3GPP TSG-RAN WG1 Meeting #117 R1-24xxxxx

Fukuoka, Japan, 20th – 24th May 2024

**Agenda Item: 8.1**

**Title: FL summary #1 for Rel-18 NR eRedCap maintenance**

**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] – [10] submitted to agenda item 8.1 and this email discussion:

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| --- |
| [117-R18-Maintenance] 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 – Chair.**RedCap*****To be moderated by Rel-18 FLs. Following tdocs will be treated in adhoc session #1 – Xiaodong:***R1-2404598 Draft CR on MBS PDSCH CBW definition for Rel-18 RedCap XiaomiR1-2404922 Draft CR on multicast transmissions for Rel-18 RedCap in INACTIVE mode NokiaR1-2405192 Discussion on R18 (e)RedCap UE remaining issues ZTE, SanechipsR1-2405193 Draft CR for eRedCap UE supporting enhanced positioning ZTE, SanechipsR1-2405194 Draft CR for eRedCap UE supporting MBS in inactive state ZTE, SanechipsR1-2405195 Draft CR for Rel-18 RedCap UE supporting MBS in inactive state ZTE, Sanechips |

The issues covered in this document are tagged and color coded with High Priority, Medium Priority or Low Priority, and those that are in focus in the initial discussion round are furthermore tagged FL1.

Follow the naming convention in this example:

* *eRedCapFLS1-v000-FL.docx*
* *eRedCapFLS1-v001-FL-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 12 in [R1-2403822](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_117/Docs/R1-2403822.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.

**FL1 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 |
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| CATT | Yongqiang Fei | feiyongqiang@catt.cn |
| Huawei, HiSilicon | Frank Yi LONG | frank.longyi@huawei.com |

# 1 MBS PDSCH bandwidth

The following contributions discuss MBS PDSCH bandwidth for eRedCap UEs:

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| [5] | [R1-2404598](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_117/Docs/R1-2404598.zip)(38.213 CR) | Draft CR on MBS PDSCH CBW definition for Rel-18 RedCap | Xiaomi |
| [6] | [R1-2404922](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_117/Docs/R1-2404922.zip)(38.213 CR) | Draft CR on multicast transmissions for Rel-18 RedCap in INACTIVE mode | Nokia |
| [7] | [R1-2405192](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_117/Docs/R1-2405192.zip)(Section 2.1) | Discussion on R18 (e)RedCap UE remaining issues | ZTE, Sanechips |
| [9] | [R1-2405194](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_117/Docs/R1-2405194.zip)(38.214 CR) | Draft CR for eRedCap UE supporting MBS in inactive state | ZTE, Sanechips |
| [10] | [R1-2405195](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_117/Docs/R1-2405195.zip)(38.214 CR) | Draft CR for Rel-18 RedCap UE supporting MBS in inactive state | ZTE, Sanechips |

RAN1 has made the following earlier agreements [4] related to MBS PDSCH bandwidth for eRedCap UEs:

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| 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).

Agreement:Adopt the following TP for 38.213 clause 17.1A:

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| A UE that has not indicated FG 48-2 is not required to process a PDSCH reception in slot $n$ 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 $n+1$. |

Agreement:For a UE with BB bandwidth reduction, for multicast MBS for inactive state specified in Rel-18, UE is not required to decode the PDSCH if the number of PRBs scheduled in DCI scrambled with G-RNTI or MCCH-RNTI is larger than 25/15 PRBs for 15/30 kHz SCS. |

The last agreement above was made in RAN1#116bis, but no corresponding specification change has yet been agreed.

Contribution [5] proposes to adopt the following changes in 38.213 clause 17.1A:

* Add channel bandwidth definition for Rel-18 multicast MBS PDSCH in inactive state.
* Relocate “or a MCCH-RNTI” from behind “for broadcast” to after “for broadcast”.
* Change “A UE that has not indicated” to “A UE not indicating” in the broadcast paragraph.

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| A UE that has not indicated *eRedCapNotReducedBB-BW* 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 or MCCH-RNTI for multicast, or G-CS-RNTI, or is associated with a SPS PDSCH configuration activated by a DCI format with CRC scrambled by CS-RNTI 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~~ not indicating *eRedCapNotReducedBB-BW* is not required to process a PDSCH reception in slot $n$ that is scheduled by a DCI format with CRC scrambled by a G-RNTI or a MCCH-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 $n+1$. |

Contribution [6] proposes a similar change in the multicast paragraph (adding the MCCH-RNTI case) as above.

Contribution [7] proposes to adopt one of the following changes in 38.214 clause 5.1:

* Draft CR [9] capturing the RAN1#116bis agreement for eRedCap UEs:

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| A UE indicating *supportOfERedCap* capability but not indicating *eRedCapNotReducedBB-BW* is not required to decode a PDSCH scheduled with MCCH-RNTI, G-RNTI for multicast in RRC\_INACTIVE state if the number of PRBs scheduled in DCI scrambled with G-RNTI or MCCH-RNTI is larger than 25/15 PRBs for 15/30 kHz SCS. |

* Draft CR [10] capturing the RAN1#116bis agreement for eRedCap UEs and extending it to RedCap UEs:

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| A UE indicating *supportOfRedCap* or *supportOfERedCap* capability but not indicating *eRedCapNotReducedBB-BW* is not required to decode a PDSCH scheduled with MCCH-RNTI, G-RNTI for multicast in RRC\_INACTIVE state if the number of PRBs scheduled in DCI scrambled with G-RNTI or MCCH-RNTI is larger than the maximum DL bandwidth that the UE supports. |

The motivations for the proposed changes can be found in the contributions.

**FL1 High Priority Question 1-1a: Companies are invited to comment on the proposed RAN1 specification changes related to MBS PDSCH bandwidth in contributions [5, 6, 7, 9, 10]. Please elaborate in the comment field.**

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| **Company** | **Comments** |
| vivo | Based on the agreement made in RAN1 116bis agreement for eRedCap UEs, we prefer CR [9].  |
| QC | Among CR [5], [6], and [9], we prefer CR [5] for eRedcap. CR [10] is a correction for Rel-17 Redcap UE. We think it should be discussed under agenda 7, while not 8.1. Plus we are not sure if it is a critical change for Rel-17 Redcap, assuming multi-cast for RRC\_inactive normally does not need wideband >20Mhz.  |
| Spreadtrum | we prefer CR [9]. |
| ZTE, Sanechips | We think the eRedCap and the Rel-18 RedCap have the same issue that the MBS may exceed the maximum bandwidth. It is unfair that only eRedCap UE supports a Rel-18 UE feature with optimization but not applied for RedCap UE. Therefore, it is better to have a unified solution. In this case, it is better to clarify in TS 38.214. Compare CR [5] and [9], [5] is not fully aligned with the agreement. We prefer [9] as starting point.  |
| DOCOMO | We support the intention and support TP in [5], [6] or [9].We are not sure [10] should be applied. At the RAN1#116 meeting, it was discussed at the online session whether CFR for RedCap should be limited to be configured within 20MHz, and it was online consensus that it should be discussed in RAN2. If CFR for RedCap is limited to 20MHz, this CR [10] is no longer necessary. In addition, similar to Rel-17 RedCap UE, UE indicating supportOfERedCap capability and eRedCapNotReducedBB-BW, the UE is not required to decode the multicast PDSCH larger than the maximum DL bandwidth that the UE supports, but the case is not included in the CR [10]. |
| CATT | The only add-on from RAN1#116bis is the MBS PDSCH bandwidth in RRC\_INACTIVE state. We can only agree on [9]. Other CR more or less putting additional changes without clear RAN1 agreements.  |
| Huawei, HiSilicon | The CR [10] is not necessary because not only multicast PDSCH but also other PDSCH cannot exceed the BWP bandwidth for R17 RedCap UEs. It is already clear in spec for Rel-17 RedCap UEs.CR [5][6] is incorrect for the following reasons,* the third change with removal of “~~or a MCCH-RNTI~~” is incorrect because it is needed for MCCH-RNTI in connected mode.
* In the agreement, it is “not required to” to clearly avoid a scheduling restriction. Therefore, the phrase “does not expect” is not good enough.
* According to S7.1 of TS 38.321, Multicast in inactive mode is not scheduled by MCCH-RNTI but Multicast MCCH-RNTI and G-RNTI for multicast.

CR [9] is incorrect about MCCH-RNTI.

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| TS 38.321

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| G-RNTI | Dynamically scheduled MBS PTM transmission | DL-SCH | MTCH |
| MCCH-RNTI | Dynamically scheduled MCCH signalling and MCCH change notification for MBS broadcast | DL-SCH | MCCH |
| PEI-RNTI | Paging Early Indication | N/A | N/A |
| Multicast MCCH-RNTI | Dynamically scheduled MCCH signalling and MCCH change notification for MBS multicast in RRC\_INACTIVE | DL-SCH | MCCH |

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Therefore, our proposed CR for TS 38.213 would be,

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| 17.1A Second procedures for RedCap UEIn this clause, the term 'UE' refers to a RedCap UE that indicates *supportOfERedCap*.A UE that has not indicated *eRedCapNotReducedBB-BW* 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 *eRedCapNotReducedBB-BW* 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, or is associated with a SPS PDSCH configuration activated by a DCI format with CRC scrambled by CS-RNTI 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 *eRedCapNotReducedBB-BW* is not required to process a PDSCH reception in slot $n$ 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 $n+1$.A UE that has not indicated *eRedCapNotReducedBB-BW* is not required to process a PDSCH reception that is scheduled by a DCI format with CRC scrambled by Multicast MCCH-RNTI or G-RNTI for multicast in RRC\_INACTIVE state 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 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 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. |

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# 2 Positioning support

The following contributions discuss positioning support for eRedCap UEs:

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| [7] | [R1-2405192](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_117/Docs/R1-2405192.zip)(Section 2.2) | Discussion on R18 (e)RedCap UE remaining issues | ZTE, Sanechips |
| [8] | [R1-2405193](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_117/Docs/R1-2405193.zip)(38.213 CR) | Draft CR for eRedCap UE supporting enhanced positioning | ZTE, Sanechips |

The contributions propose to clarify that Swith the following change in 38.213 clause 17:

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| A UE with reduced capabilities (RedCap UE) that indicates *supportOfRedCap* or *supportOfERedCap* in this document or[6, TS 38.214] supports all Layer-1 UE features that are mandatory without capability signalling, unless stated otherwise. Procedures for a RedCap UE are same as described for a UE in all other clauses of this document unless stated otherwise. |

**FL1 High Priority Question 2-1a: Is the proposed change needed? Please elaborate in the comment field.**

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| **Company** | **Y/N** | **Comments** |
| vivo |  | We are fine to clarify, but we are not sure spec update is needed. Our understanding is “A UE with reduced capabilities (RedCap UE)”include both R17 RedCap and R18 eRedCap UEs based on following spec 17 UE with reduced capabilitiesA UE with reduced capabilities (RedCap UE) supports all Layer-1 UE features that are mandatory without capability signalling, unless stated otherwise. Procedures for a RedCap UE are same as described for a UE in all other clauses of this document unless stated otherwise.17.1 First procedures for RedCap UEIn this clause, the term 'UE' refers to a RedCap UE that indicates *supportOfRedCap* or *supportOfRedCap-r18*.17.1A Second procedures for RedCap UEIn this clause, the term 'UE' refers to a RedCap UE that indicates *supportOfRedCap-r18*.For procedures only applicable to R18 eRedCap UEs, basically it is captured in 38.213 clause 17.1A Second procedures for RedCap UE, “In this clause, the term 'UE' refers to a RedCap UE that indicates *supportOfRedCap-r18*.” Or sentences in the 214 spec like following “for a reduced capability UE that indicates *supportOfRedCap-r18*”or “a UE indicating supportOfRedCap-r18 capability but not indicating FG 48-2”  |
| QC | N | We understand the intention to clarify positioning procedure for Redcap & eRedcap UE. But the proposal is too generic. Given the intention if only for positioning procedure, the TP can be more specific targeting positioning procedure only.  |
| Spreadtrum |  | We understand that based on the UE feature discussion, it is clear that eRedCap can support Rel-18 positioning enhancements based on frequency hopping. It seems that further clarify in other spec is not necessary...  |
| ZTE, Sanechips |  | The description for UE with reduced capabilities is only for TS38.213

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| 17 UE with reduced capabilitiesA UE with reduced capabilities (RedCap UE) supports all Layer-1 UE features that are mandatory without capability signalling, unless stated otherwise. Procedures for a RedCap UE are same as described for a UE in all other clauses of this document unless stated otherwise. |

In TS38.214, 1. It is not clear why only we make the clarification for TS38.213. does it mean ‘Procedures for a RedCap UE are same as described for a UE in all other clauses of this document unless stated otherwise’ is only applied for TS38.213? whether procedures in TS38.214 is also reused unless stated otherwise?
2. In TS 38.214, we think the reduced capability UE is s little bit confusing.

For example, in clause 5.1, a reduced capability UE that indicates supportOfRedCap-r18 refers to eRedCap UE

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| The maximum number of PDSCHs scheduled per slot per component carrier with C-RNTI/CS-RNTI and G-RNTI/G-CS-RNTI/MCCH-RNTI/multicast-MCCH-RNTI that the UE shall be able to decode is the same as the indicated UE capability for the number of unicast PDSCHs per slot per component carrier. If the UE is capable of receiving FDMed unicast and multicast PDSCH per slot per carrier, the UE shall be able to decode a PDSCH scheduled by a DCI format with C-RNTI or a PDSCH scheduled for a retransmission of a TB by a DCI format with CS-RNTI and a PDSCH scheduled by a DCI format with G-RNTI for multicast or a PDSCH scheduled for a retransmission of a TB by a DCI format with G-CS-RNTI that partially or fully overlap in time in non-overlapping PRBs. If the UE is capable of receiving FDMed unicast and broadcast PDSCH per slot per carrier, the UE shall be able to decode a PDSCH scheduled by a DCI format with C-RNTI or a PDSCH scheduled for a retransmission of a TB by a DCI format with CS-RNTI and a PDSCH scheduled with G-RNTI for broadcast/MCCH-RNTI that partially or fully overlap in time in non-overlapping PRBs. For a reduced capability UE that indicates *supportOfRedCap-r18* but not indicating FG 48-2, if the UE is capable of receiving FDMed unicast and multicast/broadcast PDSCH per slot, the UE can decode the two PDSCHs, with the two PDSCHs partially or fully overlapping in time in non-overlapping PRBs,- if the total number of PRBs allocated is no more than 25 PRBs when configured with SCS  = 0 or no more than 12 PRBs when configured with SCS  = 1,- otherwise, the UE may skip decoding one of the two PDSCHs. |

However, the following ‘the reduced capability UE’ is little bit unclear.

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| 5.1.6.5.1 PRS receiver frequency hoppingThe reduced capability UE may be configured to measure and report, subject to UE capability, via [*nr-Requested-DL-PRS-measurementBasedOnMultihopRx*] the DL RSTD, DL PRS-RSRP, DL PRS-RSRPP, or UE Rx-Tx time difference using receiver frequency hopping for a DL PRS resource, with a requested bandwidth of all hops that may be greater than the maximum reduced capability UE bandwidth. The reduced capability UE performing receiver frequency hopping may report via [*higher layer parameter*] one measurement associated with one received frequency hop or one measurement based on multiple hops of the DL PRS. The reduced capability UE may report whether the measurement is associated with one received frequency hop or multiple frequency hops of the DL PRS. In RRC\_CONNECTED mode, the reduced capability UE is expected to use a single instance of a configured measurement gap to receive all hops of the DL PRS using receiver frequency hopping.  |

We understand the Rel-18 positioning feature could be supported by eRedCap and RedCap according to the discussion. The confusion is ‘The reduced capability UE’ refers to which kind of UE in the spec. Also, in TS38.214, we also have reduced capability half-duplex UEs, whether HD-FD UE also can be referred based on ‘The reduced capability UE ’We don’t stick to the CR modification but just want to clarify the understanding.  |
| DOCOMO |  | We are fine with the intention. |
| CATT |  | No strong need. Spec is clear, when we combine 38.213 and UE capability report (306 or 822) together, as also mentioned by Spreadtrum. We think spec have no serious ambiguity.  |
| Huawei, HiSilicon |  | The changes are too broad and vague. UE capability description seems sufficient and better than the CR. |

# References

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| --- | --- | --- | --- |
| [1] | [RP-233637](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_102/Docs/RP-233637.zip) | Revised WID on Enhanced support of reduced capability NR devices | Ericsson |
| [2] | [RP-233638](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_102/Docs/RP-233638.zip) | Summary of WI on enhanced support of reduced capability NR devices | Ericsson |
| [3] | [R1-2403647](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_116b/Docs/R1-2403647.zip) | FL summary #3 for Rel-18 NR eRedCap maintenance | Moderator (Ericsson) |
| [4] | [R1-2403451](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_116b/Docs/R1-2403451.zip) | RAN1 agreements for Rel-18 NR eRedCap | Rapporteur (Ericsson) |
| [5] | [R1-2404598](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_117/Docs/R1-2404598.zip) | Draft CR on MBS PDSCH CBW definition for Rel-18 RedCap | Xiaomi |
| [6] | [R1-2404922](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_117/Docs/R1-2404922.zip) | Draft CR on multicast transmissions for Rel-18 RedCap in INACTIVE mode | Nokia |
| [7] | [R1-2405192](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_117/Docs/R1-2405192.zip) | Discussion on R18 (e)RedCap UE remaining issues | ZTE, Sanechips |
| [8] | [R1-2405193](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_117/Docs/R1-2405193.zip) | Draft CR for eRedCap UE supporting enhanced positioning | ZTE, Sanechips |
| [9] | [R1-2405194](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_117/Docs/R1-2405194.zip) | Draft CR for eRedCap UE supporting MBS in inactive state | ZTE, Sanechips |
| [10] | [R1-2405195](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_117/Docs/R1-2405195.zip) | Draft CR for Rel-18 RedCap UE supporting MBS in inactive state | ZTE, Sanechips |