1,wo3GPP TSG-RAN WG2 Meeting#112-e Draft\_R2-200xxxx

Online, 2nd - 13th November 2020

Agenda Item: x.x.x.x

Source: Huawei

Title: [Draft] Summary of email discussion 914 on UE identification and access restrictions (Huawei)

Document for: Discussion and Decision

# Introduction

Rel-17 SI on RedCap was started in RAN2#111-e. One of the objective in the SID is to study UE identification and access restrictions for RedCap UEs [1]:

* Study functionality that will allow devices with reduced capabilities to be explicitly identifiable to networks and network operators, and allow operators to restrict their access, if desired [RAN2, RAN1].

In RAN2#111-e, the following agreements were made for UE identification and access restrictions [2]:

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| 1. An indication in system information is needed to indicate whether a REDCAP UE can camp on the cell. FFS whether the indication is explicit or implicit. 2. UAC mechanism also apply to REDCAP UEs. 3. System information indicates whether REDCAP operation is allowed/barred on a frequency. FFS reuse the legacy intraFreqReselection or introduce separate flag 4. Further discuss enhancement of UAC for REDCAP UEs, including e.g.:    1. define new Access Identity for REDCAP UEs    2. define new Access Categories for REDCAP UEs   (for any final decision we need to check with SA1 and/or CT1) |

UE identification for RedCap UEs was also discussed in RAN1#102-e, the following agreements were made [3]:

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| Agreements:   * Further study the options for identification of RedCap UEs, including ~~at least~~ the following indication methods:   + Opt. 1: During Msg1 transmission, e.g., via separate initial UL BWP, separate PRACH resource, or PRACH preamble partitioning.   + Opt. 2: During Msg3 transmission.   + Opt. 3: Post Msg4 acknowledgment.     - E.g., during Msg5 transmission or part of UE capability reporting.   + Opt. 4: During MsgA transmission (subject to support of if 2-step RACH)   + Other options are not precluded.   + Note: This study intends to establish feasibility of, and pros and cons for the identified options from RAN1 perspective, without any intention of down-selection without guidance from RAN2.   Conclusion:   * RAN1 to wait for further progress in RAN2 on the issues of temporary access barring and congestion control. |

The following email discussion was agreed in RAN2#111-e to further discuss UE identification and access restrictions for RedCap UEs:

* [Post111-e][914][REDCAP] UE identification and access restrictions (Huawei)

Scope: Discuss UE identification and access restrictions, addressing open issues from the meeting, taking into account possible RAN1 agreements and identifying possible solutions

Intended outcome: email discussion summary

Deadline: Thursday OCT 15 0700 UTC (please respect this deadline)

# Discussion

## UE identification

In RAN2#111-e, when to identify RedCap UEs was discussed in offline discussion 110. The following options were discussed:

- Option 1: Msg1 (Separate initial UL BWP or PRACH partitioning)

- Option 2: Msg3

- Option 3: Msg5

- Option 4: MsgA for 2 step RA

Companies’ view were split and several companies did not provide any preference but suggested to wait for RAN1 input.

The same options were discussed in RAN1 also. There was no conclusion in RAN1 but according to RAN1 agreement, guidance from RAN2 is needed before down-selection:

* + Note: This study intends to establish feasibility of, and pros and cons for the identified options from RAN1 perspective, without any intention of down-selection without guidance from RAN2.

Considering that UE identification is a RAN2 led topic, we think it is useful to discuss the consequences of not having the indication at this stage for each option from RAN2 perspective and then identify RAN2 preference based on the discussion. Based on RAN2 preference, a LS can be sent to RAN1 to check the feasibility.

**Option 1: Msg1 (Separate initial UL BWP or PRACH partitioning)**

In the offline discussion 110 in last meeting, the following arguments were provided to identify the RedCap UEs during Msg1:

* For the network to schedule Msg2/3 properly, e.g. to decide whether to schedule repetition.
* If a REDCAP UE is allowed to camp on the cell with larger initial UL/DL BWP than supported by the UE, the network needs to identify the UE via Msg1 to schedule Msg3 with the BW restriction of RedCap UE.

**Question 1.** Do you think it is needed **from RAN2 perspective** to identify RedCap UEs during Msg1? What is the consequence if not?

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| ***Company name*** | ***Opinion*** | ***Comments*** |
| Huawei, HiSilicon | TBD | If RedCap UEs cannot be identify during Msg1:   * If the network indicates the support of RedCap UEs, the Msg3 of all UEs have to be scheduled with the BW restriction of RedCap UE (e.g. make sure that initial UL/DL BWP is equal to or smaller than 20Mhz or schedule Msg3 for all UEs within 20Mhz) * Other special handling of Msg2/3 for RedCap UEs is not possible   Above issues need to be confirmed by RAN1. |
| Qualcomm | Depends | We think the answer would depend on if RAN1 introduce repetition for msg2 and/or msg3 for RedCap UEs. If RAN1 do, then RedCap UEs have to identify themselves during msg1 transmission. Otherwise, we do not see the need for RedCap UEs to identify themselves during msg1 transmission.  We are neutral on the issue of smaller bandwidth, because in our view network can handle it by scheduling msg2/3 within the maximum bandwidth that RedCap UEs can support. If network does not like such a restriction, network can partitions PRACH between regular UEs and RedCap UEs so that msg2/3 for RedCap UEs can be scheduled differently. Network has full control in deciding which configuration to apply. Nothing seems broken. |
| Samsung | Depends | We share the view with Qualcomm that it depends on the RAN1 decision as RedCap UE with reduced antennas may suffer from coverage issue and scheduling restriction compared to normal UEs. Also note that to identify a RedCap UE can be achieved by having a separate PRACH configuration (or different BWP), and no additional indication would be needed. |
| Intel | Depends | It depends on whether the reception of RAR will be impacted or not, RAN1 inputs are needed. |
| Apple | Depends on RAN1 |  |
| Futurewei | Pending RAN1 progress |  |
| vivo | Depends on RAN1 decision | Actually, we cannot see a strong need for RAN to identify RedCap UEs in msg.1 by now. We agree with Qualcomm that it depends on if RAN1 will introduce repetition or scheduling restriction for msg.2/msg.3 for Redcap UEs.  As far as I know, discussion on msg.2/msg.3 repetition is being discussed in coverage enhancement WI. In their discussion, if msg.3 needs repetition, there may be indication in msg.1. Thus, we can also wait for more progress on this. |
| Ericsson | No from pure RAN2 perspective | From pure RAN2 perspective there doesn’t seem to be need. As pointed out in other replies, there may be reasons an early indication is needed e.g. if Msg2/Msg3 requires scheduling with coverage enhancement or if other special handling would be required.  The need for Msg1 indication may depend on other configuration such as system bandwidth etc, thus one possible way is to use Msg1 indication only when such is needed, that is, it would be up to NW configuration e.g. using PRACH partitions as mentioned by QC. |
| CATT | Depends on R1 | Indeed this is under discussions in R1. It seems R1 will further discuss need of coverage improvements for RACH MSGs such as Msg2/3/4. And the need for identification based on Msg1 pretty much depends on the conclusion there. |
| Sharp | Depends on RAN1 |  |
| OPPO | Depends on RAN1 progress |  |
| NEC | Depends | we also think it depends on RAN1 decision. RAN2 still needs to wait for further progress in RAN1 with respect to minimum requirements related to initial access by RedCap UEs. |
| Nokia, Nokia Shanghai Bell | Not from RAN2 POV | Allocating dedicated Msg1 resources can be a waste of resources since the NW does not know if there are any RedCap UEs in the cell. |
| ZTE | Depends on RAN1 | We also think it depends on RAN1 decision, e.g. whether repetition for coverage enhancement is needed; and whether RedCap UE is allowed to camp on a cell with larger initial BWP.  If needed, we understand RAN1 may also discuss potential solutions for identification during msg1, e.g. PRACH partition, or sperate initial uplink BWP.  From pure RAN2 point of view, we agree there seems no such requirement. |
| Xiaomi | Depends on RAN1 | Early indication of Redcap UE capabilities during the initial access is being discussed in RAN1. We should wait for more RAN1’s input. |
| Lenovo / Motorola Mobility | Wait for RAN1 input | It also depends on RAN1 conclusion whether coverage enhancement is needed or not for Redcap UEs. |
| MediaTek | No from RAN2 perspective | From a RAN2 perspective, there is no need to identify the RedCap UE as early as msg1.  RAN1 can evaluate if there is a need to identify the UE at msg1, i.e. if there is some performance impact due to RedCap operation on msg2/3 that needs to be mitigated. |
| LGE | Depends | Depends on RAN1 discussion.  From RAN2 perspective, we don’t see the need to differentiate RedCap UEs. |
| Sequans | depends on RAN1 | Not from RAN2 POV, as described above. |
| Fujitsu | TBD | We share the view with HW and QC that it depends on RAN1 study. Because there are likely to be negative impacts on performance, coexistence with legacy UEs or gNB behavious due to some of the complexity reductions for a RedCap UE. According to the email discussion of RAN1, it seems essential for the network to be aware of RedCap UEs during initial access. |
| Spreadtrum | TBD | We can waiting for the progress of RAN1, but we think this option (to identify RedCap UEs during Msg1) might result in unnecessary resource segmentation. |

**Option 2: Msg3**

In the offline discussion 110 in last meeting, the following arguments were provided to identify the RedCap UEs during Msg3:

* If a RedCap UE is allowed to camp on the cell with larger initial UL/DL BWP than supported by the UE, the network needs to identify the UE at least in Msg3 to schedule Msg4/5 with the BW restriction of RedCap UE.
* If a RedCap UE is identified at least in Msg3, network can reject the RedCap UE based on the load and its strategy.

**Question 2.** Do you think it is needed **from RAN2 perspective** to identify RedCap UEs during Msg3? What is the consequence if not?

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| --- | --- | --- |
| ***Company name*** | ***Opinion*** | ***Comments*** |
| Huawei, HiSilicon | Needed from RAN2 perspective | If RedCap UEs cannot be identify during Msg3:   * It is not possible for the gNB to reject RRC connection request from RedCap UEs only. * Considering that RedCap UEs have different minimum capability set compared with legacy eMBB UEs, the gNB may not configure RedCap UEs properly in Msg4. * The gNB need to schedule Msg5 for all UEs within 20Mhz * Other special handling of Msg4/5 for RedCap UEs is not possible   At least the first two bullets are RAN2 related thus we think UE identification no later than Msg3 is needed from RAN2 perspective. |
| Qualcomm | Needed from higher-layer perspective | Identification of RedCap UE during msg1 **transmission** is mainly for RAN to use. RedCap UEs also need to identify themselves to core network for procedures such as subscription validation (i.e. to ensure RedCap is only used for its intended use cases). This identification hence should be singalled in msg3 **payload**.  However, we do not see a strong need for RAN to identify RedCap UEs in msg3. How to handle bandwidth restriction of RedCap UEs for msg4/5 transmission can be up to network implementation. |
| Samsung | Needed from RAN2 perspective | As a RedCap UE may have limited processing capability and bandwidth, such UE has to be identified in Msg3 at the latest to complete the Random Access procedure and be properly configured. |
| Intel | Depends | The network may reject the UE if the requested service (based on cause value) is not allowed for RedCap UE.  The network may configure UE properly if the minimum capability for RedCap UE is different from normal UE. (RAN1 confirmation is needed on what capabilities will be reduced, and what impact will be for MSG4/5 configuration).  Therefore if the special handling is needed for MSG4/5, the network needs to identify RedCap UE before sending MSG4.  But there is size limitation in MSG3, only 1 bit left. Therefore, the indication may be contained via MSG1 (if anyway it is needed from RAN1 perspective).  Before RAN2 make decision, we need to understand whether special handling is needed for MSG4/5. |
| Apple | Depends, but we can also prevent the scenario of NW needing to know at MSG3, with access restriction | We are wondering on why the NW needs to know and then correspondingly reject, if it is possible to prevent the UEs from camping on the cell where the UE cannot support the minimum BWs the NW wants to the UE to support. This also depends on the set of access restriction filters which can be broadcasted to allow UEs to decide if they want to camp. Then MSG3 based differentiation is not that critical. We also agree that NAS level gating might be needed, but that doesn’t need to be at MSG3. |
| Futurewei | Yes | Indication in MSG3 should be used if Redcap specific handling needs to be introduced only from MSG4/5. |
| vivo | Depends | Actually, we also cannot see a strong need for RAN to identify RedCap UEs in msg3, which is similar as the above question. Regarding the arguments provided by rapporteur,   1. *if a RedCap UE is allowed to camp on the cell with larger initial UL/DL BWP than supported by the UE,*   We think if the network allows such UE (supports lower BW than the cell) camping on this cell, it should be up to network implementation to to schedule Msg4/5 with the BW restriction of RedCap UE.   1. *If a RedCap UE is identified at least in Msg3, network can reject the RedCap UE based on the load and its strategy.*   We would like to first understand what the intention for this behaviour is or why network needs to reject the RedCap UEs at this stage.  Regarding to the objective “to ensure RedCap is only used for its intended use cases”, we think RedCap UEs need to be identified to core network for subscription validation, which is being discussed in another email discussion [Post111-e][913]. |
| Ericsson | Yes | We think the UEs should identify as RedCap UEs in Msg3 in all cases.  It is beneficial for the NW to understand UE is RedCap for proper configuration and e.g. possibility to reject RRC connection as brought up in HW reply.  Regarding need for the NW to reject RedCap UEs during RRC establishment phase, the need depends partly on how the access triggering conditions are specified, but also additionally, network might need to temporarily reject some attempts e.g. if the intention is not to change SI to disallow RedCap operation in the cell or there is a temporary reason to reject specifically RedCap access. |
| CATT | Maybe, needs further discussions | We think the possible motivations mentioned by companies may need further discussions. e.g., regarding  a) Need for rejecting RRC connection request from RedCap UEs only: This needs checking as UAC mechanism is available already to control the access of RedCap UEs if needed. We need to  b) Need to know reduced capability for Msg4/5 handling: This may be valid, but we actually prefer to wait for R1 conclusions on reduced capabilities and handling of Msg1 as discussed already in Q1. |
| Sharp | Depends | From RAN2 perspective, as other companies’ comments, seems no much benefit to identify RedCap UE in Msg3. If RAN1 concludes Msg4/5 special handing for RedCap UE, identification of RedCap UE in Msg3 may be needed. |
| OPPO | Needs further discussion | The first argument listed above related to Q1 and we think RedCap indication in Msg1 is sufficient for proper scheduling of Msg4/5. Anyway this is up to RAN1.  The second argument listed above on rejecting RedCap UEs, we think this might be addressed by UAC control. |
| NEC | Depends | Some aspects need to be clarified at least.  On UE capability regarding initial UL/DL BWP, RAN2 should wait for RAN1 decision. If some considerations are required as in Rapporteur summary, this option 2 (Msg3-based identification) will be needed.  On UAC, we are not sure whether separate access control is necessary for normal UEs and RedCap UEs, as it seems no such requirement is coming from SA1. |
| Nokia | Needed from RAN2 POV | We agree with Huawei. |
| ZTE | Depends | Regarding scheduling of msg4/msg5 with restricted bandwidth, it is up to RAN1 to decide whether camping on cell with larger BW is allowed. So we can wait for RAN1 conclusion.  Regarding special configuration in msg4, it depends on RAN1 about whether any configuration restriction is needed for RedCap UE.  In addition, we haven’t seen much necessity to reject RRC purely based on cause value. If NW want to prevent the access of RedCap devices, it can use cell level barring and UAC mechanisms (similar view as Apple).  Regarding subscription validation in core network, there is another option in NAS level, which is under the discussion in [Post111-e][913]. |
| Xiaomi | Needs further discussion | If a Redcap UE is identified at first in Msg1 in Q1, it is sufficient for the gNB to schedule the UE properly in Msg4/5. In this way, it seems there is no strong need for RAN to identify Redcap UEs in msg3 further. But if the special configuration is needed for MSG4/5 for different types of Redcap UEs, the network needs to identify Redcap UE before sending MSG4. And more RAN1 confirmation is needed on what impact will be for MSG4/5 configuration depending on what capabilities will be reduced for different types of Redcap UEs. |
| Lenovo / Motorola Mobility | Yes | Msg3 is a good candidate to identify Redcap UEs at the earliest, e.g. by defining a new UL CCCH message and using a new logical channel identity (LCID) value.  We agree with the comments from Huawei/HiSilicon on the consequences if Msg3 is not used to identify Redcap UEs. |
| MediaTek | No | The UE type can be identified by the network at msg5 (due to capability information availability). Therefore identification at msg3 is only needed if:  1. The NW would like to reject accesses from RedCap UEs  2. There is a difference between msg4/5 scheduling between RedCap and non-RedCap UEs  *Regarding case 1:*  NW control of RedCap UE access can be controlled earlier than msg3, i.e. using SI which controls whether RedCap UE access is allowed or not, as well as using UAC. We do not see a strong reason for a third mechanism to be introduced here.  *Regarding case 2:*  As a RedCap UE will only camp onto a cell that supports RedCap operation, the network should be aware that UEs with differing capabilities attempt initial access to the cell. We therefore agree with Qualcomm that differences in msg4/5 scheduling and configuration such as bandwidth can be accommodated by NW implementation.  Considering the two arguments above, we do not see a convincing reason to indicate UE type at msg3. However, we are open to discussing this topic further. |
| LGE | FFS | For overload control, identifying RedCap UEs in Msg3 may be needed.  For other purpose, we don’t see the need. |
| Sequans | Probably yes | Based on following assumption:   * Identification in MSG1 will not be needed * Differentiation for MSG4/5 will be needed * Rejection of only part of RedCap UE should be possible |
| Fujitsu | Depends | Not quite understand why from RAN2 perspective it is needed. If msg1 is used to identify RedCaps UEs, we should not use msg3.  If the network does not need to be aware of Redcap UE before msg3, i.e. msg1 is not used to identify RedCap UEs, and there is essential impact on msg4/msg5 transmission, the RedCap UE should be identified in msg3. Otherwise, it’s not needed. |
| Spreadtrum | Yes | Agree with Huawei,HiSilicon. |
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**Option 3: Msg5**

In the offline discussion 110 in last meeting, there were company view that identifying Redcap UE in Msg5 is enough if a REDCAP UE is not allowed to camp on the cell with larger initial UL/DL BWP than supported by the UE.

**Question 3.** Do you think it is needed **from RAN2 perspective** to identify RedCap UEs during Msg5? What is the consequence if not?

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| ***Company name*** | ***Opinion*** | ***Comments*** |
| Huawei, HiSilicon | Not needed from RAN2 perspective | If UE identification of RedCap UEs during Msg1, Msg3 or MsgA are not agreed, we do not see the need to identify the UE during Msg5. Identifying RedCap UEs via UE capability should be enough. |
| Qualcomm | Not needed | We share the same view with Huawei |
| Samsung | Not needed from RAN2 perspective | We agree with Huawei. |
| Intel |  | If the indication is used by the network to check whether the RedCap UE is allowed to access the particular service, and if we do not need special handling on MSG4/5, etc, then MSG5 could be a good way compared to capability based solution since it can reduce signalling overhead and also can let the network handle it faster. |
| Apple | Not needed from RAN2 | Ideally we would like to gate the UE at access time and then NAS level gating (accept/reject service) should be enough. The rest of Redcap UE capability handling can be using legacy capability exchange. |
| Futurewei | No | There seems not to be much benefits of having Redcap indication in MSG5 over using UE capability signalling from RAN2 perspective. |
| vivo | No needed | We agree with Huawei, as there is no additional benefit to indicate RedCap UEs in msg.5, comparing to current capability reporting.  Besides, if the identification of Redcap UEs was agreed in msg.1 or msg.3, there is also no need to identify RedCap UEs during msg.5.  Thus, msg.5 based early indication has no use case, anyway. In this way, we could exclude this solution in SI phase. |
| Ericsson | No, unless optimization is needed | Agree with above comments – early indication is another question but at this point the UE capabilities should be available to gNB.  However, as pointed out by Intel there could be possibility to optimize – this discussion would anyways depend on whether Msg1/Msg3 indications would be specified, thus we propose to capture the alternative in TR but no need to decide right now. |
| CATT | No need | We agree with the comments from Huawei. |
| Sharp | Not needed | Share the same view with Huawei. |
| OPPO | Not needed | We share the same view with Huawei |
| NEC | depend on need of Opt2 (Msg3) | If Msg3-based is needed, then Msg5-based would not be needed. Otherwise (i.e. if no specific need for Msg3), Msg5-based is sufficient. |
| Nokia, Nokia Shanghai Bell | No | We share the views with HW. |
| ZTE | No | We share the same view with Huawei. |
| Xiaomi | No | If UE identification of Redcap UEs by Msg1 or Msg3 is needed, then using msg5 would not be needed More UE capabilities can be conveyed by the UE capability signalling after msg5. |
| Lenovo / Motorola Mobility | No | Is a feasible option however not optimum compared to Msg3 as network will not be able to apply congestion control mechanism for Redcap UEs. |
| MediaTek | No | UE capabilities can be known at this point, and therefore we do not see a strong reason for an additional indication. |
| LGE | No |  |
| Sequans | Probably not | Agree with Intel that this could be a possible optimization |
| Fujitsu | TBD | Msg5 may be an option to identify RedCap UE and make the UE capabilities available to gNB before UE capability information, if identification is not made in msg1/msg3. As Intel and Ericsson pointed out that there may be optimization work to do regarding signalling overhead reduction. |
| Spreadtrum | No |  |
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**Option 4: MsgA**

This option only applies to 2-step RA. Arguments similar to Option 1 and Option 2 in 4-step RA were provided in the last RAN2 meeting.

**Question 4.** For 2-step RA, do you think it is needed **from RAN2 perspective** to identify RedCap UEs during MsgA? What is the consequence if not?

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| ***Company name*** | ***Opinion*** | ***Comments*** |
| Huawei, HiSilicon | Needed from RAN2 perspective | Please see our reply to Question 2, i.e. the need of UE identification during Msg3 in 4-step RACH. |
| Qualcomm | Needed from both RAN and higher-layer perspective | Please see our reply to Q1 and Q2. |
| Samsung | Needed from RAN2 perspective | This is similar to the answer for Question 2. |
| Intel | Not sure | It depends on whether the reception of MSGB will be impacted or not, RAN1 inputs are needed. |
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| Apple | Depends on the outcome of Q2 and from RAN1 output. | Our view is the same as response to Q2. |
| Futurewei | Yes | Indication in MSGA should be used if Redcap specific handling needs to be introduced for MSGB. |
| vivo | Depends | It should be similar to the decision for Q1 and Q2. |
| Ericsson | Yes | Please see our reply to Q2 |
| CATT | See our comments to Q1 and Q2. |  |
| Sharp | Depends | Depends on Q1 and Q2 |
| OPPO |  | Depends on Q1 and Q2 |
| NEC |  | same as Q1&2 |
| Nokia, Nokia Shanghai Bell | Yes from RAN2 POV. | Same as 4-step RA. |
| ZTE | Depends | Please see our reply to Q1 and Q2 |
| Xiaomi |  | same as Q1&2 |
| Lenovo / Motorola Mobility | Yes | We don’t see any reason why Redcap UEs should not be allowed to support 2-step RA.  MsgA corresponds to Msg3 what is our preferred option for 4-step RA. |
| MediaTek | No | Follows the same reasoning as Q1 and Q2 |
| LGE | Depends | Depends on RAN1 discussion |
| Sequans | Probably yes | As mentioned in Q2 |
| Fujitsu | Depends | It depends on whether the msgA resource or the msgA payload is used. If the msgA resource, similar to the answer for Q1, while the msgA payload then similar to the answer for Q2. |
| Spreadtrum | Yes |  |

**Question 5.** Based on reply to Questions 1-4, please indicate your preference **from RAN2 perspective**:

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| ***Company name*** | ***Preference*** | ***Comments*** |
| Huawei, HiSilicon | Msg3/A are needed from RAN2 perspective | According to our reply to Question 2 and 4, the RedCap UEs need to be identified at least during Msg3/A due to the following **RAN2 reasons**:   * It should be possible for the gNB to reject RRC connection establishment request from RedCap UEs. * The gNB needs to configure RedCap UE according to its restricted capability in Msg4. |
| Qualcomm | See comment | * Identification in msg1/A **transmission** is needed by RAN; * Identification in msg3/A **payload** is needed by higher layer. * Therefore, both identifications should be studied. |
| Samsung | Msg3/A at the latest from RAN2 perspective | As commented earlier, the indication should be done in Msg3/A at the latest from RAN2 perspective, but it can also be done in Msg1 based on RAN1 input. |
| Intel |  | If anyway, MSG1/MSGA are needed from RAN1 perspective. Then we do not need MSG3/5.  If special handling is needed for MSG4/5, and if MSG1 is not needed from RAN1 perspective, then MSG3 is needed;  Otherwise MSG 5 or capability based solution should be enough.  Before RAN2 make decision, we need to understand whether special handling is needed for MSG4/5. |
| Apple | Wait for RAN1 to conclude. | Before we proceed further. |
| Futurewei | MSG3/A | From RAN2 perspective, Redcap indication should be included in MSG3/A, if there is no Redcap indication introduced in MSG1 and there is need of Redcap specific handling for MSG4/MSGB. |
| vivo | Depends | See above comments. Before making any decision, we need to first agree the intended use case or motivation for this early indication considering RAN1 inputs (by now, it is being discussed) and RAN2 requirements (by now, it is not clear for us). |
| Ericsson | Msg3/A | We should capture the options and analysis in the TR analysis. The final decision can be taken either for potential WI scope or during WI. |
| CATT | Wait for R1 to conclude first. | At least we can conclude the option of only using Msg5 is not needed.  Then whether it is in Msg1 (wait for R1) and Msg3 (FFS) can be discussed later when R1 has clear conclusion on the topic. Note that based on RP timeline planning, R1 will anyway conclude on their studies already in Q4 meeting. It seems not very urgent that R2 first made agreements without |
| Sharp |  | Wait for more RAN1 related conclusion. |
| OPPO |  | Wait for more RAN1’s progress. |
| NEC | at most Msg3/ MsgA | as commented above, we still think RAN2 should wait for RAN1 progress. |
| Nokia | MsgA/Msg3 |  |
| ZTE |  | Wait for RAN1 conclusion before proceed further. At least on:   1. Whether special handling is needed for Msg2/3/4; 2. Whether network needs to provide different configuration in Msg4/MsgB due to limited UE capability. |
| Xiaomi | - | We wait for more RAN1’s input. |
| Lenovo / Motorola Mobility | Msg3/MsgA | See our comments to Questions 2 and 4. |
| MediaTek | Wait for RAN1 | If RAN1 conclude that the performance loss due to RedCap operation needs to be mitigated during RACH, we can explore early identification to the network. Otherwise, the UE capability framework is sufficient. |
| LGE | Depends | Depends on RAN1 discussion.  From RAN2 perspective, overload control case should be considered. |
| Sequans | Depends | Probably MSGA/3, but this depends first on RAN1 decisions |
| Fujistu |  | From RAN1 perspective, it seems essential for the network to be aware of RedCap UEs from msg1/msgA. If RAN1 confirms that, msg1/msgA are needed. Then msg3/msg5 are not used.  If the network does not need to be aware of Redcap UE before msg3, i.e. msg1 is not used to identify RedCap UEs, and there is essential impact on msg4/msg5 transmission, the RedCap UE should be identified in msg3.  Otherwise, msg5 may be used to indicate the reduced capabilities at earlier stage than UE capability to reduce the signalling overhead. |
| Spreadtrum | Msg3/A |  |
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Based on reply to Questions 1-5, please comment whether a LS to RAN1 is needed, e.g.:

* To inform RAN2 conclusion
* To check the feasibility of the RAN2 preferred option (if there is RAN1 impact)
* To ask RAN1 whether they have identified the need for earlier identification from RAN1 perspective

**Question 6.** Do you agree to send LS to RAN1 including above information/question?

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| --- | --- | --- |
| ***Company name*** | ***Yes/No*** | ***Comment*** |
| Huawei, HiSilicon | Yes | We think a LS to RAN1 is needed, including:   * Indicate to RAN1 that from RAN2 perspective, RedCap UEs need to be identified by the network during which step (according to conclusion of Question 1-5)   Ask RAN1 whether they have identified the need for earlier identification from RAN1 perspective |
| Qualcomm | No | * Our understanding is that RAN1 are already discussing identification in msg1/A transmission. So we don’t have to inform them this issue. * Identification in msg3/A payload has no impact on RAN1. So we don’t need inform RAN1 about it. |
| Samsung | No | The LS would not be needed at the moment, as whether to indicate it in Msg1 (e.g. using a different PRACH resource/BWP) purely depends on the RAN1 issue (e.g. coverage). We think RAN2 can wait for RAN1 progress. |
| Intel | No | Since the two actionable items for RAN1 are anyway going to be discussed in upcoming RAN1 meeting based on decision from last meeting. |
| Apple | No | RAN1 is already discussing. |
| Futurewei | Yes | To indicate that RAN2 may introduce Redcap indication in MSG3 if it is not needed for MSG2 reception and MSG3 transmission. |
| vivo | No | As far as I know, RAN1 has already initialized the corresponding discussion. RAN2 could just wait for more progress on coverage issue, scheduling restriction, and separate initial BWP for RedCap UEs from RAN1. |
| Ericsson | No | RAN2 can start to draft text to TR from RAN2 viewpoint e.g. by listing the different options and listing pros and cons and impact of each of the alternatives.  In our understanding RAN1 is already analysing the options from RAN1 perspective, especially whether indication in Msg1 is required for RedCap UEs for proper operation. |
| CATT | No strong view | We think R1 will anyway discuss on the topic. If the LS is sent it can just capture R2’s agreements on the topic. |
| Sharp | No | RAN1 is already discussing. |
| OPPO | No | Since RAN1 is already aware of the situation. |
| NEC |  | no strong view, as we expect that RAN1 will inform RAN2 of their progress via LS anyway. |
| Nokia, Nokia Shanghai Bell |  | It would seem beneficial to inform them about RAN2 agreement once made. |
| ZTE | No |  |
| Xiaomi | No | RAN1 is discussing this. |
| Lenovo / Motorola Mobility | Yes | An LS would definitely help RAN1 to further progress on the topic. |
| MediaTek | No | We do not see a strong reason to send an LS to RAN1 on this topic. |
| LGE | No | We suggest to wait for RAN1 progress. |
| Sequans | Yes | While this is already discussed in RAN1, since the SI phase is rather short it could help speed thing up, especially w.r.t constraints on MSG4/5 scheduling, which is less straightforward than their discussion on the RACH issue |
| Fujitsu | No | RAN1 has already started the discussion on whether there is need to identify RedCap UE during msg1/msgA transmission. If RAN1 has confirmed the need, LS is sent to RAN2. RAN2 can just wait the LSin and start later discussion. |
| Spreadtrum | Yes | Agree with Lenovo / Motorola Mobility, but just to inform RAN2 analysis or preference, not RAN2 conclusion. |
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## Access restrictions

### UAC

In the last meeting, RAN2 has confirmed that UAC also applies to RedCap UEs and agreed to further discuss enhancement of UAC for REDCAP UEs, including e.g.:

* 1. define new Access Identity for REDCAP UEs
  2. define new Access Categories for REDCAP UEs

Considering that UAC is SA1 scope, LS to SA1 is needed.

**Question 7.** Do you agree to send LS to SA1 (cc CT1?) about UAC enhancement for RedCap UEs? If yes, what should be included in the LS?

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| --- | --- | --- |
| ***Company name*** | ***Yes/No?*** | ***Comments*** |
| Huawei, HiSilicon | Yes | If both legacy eMBB UEs and Redcap UEs are served by the same cell, we can see the motivation to control the access of RedCap UEs separately. But we think UAC is a pure SA1 issue. Thus, we support to send a LS to SA1 (maybe cc CT1), including:   * Indicate SA1 the motivation to have UAC enhancement from RAN2 perspective * Ask SA1 opinion regarding UAC enhancements for RedCap UEs |
| Qualcomm | Yes | The LS should include the motivations for UAC enhancements for RedCap and what RAN2 expect from the enhancements.  But this LS is better be sent after RAN1/2 have agreed on the number of RedCap UE types. |
| Samsung | Yes but | Similar view to Qualcomm: in principle, we should inform SA1/CT1 of the corresponding update (if agreed), but RAN2 should make further progress to ask them for certain actions to SA1/CT1. |
| Intel | Y | Ask them whether current access identifies/access categories can be reused for RedCap UEs. If yes, then CT1 does not need to introduce new access identifies and access categories. |
| Apple | Yes to send LS and then take this up based on their response. |  |
| Futurewei | Yes | We are fine with sending an LS either now to inform them the intention of using access identity/access category for Redcap access control or later after more progress are made on the possible types of Redcap UE. |
| vivo | Yes | We should inform SA1/CT1 the motivation for UAC enhancement from RAN2 perspective, and the above potential enhancements, either now or after making more progress. |
| Ericsson | Yes but | Agree with Samsung view.  Initially we can focus to capture analysis of solutions(s) in TR from RAN2 point of view, including the impact in other WGs (in this case at least SA1 and CT1). We don’t think there is a hurry to send LS right now until e.g. the UE type discussion is progressed. Also, a response from SA1/CT1 should not be needed for RAN2 to conclude the SI.  We can inform SA1 that RAN2 is working on RedCap and use of UAC to control the access and whether they see any issues. Depending on timing of the LS, if RAN2 has agreed to pursue a specific solution or if as a result of an analysis there is a clear recommended solution from RAN2 perspective, we can ask SA1 to consider specifying such solution. |
| CATT | Yes | We tend to agree with comments from Ericsson. |
| Sharp | Yes | To inform SA1/CT1 our motivation and conclusions on UAC. We are fine to send the LS now or after more progress on UE type. |
| OPPO | Yes | To indicate SA1 our agreements on introducing RedCap UE type and UAC enhancement and ask SA1 to provide any UAC solutions. |
| NEC | Yes | we are fine to send an LS, but the question should be the simplest one, e.g. asking a need of introducing a) and/or b). |
| Nokia | No | These WGs should have been included in the earlier phase already (ie. in the WID). |
| ZTE | Yes | We think it would be beneficial to inform SA1 the current progress in RAN2, and ask for opinions on the solutions. |
| Xiaomi | Yes | Agree with Ericsson. There is no a hurry to send LS right now until RAN2 has a clear solution on how UAC should be enhanced, e.g. to reuse current access identifies/access categories or add new ones. |
| Lenovo / Motorola Mobility | No | We think UAC enhancements are needed. However, we think it’s too early to send an LS as we are still in study phase. It makes sense to send an LS to SA1 once RAN2 concludes to define new Access Identities/Categories for Redcap UEs. |
| MediaTek | Yes | Agree with Huawei that UAC is a SA1 topic and therefore the LS should include our motivations, and ask them for their opinion. |
| LGE | Yes |  |
| Sequans | Yes | We think an early LS can still be beneficial since this is a SA1 topic. If they have comments it can be helpful to focus the discussion; if not, no harm done and we can send another LS with more complete details when they are available, even later and with more details than if nothing was ever sent. |
| Fujitsu | Yes | We have similar views as companies that the LS can include the motivations for UAC enhancements for RedCap UEs and whether SA1/CT1 see any issues. |
| Spreadtrum | No | We also think it’s too early to send an LS. |
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### Indication in system information

In the last meeting, RAN2 has confirmed that an indication in system information is needed to indicate whether a REDCAP UE can camp on the cell. Whether the indication is explicit or implicit is FFS.

According to online comments in the last meeting, whether an explicit indication is needed depends on other design aspects on initial access, e.g. if separate initial BWP or RACH partitioning is supported, explicit indication is not needed.

**Question 8.** Please companies provide your view on the indication in system information?

* Option 1: Explicit
* Option 2: Implicit and how?
* Option 3: Too early to decide

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| ***Company name*** | ***Option?*** | ***Comments*** |
| Huawei, HiSilicon | Option 3 | Whether to have an explicit or implicit indication depends on whether there is any RedCap-specific configuration in system information, e.g. separate initial UL/DL BWP or RACH resource for RedCap UEs.  There is no conclusion on this aspect yet. Thus we propose to discuss this FFS in WI phase. |
| Qualcomm | Option 3 | This question seems to be more of a stage-3 issue and hence may be discussed during WI phase. |
| Samsung | Option 3 | As indicated in our previous response, this can be achieved in many ways, so it is difficult to conclude it at the moment. |
| Intel | Option 3 | Can be discussed in normative phase. |
| Apple | Option -1 | We think some sort of SI needs to be broadcast to let the RedCap UE know if it can camp. We do agree that details need to be ironed out. We wonder if it’s a good approach to allow all RedCap UEs to RACH and then decide to allow or not (waste of resources/power)…some level of filtering should be done even before the RedCap decides to RACH. |
| Futurewei | Option 3 | Some indication will likely be present in system information. Whether it’d be explicit or implicit can be left to WI phase when more details become available. |
| vivo | Option 3 | This is related to the discussion on whether the configuration for RedCap UEs is different from non-RedCap UEs, e.g. seperate initial BWP.  Current conclusion that “*an indication in system information is needed to indicate whether a REDCAP UE can camp on the cell”* is enough for study item. Further decision on explicit or implicit indication can be discussed in work item phase. |
| Ericsson | Option 3 | We agree in principle with Apple, but in our understanding an implicit indication can achieve similar outcome.  Let’s capture analysis of alternatives in the TR, specific details can be discussed and agreed to in the normative phase. |
| CATT | Option 3 |  |
| Sharp | Option3 | It can be discussed in WI phase. |
| OPPO | Option 3 |  |
| NEC | Option 3 | agree that this can be further discussed during WI. |
| Nokia | Option 3 | Needed but stage-3 detail. |
| ZTE | Option 3 | We think it is better to indicate whether RedCap device access is allowed as early as possible (to save UE’s power). Whether the indication is explicit or implicit can be discussed during WI phase. |
| Xiaomi | Option 3 |  |
| Lenovo / Motorola Mobility | Option 3 | We have to conclude first whether there is a need to have separate initial BWP or RACH partitioning or not due to coverage enhancements. If this is the case, then an implicit indication looks acceptable if it would be in SIB1 in order not to delay decision on camping. Otherwise, we would prefer an explicit indication in SIB1. |
| MediaTek | Option 3 | This level of detail can be left to the WI phase. |
| LGE | Option 3 |  |
| Sequans | Option 3 |  |
| Fujitsu | Option 1 | The explicit indication is simple and straightforward. On the other hand, the implicit indication may depend on RAN1 design on the RedCap UE’s initial access, or may have some restriction on the network configuration, which depends on the specific option for the implicit indication. Therefore, we slightly prefer the explicit indication. We also agree that this can be decided in WI phase. |
| Spreadtrum | Option 3 | We propose to discuss this FFS in WI phase. |

There is also a FFS regarding whether to reuse the legacy intraFreqReselection or introduce a separate flag.

**Question 9.** Please companies provide your view on intraFreqReselection?

* Option 1: reuse the legacy intraFreqReselection
* Option 2: introduce separate flag
* Option 3: Too early to decide

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| ***Company name*** | ***Option?*** | ***Comments*** |
| Huawei, HiSilicon | Option 3 | We need to know the details of the enabling/disabling indication first. Thus we propose to discuss this FFS in WI phase. |
| Qualcomm | Option 2 | We prefer a separate flag. But we agree this issue can be discussed later during WI phase. |
| Samsung | Option 3 | This can be discussed in the WI phase. |
| Intel | Option 3 | It is unclear why option 2 is needed. But would be ok to discuss it during WI phase. |
| Apple | Option 3, but | We also wonder on the availability of bits in MIB. SIB1 can take in more fields. |
| Futurewei | Option 3 | More considerations would be needed. |
| vivo | Option 3 | We agree to discuss it in WI phase. |
| Ericsson | Option 3 |  |
| CATT | Option 3 |  |
| Sharp | Option 3 |  |
| OPPO | Option 3 |  |
| NEC | Option 3 | this seems not something RAN2 needs to decide during SI |
| Nokia | Option 1 | MIB cannot really be extended, we see no use case or need for a new parameter. |
| ZTE | Option 3 |  |
| Xiaomi | Option 3 |  |
| Lenovo / Motorola Mobility | Option 1 | We think that use of intraFreqReselection has nothing to do with enabling/disabling indication of Redcap UEs.  The remaining question to Option 1 is on the UE behaviour when the field intraFreqReselection is set to "not allowed”. In Rel-16 the UE behaviour was changed for this case due to NR operation in unlicensed spectrum and private networks. We think Redcap UEs should follow the specified Rel-16 behaviour, i.e. if the field intraFreqReselection is set to "not allowed":   * Only if the cell operates in licensed spectrum or if the cell belongs to a PLMN which is indicated as being equivalent to the registered PLMN, then the UE excludes both the barred cell and the cells on the same frequency as a candidate for cell selection/reselection for 300 seconds.   Otherwise, the UE excludes only the barred cell as a candidate for cell selection/reselection for 300 seconds. |
| MediaTek | Option 3 | This level of detail can be left to the WI phase. |
| LGE | Option 3 | We prefer to discuss this issue during the WI phase. |
| Sequans | Probably option 2 | A separate flag seems to us more likely to be appropriate, but agree this should wait for the WI phase |
| Fujitsu | Option 2 | A separate flag for RedCap UE is slightly preferred to allow normal UEs and RedCap UEs to reselect different cells on one frequency. We also agree that this can be decided in WI phase. |
| Spreadtrum | Option 3 | This can be discussed in the WI phase. |

# Conclusion

This offline discussion focused on UE identification and access restrictions for RedCap UEs:

**TBD**

# References

1. RP-201677, “Revised SID on Study on support of reduced capability NR devices”, Ericsson, RAN#89-e, Online, September 14 - 18, 2020
2. R2-2008122, “Report from Break-out session on R16 eMIMO, CLI, PRN, RACS and R17 NTN and REDCAP”, Vice Chairman (ZTE Corporation), RAN2#111-e, Online, August 17 – 28, 2020
3. RAN1 minutes for RAN1#102-e
4. R2-2008192, “Summary of offline 110 - Identification and access restriction”, Huawei, RAN2#111-e, Online, August 17 – 28, 2020

# Contact delegates

|  |  |  |
| --- | --- | --- |
| **Delegate** | **Company name** | **Email** |
| Baokun Shan | Huawei, HiSilicon | baokun.shan@huawei.com |
| Naveen Palle | Apple | naveen.palle@apple.com |
| Hao Bi | Futurewei | Hao.bi@futurewei.com |
| Chenli | vivo | Chenli5g@vivo.com |
| Tuomas Tirronen | Ericsson | tuomas.tirronen@ericsson.com |
| Haitao Li | OPPO | lihaitao@oppo.com |
| Hisashi Futaki | NEC | hisashi.futaki [at]nec.com |
| Samuli Turtinen | Nokia, Nokia Shanghai Bell | samuli.turtinen@nokia-bell-labs.com |
| LiuJing | ZTE | liu.jing30@zte.com.cn |
| Hyung-Nam Choi | Lenovo | hchoi5@lenovo.com |
| Pradeep Jose | MediaTek | pradeep[dot]jose[at]mediatek.com |
| HyunJung Choe | LGE | stella.choe@lge.com |
| Noam Cayron | Sequans | noam.cayron@sequans.com |
| Xiangdong Zhang | Spreadtrum | Xiangdong.zhang@unisoc.com |