3GPP TSG-RAN WG1 Meeting #102-e Tdoc R1-200xxxx

e-Meeting, August 17th – 28th, 2020

**Agenda Item: 8.6**

**Title: FL summary #4 for RedCap evaluation templates**

**Source: Moderator (Ericsson, Apple, Qualcomm)**

**Document for: Discussion, Decision**

# 1 Introduction

This is FL summary #4 for Phase 1 in the following RAN1#102-e post-meeting email discussion.

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| --- |
| [102-e-Post-NR-RedCap-01] Email discussion/approval – Johan (Ericsson)/Hong (Apple)/Chao (Qualcomm)Phase 1 (9/10-9/29): template for evaluations, including:* Cost reduction estimates
* Power saving estimates
* Coverage recovery and capacity impact simulation results

Phase 2 (9/30-10/21)* Initial collection of the above evaluation results
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Initial proposals and responses are documented in FL summary #1 (FLS1) in [R1-2007476](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_102-e/Docs/R1-2007476.zip), FL summary #2 (FLS2) in [R1-2007477](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_102-e/Docs/R1-2007477.zip), and FL summary #3 (FLS3) in R1-2007478 ([Docs](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_102-e/Docs/R1-2007478.zip), [Inbox](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_102-e/Inbox/R1-2007478.zip)).

# 2 Template for cost reduction evaluation

A draft template was provided in [RedCapCostTemplate-v002.xlsx](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_102-e/Inbox/drafts/8.6/PostPhase1/RedCapCostTemplate/RedCapCostTemplate-v002.xlsx).

A few responses (see FLS3) discussed the meaning of the note that HD-FDD operation type B has lower priority than HD-FDD operation type A. The RAN1#101-e agreement is to “*Study HD-FDD operation Type A and Type B (as defined in LTE) in RAN1, where study of Type A is prioritized*”. The agreement does not state that study of Type B is optional, but given the time constraints, it seems likely to the FL that some companies may choose to provide results for Type A but not for Type B. So, in practice the evaluation of Type B will probably be regarded as optional by some companies. If lack of results for Type B turns out to be problematic somehow, perhaps companies can be asked to provide additional results at a later stage.

One response (see FLS3) suggested to include CSI computation relaxation in the template. However, as already noted (see FLS2), RAN1#102-e has already agreed that “*Study of relaxed UE processing time related to CSI computation is not prioritized in the RedCap study item*”. The FL understanding is that this means even lower priority than the priority for HD-FDD operation type B.

One response (see FLS3) discussed the relation between “*Reduced number of DL MIMO layers*” and “*Reduced number of Rx antennas*” and proposed that some important combinations are included in the template. One issue with this proposal is that it would require evaluation of FR1 TDD combinations such as 1 layer with 4 Rx and 2 layers with 4 Rx but not e.g. 1 layer with 2 Rx. In order to avoid including many combinations already during this stage when the focus is supposed to be on individual techniques, it seems to the FL that it would be good to evaluate the reduced numbers of layers and the reduced numbers of antennas separately, and then the evaluation of the combinations will hopefully be relatively straightforward to evaluate.

With the above observations in mind, the FL recommendation is to not make any further updates of the template.

**Question 2-1c: Can the template be agreed to collect the cost reduction evaluation results for the individual cost reduction techniques? If not, what other aspects need to be added? Please do not repeat earlier discussions.**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| CATT | Yes. We are fine with the template. |
| Ericsson | Yes, we are fine with the latest draft template. |
| Samsung | OK. |
| OPPO | Fine with the template and the observations |
| vivo | OK |
| ZTE | OK |
| Huawei, HiSilicon | We have a different understanding on “that this means even lower priority than the priority for HD-FDD operation type B”, but don’t want to extend the discussion further for the time being. We think the CSI computation time is worth more attention as the UE capability for N2 may be associated with CSI for multiplexing. We again propose to add CSI computation time relaxation in the template and can also add a note mentioning it is not prioritized (so should not be concerned).For the next step of study we can assume the $Z\_{i},Z\_{i}^{'}$ (i=1, 2 or 3, up to company report) as doubled as the current specification, similar to the assumption for N1/N2. |
| Qualcomm | The latest template looks good to us. Regarding the study of relaxed UE processing time, we think companies should follow the agreements made in RAN1#101 and RAN1#102 for RedCap. |

# 3 Template for power saving evaluation

An updated draft template is provided in [RedCapPowerTemplate-v002.xlsx](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_102-e/Inbox/drafts/8.6/PostPhase1/RedCapPowerTemplate/RedCapPowerTemplate-v002.xlsx).

In current TR 38.840, TDD was assumed for power saving evaluation in FR1/FR2. It can be reused for Redcap study item to simplify the power reduction evaluation for reduced number of blind decoding and CCEs. Regarding the performance metrics, at least power saving gain and the corresponding PDCCH blocking probability should be evaluated. With these considerations in mind, three tabs were created in template as follows:

* **Tab-3:** Power saving gain – FR1, TDD, 1 RX
* **Tab-4:** Power saving gain – FR1, TDD, 2 RX
* **Tab-5:** Power saving gain – FR2, TDD, 1 RX
* **Tab-6:** Power saving gain – FR2, TDD, 2 RX
* **Tab-7:** PDCCH blocking rate evaluations

For the Tab-7, i.e. PDCCH blocking rate, “approximately” was added in front of “25%” and “50%”. The reason is that since the BD limit for FR1 (30 kHz SCS) is 36, 25% reduction in BDs is 27. However, if the UE is monitoring only 2 DCI sizes, then we will not be able to get 27 (no. of BDs = no. of DCI sizes \* total no. of PDCCH candidates for all ALs). Similarly, “approximately” is added in front of “50%” for the case where three or four DCI format sizes are monitored by UE.

Still on Tab-7, there are a few optional assumptions e.g. 3-symbols CORESET configuration, 2 slots delay toleration. The template was organized as follows to collect results:

* The first table in Tab-7 is for the combination of the non-optional assumptions, where there is no need to describe anything in the ’Comments’ column
* The second table is for all combinations that include some optional assumptions, where companies need to describe what settings they have used in the Comments column.

**Question 3-1: Can the power saving gain tabs in the template (i.e. Tab-3/4/5/6/7) be used to collect the evaluation results? If not, what other aspects need to be added?**

On Q3-1, all responses except one (i.e. 12 out of 13 companies) explicitly support to use the power saving Tab-3/4/5/6 to collect the evaluation results with some further modifications:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Index**  | **Tab(s)** | **Proposal**  | **Proposed by**  | **Other company inputs** |
| 1 | Tab-1 | Clarify TDD UL/DL configuration for power evaluation. Proposed to use the configuration agreed for capacity improvement.  | Vivo | No: OPPO (leave companies to report) |
| 2 | Tab-1 | Align the DCI format size with 40 bits | Intel |  |
| 3 | Tab-1 | Add a note to a baseline traffic model tab that companies to report the assumption of DRX being used or not.  | Intel |  |
| 4 | Tab-2 | Adding PUCCH/PUSCH power consumption | Ericsson | OPPO/ZTE (Partially yes, no need to add PUSCH) |
| 5 | Tab-2 | Modifying the ‘PDCCH+PDSCH’ power consumption model as follows: P(X) = (1-*a*)PPDCCH+PDSCH+*a*\*PPDCCH+PDSCH\*X | ZTE |  |
| 6 | Tab-2 | Align the ordering of Als of PDCCH for a given number of blind decoding  | ZTE |  |
| 7 | Tab-2 | Add the following to the power consumption model table: ‘companies to report the power consumption modelling for 3-symbols CORESET Configuration and reduced number of non-overlapped CCEs’ | Intel |  |
| 8 | Tab-2 | Add a note to clarify that the same baseline and evaluation assumptions regarding the number of DCI sizes per PDCCH candidates, number of candidates per each AL and AL distribution should be assumed for the PDCCH blocking rates in Tab-7 and the power saving results in Tab-3/4/5/6. | Huawei |  |
| 9 | Tab-2 | Add a note to clarify how the BD is reduced in the comment column when providing power saving gain results in Tab-3/4/5/6 | Huawei |  |
| 10 | Tab-3/4/5/6 | Add additional tab to capture time percentage values for different power states for different traffic model.  | Ericsson | OPPO (Intermediate values) |
| 11 | Tab-3/4/5/6 | Add absolute numbers for power consumption in power unit for each case in Tab-3/4/5/6 | Huawei |  |
| 12 | Tab-4/6 | Remove 50MHz BW for FR2 in Tab-4/6 | Samsung | Yes: Spreadtrum |

**Question 3-1a: Which of the listed proposals (P1, P2, …, P12) can be captured into the current template for power saving evaluation? If proposal(s) can be added with proper modification, please also provide details.**

Reponses from companies were summarized in the Table below:



It should be noted that it is always possible for companies to simulate other configurations and included the results in company contribution to discuss in RAN1 103 e-meeting.

Based on the responses, the power saving template was updated to v001 to reflect P2, P9 and P12 based on majority views:

* P2: Align the DCI format size with 40 bits (without including CRC).
* P9: Add a note in template that companies to clarify how the BD is reduced in the ‘comment’ column in template when providing power saving gain results in Tab-3/4/5/6
* P12: Remove 50MHz BW for FR2 in Tab-5/6

One company proposed to revise the power scaling equation: P(α) = max (Micro-sleep, α ∙ Pt + (1 – α) ∙ 0.7Pt)) with removing the cross-slot scheduling case. However, it should be noted that even in case of cross-scheduling, the power consumption is reduced in accordance to the reduced BDs, which this equation intends to capture. In any case, it is out of scope of this email thread and difficult to converge in email discussion. We can further discuss in RAN1 103 e-meeting if companies still have concerns.

**Question 3-2: Can the PDCCH blocking rate tab in the template be used to collect the evaluation results? If not, what other aspects need to be added?**

On Q3-2, all responses except one (13 out of 14 companies) support to use the Tab-7 for PDCCH blocking rate evaluation result collection. One company is ok with Tab-7 except some clarifications on the example numbers in bracket, e.g. number of users and the assumption of CORESET bandwidth.

Some modifications on Tab-7 were briefly summarized in table below for further discussions:

|  |  |  |  |
| --- | --- | --- | --- |
| **Index**  | **Tab(s)** | **Proposal**  | **Proposed by**  |
| 1 | Tab-7 | Adding note to clarify the “Number of users (e.g., 10)”  | Vivo: Clarify that it is the number of simultaneously scheduled Ues in a slot and company reports how the value is obtained, e.g. deployment scenario, traffic model, resource utilizationOPPO: Clarify either “number of simultaneously scheduled Ues in a slot” or “the system schedules the band with x user and the scheduling of user is based on the traffic models”Samsung/Futurewei: A range of values e.g. 1-10 and left it for company report. ZTE: Not use SLS here. |
| 2 | Tab-7 | Create separate Tab for 1Rx and 2 Rx case due to different AL distributions.  | Huawei |
| 3 | Tab-7 | Correct the candidate number of AL16 in the column ‘E’ of first table from ‘2’ to ‘1’ | Huawei |

It should be noted that P2 was discussed later in Q3-3a, due to the dependency on the outcome of the following Q3-3 discussions, e.g. which aggregation level distributions can be agreed for evaluation. If nothing was agreed for aggregation level distribution (i.e. Q3-3), separate 1 Rx/2 Rx Tabs maybe not necessary since companies can provide results with reporting the number of Rx and the corresponding aggregation level distributions even with a single Tab.

**Proposal 3-2: For PDCCH blocking rate evaluation, use Tab-7 in template to collect evaluation results with following modification(s):**

* **Revise “Number of users (e.g. 10)” to be “Number of users (e.g. 1 to 10)”**
* **Add a note in Tab-7 to clarify that “Number of users” represents the number of UEs that need to be scheduled simultaneously in a slot and company can provide different PDCCH blocking rates corresponding to a range of ‘number of users’ on different rows in Tab-7**

All responses seem support the proposals with different preferred values. 3 companies see the need to justify the use case of 10 UEs in a single CORESET. On the other hand, this configuration (i.e. 10 UEs) was preferred by 5 companies. Furthermore, 4 companies explicitly proposed to select a set of UEs number within the range. However, the preferred numbers are still diverged.

The following was reflected in Tab-7 template to capture the consensus:

* Revise “Number of users (e.g. 10)” to be “Number of users (e.g. 1 to 10)”
* Add a note in Tab-7 to clarify that “Number of users” represents the number of UEs that need to be scheduled simultaneously in a slot and company can provide PDCCH blocking rates corresponding to a range of ‘number of users’ on different rows in Tab-7

In the RAN1#102-e meeting, PDCCH blocking rate evaluation was discussed and consensus was reached on a few parameters including SCS/BW, CORESET duration, delay toleration. However, company views were still not converged on some important parameters e.g. aggregation level distributions and number of candidates for each AL. It therefore was agreed to leave for company report. However, the assumption should not be too broad to make the results incomparable. To produce comparable evaluation results, it was further recommended by feature leader to limit the AL distribution of [1,2,4,8,16] as one of the following:

* **Configuration 1:** [0.5, 0.4, 0.05, 0.03, 0.02], assuming majority of the Ues are in is good coverage
* **Configuration 2:** [0.1, 0.2, 0.4, 0.2, 0.1]: Majority of the Ues are in medium coverage
* **Configuration 3:** [0.05, 0.05, 0.2, 0.3, 0.4]: Majority of the Ues are in poor coverage
* **Configuration 4:** [0.2, 0.2, 0.2, 0.2, 0.2]: Uniform distribution

**Question 3-3: Can we limit the AL distributions to be one of the four configurations listed above? If not, what other configurations need to be added? It should be noted that it is important to minimize the configurations to ensure the comparable results.**

On Q3-3, all responses agree to limit AL distribution to align results for making the conclusion in TP. Companies positions can be categorized as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **Configuration index** | **Supporting companies** | **Number of supporting companies**  | **Concerns** |
| 1 | Ericsson, Qualcomm, CATT, Huawei | 4 |  |
| 2 | Ericsson, Futurewei, CATT, MediaTek | 4 |  |
| 3  | Ericsson, Qualcomm, MediaTek  | 3 | Intel (Not realistic and only happen in case of poor network planning) |
| 4 | Ericsson | 1 | Futurewei (artificial), Qualcomm, Intel |
| 5 (Revised Config.1) | Vivo: [0.7, 0.2, 0.05, 0.03, 0.02] | 1 |  |
| 6 (Revised Config.1) | OPPO: [0.4, 0.5, 0.05, 0.03, 0.02] | 1 |  |
| 7 (Revised Config.1) | Huawei: [0.3, 0.5, 0.10, 0.06, 0.04] (for 1Rx case) | 1 |  |
| 8 (Revised Config.1) | Intel: [0.5, 0.4, 0.07, 0.02, 0.01]. | 1 |  |

Most responses prefer to categorize different cases into cases e.g. good/medium/poor coverage, which represents different UEs SINR distribution in network. Configure 2 are preferred by all of responses and seems agreeable as one of configurations. Companies views on Configuration 1 are still diverse with several modifications (i.e. Configuration 5/6/8) brought up to the table.

In addition, one company proposed to clarify Configurations 1-4 above is assumed with 2 Rx. Correspondingly, it was also proposed to consider configuration 7 above for PDCCH blocking rate evaluation.

**Question 3-3a: Can we clarify that Configurations 1-4 are applied for 2 Rx case? If yes, can we agree to use Configuration 7 above for 1 Rx case for power saving evaluation as proposed by Huawei? Please provide some justification for each input.**

Reponses from companies on Q3-3a can be summarized as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **Proposals**  | **Yes** | **No** | **Num. of companies**  |
| Configuration 1-4 for 2 Rx | Futurewei, Vivo, Huawei, Qualcomm, Samsung | Ericsson, CATT, MediaTek, ZTE, Nokia, Intel, LG,  | Yes: 5No:7 |
| Configuration 7 for 1 Rx | Futurewei, Huawei,  | Ericsson, Vivo, CATT, MediaTek, Qualcomm, ZTE, Nokia, Intel, LG, Samsung, OPPO | Yes: 2No: 11 |

Note that, the configuration is counted on a per cell basis, instead of per UE AL distribution. In addition, it is great if we can adopt at least configuration that all interested companies can simulate it. Other configuration can be left company to select and report.

**Proposal 3-3: PDCCH aggregation level distribution configuration 1 and 2 listed above are used to evaluate power saving benefit of PDCCH monitoring. Other configurations are optional.**

Responses from companies on P3-3 can be summarized as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **Proposal**  | **Yes** | **No**  | **Num. of companies**  |
| P3-3 | Futurewei, Ericsson, CATT, Huawei, ZTE, Nokia, Samsung, OPPO | Vivo (Config-1), MTK/LG (Config-2/3), Qualcomm (at least keep Config-3), Intel (Config-1),  | Yes: 8No: 5 |

It seems that 12 out of 13 responses are ok with at least Configuration 1 (and perhaps have Configurations 2 and 3 as optional and leave companies to report).

**Question 3-3b: Can the updated spreadsheet v001 be used to collect the power saving evaluation results for Redcap UEs? If not, what other aspects need to be added? Please do not repeat earlier discussions.**

All responses on Q 3-3b seems support to use spreadsheet v001 excepting two companies pointed out the proposed “Note” is not implemented in v001 and should be added in new excel version. In addition, one company proposed to add one more note to request companies to clarify the blocking probability of PDCCH for each AL used in Tab3/4/5/6. We keep the DCI format size in template due to lack of consensus on the PDCCH AL distributions yet. There was one more comment regarding the size of other DCI format(s), i.e. Column “D” in Tab-7, it can be left companies to report if more than one DCI formats were evaluated.

In summary, the following was made in v002 to reflect the comments on the missed “Note”:

* Update on top of v001: Added the following Note
	+ Tab-7: “Number of users” represents the number of UEs that need to be scheduled simultaneously in a slot and company can provide PDCCH blocking rates corresponding to a range of ‘number of users’ on different rows in Tab-7.
	+ Tab-2: Companies can optionally report the blocking probability of PDCCH for each AL distribution assumption for their results in Tab 3/4/5/6 (reflecting comments from Huawei).

**Question 3-3c: Can Configuration 1 ([0.5, 0.4, 0.05, 0.03, 0.02]) to be used for PDCCH blocking evaluation and other configuration(s) are left for company report?**

Companies inputs on Q3-3c were summarized as follows:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Yes** | **No**  | **Num. of companies**  |
| **Q3-3c** | CATT (both 1RX/2Rx), Vivo, Huawei (Yes with adding Note to allow company to report the RX antenna assumption for Config-1), Ericsson, Qualcomm, Nokia, Intel, ZTE.  | Samsung, OPPO, Futurewei | **Yes: 8****No: 3** |

Given the current status, the only conclusion we can make on PDCCH AL distribution is left to companies’ report. It was recommended to use configuration 1 and 2 to make the results comparable and then use them to conclude the study in next meeting.

Considering that the deadline of Phase 1 of the email discussion has passed, the FL strongly encourage companies to consider not objecting to the latest versions of the template if they can live with them as it is just used for simulation results collection.

Having said this, the following was proposed to conclude the discussions and move to next phase to collect results.

**Question 3-3d: Can the template be agreed to collect the power saving and PDCCH blocking results? If not, what other aspects need to be added? Please do not repeat earlier discussions.**

|  |  |  |
| --- | --- | --- |
|  **Company** | **Agree (Y/N)** | **Comments** |
| CATT | Y | We are OK with the template. |
| Ericsson | Y | We are fine with the latest draft template. |
| Samsung | Y | OK |
| OPPO | Y | Yes |
| vivo | Y | OK in general. One suggestion on PDCCH blocking, we should clarify the AL distribution is reported by company and delete example in the column below**AL distribution reported by each company~~(e.g., [0.2 0.2 0.2 0.2 0.2] for AL = [1 2 4 8 16])~~** |
| ZTE | Y | We are fine with the latest template. |
| Huawei, HiSilicon | Yes with clarification on the understanding of one note | Thanks to capture the comment from us as the note: ‘Tab-2: Companies can optionally report the blocking probability of PDCCH for each AL distribution assumption for their results in Tab 3/4/5/6’. Regarding the wording of ‘optionally’, we would like to further clarify the understanding of ‘optionally’. According to the second paragraph in section 3 of the feature lead summary (as following), the intention of the simulation is to obtain the power saving gain and **corresponding** PDCCH blocking probability. Therefore, if a company does not report the blocking probability rate of PDCCH for each AL distribution assumption for their results in Tab 3/4/5/6, it means the corresponding PDCCH blocking probability rates, which are listed in Tab 7, are assumed for Tab 3/4/5/6. If this is the common understanding and can be also clarified in the template, we are fine with the current template.

|  |
| --- |
| *In current TR 38.840, TDD was assumed for power saving evaluation in FR1/FR2. It can be reused for Redcap study item to simplify the power reduction evaluation for reduced number of blind decoding and CCEs.* ***Regarding the performance metrics, at least power saving gain and the corresponding PDCCH blocking probability should be evaluated.*** *With these considerations in mind, three tabs were created in template as follows:*  |

 |
| Ericsson 2 | Y | Regarding the Huawei/HiSilicon response above, our understanding is that ‘optionally’ in Note 2 of Tab 2 means that reporting of PDCCH blocking rate for each AL distribution should not be mandatory for power saving evaluations. In our understanding, the word “corresponding” in the FL summary simply refers to “corresponding BD reduction cases”.In summary, we are fine with keeping the existing note or removing it altogether. |
| Qualcomm | Y | The latest template from FL looks good to us. |

# 4 Template for coverage recovery evaluation

Updated draft templates are provided in:

* Rural 700 MHz: [RedCapCoverageTemplate-Rural700MHz-v003.xlsx](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_102-e/Inbox/drafts/8.6/PostPhase1/RedCapCoverageTemplate/RedCapCoverageTemplate-Rural700MHz-v003.xlsx)
* Urban 2.6 GHz: [RedCapCoverageTemplate-Urban2.6GHz-v003.xlsx](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_102-e/Inbox/drafts/8.6/PostPhase1/RedCapCoverageTemplate/RedCapCoverageTemplate-Urban2.6GHz-v003.xlsx)
* Urban 4 GHz: [RedCapCoverageTemplate-Urban4GHz-v003.xlsx](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_102-e/Inbox/drafts/8.6/PostPhase1/RedCapCoverageTemplate/RedCapCoverageTemplate-Urban4GHz-v003.xlsx)
* Indoor 28 GHz: [RedCapCoverageTemplate-Indoor28GHz-v003.xlsx](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_102-e/Inbox/drafts/8.6/PostPhase1/RedCapCoverageTemplate/RedCapCoverageTemplate-Indoor28GHz-v003.xlsx)

One response (see FLS3) propose to update the example value on the row (5) to have the same 12dB value for all the channels in order not to bias the company reported values toward delta1=4dB. Given that the purpose of example value is to show possible different antenna gain values for broadcast and unicast channels, the FL understanding is that the company would report the appropriate values based on their evaluation and thus no change is done to the example values in the latest version.

One response (see FLS3) propose to add a note under row (3a) for 4GHz TDD that the value is either 33 or 24dBm/MHz. Since the description of “F20” of the excel sheet already includes this and the row(3a) has been highlighted with orange color for which company can declare the value based on their evaluation, so no change is done in the latest version.

Regarding max TRP for FR2, the FL understanding is that the CE SI agreement is to consider both 23 dBm and 12 dBm. Given that some responses indicate to evaluate both cases, the FL recommendation is not to make the down-selection at this point. Therefore, the description of “F21” of the excel sheet has been updated to include both the 23 dBm and 12 dBm values and the row (3b) has been highlighted with orange color to allow the company to declare the value.

Please note that all the change marks have been removed in the latest version. In addition, the following editorial changes are made.

* “Pathloss model(3) (select from LoS or NLoS)” changed to “Pathloss model”
* For row(4a) and (11a) in FR2 template, “For RedCap, can adjust for UE antenna efficiency loss for FR1.” are removed
* In FR2 template, in the description of evaluation options for uplink, “1T1R” and “1T2R” are replaced by “1Tx” to avoid possible misunderstanding.

**Question 4-1d: Can the template be agreed to collect coverage recovery evaluation results? If not, what other aspects need to be added? Please do not repeat earlier discussions.**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| CATT | Yes. We are fine with the template. |
| Ericsson | Yes, we are fine with the latest draft template. |
| Samsung  | OK |
| OPPO | OK with the change. |
| vivo | OK |
| ZTE | OK |
| Huawei, HiSilicon | Suggest some clarifications.Regarding row#5 on antenna gain, delta1 should be the same for all unicast channels but is not clear enough in the note. So is row#11bis. In shorts, suggest,***Proposal****: clarify the note of row#5 and row#11bis as in red “where delta1 is a correction factor and can be different ~~for~~ only to differentiate broadcast channels from ~~and~~ unicast channels.*In the notes of row#15a and 15b, typo “companly”. Additionally, “declare” could be “declares”Regarding row#17b for Msg.3, its value is SCS dependent because 2 PRBs are agreed for Msg.3 evaluation. Considering 15kHz SCS for Rural and 30kHz SCS for Urban, a fixed value has been adopted in the excel files for 2.6GHz and 4GHz. However, it is in orange and up to company report or 700MHz Rural and 28GHz, which are supposed to be fixed value as well. |
| Qualcomm | Yes |

# 5 Template for capacity impact evaluation

An updated draft template is provided in [RedCapCapacityTemplate-v003.xlsx](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_102-e/Inbox/drafts/8.6/PostPhase1/RedCapCapacityTemplate/RedCapCapacityTemplate-v003.xlsx).

Regarding the simulation bandwidth (see FLS3), seems all the responses support that the total system bandwidth in the SLS can be 100MHz for both FR1 and FR2. A note has been added in the latest template for clarification.

Regarding UE complexity reduction feature, majority of the companies support the FL proposal. One response (see FLS3) proposes to update ‘1 layer” to “1 or 2 DL layers” considering 2 Rx case. The FL understanding is that “*Reduced number of DL MIMO layers*” and “*Reduced number of Rx antennas*” as individual cost reduction techniques according to the discussion in the cost reduction evaluation. At this point, it is not clear whether RedCap UE with 2Rx should support max 2 DL layers. However, to address the concern from the company, probably we can consider the 2 DL layer as optional and company can declare the number of layers for evaluation.

For traffic model, based on the responses (see FLS3) it seems difficult to prioritize any of the traffic types for RedCap UE. From the FL perspective, ZTE’s proposal is a reasonable way forward. At this moment, without any input from the operator regarding this, we can only use what has been agreed. The FL understanding is that the current template is aligned with this proposal. Both FTP model 3 and the IM traffic model can be considered for RedCap UE and the company can report which model is used for the SLS evaluation. Regarding the concern on the maximum 1:50 traffic ratio between RedCap and eMBB UEs with the IM traffic model, if there is any issue identified from the evaluation we can further discuss it in the RAN1#103-e on whether and how to capture the results to the TR.

For the modeling of the number of UEs for burst traffic evaluation, it is difficult at this point to judge which method (i.e. fixed vs. variable number of UEs) is more reasonable and efficient. Regarding Huawei’s comment on decoupling the impact of cost reduction feature from the impact of varying number of UEs, the FL understanding is that this requirement may not be necessary. Under the same loading assumption, the performance impact to the eMBB UEs due to the presence of the RedCap UE can be evaluated by varying the number of RedCap UEs in the cell. Therefore, there is no problem to have a variable number of UEs based on the ratio of RedCap UEs in the cell for the capacity evaluation.

However, to move it forward, it is proposed to consider both options in the latest capacity template and company can report which option is used for the evaluation and how the impact to network capacity is evaluated. Note 6 in the latest template is added for this and one row is added for the non-full buffer traffic evaluation so that company can report the evaluation assumption for their results.

**Question 5-1c: Can the template be agreed to collect the capacity impact evaluation results for UE complexity reduction? If not, what other aspects need to be added? Please do not repeat earlier discussions.**

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| --- | --- |
| **Company** | **Comments** |
| Ericsson | Yes, we are fine with the latest draft template. |
| Samsung  | Yes. |
| vivo | OK |
| ZTE | OK |
| Huawei, HiSilicon | Thanks a lot for the updates, but they are not sufficient yet.Firstly, we agree on clarification of number of DL layers decoupled from number of Rx, but we disagree FL’s proposal to take 2 DL layers as optional evaluation because we are afraid that there is no logical connection between whether UE capability is optional and whether SLS evaluation scheme is optional. In 2Rx evaluations, 2 DL layers is the most interesting case that is beneficial to network performance (e.g. SE or capacity), thus it should be a focus for 2Rx evaluation.***Proposal:*** *remove “optionally” from the note#2 of the excel sheet.*Secondly, regarding note#6, since the number of eMBB UEs and the number of REDCAP UEs are the tuning variables in the SLS evaluation, they should be reported along with SLS results for better cross-comparison. Although UE ratios are reported, the exact number of UEs may be rounded up or down, resulting high variance between companies’ results. Please add such reporting to note#6.***Proposal:*** *clarify in note#6 that both the numbers of eMBB UEs and REDCAP UEs are reported for better comparison.*For the same note#6, it has never been answered how option 1 is feasible and can tell the impact of cost reduction factor from the impact of increase of UE numbers. Therefore, it is hard at this stage to claim SLS evaluation can be based on option1. To better reflect FL’s suggestion and move forward, the main bullet of note#6 should be clarified as “the following options of the number of UEs including both eMBB and RedCap UEs are starting points:”***Proposal:*** *clarify the main bullet in note#6 as*“the following options of the number of UEs including both eMBB and RedCap UEs are starting points:”The option 2 should be clarified as we suggested before, i.e. the same total number of UEs for a target RU,***Proposal:*** *clarify Option 2 in note#6 as**“Option 2: With respect to a target RU, the total number of UEs is same for all the RedCap UE ratios in the cell (e.g. firstly determine the number of UEs assuming 0% RedCap UE ratio for a target RU and use the same total number to other RedCap UE ratios)”* |
| Qualcomm | We are fine with the latest template from FL. |