3GPP TSG-RAN WG1 Meeting #115 Draft R1-2312280

Chicago, USA, 13th – 17th November 2023

**Agenda Item: 8.4.1**

**Title: FL summary #1 on Rel-18 RedCap UE complexity reduction**

**Source: Moderator (Ericsson)**

**Document for: Discussion, Decision**

# Introduction

This feature lead (FL) summary (FLS) concerns the Rel-18 work item (WI) on enhanced support of reduced capability (RedCap) NR devices [1, 2]. The final FLS from the previous RAN1 meeting can be found in [3]. The RAN1 agreement summary from the previous RAN1 meeting is available in [4].

This document summarizes contributions [5] – [29] submitted to agenda item 9.4.1 and the following email discussion:

|  |
| --- |
| [115-R18-RedCap] Email discussion on eRedCap – Johan (Ericsson)   * To be used for sharing updates on online/offline schedule, details on what is to be discussed in online/offline sessions, Tdoc number of the moderator summary for online session, etc. |

Issues in this document are tagged and color coded with High Priority, Medium Priority, and Low Priority, and the issues that are in the focus of the initial discussion round are furthermore tagged FL2.

Follow the naming convention in this example:

* *eRedCapFLS1-v000.docx*
* *eRedCapFLS1-v001-CompanyA.docx*
* *eRedCapFLS1-v002-CompanyA-CompanyB.docx*
* *eRedCapFLS1-v003-CompanyB-CompanyC.docx*

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

* Assume CompanyC wants to update *eRedCapFLS1-v002-CompanyA-CompanyB.docx*.
* CompanyC uploads an empty file named *eRedCapFLS1-v003-CompanyB-CompanyC.checkout.*
* CompanyC checks that no one else has created a checkout file simultaneously, and if there is a collision, CompanyC tries to coordinate with the company who made the other checkout (see, e.g., contact list below).
* CompanyC then has 30 minutes to upload *eRedCapFLS1-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.

In file names, please use the hyphen character (not the underline character) and include ‘v’ in front of the version number, as in the examples above and in line with the general recommendation (see slide 11 in [R1-2310782](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_115/Docs/R1-2310782.zip)), otherwise the sorting of the files will be messed up (which can only be fixed by the RAN1 secretary).

To avoid excessive email load on the RAN1 email reflector, please note that there is NO need to send an info email to the reflector just to inform that you have uploaded a new version of this document. Companies are invited to enter the contact info in the table below.

**FL2 Question 0-1a: Please consider entering contact info below for the points of contact for this email discussion.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Point(s) of contact** | **Email address(es)** |
| vivo | Lihui Wang | wanglihui@vivo.com |
| Nordic | Karol Schober | karol.schober@nordicsemi.no |
| CMCC | Jiazhen Zhang | zhangjiazhen@chinamobile.com |
| Sharp | Xiaojun Ma | xiaojun.ma@cn.sharp-world.com |
| ZTE, Sanechips | Youjun Hu | hu.youjun1@zte.com.cn |
| Spreadtrum | Sicong Zhao | sicong.zhao@unisoc.com |
| CATT | Yongqiang Fei | feiyongqiang@catt.cn |
| FUTUREWEI | Vip Desai | vipul.desai@futurewei.com |
| Panasonic | Shotaro Maki | maki.shotaro@jp.panasonic.com |
| Nokia, NSB | Rapeepat Ratasuk | rapeepat.ratasuk@nokia.com |
| NTT DOCOMO | Mayuko Okano | mayuko.okano.ca@nttdocomo.com |
| LG Electronics | Seungjin Ahn | seungjin.ahn@lge.com |
| NEC | Takahiro Sasaki | takahiro.sasaki@nec.com |
| Ericsson | Sandeep Narayanan Kadan Veedu | sandeep.narayanan.kadan.veedu@ericsson.com |
| Xiaomi | Xuemei Qiao | qiaoxuemei@xiaomi.com |
| SONY | Martin Beale | martin.beale@sony.com |
| OPPO | Zhisong Zuo | Zuozhisong@oppo.com |

# 1 Early indication

RAN1#113 made the following agreements regarding the early indication via Msg1/MsgA PRACH [4]:

|  |
| --- |
| Agreement:   * A network-configurable additional separate early indication in Msg1 for Rel-18 eRedCap UEs is supported.   + When Msg1 indication for Rel-18 eRedCap UEs is configured, it is used by Rel-18 eRedCap UEs (with or without UE BB bandwidth reduction). * When Msg1 indication for Rel-18 eRedCap UEs is not configured while Msg1 indication for Rel-17 RedCap UEs is configured, Rel-18 eRedCap UEs shall share the PRACH that is configured for Rel-17 RedCap UEs.   + Note: Rel-18 eRedCap UEs will be differentiated from Rel-17 RedCap UEs based on Msg3 of Rel-18 eRedCap UEs. * Additional early indication in MsgA PRACH is not supported. |

The following contribution discusses early indication via Msg1/MsgA PRACH:

|  |  |  |  |
| --- | --- | --- | --- |
| [11] | [R1-2311262](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311262.zip) (section 2.1) | Further consideration on specification for Rel-18 RedCap | OPPO |

Contribution [11] notes that it is unclear from the RAN1#113 agreement that a Rel-18 eRedCap UE should use Rel-17 RedCap MsgA PRACH resources if configured.

**FL1/FL2 High Priority Proposal 1-1a: When MsgA PRACH early indication for Rel-17 RedCap UEs is configured, Rel-18 eRedCap UEs shall share the MsgA PRACH that is configured for Rel-17 RedCap UEs.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| vivo | Y | Since it was agreed that additional early indication in MsgA PRACH is not supported, it is better for R18 eRedCap share Rel-17 MsgA PRACH rather than sharing non-RedCap UE’s MsgA PRACH. |
| Nordic | Y |  |
| CMCC | Y |  |
| Sharp | Y |  |
| ZTE, Sanechips | Y |  |
| Spreadtrum | Y |  |
| CATT | Y | Seems natural from previous agreement (additional separate indication in MsgA PRACH is NOT supported, so they should share the same MsgA PRACH) |
| FUTUREWEI | Y |  |
| Panasonic | Y |  |
| Nokia, NSB | Y |  |
| DOCOMO | Y |  |
| LG | Y | Same as CATT and VIVO |
| NEC | Y |  |
| OPPO | Y | We’d better to have the conclusion and inform RAN2. |
| Ericsson | Y |  |
| Samsung | Y |  |
| Xiaomi | Y |  |
| SONY | Y |  |

# 2 Random access timeline relaxation

RAN#114bis made the following agreements regarding the random access timeline relaxation [3, 4]:

|  |
| --- |
| Agreement:   * The following does not apply to FG 48-2 UEs for CFRA:   + RAR PDSCH timeline relaxation   Agreement:  For which (if any) of the following 2-step RACH cases, continue to discuss if there is a need to update the specifications to reflect the RAN1 agreement that RAR PDSCH timeline relaxation does not apply to FG 48-2 UEs for CFRA:   * Case 2a: Between reception of fallbackRAR and transmission of Msg3 * Case 2b: Between reception of successRAR and transmission of corresponding HARQ-ACK * Case 2c: Between reception of MsgB PDSCH scheduled by MSGB-RNTI in which UE does not correctly receive the transport block in the corresponding PDSCH within the window and transmission of only PRACH according to Type-1 random access procedure or to transmit both PRACH and PUSCH according to Type-2 random access procedure. * Case 2d: Between reception of MsgB PDSCH scheduled by MSGB-RNTI with RAPID which is not associated with the corresponding PRACH transmission from the UE and transmission of only PRACH according to Type-1 random access procedure or to transmit both PRACH and PUSCH according to Type-2 random access procedure. |

The relevant specification text in 38.213 clause 17.1A [36] is inserted below (with some parts highlighted), where the first paragraph corresponds to Case 2a, the middle paragraph to Case 2c/2d, and the last paragraph to Case 2b.

|  |
| --- |
| When  - a UE receives a PDSCH scheduled by a DCI format with CRC scrambled by a RA-RNTI or a MsgB-RNTI over a number of PRBs that is larger than 25 PRBs for 15 kHz SCS or larger than 12 PRBs for 30 kHz SCS, and  - the PDSCH includes a RAR message with an RAR UL grant scheduling a Msg3 PUSCH transmission from the UE, as described in Clauses 8.2 and 8.2A  the UE transmits the Msg3 PUSCH if a time between the last symbol of a PDSCH reception conveying the RAR message and the first symbol of the Msg3 PUSCH transmission is not smaller than msec for 15 kHz SCS or msec for 30 kHz SCS where and are defined in clause 8.3; otherwise, the UE behaviour is based on UE implementation.  When  - a UE receives a PDSCH scheduled by a DCI format with CRC scrambled by a RA-RNTI or a MsgB-RNTI over a number of PRBs that is larger than 25 PRBs for 15 kHz SCS or larger than 12 PRBs for 30 kHz SCS, and  - the UE does not correctly receive the transport block provided by the PDSCH, or if the higher layers at the UE do not identify a RAPID associated with a corresponding PRACH transmission from the UE  if requested by higher layers, the UE shall be ready to transmit a PRACH no later than msec for 15 kHz SCS, or no later than msec for 30 kHz SCS, after the last symbol of the PDSCH reception, or after the last symbol of the window as described in Clauses 8.2 and 8.2A.  When  - a UE receives a PDSCH scheduled by a DCI format with CRC scrambled by MsgB-RNTI over a number of PRBs that is larger than 25 PRBs for 15 kHz SCS or larger than 12 PRBs for 30 kHz SCS, and  - the PDSCH includes a RAR message that is for successRAR for the UE as described in Clause 8.2A  the UE transmits a PUCCH with HARQ-ACK information if a time between the last symbol of the PDSCH reception conveying the RAR message and the first symbol of the PUCCH transmission is not smaller than msec for 15 kHz SCS or msec for 30 kHz SCS; otherwise, the UE behaviour is based on UE implementation. |

The following contributions discuss random access timeline relaxation:

|  |  |  |  |
| --- | --- | --- | --- |
| [7] | [R1-2310992](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2310992.zip) (TP 3) | Discussion on further UE complexity reduction | ZTE, Sanechips |
| [8] | [R1-2311000](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311000.zip) (section 2.1) | Maintenance on UE complexity reduction for eRedCap | Panasonic |
| [9] | [R1-2311101](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311101.zip) (section 2) | Remaining issues on further UE complexity reduction | Vivo |
| [11] | [R1-2311262](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311262.zip) (section 2.2) | Further consideration on specification for Rel-18 RedCap | OPPO |
| [12] | [R1-2311346](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311346.zip) (section 3) | Remaining issues of Rel-18 RedCap | CATT |
| [13] | [R1-2311406](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311406.zip) (section 2.1) | Discussion on further complexity reduction for eRedCap UEs | Xiaomi |
| [14] | [R1-2311486](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311486.zip) (section 2.4) | Maintenance on further complexity reduction for eRedCap | CMCC |
| [16] | [R1-2311545](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311545.zip) | Remaining issues on UE complexity reduction for eRedCap UEs | China Telecom |
| [17] | [R1-2311626](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311626.zip) (section 2.2) | Maintenance on further UE complexity reduction for eRedCap | NTT DOCOMO, INC. |
| [18] | [R1-2311688](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311688.zip) (section 2.1) | Further RedCap UE complexity reduction | Apple |
| [19] | [R1-2311746](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311746.zip) (proposal 1) | Discussion on UE complexity reduction | DENSO CORPORATION |
| [21] | [R1-2311786](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311786.zip) (issue 1/2) | Remaining Issues for eRedCap | Nokia, Nokia Shanghai Bell |
| [24] | [R1-2311894](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311894.zip) (issue 1) | Remaining issues of further UE complexity reduction for eRedCap | LG Electronics |
| [25] | [R1-2311978](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311978.zip) | Maintenance on eRedCap UE complexity reduction | MediaTek Inc. |
| [26] | [R1-2312040](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2312040.zip) (section 2.1) | UE complexity reduction for eRedCap | Qualcomm Incorporated |
| [27] | [R1-2312126](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2312126.zip) (section 2.1) | On maintenance of further complexity reduction of NR UE | Nordic Semiconductor ASA |
| [29] | [R1-2312204](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2312204.zip) (section 2.1) | Maintenance issues for UE Redcap | Sony |

Several contributions express that one or more of the cases may not valid or already covered by current specification:

* For Case 2a, several contributions [9, 13, 17, 19, 21, 24, 25] claim that it is not valid in 2-step CFRA.
* For Case 2b, some contributions [12, 17, 24, 25] express that the current specification already allows PUCCH to be transmitted without timeline relaxation thanks to the formulation “otherwise, the UE behaviour is based on UE implementation”, which does not preclude earlier PUCCH transmission.
* For Case 2c/2d, some contributions [17, 21, 24, 25] express that the current specification already allows PRACH to be transmitted without timeline relaxation thanks to the formulation “the UE shall be ready to transmit a PRACH no later than”, which does not preclude earlier PRACH transmission.

As a result, there are different views regarding the need for specification changes:

* Some contributions [16, 18, 29] propose to confirm that the random access timeline relaxation does not apply for Cases 2a/2b/2c/2d for CFRA for an FG 48-2 UE.
* Several contributions [7, 11, 13, 14, 19, 21, 26] express that a spec update is needed for one or more valid cases, and contributions [7, 11, 14, 26] provide corresponding TPs for 38.213.
* Several contributions [8, 9, 24, 25, 27] express that no spec update is needed for any of the cases.
* Some contributions [12, 17] express that either the spec should be updated for the valid cases, or it should be clarified that according to the current spec, an FG 48-2 UE does not apply relaxed timeline for 2-step CFRA.

Companies are invited to reply to the following question:

**FL1 High Priority Question 2-1a: Companies are invited to indicate a preference between these options.**

* **Option 1: Make a RAN1 conclusion that the current specification reflects the RAN1 agreement that RAR PDSCH timeline relaxation does not apply to FG 48-2 UEs for CFRA.**
* **Option 2: Update the RAN1 specification to reflect the RAN1 agreement that RAR PDSCH timeline relaxation does not apply to FG 48-2 UEs for CFRA.**
* **Option 3: Other way forward (please elaborate in the comment field).**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comments** |
| Vivo | Opt.1 | For case 2a, Msg.3 does not exist for 2-step CFRA.  For case 2b, it does not exist for 2-step CFRA. Because the successRAR is used for contention resolution for contention based 2-step RACH.   * In TS 38.321 spec, the successRAR is to response for the MsgA PUSCH which includes the CCCH, and CCCH is used for CBRA for Idle/inactive UEs, not for CFRA for connected UEs. In addition, in TS38.321 Figure 6.2.3a-2, successRAR includes the UE Contention Resolution Identity which is used for CBRA, not CFRA.   For case 2c and 2d, the spec says ”the UE shall be ready to transmit a PRACH no later than...”, it does not restrict the UE to transmit PRACH in earlier timing. |
| Nordic | Option1 |  |
| CMCC | Option2 | For case 2a, when fallback to 4-step CFRA, Msg.3 does not exist.  For case 2b, successRAR does not exist for 2-step CFRA.  For case 2c and 2d, UE retransmits PRACH depends on its capability, the spec should restrict RAR timeline relaxation is only for FG48-1 UE, and FG48-2 UE in idle mode. |
| Sharp | Option1 |  |
| ZTE, Sanechips | Opt3 | For the paragraph with “the UE shall be ready to transmit a PRACH no later than”, we do not have strong view to change, because it does not restrict the UE to transmit PRACH earlier.  However, for the paragraph with “otherwise, the UE behaviour is based on UE implementation”, it is better to have some change, because, if the timeline for on PUCCH is earlier, up to UE implementation means the UE may not send PUCCH even the UE can handle it. Additionally, if there is no change, it actually reverts the agreement. |
| Spreadtrum | Option 1 |  |
| CATT | Option 1 (1st)  Option 2 (2nd, only for 2c, 2d) | As we mentioned in our paper, **case 2b is invalid** because MsgA PUSCH shall carry C-RNTI in CFRA. If MsgA PUSCH is successfully decoded by gNB, the gNB shall schedule the subsequent PDSCH with C-RNTI. There is no PDSCH carrying successRAR asking HARQ-ACK feedback.  Having said this, we 1st prefer Option 1. If we really need to update specification, only 2c and 2d shall be considered. |
| FUTUREWEI | Option 1 |  |
| Panasonic | Option 1 | In the CFRA case, the PDSCH can be scheduled with C-RNTI and then the separate handling between FG 48-1 and 48-2 is possible. The cases 2a/2b/2c/2d using MSGB-RNTI are not required to be optimized. |
| Nokia, NSB | Option 1 | We think Option 1 is the best option. The relaxed timeline is not applicable to Case 2a. For 2c/2d, the UE can already transmit the PRACH earlier than the indicated timeline. For 2b, there is no need to optimize. |
| DOCOMO | Option 1 | We don’t see the strong need but tend to agree with ZTE that it should be clarified the details of FG48-2 UE behavior on “otherwise, the UE behaviour is based on UE implementation”. |
| LG | Option 1 | We think that the pink screened phrases can cover 2c,2d cases to FG 48-2 for CFRA on timeline relaxation. The others cannot exist. |
| NEC | Option 1 |  |
| QC | Option 2 | We disagree with the statement that “otherwise, the UE behaviour is based on UE implementation” or “the UE shall be ready to transmit a PRACH no later than” already capture the agreement because earlier PUCCH/PRACH transmission is not precluded. With all due respect, we have to say that statement is against basic RAN1 logic/philosophy. With CFRA, that max time gap should be 1 slot shorter. Current specification erroneously specified 1 slot longer max time gap for PUCCH/PRACH transmission for CFRA. Current specification allows correct UE behavior by so called “earlier PUCCH/PRACH transmission”. But Current specification also allows wrong UE behavior by allowing that UE send PUCCH/PRACH later, with time gap larger than it supposed to be, which is a UE behavior violates the agreement that FG 48-2 UEs for CFRA does not need RAR PDSCH timeline relaxation.  In summary, we think current specification is not following the agreement, which should be modified to capture the agreement. This is a RAN1 procedure we should follow. |
| OPPO | Option 2 | At least the Case 2c and Case 2d need some clarification in the specification, otherwise, the spec. are not inline with the last meeting conclusion. |
| Ericsson | Option 2 | We think there should be spec update(s) to capture cases 2c and 2d. |
| Samsung | Option 1 |  |
| Xiaomi | Option 2 | Capture case 2c and 2d. |
| SONY | Option 2 | The current specs say nothing about when the FG48\_2 UEs should transmit a response to the RAR. For example, for case 2a, we know that the FG48\_1 UE should transmit a response to RAR if the RAR-to-PUSCH time is greater than ms. An FG48\_2 UE can send PUSCH if the timeline is shorter than ms (the spec says that it is up to implementation), but how short? Is it OK that the FG48\_2 UE responds if the gap is ms? Should it respond if the gap is ms? What about a shorter gap than that?  It basically seems unclear what timeline the FG48\_2 UE needs to meet. Hence, we think that a specification change would be beneficial. |
| FL2 | Most received responses expressed a preference for Option 1, but there was also some support for Option 2. Some responses expressed that for Case 2c/2d, the formulation “the UE shall be ready to transmit a PRACH no later than” is not stringent enough. Perhaps the following proposal can be considered to address the concerns for Case 2c/2d.  **High Priority Proposal 2-1b: Adopt the following TP for 38.213 clause 17.1A:**   |  | | --- | | For a UE not supporting FG 48-2 performing random access procedure, and for a UE supporting FG 48-2 performing contention-based random access procedure, w~~W~~hen  - a UE receives a PDSCH scheduled by a DCI format with CRC scrambled by a RA-RNTI or a MsgB-RNTI over a number of PRBs that is larger than 25 PRBs for 15 kHz SCS or larger than 12 PRBs for 30 kHz SCS, and  - the UE does not correctly receive the transport block provided by the PDSCH, or if the higher layers at the UE do not identify a RAPID associated with a corresponding PRACH transmission from the UE  if requested by higher layers, the UE shall be ready to transmit a PRACH no later than msec for 15 kHz SCS, or no later than msec for 30 kHz SCS, after the last symbol of the PDSCH reception, or after the last symbol of the window as described in Clauses 8.2 and 8.2A. | | |
| **Company** | **Y/N** | **Comments** |
| Nordic | N | In CFRA, a UE does not get DCI format with CRC scrambled with MSGB or RA RNTI. No change needed |
| Sharp | N | We don’t think the change is necessary. The time for UE to transmit PRACH is requested by UE highlayer. The UE knows its capability and can trans PRACH as early as possible, “no later than” has covered this possibility. |
| CMCC | Y |  |
| Nokia, NSB | N | We do not think this change is necessary as UE can always transmit PRACH earlier. |
| ZTE, Sanechips |  | For PRACH transmission, we are OK with it and also OK with no change.  For PUCCH feedback, we think it is more important to have a change. |
| Panasonic |  | We do not yet think the TP is essential. The first reason is that it would not be a usual case that the PDSCH is scheduled with MSGB-RNTI during CFRA. The second reason is that the earlier PRACH transmission by FG 48-2 UEs is still allowed even by the current spec, as companies mentioned. |
| vivo | N | Same views as Nokia. |
| LG | N | We think that the red written phrases are not needed. The pink screened phrase means that the time periods is only a duration for preparation to transmit, the time when to transmit is up to UE decision in the aspect of UE implementation. Any UEs are not stopped from completing the preparation and transmitting earlier than the longest time duration at least. |
| Ericsson | Y |  |
| OPPO | Y | We are OK with the text proposal.  To those who think this should not introduced. The whole bullet in timeline in 17.1A is about UE not late than a relaxed time. But For FG 48-2 UE in CFRA, the gNB must expect that time earlier. |

# 3 Msg4 PDSCH bandwidth

RAN1#112bis-e sent the following LS to RAN2 in [30]:

|  |  |
| --- | --- |
| 1 Overall description  RAN1 discussed Msg4 PDSCH transmission to Rel-18 eRedCap UEs and made the following agreement:   |  | | --- | | Agreement  Confirm the following working assumption by assuming that Msg3 indication is available  Working Assumption   * For UE BB complexity reduction, a UE is able to receive a Msg4 PDSCH resource allocation spanning a bandwidth of more than ~5 MHz per slot.   + The UE is not required to process a Msg4 PDSCH with a larger number of PRBs than 25 PRBs for 15 kHz SCS and 12 PRBs for 30 kHz SCS. |   RAN1 would like to inform RAN2 about the following case, to consider, if needed, the UE behavior in the RAN2 specifications, and ask RAN2 for feedback if any:   * For UE BB complexity reduction, the case when the UE detects a DCI scheduling a Msg4 PDSCH transmission with a larger bandwidth than it can receive or process   The case was also discussed in RAN1 in Question 2.7-2b of summary [R1-2303936](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112b-e/Docs/R1-2303936.zip).  2 Actions  **To RAN2:**  **ACTION:** RAN1 respectfully requests RAN2 to take the above into account in their future work and to provide feedback to RAN1 if any. |

RAN1#114bis received the following LS reply from RAN2 in [31]:

|  |
| --- |
| **1. Overall Description:**  RAN2 would like to thank RAN1 on the LS on Msg4 PDSCH transmission to Rel-18 eRedCap UEs. RAN2 had some discussion on the issue mentioned in the LS, and achieved the following agreement:   * **An eRedCap UE considers the contention resolution not successful and stop the *ra-ContentionResolutionTimer*, when the UE detects a PDCCH transmission addressed to its TEMPORARY\_C-RNTI with a DCI that schedules a Msg4 PDSCH transmission with a larger bandwidth than it can receive or process, i.e. option 1 is adopted.**   **2. Actions:**  **To RAN WG1:**  RAN2 kindly request RAN1 to take the above information into account, and provide feedback, if any. |

RAN1#114bis discussed the RAN2 reply and considered the following proposal without reaching a conclusion [3].

|  |
| --- |
| **RAN1#114bis High Priority Proposal 2.3-1c:**   * Conclusion: It is up to UE implementation about how the physical layer notifies higher layers when it detects a DCI that schedules a Msg4 PDSCH transmission with a larger bandwidth than the UE can receive or process. |

The following contributions discuss Msg4 PDSCH bandwidth:

|  |  |  |  |
| --- | --- | --- | --- |
| [5] | [R1-2310820](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2310820.zip) (section 2.1) | Maintenance of R18 RedCap | FUTUREWEI |
| [9] | [R1-2311101](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311101.zip) (section 4) | Remaining issues on further UE complexity reduction | Vivo |
| [15] | [R1-2311541](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311541.zip) | Maintenance on Rel-18 RedCap UE | NEC |
| [17] | [R1-2311626](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311626.zip) (proposal 2/3) | Maintenance on further UE complexity reduction for eRedCap | NTT DOCOMO, INC. |
| [19] | [R1-2311746](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311746.zip) (proposal 2) | Discussion on UE complexity reduction | DENSO CORPORATION |

The above contributions express the following views on Msg4 PDSCH bandwidth:

* Contribution [5] expresses that Msg4 PDSCH bandwidth restriction should be applied to FG 48-2 UE in RRC\_IDLE and RRC\_INACTIVE.
* Contribution [9] proposes to apply Msg4 PDSCH bandwidth restriction to FG 48-2 UE in RRC\_INACTIVE.
* Contribution [15] proposes that the Msg4 PDSCH bandwidth restriction only applies in RRC\_IDLE or CBRA.
* Contribution [17] expresses that it would be unnecessary for an FG 48-2 UE to stop the contention resolution timer when it encounters a Msg4 PDSCH larger than 25/12 PRBs for 15/30 kHz SCS.
* Contribution [19] proposes to discuss the potential physical layer notification to higher layers when the RAN2 specifications are more complete.

Companies are invited to comment on the question below.

**FL1 Medium Priority Question 3-1a: To avoid that the contention resolution timer is stopped unnecessarily if/when gNB happens to schedule a Msg4 PDSCH wider than 25/12 PRBs for 15/30 kHz SCS (e.g., to non-eRedCap UEs), would it be acceptable to agree the following TP for 38.213 clause 17.1A?**

|  |  |  |
| --- | --- | --- |
| A UE not supporting FG 48-2 is not required to process a PDSCH reception that is scheduled by a DCI format with CRC scrambled by a TC-RNTI over a number of PRBs that is larger than 25 PRBs for 15 kHz SCS, or larger than 12 PRBs for 30 kHz SCS, in a slot. | | |
| **Company** | **Y/N** | **Comments** |
| vivo | N | Same procedure applies to FG48-1 and 48-2 RedCap UEs during the initial access. |
| Nordic | No | do not support change. |
| Sharp | N | For CBRA, the same procedure should be applied for FG48-1 and FG48-2 UEs. For CFRA, there are no msg4 PDSCH scheduled by TC-RNTI. |
| ZTE, Sanechips | N |  |
| Spreadtrum | N |  |
| CATT | N | In RRC\_IDLE or RRC\_INACTIVE, gNB cannot distinguish FG 48-1 or FG 48-2 UE, so it is unlikely to schedule >5MHz Msg4 for either FG 48-1 or FG 48-2 UE. |
| FUTUREWEI | N | A FG 48-2 UE follows the same initial access procedures as a FG 48-1 UE |
| Nokia, NSB | N |  |
| DOCOMO |  | While we don’t see the strong need to apply the new behavior of contention timer to UE supporting FG48-2, we are fine without this spec change at least it is clarified whether to apply Msg4 PDSCH BW restriction and corresponding behaviour related to contention resolution timer is applied to UE supporting FG48-2. |
| LG | N | Same as FUTUREWEI, CATT, VIVO |
| NEC | N |  |
| QC | Yes | We support the proposal to capture correct UE behavior. Specification is written for UE to follow. It is simply a factor that a UE supporting FG 48-2 can process Msg 4 wider than 25/12 PRBs for 15/30 kHz SCS. If, from NW perspective, NW want to have unified behavior for PR1 PR3 UE thus does not schedule 25/12 PRBs for Msg 4, it is up to NW. Specification should not describe NW behavior. |
| OPPO | N | We see the spec. already cover the FG 48-1 behavior requested by RAN2. The stage has to treat FG 48-2 UE same way, since UE is not identified yet. |
| Ericsson | Y |  |
| Samsung | N |  |
| Xiaomi |  | Msg4 PDSCH limitation should be applied for FG 48-2 at least in the RRC idle mode. |
| SONY | N | FG48\_1 and FG48\_2 UEs should apply the same initial access procedure |
| FL2 | Based on the received responses, there does not seem to be much support for a spec change. | |

# 4 MBS PDSCH bandwidth

RAN1#114 and RAN#114bis made the following agreements on broadcast/multicast MBS PDSCH bandwidth [3, 4]:

|  |
| --- |
| Agreement:   * For UE BB bandwidth reduction, the number of PRBs scheduled in DCI can be larger than 25 PRBs for 15 kHz SCS and 12 PRBs for 30 kHz SCS for:   + Broadcast MBS PDSCH without any PDSCH in next slot   + Broadcast MBS PDSCH without MBS PDSCH repetition   Agreement:   * For a UE with BB bandwidth reduction, for multicast MBS specified in Rel-17, the number of PRBs scheduled in DCI is not larger than 25/15 PRBs for 15/30 kHz SCS (irrespective of whether HARQ feedback is enabled or disabled). |

The following contributions discuss broadcast/multicast MBS PDSCH bandwidth:

|  |  |  |  |
| --- | --- | --- | --- |
| [5] | [R1-2310820](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2310820.zip) (section 2.2) | Maintenance of R18 RedCap | FUTUREWEI |
| [6] | [R1-2310857](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2310857.zip) (section 2.2.1) | Maintenance on Rel-18 RedCap | Huawei, HiSilicon |
| [12] | [R1-2311346](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311346.zip) (section 2.2) | Remaining issues of Rel-18 RedCap | CATT |
| [13] | [R1-2311406](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311406.zip) (section 2.2) | Discussion on further complexity reduction for eRedCap UEs | Xiaomi |
| [14] | [R1-2311486](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311486.zip) (section 2.1) | Maintenance on further complexity reduction for eRedCap | CMCC |
| [17] | [R1-2311626](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311626.zip) (section 2.3) | Maintenance on further UE complexity reduction for eRedCap | NTT DOCOMO, INC. |
| [20] | [R1-2311749](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311749.zip) (issue 1) | Remaining issues on UE complexity reduction | Sharp |
| [26] | [R1-2312040](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2312040.zip) (section 3.1) | UE complexity reduction for eRedCap | Qualcomm Incorporated |

The contributions express the following views regarding broadcast MBS:

* For broadcast MBS with other PDSCH in next slot or with MBS PDSCH repetition, contribution [12] proposes that it should be supported when the number of PRBs is not larger than 25/12 PRBs for 15/30 kHz, while contributions [13, 14] propose that it can be up to UE implementation whether larger number of PRBs is also supported.
* The Rel-18 broadcast MBS feature for RedCap-specific CFR is brought up in contribution [17] which proposes that it should be supported with other PDSCH in next slot or with MBS PDSCH repetition even when the number of PRBs is larger than 25/12 PRBs for 15/30 kHz SCS.
* Contribution [20] proposes that the UE should be able to receive MCCH PDSCH with larger number of PRBs than 25/12 PRBs for 15/30 kHz SCS when another PDSCH is scheduled in the same slot.
* Contribution [20] proposes that the same broadcast MBS procedure should be used for UEs with and without UE BB bandwidth reduction.
* Contribution [6] provides a TP for 38.213 clause 17.1A to rewrite the broadcast MBS paragraph to refer to slots {*n*-1, *n*} instead of slots {*n*, *n*+1}.

The contributions express the following views regarding multicast MBS:

* The Rel-18 multicast MBS feature for inactive state is brought up in contributions [5, 26] which propose that it should support the same number of PRBs as broadcast MBS (without any PDSCH in next slot, and without MBS PDSCH repetition), whereas contribution [12] instead proposes that it supports the same number of PRBs as Rel-17 multicast MBS for connected state.

Companies are invited to comment on the questions below.

**FL1 High Priority Question 4-1a: Please indicate your preference among the following options:**

* **Option 1: For UE BB bandwidth reduction, the number of PRBs scheduled in DCI is not larger than 25/12 PRBs for 15/30 kHz SCS for (Rel-17) broadcast MBS PDSCH with any PDSCH in next slot or MBS PDSCH repetition.**
* **Option 2: For UE BB bandwidth reduction, the number of PRBs scheduled in DCI can be larger than 25/12 PRBs for 15/30 kHz SCS for (Rel-17) broadcast MBS PDSCH with any PDSCH in next slot or MBS PDSCH repetition.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comments** |
| vivo | Option 2, but | Current spec reads like the option 2:  “A UE that has not indicated FG 48-2 is not required to process a PDSCH reception in slot that is scheduled by a DCI format with CRC scrambled by a G-RNTI for broadcast over a number of PRBs that is larger than 25 PRBs for 15 kHz SCS, or larger than 12 PRBs for 30 kHz SCS, when the PDSCH reception is with repetitions or when the UE receives another PDSCH in slot .”  But it seems not clear how to understand the UE behavior. Does above text mean the UE is not required to process a broadcast MBS PDSCH in slot n, but the UE should prioritize the broadcast MBS PDSCH repetition in slot n+1, over the repetition in slot n, if the broadcast MBS PDSCH is with repetition, and the UE should prioritize another PDSCH in slot n+1? Or the UE behavior is up to implementation for such case? |
| Nordic | Option 1 | i.e. current agreement |
| CMCC | Option2 | Current spec aligns with option 2. Supporting broadcast larger than 5MHz can avoid impose restriction on broadcast for legacy UEs. Considering capability of FG48-1 UE, it can process broadcast in one slot or one repetition. |
| Sharp | Option2 | “Can be larger than 25/12 PRBs” and “UE does not require to…” are not contradict. |
| ZTE, Sanechips | Option 2 | Actually, if gNB side restrict the broadcast PDSCH for eRedCap UE within 5MHz, it is unfair to the Rel-17 RedCap UE. Therefore, it is not Okay to restrict the broadcast bandwidth.  For the UE behavior, the UE should prioritize another PDSCH in slot n+1 if any. For the MBS PDSCH in slot n, it can be dropped or something else, which is up to UE implementation. |
| Spreadtrum |  | For option 1, we understand that the 48-1 UE can handle this case. Do we need to reflect this case in the spec?  For option 2, actually, we don’t think the current spec is align with option 2, option 2 didn’t say anything about UE behavior for dropping. Option 2 may require a higher UE capability, i.e., to process MBS in slot n, even when the PDSCH reception is with repetitions or when the UE receives another PDSCH in slot . Then, we are negative for option 2.   * If option 2 includes UE behavior for dropping, then we may need to make it more clear before we agree it, for example:   + Reuse the current spec, i.e., “the UE is not required to process a PDSCH reception in slot that is scheduled …”. If it is, option 2 is already included in the current spec...   + Up to UE implementation. |
| CATT | Option 2, but | Current spec looks like Option 1. (is NOT … when … or …). |
| FUTUREWEI | Option 1 |  |
| Panasonic | Option 2 | We assume the question is whether the scheduling is restricted or not. The Option 1, the scheduling restriction, would impact the non-eRedCap UE’s performance, which is not reasonable. The eRedCap UE behavior in that case can be up to the implementation. |
| Nokia, NSB | Option 2 | There should not be any scheduling restriction since this will impact Rel-17 RedCap UE. |
| DOCOMO | Option 2 | In our understanding, based on the previous meeting, at least UE can support option 1 case.  If only option 1 is supported, scheduling of the broadcast MBS PDSCH would be restricted even for legacy UEs if the NW accommodate eRedCap UEs. MBS features are not essential for eRedCap UEs with BB BW reduction, and hence we don’t see the need to optimize the scheduling of broadcast MBS PDSCH for eRedCap UEs. |
| LG | Option2 |  |
| QC |  | Maybe I missed something. But I think this issue has been discussed and resolved by previous agreement, no?  Agreement:   * For UE BB bandwidth reduction, the number of PRBs scheduled in DCI can be larger than 25 PRBs for 15 kHz SCS and 12 PRBs for 30 kHz SCS for:   + Broadcast MBS PDSCH without any PDSCH in next slot   + Broadcast MBS PDSCH without MBS PDSCH repetition |
| Ericsson | Option 2, but | The UE is not required to process the corresponding PDSCH, as per the current specification. |
| Samsung | Option 2 | Similar view with ZTE and Panasonic. We also think that the restriction on the broadcast bandwidth for non-eRedCap UE is not reasonable. |
| Xiaomi | Option 2 | For this issue, we assume there is a pre-condition that eRedCap should share the same broadcast MBS PDSC with non-eRedCap with the same CFR. So, it is not reasonable to affect legacy UE’s scheduling.  Besides, we think it is up to UE implementation for the case that the broadcast PDSCH CBW is larger than 25/12 PRBs and there is PDSCH in the next slot. |
| SONY | Option 1 | This is the current agreement.  If the gNB scheduled more than 5MHz of bandwidth for the MBS PDSCH, the FG48\_1 UE would not be able to receive that PDSCH. The gNB can schedule such a wide bandwidth MBS PDSCH, but the FG48\_1 UEs won’t receive it. Maybe the gNB would be OK scheduling this sort of MBS PDSCH in the knowledge that FG48\_1 UEs would not be able to receive the MBS PDSCH, but other UEs (Rel-17 UEs etc) could receive that MBS PDSCH. |
| FL2 | Based on the received responses, the following question regarding Option 2 can be considered.   * Option 2: For UE BB bandwidth reduction, the number of PRBs scheduled in DCI can be larger than 25/12 PRBs for 15/30 kHz SCS for (Rel-17) broadcast MBS PDSCH with any PDSCH in next slot or MBS PDSCH repetition.   **High Priority Question 4-1b: If Option 2 is adopted, would a spec change be needed?** | |
| **Company** | **Y/N** | **Comments** |
| Nordic | N | Option 2 is specified, but clearly does not match the agreement RAN1 made. |
| Sharp | Y | At least for MCCH |
| CMCC |  | Rewriting the broadcast MBS paragraph to refer to slots {*n*-1, *n*} instead of slots {*n*, *n*+1} can be considered to reduce complexity when UE decides which PDSCH is dropped. |
| ZTE, Sanechips |  | We are fine with option2. seems no spec change is needed. |
| Panasonic | N | There would be no additional scheduling restriction by the Option 2. So, no spec change is needed. |
| vivo |  | Option 2 is fine for us. Whether any spec update is needed depends on whether companies have the common understanding for UE behavior in slot n and/or slot (n+1).  Does option 2 mean the UE is not required to process a broadcast MBS PDSCH in slot n, but the UE should prioritize the broadcast MBS PDSCH repetition in slot n+1 over the repetition in slot n, if the broadcast MBS PDSCH is with repetition? and the UE should prioritize another PDSCH in slot n+1? Or the UE behavior is up to implementation for both slot n and slot n+1? |
| Spreadtrum | N | No spec change be needed.  As we commented in the last round. Option 2 didn’t say anything about UE behavior for dropping. The current option 2 may require a higher UE capability, i.e., to process MBS in slot n, even when the PDSCH reception is with repetitions or when the UE receives another PDSCH in slot . Therefore, we think UE dropping behavior for option 2 is required, and the current spec can be reused, i.e.,   * “A UE that has not indicated FG 48-2 **is not required to process a PDSCH reception in slot** that is scheduled by a DCI format with CRC scrambled by a G-RNTI for broadcast over a number of PRBs that is larger than 25 PRBs for 15 kHz SCS, or larger than 12 PRBs for 30 kHz SCS, when the PDSCH reception is with repetitions or when the UE receives another PDSCH in slot .”   Based on the above, no spec change would be needed. |
| LG | N | It is thought that a spec change is not needed. |
| Ericsson |  | To our understanding, the current specification supports Option 2 (i.e., the number of PRBs scheduled in DCI can be larger, but the UE is not required to process it).  Further, we support CMCC’s suggestion to rewrite the broadcast MBS paragraph to refer to slots {*n*-1, *n*} instead of slots {*n*, *n*+1}. |

**FL1/FL2 Medium Priority Question 4-2a: Please indicate your preference among the following options:**

* **Option 1: For UE BB bandwidth reduction, the number of PRBs scheduled in DCI is not larger than 25/12 PRBs for 15/30 kHz SCS for Rel-18 multicast MBS feature for inactive state.**
* **Option 2: For UE BB bandwidth reduction, the number of PRBs scheduled in DCI can be larger than 25/12 PRBs for 15/30 kHz SCS for Rel-18 multicast MBS feature for inactive state.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comments** |
| Nordic |  | This R18 feature combination is of lower priority, we should first resolve R17MBS with R18eRedCap. |
| CMCC | Option1 | Considering multicast UE in inactive mode and in connected mode may be in one group, the same bandwidth restriction is preferred. |
| ZTE, Sanechips |  | Agree with Nordic, there are many Rel-18 features also, and this MBS issue could be deprioritized, or other R18 features also should be treated. |
| Spreadtrum |  | Agree with Nordic, this R18 feature combination is of lower priority, we should focus on R17 MBS.  For R17 MBS, we understand that all the cases we discussed for R18 eRedCap is that the total span of R17 MSB CFR and RedCap BWP is no larger than 20MHz. This means for the case that the total span of MSB CFR and RedCap BWP is larger than 20MHz (as shown in the following figure), R18 eRedCap does not need to handle.    In order to avoid ambiguous, we suggest RAN1 to conclude the following:   * R18 eRedCap does not need to handle the case that the total span of R17 MSB CFR and RedCap BWP is larger than 20MHz. |
| CATT | Option 1 | Slightly prefer Option 1 to make multicast MBS easier. |
| FUTUREWEI | Option 2 | Slight preference for option 2 |
| Nokia, NSB | Option 2 | No strong view but we have slight preference for option 2. |
| DOCOMO | Option 1 | Agree with companies that this is low priority. |
| LG | Option 2 | We prefer Option 2 for flexibility. How to schedule MBS Broadcast PDSCH can be similarly applied to MBS Multicast PDSCH for inactive state. |
| NEC | Option 1 | The same behavior as in RRC\_CONNECTED would be preferable. |
| QC | Option 2 |  |
| Ericsson | Option 2 | Fine with down prioritizing this issue, as suggested by companies above. |
| Xiaomi | Both are OK | No strong view for this issue. |
| SONY | Option 1 | The FG48\_1 UE is a bandwidth-limited UE, so it should only have to receive a limited bandwidth. |
| vivo | Option 1 | Agree with Nordic, but if we need to discuss, option 1 is preferred for simplicity. |
| OPPO | Option 1 |  |

**FL1/FL2 Medium Priority Question 4-3a: Please indicate which (if any) of the following proposals you think should be prioritized in this meeting (and please elaborate in the comment field):**

* **Proposal 1: The Rel-18 broadcast MBS feature for RedCap-specific CFR is brought up in contribution [17] which proposes that it should be supported with other PDSCH in next slot or with MBS PDSCH repetition even when the number of PRBs is larger than 25/12 PRBs for 15/30 kHz SCS.**
* **Proposal 2: Contribution [20] proposes that the UE should be able to receive MCCH PDSCH with larger number of PRBs than 25/12 PRBs for 15/30 kHz SCS when another PDSCH is scheduled in the same slot.**
* **Proposal 3: Contribution [20] proposes that the same broadcast MBS procedure should be used for UEs with and without UE BB bandwidth reduction.**
* **Proposal 4: Contribution [6] provides a TP for 38.213 clause 17.1A to rewrite the broadcast MBS paragraph to refer to slots {*n*-1, *n*} instead of slots {*n*, *n*+1}.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Proposal(s)** | **Comments** |
| Nordic | None |  |
| CMCC |  | Proposal 4 can be further discussed. |
| Sharp | At least 2 | In 38.331, UE is requred to process the MCCH immediately if the DCI indicated a MCCH change notification. For this case, the UE should receive MCCH PDSCH with higher priority even if another PDSCH is scheduled in next slot. |
| ZTE, Sanechips |  | For P1, we did not see the spec change. If there is no spec change, we do not think it is critical in this maintenance stage.  For P2, there is no need to make such differentiation between MCCH and MTCH PDSCH. If the UE can process, then it will process the MCCH and does not impact the next slot processing. If the UE can not process MCCH within slot n, the slot n+1 PDSCH still should be prioritized.  For P3, we are open to discuss the procedure if the peak data rate is larger than 10Mbps for UE with 48-2. but whether it should be the same procedure for the UE with 48-1 and 48-2, we donot think it is critical.  For P4, it has been discussed in last meeting and there is no consensus. Moreover, with such change, the unicast PDSCH in slot n may be dropped, which is not aligned with the agreement. Therefore, there is no need to discuss P4. |
| DOCOMO |  | We think it can be discussed after Question 4-1a is concluded. |
| LG | None | We think that all proposals are not needed to be prioritized. |
| QC |  | Don’t see clear motivation to prioritize these proposals. |
| Ericsson | At least P4 |  |
| Xiaomi | None |  |
| SONY | None |  |

# 5 Simultaneous reception of MBS and other PDSCH

RAN#114bis made the following agreements regarding simultaneous reception of MBS and other PDSCH [3, 4]:

|  |
| --- |
| Agreement:   * An eRedCap UE with bandwidth reduction, depending on indicated UE capability, the UE can decode a PDSCH for MBS broadcast and a PDSCH for unicast with the two PDSCH partially or fully overlapping in time in non-overlapping PRBs, if the total number of PRBs does not exceed the maximum number of PRBs that the UE can receive or process per slot.   Agreement:   * An eRedCap UE with bandwidth reduction, depending on indicated UE capability, the UE can decode a PDSCH for MBS multicast and a PDSCH for unicast with the two PDSCH partially or fully overlapping in time in non-overlapping PRBs, if the total number of PRBs does not exceed the maximum number of PRBs that the UE can receive or process per slot.   Agreement:   * Continue to discuss whether and how to update the specification regarding the following aspect:   + simultaneous MBS broadcast/multicast and unicast when the total number of PRBs exceeds the maximum number of PRBs that the UE can receive or process per slot (if this is a valid case) |

The following contributions discuss simultaneous reception of MBS and other PDSCH:

|  |  |  |  |
| --- | --- | --- | --- |
| [5] | [R1-2310820](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2310820.zip) (section 2.2) | Maintenance of R18 RedCap | FUTUREWEI |
| [6] | [R1-2310857](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2310857.zip) (section 2.1) | Maintenance on Rel-18 RedCap | Huawei, HiSilicon |
| [7] | [R1-2310992](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2310992.zip) (proposal 1) | Discussion on further UE complexity reduction | ZTE, Sanechips |
| [8] | [R1-2311000](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311000.zip) (section 2.2) | Maintenance on UE complexity reduction for eRedCap | Panasonic |
| [9] | [R1-2311101](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311101.zip) (section 3) | Remaining issues on further UE complexity reduction | Vivo |
| [10] | [R1-2311169](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311169.zip) (section 2.2) | Remaining issues on enhanced support of RedCap devices | Spreadtrum Communications |
| [11] | [R1-2311262](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311262.zip) (section 2.3) | Further consideration on specification for Rel-18 RedCap | OPPO |
| [12] | [R1-2311346](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311346.zip) (section 2.3) | Remaining issues of Rel-18 RedCap | CATT |
| [14] | [R1-2311486](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311486.zip) (section 2.2) | Maintenance on further complexity reduction for eRedCap | CMCC |
| [17] | [R1-2311626](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311626.zip) (section 2.3) | Maintenance on further UE complexity reduction for eRedCap | NTT DOCOMO, INC. |
| [18] | [R1-2311688](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311688.zip) (section 2.2) | Further RedCap UE complexity reduction | Apple |
| [19] | [R1-2311746](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311746.zip) (proposal 3) | Discussion on UE complexity reduction | DENSO CORPORATION |
| [20] | [R1-2311749](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311749.zip) (issue 2) | Remaining issues on UE complexity reduction | Sharp |
| [21] | [R1-2311786](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311786.zip) (issue 3) | Remaining Issues for eRedCap | Nokia, Nokia Shanghai Bell |
| [24] | [R1-2311894](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311894.zip) (issue 3) | Remaining issues of further UE complexity reduction for eRedCap | LG Electronics |
| [26] | [R1-2312040](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2312040.zip) (section 4) | UE complexity reduction for eRedCap | Qualcomm Incorporated |
| [27] | [R1-2312126](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2312126.zip) (section 2.3.1) | On maintenance of further complexity reduction of NR UE | Nordic Semiconductor ASA |
| [28] | [R1-2312167](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2312167.zip) (section 3) | Maintenance issues for Rel-18 eRedCap | Ericsson |
| [29] | [R1-2312204](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2312204.zip) (section 2.2) | Maintenance issues for UE Redcap | Sony |

The contributions express the following views regarding simultaneous reception of MBS and other PDSCH:

* Contributions [5, 7, 9, 11, 12, 17, 18, 19, 27] propose to only support simultaneous MBS broadcast/multicast and unicast when the total number of PRBs does not exceed the maximum number of PRBs that the UE can receive or process per slot (and possibly leave the behavior unspecified when the number of PRBs is larger).
* Contributions [6, 8, 21, 24, 28, 29] propose for simultaneous MBS broadcast/multicast and unicast that when the total number of PRBs exceeds the maximum number of PRBs that the UE can receive or process per slot, the UE is not required to decode both PDSCHs. Furthermore, contributions [8, 21, 24, 28, 29] propose to prioritize the unicast over the broadcast/multicast MBS.
* Contributions [14, 20] propose to support simultaneous MBS broadcast and unicast with a larger number of PRBs, but not simultaneous MBS multicast and unicast with a larger number of PRBs.
* Contributions [10, 26] propose to use UE capabilities to indicate whether the UE supports simultaneous MBS multicast and unicast with a smaller or a larger number of PRBs than the UE can receive or process per slot. Furthermore, contribution [26] proposes additional UE capabilities related to MIMO and 256QAM.

Companies are invited to comment on the questions below.

**FL1 High Priority Question 5-1a: Please indicate your preferences among the following options:**

* **Option 1: For UE BB bandwidth reduction, simultaneous MBS broadcast/multicast and unicast when the total number of PRBs exceeds the maximum number of PRBs that the UE can receive or process per slot is not a valid case.**
* **Option 2: For UE BB bandwidth reduction, simultaneous MBS broadcast/multicast and unicast when the total number of PRBs exceeds the maximum number of PRBs that the UE can receive or process per slot is a valid case, and the UE prioritizes unicast over MBS broadcast/multicast.**
* **Option 3: Other option (please elaborate in the comment field).**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Preferred option for broadcast** | **Preferred option for multicast** | **Comments** |
| vivo | Option 1, but open for Option 2 | Option 1 | Option 1 is our preference for both broadcast and multicast. But we can be open to support option 2 for broadcast if companies think option 1 for broadcast MBS is too restrictive. Because for multicast, the UE will always receive each multicast PDSCH. While for broadcast MBS, the UE only receives it when the UE wants to receive. |
| Nordic | Option 1 | Option 1 |  |
| CMCC | Option3 | Option1 | Since broadcast has no processing timeline requirement and no HARQ feedback, UE can buffer broadcast and process it later, thus simultaneous reception of broadcast and unicast can depend on UE capability.  In MBS topic, FDMed DG multicast and DG unicast is allowed. If bandwidth of FDMed DG multicast and DG unicast is larger than maximum number of PRBs and multicast has HARQ feedback, decoding unicast firstly may impact HARQ of multicast. One solution is option1, and gNB avoids scheduling unicast to be FDMed with DG multicast if total PRB is larger than maximum number of PRBs. In this way, when R18 RedCap UEs and legacy UEs are in the same multicast group, the scheduling of multicast of legacy UEs will not be impacted. |
| Sharp | Option3 | Option1 | For the cases simultaneous MBS broadcast and unicast reception, it can be up to UE to select one of PDSCH to decode. For example, UE can decode the MBS broadcast to get better MBS experience and trans a NACK for the discarded unicast PDSCH, or UE can decode the unicast PDSCH with higher priority and skip the MBS broadcast which may be not so critical. |
| ZTE, Sanechips | Option2 | Option2 | We do not think UE can process the PRBs number larger than 5MHz without relaxation. Therefore, option2 is a baseline solution. If companies has strong preference on option1, we are OK to consider it as an optional capability. |
| Spreadtrum | Option 1 | Option 1 |  |
| CATT | Option 1 (1st)  Option 2(2nd) | Option 1 | We would like to simplify the case as much as possible. But we also notice that broadcast MBS<5 MHz is restrictive for sharing with other UEs. |
| FUTUREWEI |  |  | For clarification, does this proposal assume a UE supports the following feature groups [FG33-1-2: FDM-ed unicast PDSCH and group-common PDSCH for broadcast] and [FG 33-3-2: FDM-ed unicast PDSCH and one group-common PDSCH for multicast]. If this is the case, we can support option 2 for both. |
| Panasonic |  |  | We think the Option 2 is more beneficial for the scheduling flexibility. But the Option 1 is also fine since it can reduce the UE complexity. |
| Nokia, NSB | Option 2 | Option 2 | In our view, this is a valid case as otherwise the gNB would either have to always restrict the number of PRBs to be within the 5 MHz limit or avoid simultaneous scheduling of unicast and broadcast/multicast all together. Unicast should be prioritized over MBS broadcast/multicast |
| DOCOMO | Option 1 (1st)  Option 2(2nd) | Option 1 | While our preference is option 1 to make the discussion simpler, we are open to discuss to support option 2. |
| LG | Option 2 | Option 2 | Option 1 means that UE does not expect the scheduling. But in repetition cases, Unicast PDSCH cannot be scheduled during at most 8 consecutive slot. It is obviously hard restriction and unicast PDSCH can be long delayed in Option1 at worst cases. |
| NEC | Option 1 | Option 1 | Simpler option would be preferable to keep Rel-18 RedCap UE simpler. But open to other options. |
| QC | Option 1 | Option 1 | If we consider it as a valid case, we think a better way to prioritize should be based on the PDSCH has HARQ\_ACK feedback or not. UE should prioritize the PDSCH with feedback. |
| OPPO | Option 1 | Option 1 | It may be over design to stipulate some certain case with larger total bandwidth, including MBS. |
| Ericsson | Option 2 | Option 2 | It may not be always possible for the network to avoid the case where the combined bandwidth of MBS broadcast/multicast (which is intended for several UEs) and unicast (which is intended for a single UE) exceeds ~5 MHz. Therefore, Option 2 is preferred. Note that Option 2 is also in line with the following note in TS 38.331 clause 5.2.2.3.1.   |  | | --- | |  | |
| Samsung | Option 1 | Option 1 | We prefer to simplify the case, but we are open to support option 2 for broadcast case if the majority prefer it. |
| Xiaomi | Option 1 | Option 1 | Simultaneous reception between broadcast MBS PDSCH and unicast PDSCH must be occurred during RRC\_CONNECTED states. In our view, it seems not hard for the gNB to avoid this invalid case. No spec change is necessary. |
| SONY | Option 2 | Option 2 | Also OK with option 1, but we think that applying option 1 would be more restrictive to the network. |
| FL2 | Based on the received responses, the following question regarding Option 1 can be considered.   * Option 1: For UE BB bandwidth reduction, simultaneous MBS broadcast/multicast and unicast when the total number of PRBs exceeds the maximum number of PRBs that the UE can receive or process per slot is not a valid case.   **High Priority Question 5-1b: If Option 1 is adopted, would it mean that gNB should not schedule MBS broadcast/multicast to any UEs if the total number of PRBs is exceeded for just one of them (e.g., in a scenario where only one of the UEs is to be scheduled with unicast)?** | | |
| **Company** | **Y/N** | **Comments** | |
| Nordic | No | gNB can happily schedule unicast for legacy, for FG48-2 UEs | |
| Sharp |  | Yes for the question, but we still think the MBS broadcast and multicast should be discussed seperately | |
| CMCC | N | We prefer gNB avoids scheduling unicast to be FDMed with multicast/broadcast. In this way, when R18 RedCap UEs and legacy UEs are in the same multicast group, the scheduling of multicast of legacy UEs will not be impacted, the scheduling of broadcast of legacy UEs will not be impacted. | |
| Nokia, NSB |  | The gNB would have to avoid this case but it may avoid scheduling the unicast instead of broadcast/multicast. Either way, it is not preferred to have this scheduling restriction. | |
| ZTE, Sanechips |  | It means the gNB should consider to avoid this kind of scheduling. Actually, considering the other UEs MBS service, the gNB is not going to schedule unicast. In this case, the unicast PDSCH is deprioritized in some sense. Therefore, we do not think option1 should be adopted. | |
| Panasonic | Y | Yes for the question when the cell allows the access form the eRedCap UEs. And then, it would be a bit tight restriction for the gNB especially when the gNB is to schedule the MBS PDSCH with repetition. | |
| vivo |  | Same views as CMCC. | |
| LG |  | Even if gNB can do it, it will be generally a big burden and hard for gNB to schedule the UE with avoiding this kind of the FDMed scheduling (e.g., especially in repetition case for at most 8 consecutive slots). So, option 2 is preferred. | |
| Ericsson | Y | Option 1 seems to imply that gNB cannot schedule MBS broadcast/multicast to any UEs in the group if a UE with UE BB bandwidth reduction is simultaneously scheduled with said MBS broadcast/multicast and unicast with a too large total number of PRBs.  As others have commented, another viewpoint of this is that gNB should avoid unicast transmission to that UE in that case.  All in all, Option 1 seems to introduce undesired scheduling restrictions for gNB and/or undefined UE behavior for this case. | |
| OPPO |  | In that case the UE will be scheduled with small unicast. | |

# 6 Simultaneous reception of SI and other PDSCH

RAN1#114 made the following agreements related to simultaneous reception of SI/RAR/MBS and other PDSCH [4]:

|  |
| --- |
| Agreement:   * For handling of multiple reception in a slot during P-RNTI triggered SI acquisition when the total number of PRBs for the PDSCH scheduled with SI-RNTI and the PDSCH scheduled with C-RNTI, MCS-C-RNTI, or CS-RNTI scheduled in the slot is larger than the maximum number of PRBs that the UE can process per slot, the UE may skip decoding of the scheduled PDSCH with C-RNTI, MCS-C-RNTI, or CS-RNTI.   Agreement:   * For UE BB bandwidth reduction, when PDSCH scheduled with RA-RNTI or MSGB-RNTI is greater than 25/12 PRBs with 15/30kHz SCS, support the following UE behavior:   + UE behavior 2: Relaxed random access processing timeline in connected mode:     - The UE is not expected to decode a PDSCH scheduled with C-RNTI, MCS-C-RNTI, G-RNTI for multicast or broadcast, MCCH-RNTI, G-CS-RNTI or CS-RNTI in the same or next slot if another PDSCH in the same cell is scheduled with RA-RNTI or MSGB-RNTI.   Agreement:   * For UE BB bandwidth reduction, the number of PRBs scheduled in DCI can be larger than 25 PRBs for 15 kHz SCS and 12 PRBs for 30 kHz SCS for:   + Broadcast MBS PDSCH without any PDSCH in next slot   + Broadcast MBS PDSCH without MBS PDSCH repetition |

The following contribution discusses the consistency between the agreements listed above.

|  |  |  |  |
| --- | --- | --- | --- |
| [28] | [R1-2312167](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2312167.zip) | Maintenance issues for Rel-18 eRedCap | Ericsson |

Contribution [28] notes that the first agreement listed above (related to SI PDSCH reception) seems to be based on an assumption that the UE only needs a single slot to process a transmission wider than 25/12 PRBs for 15/30 kHz SCS, whereas the second agreement (related to RAR PDSCH reception) and the third agreement (related to MBS PDSCH reception) seem to be based on an assumption that the UE may need two slots to process a transmission.

**FL1/FL2 Medium Priority Question 6-1a: Is there a need to relax the agreed requirement on simultaneous reception of SI PDSCH and other PDSCH? If the answer is no, please elaborate in the comment on whether you think the requirement is consistent with the RAR/MBS PDSCH requirements.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| vivo | N? | Different from RAR, there is no subsequent transmission is requested for SI reception and broadcast MBS PDSCH reception. Comparing the SIB and broadcast MBS PDSCH reception, the TBS is usually smaller than broadcast MBS PDSCH, so additional slot may not be needed. |
| Nordic | Y | we support relaxing the requirement, to have consistent processing with RAR and broadcast. But agree that TBS is much smaller for SI compared to unicast. |
| ZTE, Sanechips | Y | We think it can be aligned with RAR processing and there is no harm to the UE. |
| CATT | N | In our understanding SI PDSCH is usually transmitted like ‘repetition behavior’ using different SSB beams. UE can just pickup the preferred one and skip subsequent ones based on SSB (unless the very unfortune case, i.e. the preferred SSB is the largest index SSB), and thus the timeline is already relaxed.  More importantly, SI PDSCH does not require any acknowledgement. |
| DOCOMO | N | Regarding the first and second agreement, for SI PDSCH, there is no HARQ-ACK feedback while there is corresponding uplink transmission for RAR PDSCH. That is the difference between SI PDSCH and RAR PDSCH, and hence, the relaxed requirement was agreed to applied for the RAR PDSCH case per our understanding. |
| LG | N | Partially same as CATT and DCM, the TBS size of SI PDSCH is not generally larger than unicast. And, SI PDSCH can be buffered and be decoded in/within a few slots. such consideration such as autonomous SI PDSCH can be applied for PI-RNTI triggered SI PDSCH. |
| QC |  | The 1 slot extra processing time was never fully justified – we have provided counter example in an offline discussion in previous meeting to show the necessity of it is not solid. Plus, we never thought such long timeline relaxation is needed. The agreements of timeline relaxation were compromises to make RAN1 moving forward. It does not mean we agree to extend same timeline relaxation everywhere.  Therefore, we don’t see any necessity to revert previous agreements. |
| OPPO | N | We consider the SI information would not be too large to have 2 slot to be processed. Thus, would be fine with the inconsistent style of conclusions. |
| Ericsson |  | We think it would be good to discuss. Although we don’t have a strong view regarding whether to relax the agreed requirements or not, we are open to hear the views from other companies. |
| Xiaomi | N | Share similar views with CATT. |
| SONY | Y | We would like the specifications to be clear that the UE can apply some form of relaxation, rather than leaving it down to assumptions on SI TBS etc. The UE implementation needs to be based on the corner case rather than some assumptions (like on SI TBS size), however valid / reasonable such assumptions are. |
| CMCC | N | Share similar views with CATT. |

# 7 Default values of peak rate related UE capabilities

RAN1#114bis discussed a proposal to modify the default values of the peak rate related UE capability parameters for eRedCap UEs [3]. It was suggested to continue the discussion if needed when it is clear how RAN2 will capture the RAN1 agreements listed in the LS in [32] in their specifications. The running RAN2 CRs can be found in [33, 34].

|  |  |  |  |
| --- | --- | --- | --- |
| [32] | [R1-2308610](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_114/Docs/R1-2308610.zip) | LS on reduced peak data rate for Rel-18 eRedCap UEs | RAN1, Ericsson |
| [33] | [R2-2312189](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_124/Docs/R2-2312189.zip) | 38.306 CR draft (Rel-18, B) UE capabilities for Rel-18 eRedCap WI | Intel Corporation |
| [34] | [R2-2312190](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_124/Docs/R2-2312190.zip) | 38.331 CR draft (Rel-18, B) UE capabilities for Rel-18 eRedCap WI | Intel Corporation |
| [13] | [R1-2311406](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311406.zip) (section 2.3) | Discussion on further complexity reduction for eRedCap UEs | Xiaomi |

Contribution [13] expresses that the current default values of the peak rate related UE capability parameters are not suitable for eRedCap UEs and proposes to follow one of these directions:

* **Direction 1:** Specify that it is mandatory for Rel-18 eRedCap UEs to report UE capability related RRC parameters *scalingFactor*, *supportedModulationOrderDL* and *supportedModulationOrderUL* to the gNB.
* **Direction 2:** Introduce new default values for *scalingFactor*, *supportedModulationOrderDL* and *supportedModulationOrderUL*.

**FL1 High Priority Question 7-1a: Is there an issue with the current default values of the peak rate related UE capability parameters that needs to be addressed? Please elaborate in the comment field.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| vivo |  | If the NW knows the UE is Rel-18 eRedCap, then it seems clear that the peak data rate for Rel-18 eRedCap is around 10Mbps? |
| Nordic | Y | Capability reporting overhead is unnecessary. But corresponding spec is RAN2. |
| CMCC |  | Similar view as vivo. |
| ZTE, Sanechips |  | We can come back to this issue, if RAN2 does not discuss this in this meeting. |
| CATT |  | Do not feel necessary to introduce UE capability report just for this reason. Direction 2 can be up to RAN2. |
| FUTUREWEI | N | RAN2 is capable of resolving any issue about default values |
| Panasonic |  | Should be up to RAN2. |
| Nokia, NSB |  | We don’t see an issue. If any, we can leave to RAN2 |
| DOCOMO |  | We don’t see the need of new UE capability reporting. We are fine to leave it to RAN2. |
| LG | N | It seems to be up to RAN2 |
| NEC |  | Signaling details should be up to RAN2. The network knows the UE type through EI. Irrespective of the signaled value, the peak data rate is fixed to 10Mbps (10000000 bps)? |
| QC |  | We are open to discuss this issue. |
| OPPO |  | Don’t see the issue of default values for RedCap Rel-18. |
| Ericsson | N | We are fine with leaving this to RAN2.  However. we think that the current specification works fine. The UE needs to report appropriate values for *scalingFactor*, *supportedModulationOrderDL*, *supportedModulationOrderDL* based on the values for the component agreed in RAN1, which is addressed in the running RAN2 CR in [33]. |
| Samsung |  | It should be handled in RAN2 |
| Xiaomi |  | Agree with Majority companies view that this issue could be discussed in RAN2 but the related LS can be sent to RAN2 for this information. |
| SONY |  | Agree with vivo |
| FL2 | Based on the received responses, the following proposal can be considered.  **High Priority Proposal 7-1b: Conclusion: It is up to RAN2 to decide whether or not to change the current default values of the peak rate related UE capability parameters.** | |
| Nordic | Y |  |
| CMCC | Y |  |
| Nokia, NSB | Y |  |
| FUTUREWEI | Y |  |
| Panasonic | Y |  |
| vivo | Y |  |
| LG | Y | OK |
| Ericsson | Y |  |
| OPPO | N | We see no need for RAN2 to decide. We would like not trigger RAN2 to discuss the issue. |

# 8 Clarification of “UE that [has not] indicated FG 48-2”

RAN1#114bis discussed and agreed to continue to discuss potential clarification of “A UE that has not indicated FG 48-2” and “A UE that indicated FG 48-2” in the following paragraphs in 38.213 clause 17.1A [3, 35, 36]:

|  |
| --- |
| A UE that has not indicated FG 48-2 does not expect to transmit a PUSCH over a bandwidth that is larger than 25 PRBs for 15 kHz SCS, or larger than 12 PRBs for 30 kHz SCS, per hop in a slot.  A UE that has not indicated FG 48-2 does not expect to process a PDSCH reception that is scheduled by a DCI format with CRC scrambled by a C-RNTI, CS-RNTI, MCS-C-RNTI, G-RNTI for multicast, or G-CS-RNTI over a number of PRBs that is larger than 25 PRBs for 15 kHz SCS, or larger than 12 PRBs for 30 kHz SCS, in a slot.  A UE that has not indicated FG 48-2 is not required to process a PDSCH reception in slot that is scheduled by a DCI format with CRC scrambled by a G-RNTI for broadcast or a MCCH-RNTI over a number of PRBs that is larger than 25 PRBs for 15 kHz SCS, or larger than 12 PRBs for 30 kHz SCS, when the PDSCH reception is with repetitions or when the UE receives another PDSCH in slot .  A UE is not required to process a PDSCH reception that is scheduled by a DCI format with CRC scrambled by a TC-RNTI over a number of PRBs that is larger than 25 PRBs for 15 kHz SCS, or larger than 12 PRBs for 30 kHz SCS, in a slot.  A UE that indicated FG 48-2 does not expect to transmit a PUSCH over a bandwidth that is larger than 25 PRBs for 15 kHz SCS, or larger than 12 PRBs for 30 kHz SCS, per hop in a slot, where the PUSCH is scheduled by RAR UL grant or by a DCI scrambled by a TC-RNTI, or is configured for a Type-2 random access procedure. |

The potential clarification of “A UE that [has not] indicated FG 48-2” is discussed in the following contributions:

|  |  |  |  |
| --- | --- | --- | --- |
| [5] | [R1-2310820](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2310820.zip) (section 2.1) | Maintenance of R18 RedCap | FUTUREWEI |
| [6] | [R1-2310857](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2310857.zip) (section 2.2.2) | Maintenance on Rel-18 RedCap | Huawei, HiSilicon |
| [7] | [R1-2310992](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2310992.zip) (TP 2) | Discussion on further UE complexity reduction | ZTE, Sanechips |
| [8] | [R1-2311000](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311000.zip) (section 2.3) | Maintenance on UE complexity reduction for eRedCap | Panasonic |
| [9] | [R1-2311101](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311101.zip) (section 4) | Remaining issues on further UE complexity reduction | Vivo |
| [10] | [R1-2311169](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311169.zip) (section 2.1) | Remaining issues on enhanced support of RedCap devices | Spreadtrum Communications |
| [12] | [R1-2311346](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311346.zip) (section 4) | Remaining issues of Rel-18 RedCap | CATT |
| [13] | [R1-2311406](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311406.zip) (section 2.5) | Discussion on further complexity reduction for eRedCap UEs | Xiaomi |
| [14] | [R1-2311486](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311486.zip) (section 2.5) | Maintenance on further complexity reduction for eRedCap | CMCC |
| [15] | [R1-2311541](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311541.zip) | Maintenance on Rel-18 RedCap UE | NEC |
| [17] | [R1-2311626](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311626.zip) (section 2.1/2.2) | Maintenance on further UE complexity reduction for eRedCap | NTT DOCOMO, INC. |
| [20] | [R1-2311749](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311749.zip) (issue 3) | Remaining issues on UE complexity reduction | Sharp |
| [21] | [R1-2311786](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311786.zip) (issue 4) | Remaining Issues for eRedCap | Nokia, Nokia Shanghai Bell |
| [23] | [R1-2311848](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311848.zip) | Remaining issues on further UE complexity reduction for eRedCap | Samsung |
| [24] | [R1-2311894](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311894.zip) (issue 2) | Remaining issues of further UE complexity reduction for eRedCap | LG Electronics |
| [26] | [R1-2312040](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2312040.zip) (section 2.2) | UE complexity reduction for eRedCap | Qualcomm Incorporated |
| [27] | [R1-2312126](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2312126.zip) (section 2.2) | On maintenance of further complexity reduction of NR UE | Nordic Semiconductor ASA |
| [28] | [R1-2312167](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2312167.zip) (section 4) | Maintenance issues for Rel-18 eRedCap | Ericsson |

The views expressed in the contributions are summarized below for each one of the affected paragraphs in 38.213 [36].

First, we have the first PUSCH paragraph:

|  |  |  |
| --- | --- | --- |
| A UE that has not indicated FG 48-2 does not expect to transmit a PUSCH over a bandwidth that is larger than 25 PRBs for 15 kHz SCS, or larger than 12 PRBs for 30 kHz SCS, per hop in a slot. | | |
| The contributions express the following views regarding the above paragraph:   * **View 1:** Contributions [8, 9, 12, 17, 21, 27, 28] propose to replace the highlighted text with “A UE not supporting FG 48-2” to eliminate potential ambiguous interpretations. * **View 2:** Contributions [10, 14] propose to clarify that the highlighted text refers to UEs with UE BB bandwidth reduction in all RRC states, and FG 48-2 UEs in RRC\_IDLE. * **View 3:** Contribution [7] proposes to replace the highlighted text with “A UE not indicating FG 48-2” to make the text clearer. * **View 4:** Contributions [13, 15, 20, 23, 24] express that there is no need for a clarification in this paragraph.   **FL1 Medium Priority Question 8-1a: Please indicate your preferred view(s) for the above 38.213 paragraph.** | | |
| **Company** | **Preferred view(s)** | **Comments** |
| vivo | View 1 | The wording of “has not indicated” and “indicated” is ambiguous on the timing and the valid period for the capability indication. For example, the indicated capability can be considered valid/effective as long as an eRedCap UE indicates once, even if the eRedCap is release to the idle mode or changed the cell/operators. The UE may consider it “has indicated”. |
| Nordic | View 1 or View 4 |  |
| CMCC |  | Understand the worry about “has not indicated” and “indicated”. IF view 1 is chosen, another paragraph is needed to restrict PUSCH bandwidth for FG 48-2 UE in idle mode. Similarly, whole clause 17.1A needs to be checked to cover all previous agreements. |
| Sharp | View 4 | The change of “does not support” has also take ambiguity for gNB’s scheduler, we perfer to keep current wording. |
| ZTE, Sanechips | View 3, can live with View 1 | Current spec has similar wording using ‘indicate’. |
| Spreadtrum | View 2, can live with view 1 | If view 1 is adopted, then paragraph 5 needs to be updated, otherwise, the restriction for 48-2 UE for initial access is not clear (we need to keep the same initial access behavior between 48-1 and 48-1 UEs). |
| CATT | View 1 |  |
| FUTUREWEI | View 4 | The specification ensures a FG 48-2 UE follows the same operation as a FG 48-1 during initial access. The phrase “indicated” is used throughout 38.213. |
| Panasonic | View 1 |  |
| Nokia, NSB | View 1 |  |
| DOCOMO | View 1 | We think we can first clarify the intention of each description. We provide our understanding below.  For “A UE that has not indicated FG 48-2”, it represents the UE supports only FG48-1 and the UE supports FG48-2 before reporting its UE capability.  For “A UE that indicated FG 48-2”, it represents the UE supports FG48-2 after reporting its UE capability.  For “A UE not supporting FG 48-2”, it represents the UE supports only FG48-1.  For “A UE supporting FG 48-2”, it represents the UE supports FG48-2. |
| LG | View 4 | But, we can live with View 1 |
| NEC | View 4 |  |
| QC | View 1 |  |
| OPPO | View 4 | We see the current phase is good enough in our contribution. |
| Ericsson | View 1 |  |
| Samsung | View 4 | We think that “A UE that has not indicated” is more suitable wording considering that it can include FG48-2 UE in RRC\_IDLE mode. |
| Xiaomi | View 1, view 4 | In our view, broadcast MBS PDSCH limitation in idle mode shouldn’t be applicable for FG 48-2. So, at least the third sentence marked in yellow should be changed as follows:  A UE ~~that has not indicated~~ not supporting FG 48-2 is not required to process a PDSCH reception in slot that is scheduled by a DCI format with CRC scrambled by a G-RNTI for broadcast or a MCCH-RNTI over a number of PRBs that is larger than 25 PRBs for 15 kHz SCS, or larger than 12 PRBs for 30 kHz SCS, when the PDSCH reception is with repetitions or when the UE receives another PDSCH in slot .  For other three sentences, there is no problem if they are not revised and they have already covered all the cases we expect, including all kinds of the PDSCH and PUSCH channel bandwidth limitation for FG 48-1 during all RRC states, and the CBW limitation of PDSCH/PUSCH scheduled by RAR UL grant or TC-RNTI, or configured by gNB for FG 48-2.  Of course, we are also ok to revise it to make the expression clear if the first and the last sentences marked in yellow are revised together to cover all the PUSCH cases mentioned above. |
| SONY | View 1 |  |
| FL2 | Based on received responses, it seems unlikely that there will be consensus for a spec change. | |

Second, we have the unicast PDSCH paragraph:

|  |  |  |
| --- | --- | --- |
| A UE that has not indicated FG 48-2 does not expect to process a PDSCH reception that is scheduled by a DCI format with CRC scrambled by a C-RNTI, CS-RNTI, MCS-C-RNTI, G-RNTI for multicast, or G-CS-RNTI over a number of PRBs that is larger than 25 PRBs for 15 kHz SCS, or larger than 12 PRBs for 30 kHz SCS, in a slot. | | |
| The contributions express the following views regarding the above paragraph:   * **View 1:** Contributions [8, 9, 12, 17, 21, 27, 28] propose to replace the highlighted text with “A UE not supporting FG 48-2” to eliminate potential ambiguous interpretations. * **View 2:** Contributions [10, 14] propose to clarify that the highlighted text refers to UEs with UE BB bandwidth reduction in all RRC states, and FG 48-2 UEs in RRC\_IDLE. * **View 3:** Contribution [5] proposes to replace the highlighted text with “A UE that has indicated FG 48-1” to make the text clearer. * **View 4:** Contribution [7] proposes to replace the highlighted text with “A UE not indicating FG 48-2” to make the text clearer. * **View 5:** Contributions [13, 15, 20, 23, 24] express that there is no need for a clarification in this paragraph.   **FL1 Medium Priority Question 8-2a: Please indicate your preferred view(s) for the above 38.213 paragraph.** | | |
| **Company** | **Preferred view(s)** | **Comments** |
| vivo | View 1 | Same comments for Question 8-1a. |
| Nordic | View 1 or View 5 |  |
| CMCC |  | Same comments for Question 8-1a. |
| Sharp | View5 |  |
| ZTE, Sanechips | View 3, can live with View 1 |  |
| Spreadtrum | View 2, can live with view 1 |  |
| CATT | View 1 |  |
| FUTUREWEI | View 5 | We can accept view 5 |
| Panasonic | View 1 |  |
| Nokia, NSB | View 1 |  |
| DOCOMO | View 1 |  |
| LG | View 5 | But, we can live with view 1 |
| NEC | View 5 |  |
| QC | View 1 |  |
| OPPO | View 5 |  |
| Ericsson | View 1 |  |
| Samsung | View 5 | Same comment on Question 8-1a. |
| Xiaomi | View 1 or view 5 | Same comment on Question 8-1a. |
| SONY | View 1 |  |
| FL2 | Based on received responses, it seems unlikely that there will be consensus for a spec change. | |

Third, we have the broadcast PDSCH paragraph:

|  |  |  |
| --- | --- | --- |
| A UE that has not indicated FG 48-2 is not required to process a PDSCH reception in slot that is scheduled by a DCI format with CRC scrambled by a G-RNTI for broadcast or a MCCH-RNTI over a number of PRBs that is larger than 25 PRBs for 15 kHz SCS, or larger than 12 PRBs for 30 kHz SCS, when the PDSCH reception is with repetitions or when the UE receives another PDSCH in slot . | | |
| The contributions express the following views regarding the above paragraph:   * **View 1:** Contributions [8, 9, 12, 13, 17, 21, 27, 28] propose to replace the highlighted text with “A UE not supporting FG 48-2” to eliminate potential ambiguous interpretations. * **View 2:** Contributions [10, 14] propose to clarify that the highlighted text refers to UEs with UE BB bandwidth reduction in all RRC states, and FG 48-2 UEs in RRC\_IDLE. * **View 3:** Contribution [7] proposes to replace the highlighted text with “A UE not indicating FG 48-2” to make the text clearer. * **View 4:** Contributions [15, 20, 23, 24] express that there is no need for a clarification in this paragraph.   **FL1 Medium Priority Question 8-3a: Please indicate your preferred view(s) for the above 38.213 paragraph.** | | |
| **Company** | **Preferred view(s)** | **Comments** |
| vivo | View 1 | Same comments as before. |
| Nordic | View 1 or View 4 |  |
| CMCC |  | Same comments for Question 8-1a. |
| Sharp | View 4 |  |
| ZTE, Sanechips | View 3, can live with View 1 |  |
| Spreadtrum | View 2, can live with view 1 |  |
| CATT | View 1 |  |
| FUTUREWEI | View 4 |  |
| Panasonic | View 1 |  |
| Nokia, NSB | View 1 |  |
| DOCOMO | View 1 |  |
| LG | View 4 | But, we can live with view 1 |
| NEC | View 4 |  |
| QC | View 1 |  |
| OPPO | View 4 |  |
| Ericsson | View 1 |  |
| Samsung | View 4 | Same comment on Question 8-1a. |
| Xiaomi | View 1 | Same comment on Question 8-1a. |
| SONY | View 1 |  |
| FL2 | Based on received responses, it seems unlikely that there will be consensus for a spec change. | |

Finally, skipping the Msg4 PDSCH paragraph (which is treated in Section 3), we get to the Msg3 PUSCH paragraph:

|  |  |  |
| --- | --- | --- |
| A UE that indicated FG 48-2 does not expect to transmit a PUSCH over a bandwidth that is larger than 25 PRBs for 15 kHz SCS, or larger than 12 PRBs for 30 kHz SCS, per hop in a slot, where the PUSCH is scheduled by RAR UL grant or by a DCI scrambled by a TC-RNTI, or is configured for a Type-2 random access procedure. | | |
| The contributions express the following views regarding the above paragraph:   * **View 1:** Contributions [6, 8, 9, 10, 12, 15, 23, 27, 28] propose to replace the highlighted text with “A UE” or “A UE supporting FG 48-2” to eliminate potential ambiguous interpretations. * **View 2:** Contributions [17, 26] express that the Msg3 PUSCH bandwidth restriction is not necessary for FG 48-2 and that the paragraph should be removed. * **View 3:** Contribution [7] proposes to replace the highlighted text with “A UE indicating FG 48-2” to make the text clearer. * **View 4:** Contribution [17] argues that if the motivation for the restriction is that the UE capabilities are not known yet, then the Msg5 PUSCH bandwidth should be restricted in the same way as the Msg3 PUSCH bandwidth. * **View 5:** Contribution [14] proposes to clarify that the highlighted text refers to FG 48-2 UEs in RRC\_INACTIVE and RRC\_CONNECTED. * **View 6:** Contributions [13, 20, 21, 24] express that there is no need for a clarification in this paragraph.   **FL1 Medium Priority Question 8-4a: Please indicate your preferred view(s) for the above 38.213 paragraph.** | | |
| **Company** | **Preferred view(s)** | **Comments** |
| vivo | View 1 | For Msg.3 and configured Msg.A PUSCH, we prefer the same handling as following text for Msg.4 scheduled by a DCI format with TC-RNTI, which includes both FG48-1 and FG48-2 eRedCap.  “A UE is not required to process a PDSCH reception that is scheduled by a DCI format with CRC scrambled by a TC-RNTI over a number of PRBs that is larger than 25 PRBs for 15 kHz SCS, or larger than 12 PRBs for 30 kHz SCS, in a slot.” |
| Nordic | View 1 or View 6 |  |
| CMCC |  | PUSCH bandwidth restriction is different for FG 48-2 UE in idle mode and connected mode. In idle mode, PUSCH bandwidth<5MHz. In inactive and connected mode, PUSCH bandwidth can be larger than 5MHz for Type-2 random access for CFRA. |
| Sharp | View 6 | it is aligned with the conclusion of that FG48-1 and FG48-2 UEs have the same procedure in CFRA. |
| ZTE, Sanechips | View 3, can live with View 1 |  |
| Spreadtrum | View 1 |  |
| CATT | View 1 | And support change to ‘“A UE” to be more inclusive.  Also, View 4 seems valid too. |
| FUTUREWEI | View 6 | We can consider View 1 when the highlighted text is replaced with “A UE” |
| Panasonic | View 1 | Either “A UE” or “A UE supporting FG 48-2” is fine. |
| Nokia, NSB | View 6 | No strong view, we can also consider View 1 with the highlighted text replaced with “A UE” |
| DOCOMO | View 2, but can live with view1 | While we don’t see the need to apply such restriction to UE supporting FG48-2 even during initial access, we can live with view 1 with the clarification on view 4. |
| LG | View 6 | But, we can live with view 1 |
| NEC | View 1 | Our preference is “A UE in the initial access procedure or CBRA”. View 6 is also fine. |
| QC | View 2 | Just want to remind the group this whole paragraph was controversial when we RAN1 **conditionally** endorsed the Rel-18 CR to introduce eRedcap in 213. Please check editor’s email when he proposed conditional endorsement. So, if there is no consensus can be achieved eventually, by default, this whole paragraph should be deleted. If the group have different views on this, we should ask 213 spec editor to clarify the situation. |
| OPPO | View 2 | In contribution [11], it sugest remove that. |
| Ericsson | View 1 |  |
| Samsung | View 1 |  |
| Xiaomi | View 1, view 6 | We can’t live with view 1 |
| SONY | View 1 |  |
| FL2 | Based on the received responses, the following proposal can be considered.  **Medium Priority Proposal 8-4b: Adopt the following TP for TS 38.213 clause 17.1A:**   |  | | --- | | A UE ~~that indicated FG 48-2~~ does not expect to transmit a PUSCH over a bandwidth that is larger than 25 PRBs for 15 kHz SCS, or larger than 12 PRBs for 30 kHz SCS, per hop in a slot, where the PUSCH is scheduled by RAR UL grant or by a DCI scrambled by a TC-RNTI, or is configured for a Type-2 random access procedure. | | |
| **Company** | **Y/N** | **Comments** |
| Nordic | Y |  |
| CMCC | Y |  |
| Nokia, NSB | Y | We are OK to accept this |
| ZTE, Sanechips | Y |  |
| FUTUREWEI | Y |  |
| Panasonic | Y |  |
| vivo | Y |  |
| Spreadtrum | Y |  |
| LG | Y | We can accept it |
| Ericsson | Y | Perhaps a move of the affected paragraph can be considered, so that the two PUSCH-related paragraphs are next to each other (instead of separated by the PDSCH-related paragraphs), for better readability of the section. |
| OPPO | N | We still think removing the whole sentence would be aligned with agreements. |

# 9 Other aspects

The following contributions bring up some other aspects which are not covered in any other section in this FLS.

|  |  |  |  |
| --- | --- | --- | --- |
| [22] | [R1-2311797](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311797.zip) | Remaining issues on UE complexity reduction | Transsion Holdings |
| [23] | [R1-2311848](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311848.zip) | Remaining issues on further UE complexity reduction for eRedCap | Samsung |
| [27] | [R1-2312126](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2312126.zip) (section 3) | On maintenance of further complexity reduction of NR UE | Nordic Semiconductor ASA |

The above contributions have the following proposals:

* Contribution [22] proposes that the optional feature of DL 256QAM is not applicable to FG 48-2 UEs.
* Contribution [23] proposes that unicast FDRA indications and RBG sizes can be based on 5-MHz sub-bands.
* Contribution [27] proposes that HD-FDD UE is capable of processing one additional unicast DCI for PUSCH.

Companies were invited to comment on similar proposals also in the previous RAN1 meeting [3].

**FL1/FL2 Low Priority Question 9-1a: Is there a need to treat any of the proposals listed above in this meeting?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| LG | Y, conditionally | If we have enough time to discuss them, |
| QC | No |  |
| Xiaomi | N |  |
| Nordic | Y | We should discuss |
| Nokia, NSB | N |  |
| Ericsson | N | The proposals do not seem like essential corrections. |

# References

|  |  |  |  |
| --- | --- | --- | --- |
| [1] | [RP-232671](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_101/Docs/RP-232671.zip) | Revised WID on Enhanced support of reduced capability NR devices | Ericsson |
| [2] | [R1-2300177](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300177.zip) | WI work plan for Rel-18 RedCap | Rapporteur (Ericsson) |
| [3] | [R1-2310568](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_114b/Docs/R1-2310568.zip) | FL summary #4 on Rel-18 RedCap UE complexity reduction | Moderator (Ericsson) |
| [4] | [R1-2310329](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_114b/Docs/R1-2310329.zip) | RAN1 agreements for Rel-18 NR RedCap | Rapporteur (Ericsson) |
| [5] | [R1-2310820](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2310820.zip) | Maintenance of R18 RedCap | FUTUREWEI |
| [6] | [R1-2310857](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2310857.zip) | Maintenance on Rel-18 RedCap | Huawei, HiSilicon |
| [7] | [R1-2310992](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2310992.zip) | Discussion on further UE complexity reduction | ZTE, Sanechips |
| [8] | [R1-2311000](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311000.zip) | Maintenance on UE complexity reduction for eRedCap | Panasonic |
| [9] | [R1-2311101](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311101.zip) | Remaining issues on further UE complexity reduction | Vivo |
| [10] | [R1-2311169](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311169.zip) | Remaining issues on enhanced support of RedCap devices | Spreadtrum Communications |
| [11] | [R1-2311262](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311262.zip) | Further consideration on specification for Rel-18 RedCap | OPPO |
| [12] | [R1-2311346](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311346.zip) | Remaining issues of Rel-18 RedCap | CATT |
| [13] | [R1-2311406](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311406.zip) | Discussion on further complexity reduction for eRedCap UEs | Xiaomi |
| [14] | [R1-2311486](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311486.zip) | Maintenance on further complexity reduction for eRedCap | CMCC |
| [15] | [R1-2311541](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311541.zip) | Maintenance on Rel-18 RedCap UE | NEC |
| [16] | [R1-2311545](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311545.zip) | Remaining issues on UE complexity reduction for eRedCap UEs | China Telecom |
| [17] | [R1-2311626](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311626.zip) | Maintenance on further UE complexity reduction for eRedCap | NTT DOCOMO, INC. |
| [18] | [R1-2311688](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311688.zip) | Further RedCap UE complexity reduction | Apple |
| [19] | [R1-2311746](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311746.zip) | Discussion on UE complexity reduction | DENSO CORPORATION |
| [20] | [R1-2311749](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311749.zip) | Remaining issues on UE complexity reduction | Sharp |
| [21] | [R1-2311786](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311786.zip) | Remaining Issues for eRedCap | Nokia, Nokia Shanghai Bell |
| [22] | [R1-2311797](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311797.zip) | Remaining issues on UE complexity reduction | Transsion Holdings |
| [23] | [R1-2311848](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311848.zip) | Remaining issues on further UE complexity reduction for eRedCap | Samsung |
| [24] | [R1-2311894](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311894.zip) | Remaining issues of further UE complexity reduction for eRedCap | LG Electronics |
| [25] | [R1-2311978](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311978.zip) | Maintenance on eRedCap UE complexity reduction | MediaTek Inc. |
| [26] | [R1-2312040](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2312040.zip) | UE complexity reduction for eRedCap | Qualcomm Incorporated |
| [27] | [R1-2312126](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2312126.zip) | On maintenance of further complexity reduction of NR UE | Nordic Semiconductor ASA |
| [28] | [R1-2312167](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2312167.zip) | Maintenance issues for Rel-18 eRedCap | Ericsson |
| [29] | [R1-2312204](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2312204.zip) | Maintenance issues for UE Redcap | Sony |
| [30] | [R1-2304262](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112b-e/Docs/R1-2304262.zip) | LS on Msg4 PDSCH transmission to Rel-18 eRedCap UEs | RAN1, Ericsson |
| [31] | [R1-2308830](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2308830.zip) | Reply LS to RAN1 on Msg4 PDSCH transmission to Rel-18 eRedCap UEs | RAN2, Vivo |
| [32] | [R1-2308610](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_114/Docs/R1-2308610.zip) | LS on reduced peak data rate for Rel-18 eRedCap UEs | RAN1, Ericsson |
| [33] | [R2-2312189](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_124/Docs/R2-2312189.zip) | 38.306 CR draft (Rel-18, B) UE capabilities for Rel-18 eRedCap WI | Intel Corporation |
| [34] | [R2-2312190](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_124/Docs/R2-2312190.zip) | 38.331 CR draft (Rel-18, B) UE capabilities for Rel-18 eRedCap WI | Intel Corporation |
| [35] | [TS 38.213 V18.0.0](https://www.3gpp.org/ftp/Specs/archive/38_series/38.213/38213-i00.zip) | NR; Physical layer procedures for control (Release 18) | 3GPP |
| [36] | [R1-2310738](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_114b/Docs/R1-2310738.zip) | 38.213 CR draft (Rel-18, F) Maintenance of support for enhanced reduced capability NR devices | Samsung |
| [37] | [TS 38.214 V18.0.0](https://www.3gpp.org/ftp/Specs/archive/38_series/38.214/38214-i00.zip) | NR; Physical layer procedures for data (Release 18) | 3GPP |
| [38] | [R1-2310767](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_114b/Docs/R1-2310767.zip) | 38.214 CR draft (Rel-18, F) Correction of enhanced reduced capability NR devices | Nokia |