3GPP TSG-RAN WG1 Meeting #103-e Tdoc R1-20xxxxx

e-Meeting, October 26th – November 13th, 2020

**Agenda Item: 8.6**

**Title: FL summary #2 for TR38.875 update for RedCap**

**Source: Moderator (Ericsson)**

**Document for: Discussion, Decision**

# 1 Introduction

This document captures the RAN1#103e RedCap email discussion for TR38.875 update [103-e-NR-RedCap-01].

For this FLS discussion document, follow the naming convention in this example:

* *RedCapTRupdateFLS2-v000.docx*
* *RedCapTRupdateFLS2-v001-CompanyA.docx*
* *RedCapTRupdateFLS2-v002-CompanyA-CompanyB.docx*
* *RedCapTRupdateFLS2-v003-CompanyB-CompanyC.docx*

If needed, you may “lock” a file for 30 minutes by creating a checkout file, as in this example:

* Assume CompanyC wants to update *RedCapTRupdateFLS2-v002-CompanyA-CompanyB.docx*.
* CompanyC uploads an empty file named *RedCapTRupdateFLS2-v003-CompanyB-CompanyC.checkout*
* CompanyC then has 30 minutes to upload *RedCapTRupdateFLS2-v003-CompanyB-CompanyC.docx*
* If no update is uploaded in 30 minutes, other companies can ignore the .checkout file.
* Note that the file timestamps on the server are in UTC time.

The draft TR version under review is [RedCapTRupdate-v005-Rapporteur-Rapporteur.docx](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_103-e/Inbox/drafts/8.6/TRupdate/TP/RedCapTRupdate-v005-Rapporteur-Rapporteur.docx)

* It is possible to leave review comments in the table in Section 2 in this FLS discussion document.
	+ <https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_103-e/Inbox/drafts/8.6/TRupdate/>
* It is also possible to leave review comments as Word comments in the draft TR.
	+ <https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_103-e/Inbox/drafts/8.6/TRupdate/TP/>
	+ Note that the draft TR has a different file name and resides in a different folder than this FLS.
	+ Please do NOT make changes to the draft TR text – only leave Word comments (if anything).

In ALL file names, please use hyphen characters (not underline characters) and include ‘v’ in front of the version numbers, otherwise the files will not sort as nicely and it will be less obvious which file contains the latest version of the document and whether it is checked out or not.

# 2 Discussion

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| --- | --- |
| **Company** | **Comments or suggested revisions for** [RedCapTRupdate-v005-Rapporteur-Rapporteur.docx](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_103-e/Inbox/drafts/8.6/TRupdate/TP/RedCapTRupdate-v005-Rapporteur-Rapporteur.docx) |
| FUTUREWEI | Thanks so much for the huge effort assembling the TR! A few comments, below.* All editor's notes should be removed for the version sent to RAN, except perhaps for a note (in black font) for 10.2.1 and 11.2.1 saying that this is up to RAN2 in the SI or WI. You can also consider to remove the empty subsections 10.1.2, 10.1.3, 10.2.2, 10.2.3, 11.1.2, 11.1.3, 11.2.2, 11.2.3 if there is no text being added at this RAN.
* p8 Introduction change URLCC to URLLC
* p14 Table 6.2.2-3 consider to delete the red text in the Note

Note: For the cases where the number of PDCCH candidates per AL is more than 8, the following configuration should be assumed, i.e., multiple overlapping search space sets are allowed.* p14 second bullet of Step 1 change: "for company ‘j’. M represents  " to  "for company ‘j’, 'M' represents"
* p16 if nobody submitted results for 50MHz using the “Optionally, 12.5Mbps..” it would be better to delete that subbullet
* p22 add a d to analyze : A few contributions analysed other mixes of bandwidths.
* p27 After the first sentence of 7.5.1 it would be good to add a sentence to explain what N1 and N2 are, though it can be inferred from the later text under Latency and reliability.
* p28 in latency and reliability the variables N1 and N2 should use subscripts
* p63 the TR should not include 'FFS', so in the conclusion should not include the FFS point in the text. It can still be discussed in the WI.
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| vivo | 1. On section 11.1.1,
	1. The following RAN1 agreement regarding option 4 is missing thus should be added

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| Agreements:* Considerations on Option 4 (during MsgA transmission) are deprioritized until further progress is made on Options 1 and 2 for 4-step RACH procedure.
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* 1. The following note is missing for the feasibility of option 1

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| * **Note:** The appropriateness of each solution, considering the number of UE type(s) to be indicated, etc. needs further considerations.
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* 1. The following conclusion is missing thus should be added

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| **Conclusion:** The option of carrying RedCap UE type(s) identification as part of UCI multiplexed in Msg3 PUSCH is not considered during the Rel-17 RedCap SI. |

1. On Annex B, the following change should be made
* Case 1: Reference case with no reduction in BD limit.
* Case 2: Power saving gain at approximately 25% reduction in BDs
* Case 3: Power saving gain at approximately 50% reduction in BDs
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| Ericsson | 1. Section 6.2, p12: “Companies to report if other traffic models are assumed in evaluation.” can be removed.
2. Table 6.2.2-1, p13: “of [3]” can be added at the end of Note 1.
3. Change numbers for tables 6.2.2-1/2/3 to Table 6.2.1-4/5/6 (make corresponding changes in Section 8.2).
4. TR can be consistent in using either “blocking probability” or “blocking rate” throughout the document.
5. In 8.2.3, under the heading “PDCCH blocking probability for FR1”, there seems to be duplicate sentences. The style is also different from the subsequent paragraphs. Our suggested revision:

Evaluation results of PDCCH blocking rate were reported for FR1 with AL distribution configuration ‘A1’ in Table 6.2.2-2 and the baseline evaluation parameters in Table 6.2.2-1. Based on Table B.1-1, the observations from these evaluation results are summarized as follows:* 10 sources (Vivo, Ericsson, Qualcomm, Nokia, Huawei/HiSilicon, InterDigital, Intel, ZTE, Samsung, Futurewei) reported the following evaluation results ~~of PDCCH blocking rate for FR1 with baseline evaluation parameters in Table 6.2.2-1 and configuration ‘A1’ in Table 6.2.2-2. From Table B.1-1, the following was observed for PDCCH blocking rate performance impact for FR1 with AL distribution configuration A1~~:
1. For 9.1, a better heading would be “Coverage recovery analysis” (instead of “Introduction to coverage recovery”). That would also match the heading of clause 9.1.5 (“Summary of coverage recovery analysis”).
2. In 11.1.1, the square brackets around the notes can be removed.
3. Chapter 12: The sentence “In addition, scheduling flexibility and latency impacts have also been studied in clause 8.2.3.” seems to be there twice. Consider removing one of them.
4. In Table A.1.1 to A.1.4 and A.2.1 to A.2.4 Ericsson’s results can be captured together, instead of having two separate rows.
5. In Annex B (p71), replace Case 1/2/3 with the following:

- Case 1: Reference case with no reduction in BD limit. - Case 2: Approximately 25% reduction in BD limit. - Case 3: Approximately 50% reduction in BD limit |
| NEC | Introduction: “eMTC” should be used instead of “LTE-M” to be consistent with TR37.910 as cited below:7.1.2 LTEThe connection density of NB-IoT and eMTC are evaluated using both the full buffer, and the non-full buffer system level simulation as defined in Report ITU-R M.2412 [6]. |
| DOCOMO | Editorial modification* The numbering of Table 6.2.1-1 to Table 6.2.2-3 is not aligned with Clause number 6.2 as it has no sub-clauses. Either making sub-clauses 6.2.1/6.2.2 or renumbering of Table 6.2.1-1 to Table 6.2.2-3 would be necessary
* “CE SI” should be replaced as “coverage enhancement SI” for readability
* Table 1 in Clause 8.2.1 should be renumbered to Table 8.2.1-1
* In the second sub-bullet in Clause 8.2.5, “For Extending the PDCCH monitoring gap to X slots (X>1)”
* “Table 11.1-1-1”, “Table 11.1-1-2”, and “Table 11.1-1-3” should be modified to “Table 11.1.1-1”, “Table 11.1.1-2”, and “Table 11.1.1-3”
* In Note 7 in Table B.1-1 to Table B.1-3 and Table B.2-1 to Table B.2-3, “With enhancement of PDCCH dro~~o~~ping...”
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| CATT | Thanks for preparing the nice TR. Our comments are listed below:1. P13, Table 6.2.2-1, for SCS/BW in FR2, seems square bracket of 120KHz/[100]MHz can be deleted, or updated if other BW was acturally used.
2. P14, the second bullet of Step 1, ‘for company ‘j’. M represents…’ should be left aligned.
3. P22, to align with the bandwidth description of RedCap UE, the maximum bandwidth capability of the reference UE seems not need to include ‘for DL and UL’.

• For FR1: 100 MHz ~~for DL and UL~~• For FR2: 200 MHz ~~for DL and UL~~ Such description is already captured in the subsequent paragraph (‘this maximum UE bandwidth is assumed for both DL and UL’).1. P24, Section 7.3.4, the 3 bullets with ‘20-MHz’, ‘100-MHz’, ‘50-MHz’, the hyphen character ‘-’ should be replaced by space character.
2. P27, Section 7.5.1 and 7.5.2, some ‘N1’ should change to ‘N1’ instead.
3. P47, not sure whether Section 8.3&8.4, 10.1.2~10.2.3, 11.1.2~11.2.3 should be kept or not. They are empty now.
4. We are supportive to Section 12. Moreover, we think contends of Section 9.1.5 (coverage recovery conclusions) can also be added here.
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| Intel | We have the following suggestions: * **Section 8.2.3:** “The latency impact due to BD reduction may largely depend on PDCCH blocking rate performance impact. If the PDCCH blocking rate is increased by BD reduction, the latency performance is expected to be increased; Otherwise, BD reduction has no impact on the latency.”
	+ The highlighted phrase is ambiguous as to what is meant by “latency performance” since the desirable performance (typically associated with ”performance increase/improvement”) in the context of latency is when the latter reduces and not when it is increased. Thus, we suggest an editorial update as following, where “average” is added since it is the average latency that can be expected to increase (the worst-case latency may not increase).
		- “The latency impact due to BD reduction may largely depend on PDCCH blocking rate performance impact. If the PDCCH blocking rate is increased by BD reduction, the average latency ~~performance~~ is expected to be increased; Otherwise, BD reduction has no impact on the latency. ”
* **Section 9.1.5:** “For other carrier frequencies or DL PSD other than 24 dBm/MHz, coverage recovery is not needed for the downlink channels if the target for coverage recovery is based on the MIL of the bottleneck channel for the reference NR UE”
	+ In the above, “other than” should perhaps be replaced by “**greater than**”? While ”other than” may be clear to us since we only considered two values, the statement standing on its own could be misleading to the general reader.
 |
| Intel2 | With slightly updated suggestion for Section 9.1.5:* **Section 8.2.3:** “The latency impact due to BD reduction may largely depend on PDCCH blocking rate performance impact. If the PDCCH blocking rate is increased by BD reduction, the latency performance is expected to be increased; Otherwise, BD reduction has no impact on the latency.”
	+ The highlighted phrase is ambiguous as to what is meant by “latency performance” since the desirable performance (typically associated with ”performance increase/improvement”) in the context of latency is when the latter reduces and not when it is increased. Thus, we suggest an editorial update as following, where “average” is added since it is the average latency that can be expected to increase (the worst-case latency may not increase).
		- “The latency impact due to BD reduction may largely depend on PDCCH blocking rate performance impact. If the PDCCH blocking rate is increased by BD reduction, the average latency ~~performance~~ is expected to be increased; Otherwise, BD reduction has no impact on the latency. ”
* **Section 9.1.5:** “For other carrier frequencies or DL PSD other than 24 dBm/MHz, coverage recovery is not needed for the downlink channels if the target for coverage recovery is based on the MIL of the bottleneck channel for the reference NR UE”
	+ In the above, “DL PSD other than 24 dBm/MHz” should perhaps be replaced by “DL PSD ~~other than 24~~ **of** **33** dBm/MHz”? While ”other than” may be clear to us since we only considered two values, the statement standing on its own could be misleading to the general reader, especially if the observations are moved/copied to Section 12.
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| Vivo2 | For section “X Impact to network capacity and spectral efficiency”, as heavily debated during the meeting, the main reason leading to different observation is that companies used different assumptions in their simulations. However, these differences are not highlighted in this section but only seen in each source’s contribution. Given this situation, it would be necessary to clearly refer to the source number or contribution number so that readers can further look into the contributions if they are interested to do so. For burst traffic evaluation with IM traffic model for RedCap users:* 3 sources observed that the RedCap users have minor or no impact on spectral efficiency and capacity, and little impact to the performance of co-existing eMBB users in the system
* It is further noted that the 1 Rx RedCap users do not make an appreciable change on the user throughput performance of the eMBB users compared to the 2 Rx RedCap users

For burst traffic evaluation with FTP model 3 for RedCap users:* One source with the respective simulation assumptions including the schedulable bandwidth reported the user throughput performance of the eMBB users is not degraded with the presence of the RedCap users in the system.
* One source with the respective simulation assumptions including the schedulable bandwidth reported the impact on spectral efficiency will be substantial. It is further observed substantial cell spectral efficiency loss about 30% due to UE Rx antenna reduced from four to two and DL modulation order restriction from 256QAM to 64QAM in FR1 and about 50% spectral efficiency reduction due to UE Rx antenna reduced from four to one and DL modulation order restriction from 256QAM to 64QAM in FR1.

For optional full buffer traffic evaluation:* One source with the respective simulation assumptions including the schedulable bandwidth reported a minor degradation of the spectral efficiency for the eMBB users and the degree of spectral efficiency loss is irrespective of the number of Rx antennas for RedCap users.
* One source with the respective simulation assumptions including the schedulable bandwidth reported the impact on spectral efficiency will be substantial. It is further observed substantial cell spectral efficiency loss about 54% due to UE Rx antenna reduced from four to two and DL modulation order restriction from 256QAM to 64QAM in FR1 and about 70% spectral efficiency reduction due to UE Rx antenna reduced from four to one and DL modulation order restriction from 256QAM to 64QAM in FR1.
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| Huawei, HiSi | **General & Methodology*** There are places using “Redcap”, “RefCap” in Table C.4-5 and “ReCap” instead of “RedCap”
* Consider to correct the indices of tables in sub-clause 6.2 where “Table 6.2.x-y” are used. However, this needs carefulness as they are also referred to in sub-clause of 8.2.3 and Annex B. Also, may consider to replace “Table 1” used in sub-clause 8.2.1 with “Table 8.2.1-1”. (Several other places for Table index have been commented by Docomo).
* Good to remove FFS.
* Strictly speaking, the content with [ ] should also be removed as it is not with consensus. However given the large amount of affected content (including many results based on assumptions with [ ]), FL might consider to add one general statement at the beginning of methodology/somewhere that the assumptions/results with [ ] may not be stable.

**Cost/complexity reduction*** There are places using “N1 and N2”, “N1 and N2”, “N1/N2” and “N1 and N2”. Can be aligned as “N1 and N2”.
* P28: missing “of” in “Relaxed UE processing time in terms of CSI computation time”

**PDCCH monitoring reduction*** P43, the following captured results are not the one in the agreements.
	+ *1 source (Samsung) reported the following evaluation results:*
		- *<2, 0.07%, [25%, 2.07%, 3100%], [50%, 4.93%, 7400%]>*

According to **Proposal 8.2.3.1-16 in R1-2009720, the captured results should be：*** + *1 source ([Samsung]) reported the following evaluation results:*
		- *<9, 22%, [25%, 20%, 91%], [50%, 33%, 150%]>*
* P13, in Table 6.2.2-1, regarding the following note1, there is no “Tab-7” defined in the TR. This should be updated accordingly.

*Note 1: “Number of users” represents the number of UEs that need to be scheduled simultaneously in a slot and company can provide PDCCH blocking probabilities corresponding to a range of ‘number of users’ on different rows in Tab-7** P71, for Annex B, the description of Case1 and Case 2 seem to be copied from that of power saving gain. The three cases should be updated as following, which are captured in the text following table 9 in FL (**R1-2009720**):
* *Case 1: Reference case with no reduction in BD limit.*
* *Case 2: Approximately 25% reduction in BD limit.*
* *Case 3: Approximately 50% reduction in BD limit.*

**Coverage recovery & Capacity*** Change the “conclusion” to “observation” from the following:
	+ P54, clause 9.1.5: *in summary, based on the evaluation results, the following conclusion can be made*
	+ P63, clause 12: *The main conclusions from the coverage recovery evaluations are captured in clause 9.1.5.*
* Any reason to use clause “X” for impact of capacity and SE? Might be possible to replace the clause “X” as “10” (thus needs update on the texts afterwards) or move “X” to be clause “12” such that only the current clause 12 needs update to be clause 13 (in order to minimize the workload). Can accept no change if it causes too much workload for rapporteur but then prefer some response for reasoning.
* In Table-D-1, for source 2 (Huawei), take the following updates
	+ *FTP model 3 for both eMBB and RedCap UEs. In each 20MHz frequency block within 100MHz bandwidth, p~~P~~acket packet size is 0.125 Mbytes for DL and 0.05 MB for UL and mean inter-arrival time is 200 ms.*
	+ *100MHz system bandwidth comprises five frequency blocks of 20MHz. ~~Max 20MHz~~ Scheduled within one frequency block for both eMBB UE and RedCap UE*
	+ Add a column for key assumption max number of DL layer that have key impact on DL capacity/SE and have been discussed during template discussion, i.e. add column with title of Max Scheduled number of DL layers, add “2@2Rx, 1@1Rx” for source 2.
* In Table-D-1, for source 6 (Nokia), suggest the following updates
	+ *FTP model 3 for both eMBB and RedCap UEs (Packet size and packet arrival rate adapt to target RU).* Or please Nokia clarifies the key assumption*.*
	+ *Total number of UEs per cell is 10 (Neither Option 1 nor Option 2).*Please make it clearer or please Nokia clarifies the key assumption.

**UE Type and UE identifications*** Ok with removing empty (sub-)clauses e.g. 10.1.2 ~. There does not seem to be further input to those sections anymore.
* Can consider to move the conclusive information of the following to clause 12: conclusion:
	+ *At least for RedCap UE identification, explicit definition of RedCap UE type(s) is needed. If early identification during initial access is supported, at least maximum supported UE bandwidth during initial access (20 MHz for FR1 and 100 MHz for FR2) is included in the set of L1 capabilities of the device type for RedCap early identification.*
* Not a strong preference, for the tables for pros and cons analysis for each option of RedCap UE identification, it might be ok to move them to a new sub-clause such as “11.1.2 Analysis of benefits, impact and/or coexistence with legacy UEs” thus the current empty (sub-) clauses 11.1.2~ can be removed.
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