94e-07-R18-RedCapEvo - Version 0.0.12
RAN

3GPP TSG-RAN Meeting #94-e

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Electronic Meeting, December 6 - 17, 2021

Agenda Item: 8A.1

Source: Ericsson

Title: Moderator's summary of discussion [94e-07-R18-RedCapEvo]

Document for: Discussion

1 Introduction

This contribution is the moderator summary of the 2nd week of the RAN#94-e discussion of the potential Rel-18 SI scope for RedCap evolution. It is a continuation of the discussion that took place in the 1st week of the RAN#94-e meeting, where the latest draft SID can be found in RP-213582 [7] and the moderator's summary in RP-213581 [8].

The goal of the discussion is to discuss and provide the final scope of the SI. The discussion on whether to include a RedCap SI (or WI) in the Rel-18 work is part of the discussion led by the chairman and is not included here.

Please avoid any input like "We support / we do not support" without giving additional justification and motivation as this is not a "number counting" driven discussion. Instead justify your view with strong technical arguments and/or tangible commercial interests (near & longer terms).

The input documents to the discussion are listed in the reference section.

2 Initial round

2.1 Updated draft SID

An updated draft SID has been provided with the following updates:

- The title and lists of new/impacted specs have been updated according to guidance from the RAN secretary.
- The term complexity/cost has been replaced with the term complexity in line with a comment from T-Mobile, without any intention to change the scope of the SI or the discussion/work in RAN1.
- The objective has been updated as shown in Figure 1 as a way to address concerns raised during the 1st week.

The draft SID can be found in the RAN#94-e drafts inbox:

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_94e/Inbox/Drafts/%5B94e-07-R18-RedCapEvo%5D/Second_week_initial_phase/RP-21xxxx_New_SID_on_Study_on_further_NR_RedCap_UE_complexity_reduction.docx

4 Objective

4.1 Objective of Core part WI

To further reduce the complexity~~/cost~~ of RedCap devices, the following should be studied, and the results should be captured in TR 38.8xx:

- Study further UE complexity~~/cost~~ reduction techniques based on Rel-17 evaluation methodology [RAN1]
  - Consider network impact, coexistence of Rel-17 and Rel-18 RedCap and non-RedCap UEs in a cell, UE impact, specification impact
  - Potential solutions, which may complement each other, for reducing device complexity~~/cost~~ are focusing on:
    - UE bandwidth reduction to 5MHz in FR1,
      - Note: ~~The basic design of~~ Rel-15 SSB should be reused and L1 changes minimized.
      - Note: Operation in BWP with/without SSB and without/with RF retuning should be considered.
      - Possibly in combination with relaxed UE processing timeline for PDSCH and/or PUSCH and/or CSI
    - reduced UE peak data rate in FR1,
      - including the possibility of restricted bandwidth for PDSCH and/or PUSCH
      - Possibly in combination with relaxed UE processing timeline for PDSCH and/or PUSCH and/or CSI
    - Note: It is not precluded that some solutions for FR1 can be applied to FR2 in WI stage.

Figure 1: Objective (initial round)

Companies can provide input on the justification and the objectives in the feedback form.

Feedback Form 1: Views on the updated draft RedCap SID (initial round)

1 – Spreadtrum Communications

For the objective part:

During the final round last week, we share the same views with quite some companies that there is no reason to put "UE processing timeline" as a sub-bullet under "UE bandwidth reduction" or "reduced UE peak data rate".

However, another possible compromised way forward is to remove "UE processing timeline" from SID with a note that possibly relaxed UE processing timeline will be specified in WID with/without a small

study phase. By that, it will not only help to relieve SI workload pressure, but also potentially avoiding unnecessary design on relaxed UE processing timeline as Rel18 SI output will give a more clear picture on Rel18 RedCap before WI stage (i.e., we can focus on "UE bandwidth reduction" and "reduced UE peak data rate" in the Rel18 SI phase).

For T-Mobile's concern:

To align with Rel.17 RedCap SID/WID, we think the word "cost" can be kept at least in the justification part of the RedCap Rel.18 SID. In addition, it is well worth noticing that we analyzed and descripted a lot for the cost in the TR 38.875, and some industry customers showed strong interest in the cost aspect for Rel 17&Rel 18 RedCap.

2 – ZTE Corporation

We are fine with the current version.

3 – Guangdong OPPO Mobile Telecom.

Removing coreset#0 is OK, and the SSB can be reused. Agreed with the bullet.

We believe addition of "in combination with" in 2 replicated bullets would be more proof the have the bullet merged and promoted. But we we live with the change.

Other parts are fine.

4 – VODAFONE Group Plc

We're generally fine with the draft SID. A question for clarification: why was the bullet for reduced maximum number of HARQ processes removed from the last draft?

5 – Ericsson LM

As moderator : Regarding the above question from Vodafone, the bullet for reduced maximum number HARQ processes was removed by the chair during the online session, presumably to reduce the scope given the limited (1+1) TU allocation.

6 – Samsung Electronics Polska

1) We cannot get the relationship between UE processing timeline and 5MHz BW reduction. We can be fine to make UE processing timeline as a separate bullet together with BW reduction and peak data rate, with the wording "which may complement each other," in the main bullet should be enough.

2) If companies have strong concern to keep reusing CORESET #0 in the note for 5MHz, we suggest the following changes for the note: "Note: ~~The basic design of~~ Rel-15 SSB should be reused and L1 changes minimized ", which is align with R17 redcap SI. Otherwise, we have strong concern on the TUs for this SI, i.e. 1+1 TU .

3) Suggest to change the last notes: § Note: It is not precluded that **some** solutions for FR1 can be applied to FR2 in WI stage. We don't think 5MHz BW reduction can be applied to FR 2.

7 – Deutsche Telekom AG

The notes in the objectives are misplaced. They should not be sub-bullet points to main bullets, but use the NOTE Style.

Like this is it confusing and not based on 3GPP drafting rules ! Please change this before considering approval.

8 – Samsung Electronics Polska

Comments on the new version:

We are general fine with the updated version. We agree with DT on the format of note.

Please add Samsung as supporting company.

9 – Ericsson LM

As moderator : To my understanding, the drafting rules in 21.801 only concern TSs and TRs, not WIDs. And the guidance in the WID template only states "*Summary of what is intended to be achieved. Free text*" for the Objective section. So I don't think there is any formal rule forcing us to use a particular format for the notes. That being said, there may of course be other reasons to move the notes to the main level (to make the objective look cleaner, if nothing else).

10 – Everactive

We are good with this version.

11 – Huawei Tech.(UK) Co.. Ltd

The reduction of PDSCH/PUSCH bandwidth seems to produce a lower-rate UE with no analysis of much complexity saving, particularly by comparison to a UE-level BW reduction, in the first bullet. It may also produce at least two UE types out of this SI/WI. We'd suggest dropping the bullet to avoid such an outcome, particularly given the understanding that BB-only reduction is understood to be included in the 5 MHz BW objective. (In fact, with that clarification given in GTW, we had expected the bullet to be merged/removed).

12 – Ericsson LM

As moderator : Regarding the comments on relaxed UE processing timeline, it was reverted into sub-bullets by the chair during the online session, presumably in order to limit the total number of combinations of UE complexity reduction techniques that need to be considered during this brief SI. Relaxed UE processing timeline will thus only be considered in combination with the other techniques, not as a stand-alone technique. Note that relaxed UE processing timeline as a stand-alone technique has already been evaluated in the Rel-17 RedCap SI (TR 38.875).

13 – Ericsson LM

It is important that the SI scope explicitly includes study of different BW reduction options, i.e., not only RF+BB bandwidth reduction but also BB-only bandwidth reduction. We are fine with capturing this aspect either under the UE bandwidth reduction bullet or under the UE peak data rate reduction bullet or as a separate bullet, as long as it is clear that not only RF+BB bandwidth reduction but also BB-only bandwidth reduction is in the SI scope. One option that seems attractive is BB-only bandwidth reduction for PDSCH/-PUSCH (to approximately 5 MHz). We have provided initial results for this and other BW reduction options in R1-2108824 and R1-2110772.

14 – Nordic Semiconductor ASA

We do not have strong opinion on whether to keep "UE peak data-rate bullet", but if removed, it should be confirmed/clarified that "BB-only reduction is understood to be included in the 5 MHz BW objective" is common view.

15 – Samsung Electronics Polska

We share similar view as Ericsson on BB-only cost reduction.

We expect SI will provide conclusions/recommendations on which (none, one or both) solution to be specified, considering all the aspects mentioned in SID. We don't agree on dropping one now, especially in this late phase of SI drafting.

16 – Futurewei Technologies

The RedCap UE type discussion for Rel-17 was very painful. We hope that going in we should have the understanding that we would be getting (at most) one new Rel-18 RedCap UE type as a recommendation from the study.

17 – Ericsson LM

As moderator : Regarding the BW reduction option discussion in the above comments, it seems a bit unclear whether everyone is still on the same page. It is the moderator's understanding that different BW reduction options should be studied. It would be good to make that very clear already now so that we do not have to spend time in the May RAN1 meeting debating that question. Then hopefully the August RAN1 meeting can give a clear recommendation to RAN based on the evaluation that takes place between the May and August RAN1 meetings.

18 – Nokia France

We are fine with the latest version of the SID.

Regarding the question on the maximum number of HARQ processes, we see this being logically related to reduced UE peak rate, but in any case we believe it can still be discussed as the first sub-bullet says "including", which clearly implies that other methods are not precluded.

Overall, we believe the SI allows enough flexibility to study carefully a new type of further-reduced-complexity RedCap UE, and we recommend approving it as-is.

19 – T-Mobile USA Inc.

The deletion of cost from the proposed SID address T-Mobile's concerns. As for the other items it is really hard to compare the complexity reduction of lower peak data rate with 5 MHz CBW. As a general rule any changes must be minimized to leverage the MBB economies of scale.

20 – NEC Corporation

We are fine with the latest version of the SID.

21 – LG Electronics Inc.

Thanks for the effort.

Although we think some of the updates in the Notes are not necessary, we can support this updated draft RedCap SID as it is.

22 – vivo Mobile Communication Co.

We are fine with the latest version of the SID.

About the maximum number of HARQ processes, we share the views with Nokia that it can still be discussed in combination with the reduced UE peak rate.

23 – SoftBank Corp.

We share the proposal by Ericsson(#13) on the RF BW vs BB BW. We think it is one of the good topics to be discussed during the Study phase. We would choose better option considering both UE cost and network impact then.

24 – CATT

For UE bandwith reduction, we share the same view as Ericsson and Samsung that BB-only UE BW reduction is included. We support moderator's proposal to make it clear in the SID.

For UE peak data rate reduction, our understanding is that reduced maximum number of HARQ processes is not included as per the latest SID.

25 – DOCOMO Communications Lab.

While we understood that the other techniques than restricted bandwidth for PDSCH and/or PUSCH are precluded as moderator commented, Nokia and vivo seem to have a different understanding. So we are not sure whether it is common understanding or not that other techniques are precluded, e.g., reduced number of HARQ process can or cannot be discussed in the study phase. Thus, it would be good to clarify whether other techniques than restricted bandwidth for PDSCH and/or PUSCH are out of scope or not in this SID to avoid same discussion in study phase.

26 – Spreadtrum Communications

Thank moderator for hard job.

For UE processing timeline bullet, we thought putting it into WID would potentially reduce the overall work on this topic, as SI will reduce the type of Rel-18 RedCap mentioned by some companies. However, if the majority are fine with the current updated version, we are flexible to live with it as well.

27 – SHARP Corporation

Considering the workload on Rel-18 RedCap based on the last GTW, we are OK with the latest version of the SID.

28 – Panasonic Corporation

We are ok with the current draft.

29 – Qualcomm Incorporated

We are fine with the latest version of the SID. Just a comment on the following note.

- Note: Operation in BWP with/without SSB and without/with RF returning should be considered.

Our understanding is that the ordering has to be correctly matched between "**with/without SSB**" and "**without/with RF retuning**". So our interpretation of the note is that "operation in **BWP with SSB without RF retuning**" and "operation in **BWP without SSB with RF retuning**" should be considered. If this interpretation is shared by all companies, we are fine with the current wording and current SID as well.

30 – Intel Corporation (UK) Ltd

It would be good to clarify how "focusing on" is to be interpreted. Our understanding is that this implies other complexity reduction mechanisms are not precluded for consideration in defining potential evolution of RedCap devices in Rel-18. With this understanding, we can accept the current formulation.

On removing “cost” from “cost/complexity”, given that such terminology has been used in Rel-17 and we are expected to follow the “relative cost” analysis framework from TR 38.875 for Rel-18 studies, it may be preferable to keep the same terminology.

Lastly, we share the understanding that different BW reduction options, involving combinations of reduction at RF and BB, etc. can be considered as part of the study.

31 – Xiaomi Communications

We are fine with current version

32 – Sony Europe B.V.

At the study stage, we think it is important to be able to study various options for reduced bandwidth, including baseband-only bandwidth reduction. It would be good if it were explicitly stated in the SID that both RF+BB and BB-only bandwidth reduction options are in scope. If there is no explicit statement, we are concerned that the May RAN1 meeting will be consumed with discussing the scope of the bandwidth reduction objective rather than actually studying bandwidth reduction.

We are OK with the SID structure that relaxed UE processing timeline is considered in combination with other techniques (reduced bandwidth, reduced peak data rate) and not in a standalone objective.

We are OK with the reduced peak data rate objective. We note that combination with reduced bandwidth is only a possibility. We think that it should also be possible to reduce the peak data rate without reference to the bandwidth. This was done for eMTC in Rel-13 where the peak data rate was defined as 1Mbps. It should be possible to take an equivalent approach in NR-RedCap (e.g. peak data rate = 10Mbps. Full stop).

33 – MediaTek Inc.

On the UE processing timeline aspects, it was strange and disappointing that despite overwhelming support to have this as an independent objective, the entire first week of discussion has been made obsolete and we’re exactly back to where we started.

34 – Sequans Communications

We are generally fine with the update. We also share the view that BB-only BW reduction is also included in the SI, which seems clear with current wording. Regarding other techniques (e.g. HARQ processes number reduction), we have same understanding as Nokia.

35 – Nordic Semiconductor ASA

One more comment on ”cost”. I copy paste below the text for R17 RedCap WID. So we are very puzzled why cost KPI is removed from R18 RedCap?

R17 WID: Generic requirements:

· *Device complexity: Main motivation for the new device type is to lower the device cost and complexity as compared to high-end eMBB and URLLC devices of Rel-15/Rel-16. This is especially the case for industrial sensors.*

2.2 Summary of initial round

The updated draft SID received rather good support, but there were still some comments and questions.

Regarding the replacement of the terms ”cost” and ”complexity/cost” with ”complexity” only, one company

(T-Mobile) expressed that the update addresses their concerns, whereas some companies (Intel, Nordic Semiconductor, Spreadtrum) commented that the term ”cost” has been used in earlier releases, and it was suggested to at least mention cost in the Justification part.

Regarding the notes, some companies (Deutsche Telecom, Samsung) expressed that they should not be sub-bullets to the objectives.

Related to the bullets on reduced UE bandwidth and reduced UE peak rate, several companies (CATT, Ericsson, Intel, Nordic Semiconductor, Sequans, SoftBank, Sony) expressed that it is important that different options (particularly RF+BB bandwidth reduction as well as BB-only bandwidth reduction) are included in the scope. Some of these companies expressed that it could either be included as a sub-bullet to reduced UE bandwidth or as a sub-bullet to reduced UE peak rate. One company (Huawei) proposed dropping the sub-bullet on PDSCH/PUSCH bandwidth restriction, ”particularly given the understanding that BB-only reduction is understood to be included in the 5 MHz BW objective”. It is the moderator’s understanding that a sub-bullet explicitly stating that bandwidth reduction in RF and/or BB parts should be considered might make it even clearer than it is now, but that the presence of the sub-bullet about PDSCH/PUSCH bandwidth restriction at least makes it clear that various options related to UE bandwidth reduction and UE peak rate reduction are considered part of the SI scope. So it may not make a big difference whether a sub-bullet is included under UE bandwidth reduction or under UE peak rate reduction.

Regarding reduced maximum number of HARQ processes, some companies (Nokia, Vivo) expressed that they can be studied as solutions for reduced UE peak rate, whereas one company (CATT) expressed that it is not in the scope, and one company (NTT DOCOMO) expressed that it needs to be clarified whether it can be studied or not. Some companies (Intel, Sony) expressed a similar sentiment that other techniques than the ones explicitly listed can be studied. The moderator’s understanding is that there is nothing explicitly precluding study of these other techniques as long as they can be considered to be within the scope of the objective, but that study of the techniques that are explicitly listed as being in the ”focus” of the study need to be prioritized over study of other potential techniques in case there is a need to prioritize due to lack of time, which seems quite likely given the small (1+1 TU) time allocation for this SI.

3 Intermediate round

3.1 Updated draft SID

Based on the summary of the initial round in Section 2.2, the draft SID has been updated as follows:

- In the Justification, it is mentioned that the further complexity reduction is motivated by ”RedCap use cases with relatively low cost, low power consumption, and low data rate requirements”. In all other places, the term ”complexity” only is used.
- The notes are moved to the end of the objective section.
- It is clarified that the ”Rel-17 evaluation methodology” can be found in TR 38.875.
- Some missing details are added in the ”Expected Output and Time scale” section.

The draft SID can be found in the RAN#94-e drafts inbox:

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_94e/Inbox/Drafts/%5B94e-07-R18-RedCapEvo%5D/Second_week_intermediate_phase/RP-21xxxx_New_SID_on_Study_on_further_NR_RedCap_UE_complexity_reduction_v2.docx

The updated Justification and Objective parts are also shown in Figure 2 and Figure 3, respectively.

3 Justification

5G aims to accelerate industrial transformation and digitalization, which improve flexibility, enhance productivity and efficiency, reduce maintenance ~~cost~~, and improve operational safety. Industrial sensors play an important role for realizing such a vision. Not only widely used in industrial automation and digitalization use cases, industrial sensors are also widely used in the general environmental monitoring use cases such as monitoring of critical infrastructure (e.g., buildings, bridges, water dams, etc.) or monitoring for natural disasters (e.g., wild fire, flood, tsunami, earthquake, etc.).

Another emerging new class of new 5G use cases is the smart city vertical, which covers data collection and processing to more efficiently monitor and control city resources, and to provide services to city residents. Especially, the deployment of surveillance cameras is an essential part of the smart city but also of factories and industries.

Furthermore, there have been increasing interests in wearables use cases such as smart watches, eHealth related devices, and medical monitoring devices. These use cases call for different design considerations and have different requirements in terms of form factor, UE complexity and energy efficiency, compared to eMBB devices.

The support of industrial sensors, video surveillance, and wearables were the motivations behind Rel-17 RedCap. Through the Rel-17 NR RedCap work item, 3GPP has established a framework for enabling reduced capability NR devices suitable for a range of use cases, including the industrial sensors, video surveillance, and wearables use cases, with requirements on low UE complexity and sometimes also on low UE power consumption.

Now when the foundation has been laid in Rel-17, enhancements can be considered to improve the support for the mentioned use cases and also to expand RedCap into a new range of use cases such as smart grid.

To further expand the market for RedCap use cases with relatively low ~~cost~~~~complexity~~cost, low energy consumption, and low data rate requirements, e.g., industrial wireless sensor network use cases, some further ~~cost and~~ complexity reduction enhancements should be considered.

Rel-18 RedCap should provide NR support for low-tier devices between existing LPWA UEs and the capabilities of Rel-17 RedCap UEs. The supported peak data rate for Rel-18 RedCap targets to 10Mbps. Rel-18 RedCap should not overlap with existing LPWA solutions.

The enhancements should be introduced while maintaining the integrity of the RedCap ecosystem and maximizing the benefit of economies of scale. The SI targets enhancements applicable to the RedCap framework defined in Rel-17, including principles of network awareness of device capabilities.

Figure 2: Justification (intermediate round)

Companies can provide input on the justification and the objectives in the feedback form.

Feedback Form 2: Views on the updated draft RedCap SID (intermediate round)

1 – Nokia France We are happy for this SID to be approved. Thank you Johan for your efforts.
2 – Huawei Tech.(UK) Co.. Ltd We cannot follow the moderator summary's logic on UE vs. channel bandwidth. If it means that RF+BB is in scope to the 5 MHz bullet (which it is), then the PDSCH/PUSCH BW bullet is redundant and confusing, and will lead to intersecting discussions in RAN1 between the two apparent purposes of BW reduction. Sorry to repeat a point, but the SID is also repeating itself! We need to ensure this SI/WI combo does not spawn a multitude of UE types. A revision to address this would be very welcome.

3 – DOCOMO Communications Lab.

Thank moderator for your effort. We are fine with moderator's understanding as for reduced maximum number of HARQ processes.
Regarding whether RF and/or BB BW reduction are/is included in the scope, we understood Huawei's concern that Rel-18 RedCap UE should not be divided into multiple UE types to avoid market fragmentation, and it would be good clarify it in SID. So we suggest adding note such as "Aim to define a single Rel-18 RedCap UE type for further UE complexity reduction"

4 – Panasonic Corporation

We support the proposal.

5 – vivo Mobile Communication Co.

Thanks a lot moderator's efforts.

We are fine with the updated SID. We are also fine to make it clear that RF+BB bandwidth reduction and BB-only bandwidth reduction are included in the scope of reduced bandwidth reduction to the 5MHz in FR1.

6 – Futurewei Technologies

Our understanding is that the BB-only reduction is in the 5 MHz BW objective, so the bullet "including the possibility of restricted bandwidth for PDSCH and/or PUSCH" should be removed. As we commented earlier, we are very concerned with the type discussion, and it is better going in that we are all on the same page that we will strive to recommend at most one new UE type or peak rate reduction feature from the study. A note to that effect should be added to the SID.

7 – Samsung Electronics Polska

We are fine with DoCoMo's suggestion on "Aim to define a single Rel-18 RedCap UE type for further UE complexity reduction".

We agree that it may require some further discussion on "BB-only BW reduction". However, different from LTE, NR doesn't have full band PDCCH. So, we think it is hard to define BB-only BW reduction by this simple term. On the other hand, it provide more information on restriction PDSCH/PUSCH BW, i.e., other channel may span to larger BW. Details can be discussed in SI phase in WG.

We are happy to co-sign this SID.

8 – Guangdong OPPO Mobile Telecom.

We see this update of the SID have the logic that we anyway will discussed the reduced BW for RF and/or BB The first sub-bullet may include all. The BW restriction on PDSCH/PUSCH can further explicitly have specific BB case. It is OK for us to go with the SID.

If there is really problem we can remove the BW restriction of PDSCH/PUSCH bullet.

9 – Qualcomm Incorporated

We are fine with the updated draft SID and would like to be added as a supporting company.

10 – Spreadtrum Communications

Thank moderator a lot for your great efforts.

We are fine with this SID version which has been polished quite good. Spreadtrum support it and would like to continue co-source.

One minor editorial refinement suggestion below may possibly resolve some people's some concern. But we are fine with no refinement as well.

- reduced UE peak data rate in FR1,
  - ~~including the possibility of~~ **Possibly including the** restricted bandwidth for PDSCH and/or PUSCH
  - Possibly in combination with relaxed UE processing timeline for PDSCH and/or PUSCH and/or CSI

11 – Intel Corporation (UK) Ltd

We are mostly fine with the latest version.

On the cost/complexity issue, if we are only keeping "complexity" in the objectives, we should do the same for the Justification part to avoid any potential confusion. Thus, we suggest the following change:

To further expand the market for RedCap use cases with relatively low ***~~cost~~ complexity****, low energy consumption, and low data rate requirements, e.g., industrial wireless sensor network use cases, some further complexity reduction enhancements should be considered.*

12 – Lenovo (Beijing) Ltd

We are basically fine with the SID. DOCOMO's suggestion "Aim to define a single Rel-18 RedCap UE type for further UE complexity reduction" is good with us.

13 – Spreadtrum Communications

@Intel @moderator: From our perspective, we prefer to keep "cost" in the justification, which is aligned with Rel-17 RedCap. If removing "cost" in the justification, we are afraid it may bring a wrong image/message to industries that Rel-17 RedCap study and focus on complexity/cost, while Rel-18 RedCap only care about complexity.

14 – ZTE Corporation

We are OK with the current justification and objective.

We share similar understanding with moderator that reduced maximum number of HARQ processes is not precluded. Additionally, regarding the comment from Huawei, from our understanding, restricted bandwidth in peak date reduction refers that a UE with 20MHz capability is only scheduled with 5MHz PDSCH/PUSCH, but the BWP can be up to 20MHz. The 5MHz bandwidth reduction refers to a UE with 5M capability which means the BWP is no larger than 5MHz.

15 – Nordic Semiconductor ASA

We have same understanding as ZTE, and thus perhaps it is correct to keep Peak Data rate bullet in the SID. With understanding that BB-only reduction (i.e. BWP is no larger than 5MHz) is not precluded from study, we are fine to co-source SID.

16 – Verizon UK Ltd

We are fine with the SID and happy to cosign, with the understnding of other BB-only BW reduction is not precoded.

17 – Ericsson LM

We are happy with this version of the SID.

We would also be fine with adding the note proposed by DoCoMo (i.e., ”Aim to define a single Rel-18 RedCap UE type for further UE complexity reduction”) as long as it is clear that the study considers different options.

We would also be fine with adding a ”Possibly” in the sub-bullet about restricted bandwidth for PDSCH and/or PUSCH in line with Spreadtrum’s suggestion. We would however not be fine with removing the sub-bullet unless it is clarified in some other way that BB-only bandwidth reduction is part of the study scope, for example by adding a sub-bullet under UE bandwidth reduction (e.g., ”including bandwidth reduction in RF and/or BB parts”). We do not want to spend time in RAN1 debating whether different bandwidth reduction options can be studied, so it needs to be explicitly stated in the SID.

18 – Panasonic Corporation

Related to the comment from ZTE and Nordic, we agree the restriction of PDSCH/PUSCH can be only the assignment and not BWP. As the term ”bandwidth” might be interpreted as BWP, following modification can make it clear. On the other hand, as we said before, we are also fine with the current draft. We also support DOCOMO proposal of ”Aim to define a single Rel-18 RedCap UE type for further UE complexity reduction”

- ~~including the possibility of~~ **Possibly including the** restricted bandwidth **or the assignment** for PDSCH and/or PUSCH

19 – Nokia France

We are also OK to add Docomo-san’s suggestion ”Aim to define a single Rel-18 RedCap UE type for further UE complexity reduction”.

20 – VODAFONE Group Plc

We agree with NTT Docomo’s comments regarding aiming to define a single RedCap UE type. We think the discussion on BB-only or RF+BB BW reduction could be held at the WG, however if the helps to clarify the scope and avoid repeated discussion it should be clarified. We also agree with the moderators assessment on the reduced number of HARQ processes not being precluded from the reduced UE peak data rate (maybe adding it as an example would clarify it).

21 – Sony Europe B.V.

We are OK with the current SID.

Studying different options for bandwidth reduction (RF+BW or BB-only) does not mean that we will spawn multiple UE types. It means that we will *study* various options for bandwidth reduction [with the goal of there being a single ”type”]. We are OK with the SID objective on reduced bandwidth.

We do not see how reduced number of HARQ processes is within the scope of reduced peak data rate. We are OK for companies to discuss why this is a useful technique for reduced peak data rate WG meetings.

We understand that for objectives with an ”including”-type of sub-bullet, other techniques can also be considered. For example, for reduced peak data rate, WGs can also consider defining a max peak data rate (as was done for eMTC, where a peak data rate of 1Mbps was defined in Rel-13).

22 – Philips International B.V.

We are OK with the current SID

23 – LG Electronics Inc.

We support the updated draft SID.

4 Objective

4.1 Objective of Core part WI

To further reduce the complexity~~/cost~~ of RedCap devices, the following should be studied, and the results should be captured in TR 38.8xx:

- Study further UE complexity~~/cost~~ reduction techniques based on Rel-17 evaluation methodology in TR 38.875 [RAN1]
    - Consider network impact, coexistence of Rel-17 and Rel-18 RedCap and non-RedCap UEs in a cell, UE impact, specification impact
    - Potential solutions, which may complement each other, for reducing device complexity~~/cost~~ are focusing on:
        - UE bandwidth reduction to 5MHz in FR1,
            - ~~Note: The basic design of Rel-15 SSB should be reused and L1 changes minimized.~~
            - ~~Note: Operation in BWP with/without SSB and without/with RF retuning should be considered.~~
            - Possibly in combination with relaxed UE processing timeline for PDSCH and/or PUSCH and/or CSI
        - reduced UE peak data rate in FR1,
            - including the possibility of restricted bandwidth for PDSCH and/or PUSCH
            - Possibly in combination with relaxed UE processing timeline for PDSCH and/or PUSCH and/or CSI
        - ~~Note: It is not precluded that some solutions for FR1 can be applied to FR2 in WI stage.~~
- Notes:
    - Rel-15 SSB should be reused and L1 changes minimized.
    - Operation in BWP with/without SSB and without/with RF retuning should be considered.
    - It is not precluded that some solutions for FR1 can be applied to FR2 in WI stage.

Figure 3: Objective (intermediate round)

3.2 Summary of intermediate round

The updated draft SID received good support, but there were still some comments and questions.

In particular, the relation between the bullets on ”UE bandwidth reduction to 5 MHz” and ”reduced UE peak data rate” was discussed by several companies.

Some companies expressed a concern that the outcome might be a multitude of new RedCap UE types. One company commented that study of different options in the SI does not mean that multiple UE types will be defined in the WI. A proposal to add a note ”Aim to define a single Rel-18 RedCap UE type for further UE complexity reduction” received support from many companies.

Some companies discussed whether the study of BB-only bandwidth reduction belonged to the ”UE bandwidth reduction to 5 MHz” or to the ”reduced UE peak data rate”. Two companies proposed to remove the sub-bullet on ”restricted bandwidth for PDSCH and/or PUSCH”. Some companies expressed that it needs to be clear that BB-only bandwidth reduction is part of the scope, although it may not matter whether this is captured under bandwidth reduction or under peak rate reduction. One company commented that some options of interest may not fit under the current formulation ”UE bandwidth reduction to 5 MHz” since it may be desired to consider other maximum physical channel bandwidths than exactly 5 MHz and that the details can be discussed in SI phase in RAN1. One company commented that ”UE bandwidth reduction to 5 MHz” may be associated with a maximum BWP bandwidth of 5 MHz, whereas the ”restricted bandwidth for PDSCH and/or PUSCH” under ”reduced UE peak data rate” may be associated with a maximum BWP bandwidth of 20 MHz. There were also some comments proposing slight rewording of the sub-bullet on ”restricted bandwidth for PDSCH and/or PUSCH”.

Based on the discussion, the updated objective in Figure 4 can be considered, where the note ”Aim to define a single Rel-18 RedCap UE type for further UE complexity reduction” has been added and the sub-bullet on ”restricted bandwidths for PDSCH and/or PUSCH” has been slightly reworded. A corresponding updated SID proposal has been provided in RP-213636 [9].

4 Objective

4.1 Objective of Core part WI

To further reduce the complexity~~/cost~~ of RedCap devices, the following should be studied, and the results should be captured in TR 38.8xx:

- Study further UE complexity~~/cost~~ reduction techniques based on Rel-17 evaluation methodology in TR 38.875 [RAN1]
    - Consider network impact, coexistence of Rel-17 and Rel-18 RedCap and non-RedCap UEs in a cell, UE impact, specification impact
    - Potential solutions, which may complement each other, for reducing device complexity~~/cost~~ are focusing on:
        - UE bandwidth reduction to 5MHz in FR1,
            - ~~Note: The basic design of Rel-15 SSB should be reused and L1 changes minimized.~~
            - ~~Note: Operation in BWP with/without SSB and without/with RF retuning should be considered.~~
            - Possibly in combination with relaxed UE processing timeline for PDSCH and/or PUSCH and/or CSI
        - reduced UE peak data rate in FR1,
            - Possibly including ~~the possibility of~~ restricted bandwidth for PDSCH and/or PUSCH
            - Possibly in combination with relaxed UE processing timeline for PDSCH and/or PUSCH and/or CSI
        - ~~Note: It is not precluded that some solutions for FR1 can be applied to FR2 in WI stage.~~
- Notes:
    - Rel-15 SSB should be reused and L1 changes minimized.
    - Operation in BWP with/without SSB and without/with RF retuning should be considered.
    - It is not precluded that some solutions for FR1 can be applied to FR2 in WI stage.
    - Aim to define a single Rel-18 RedCap UE type for further UE complexity reduction.

Figure 4: Objective (intermediate round summary)

4 References

1. RP-212665, ”Moderator’s summary for discussion [RAN94e-R18Prep-05] RedCap (Reduced Capability) Evolution”, Ericsson
2. RP-212732, ”New SI: Study on further reduced RedCap UE complexity / cost for NR”, Ericsson (Moderator)
3. RP-212705, ”New WI: Enhanced support of reduced capability NR devices”, Ericsson (Moderator)
4. RP-213469, ”Summary for RAN Rel-18 Package”, RAN Chair (Qualcomm), RAN1 Chair (Samsung), RAN2 Chair (MediaTek), RAN3 Chair (ZTE), RAN4 Chair (Huawei)
5. RP-213487, ”Moderator’s summary of discussion [94e-07-R18-RedCapEvo]”, Ericsson
6. RP-213521, ”New SID on further NR RedCap UE complexity/cost reduction”, Ericsson
7. RP-213582, ”New SID on further NR RedCap UE complexity/cost reduction”, Ericsson
8. RP-213581, ”Moderator’s summary of discussion [94e-07-R18-RedCapEvo]”, Ericsson
9. RP-213636, ”New SID on Study on further NR RedCap UE complexity reduction”, Ericsson