would like to ask whether you think that there might be a need to do something to improve PDCCH blocking also for non-RedCap UEs, or only for RedCap UEs?

We think it is necessary only for RedCap UEs (both with max 20/100MHz BW and max 5MHz BW) as they consume radio resources more than non-RedCap UEs.

[LGE#1] Regarding the power saving and minimum impact on current NW (support high UE density) in your suggested WI scope, it is not clear for us what it means by “applicable both to Rel-17 RedCap UEs and Rel-18 eRedCap UEs. Can you elaborate further on your idea?

Thanks for pointing this out. Our intention is that these features are applicable to following UEs:

1. RedCap UEs with max 20MHz BW for FR1 specified in Rel-17
2. RedCap UEs with max 100MHz BW for FR2 specified in Rel-17
3. eRedCap UEs with max 5MHz BW for FR1 to be specified in Rel-18

[Samsung#1] In Rel-17, there have been no specific schemes introduced for coverage recovery in RedCap. But, it was noted in WID that UL coverage enhancements in NR coverage enhancement WI shall be assumed to be available to RedCap UE by default. So, we don't think some coverage recovery is needed for at

least UL. In this sense, could you elaborate your proposal "potential coverage recovery for same coverage as non-RedCap and Rel-17 RedCap UEs"?

As we answered in [vivo#2], we expect some loss of frequency diversity due to 5MHz BW which mainly affects DL coverage. DL coverage recovery may be necessary to achieve the same coverage as non-RedCap and Rel-17 RedCap UEs.

3.2 Round 2

3.2.1 Comments/questions on eRedCap

Feedback Form 5: Round 2 comments/questions on eRedCap

1 – vivo Communication Technology

Thanks for your reply. Besides BW reduction, we think there can be multiple other areas for Rel-18 eRedcap, would like to know your views about the following in particular? Thanks.

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

2 – Spreadtrum Communications

Regarding the "Minimum impact on current NW" part, we are agree with your point that reuse Rel 15 SSB at least for 15kHz SCS, but we are confused by for the FFS part of the 60KHz SCS, could you please clarify it?

3.2.2 Answers on eRedCap

Feedback Form 6: Round 2 answers on eRedCap

1 – NTT DOCOMO INC.

Thank you very much for the comments/questions! We would like to provide our answers per company as follows:

2 – NTT DOCOMO INC.

[vivo#3] Thanks for your reply. Besides BW reduction, we think there can be multiple other areas for Rel-18 eRedcap, would like to know your views about the following in particular? Thanks.

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

We are generally supportive for the features which provide the low-end NR platform and have reasonable tradeoff between cost reduction/power saving gain and specification/NW impact, as long as the low-end

NR platform does not overlap with LTE eMTC/NB-IoT, to further extending NR-IoT market. In that sense,

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UE processing time relaxation (data, CSI) can be considered for further cost reduction as it would provide 6% and 5% cost reduction gain, respectively, according to TR38.875.

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Reduced number of HARQ processes was discussed in Rel-17 RedCap SI but no observation was captured in TR38.875. As mentioned in R1-2009393, some companies observed 3 9% cost saving gain by reduced number of HARQ processes and thus, we are open to further study this point.

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Serving cell RRM relaxation for stationary devices can provide 3.6% 13.4% power saving gain according to TR38.875. However, eDRX enhancements, which relax serving cell RRM measurement, are to be specified for Rel-17 RedCap UEs. In addition, handover may not be carried out appropriately due to serving cell RRM relaxation when the radio condition is poor. Therefore, we are not supportive for this feature so far, while we are also fine to further study whether sufficient power saving gain can be obtained by this feature in addition to Rel-17 eDRX enhancements.

-

Lower UE power class is beneficial for power saving as mentioned in some contributions for this Rel-18 Workshop. However, Lower UE power class would degrade UL coverage and hence UL coverage recovery may be necessary to achieve the same coverage as non-RedCap UEs and Rel-17 RedCap UEs. We are fine to introduce Lower UE power class only if corresponding UL coverage recovery solution is supported.

3 – NTT DOCOMO INC.

[Spreadtrum#1] Regarding the “Minimum impact on current NW part, we are agree with your point that reuse Rel 15 SSB at least for 15kHz SCS, but we are confused by for the FFS part of the 60KHz SCS, could you please clarify it?

Thank you for pointing this out. It is our mistake, 60kHz SCS shouldn't be included in the FFS part as it is not supported for SSB SCS. We are open to further discuss whether 30kHz SCS is supported as SSB SCS for eRedCap UEs with max 5MHz BW.

4 HAPS [2]

4.1 Round 1

4.1.1 Comments/questions on HAPS

Feedback Form 7: Round 1 comments/questions on HAPS

1 – Asia Pacific Telecom co. Ltd

We wonder the idea is to support HAPS WID led by RAN4 or a new HAPS WID worked by RAN1 to RAN4.

2 – Sony Europe B.V.

On Frequency sharing between HAPS and terrestrial network which are deployed by a single operator, could you elaborate which aspects should be studied? e.g. from UE and/or network side? sharing mechanism?

3 – Qualcomm Incorporated

Could you elaborate on the potential specification impacts in order to support HAPS as a IAB node?

4 – Samsung Electronics Co.

Which altitude of HAPS could be considered here? Based on that, it seems RAN4 might be the main WG for HAPS in order to check coexistence.

4.1.2 Answers on HAPS

Feedback Form 8: Round 1 answers on HAPS

1 – DOCOMO Communications Lab.

Thank you for questions. Please see answers for each below.

To Asia Pacific Telecom

Q. We wonder the idea is to support HAPS WID led by RAN4 or a new HAPS WID worked by RAN1 to RAN4.

A. To support HAPS, we assume study/work at RAN1 to RAN4 is necessary. Not only in RAN4. The reason is, we believe relay-like architecture (named as ISL for satellites) is one of the key features for HAPS network. Regenerative type should be introduced, then study/work other than in RAN4 will be essential definitely.

To Sony

Q. On Frequency sharing between HAPS and terrestrial network which are deployed by a single operator, could you elaborate which aspects should be studied? e.g. from UE and/or network side? sharing mechanism?

A. Due to stratosphere-specific characteristics, it is said that each HAPS is always swaying. This could lead to fluctuation of the covered area, so some interference mitigation mechanism at UE side might be needed. Firstly performance level in the targeted situation is carefully evaluated, including whether such a mechanism is necessary or not. Then, if desirable, some work can be done at each WG. Or study/work from NW side should be OK as well if solution from NW side is better for this issue. In this case, spec impact would be studied at the same time. The outcome might only be RAN4 work on coex, then it would be fine after the careful study in 3GPP.

To QC

Q. Could you elaborate on the potential specification impacts in order to support HAPS as a IAB node?

A. Rel-17 supports transparent only, thereby new architecture (i.e. regenerative one) will be introduced. Then even when HAPS is a IAB node, at least time/freq sync and timing relationship will require to be enhanced from Rel-17 NTN, where they will be specified only for transparent type. In addition, such an aspect would impact on at least resource management for MT/DU of IAB spec in our current understanding. One note is that TR 38.821 is mentioning as IAB mechanism with NTN needs further study.

To Samsung

Q. Which altitude of HAPS could be considered here? Based on that, it seems RAN4 might be the main WG for HAPS in order to check coexistence.

A. Regarding altitude, we do not have certain preference currently. We have used around 20 km in our previous experiment, but other altitude can be considered in same priority level. Then regarding WG perspective, as commented to Sony, only RAN4 work might be OK but might not. We prefer to have careful study at first.

4.2 Round 2

4.2.1 Comments/questions on HAPS

Feedback Form 9: Round 2 comments/questions on HAPS

1 – Fujitsu Limited

Thank you for the contribution.

We have just one question. Could you more elaborate distance among HAPSs and frequency? Depending on that, the communication may be instable because the scenario in this proposal seems to be similar with mobility of IAB-nodes that are connected with each other.

2 – ZTE Corporation

Thanks for your contribution and replies. For this topic, if the shared spectrum is used for HAPS and TN, the co-channel evaluation is needed. W.r.t the links between regenerative payload at HAPS and ground station, we understand that there is need to evaluate the performance due to the mobility issue, but it seems that there is potential overlapping with other item, e.g., IAB or relay topic, which may also be enhanced toward the mobile case. Any views on this part including how to organize the discussion.

4.2.2 Answers on HAPS

Feedback Form 10: Round 2 answers on HAPS

1 – DOCOMO Communications Lab.

Thank you for questions in second round. Please see answers for each below.

To Fujitsu

Q. Thank you for the contribution. We have just one question. Could you more elaborate distance among HAPSs and frequency? Depending on that, the communication may be instable because the scenario in this proposal seems to be similar with mobility of IAB-nodes that are connected with each other.

A. Currently we are open to discuss which distance/frequency is feasible. Our view is that sufficient redundancy on NTN NW should be prepared for better reliability, more effective QoS, etc. Some restriction is OK for us only if these motivations can be guaranteed. It seems that RAN WGs discuss firstly such aspect, i.e. assumption/scenario/etc.

To ZTE

Q. Thanks for your contribution and replies. For this topic, if the shared spectrum is used for HAPS and TN, the co-channel evaluation is needed. W.r.t the links between regenerative payload at HAPS and ground station, we understand that there is need to evaluate the performance due to the mobility issue, but it seems

that there is potential overlapping with other item, e.g., IAB or relay topic, which may also be enhanced toward the mobile case. Any views on this part including how to organize the discussion.

A. Exactly, other SI/WI may treat similar things. Rel-18 package should consider this. On the other hand, TN and NTN have many differences as we are discussing in Rel-17 WI. We are afraid that NTN part is not handled appropriately or is deprioritized over TN part. Such situation is not preferable for us. Therefore currently we prefer to have separate SI/WI. But we can discuss further since we need to consider as a Rel-18 package. Joint SI/WI might become OK for us based on discussions.