3GPP TSG RAN WG2 Meeting #123bis R2-230xxxx

**Xiamen, China, October 09-13, 2023**

**Agenda item:** 7.x.x

**Source:** Intel Corporation

**Title:** Outcome of email discussion [POST123][753][eRedCap] on UE Capabilities for Rel-18 eRedCap

**Document for:** Discussion and decision

# Introduction

This document aims to review the running CRs on UE capabilities for Rel-18 eRedCap and to also discuss the open topics identified during RAN2#123 meeting.

* [Post123][753] Running eRedCap CRs for 38306 and 38331 for capabilities (Intel)

Scope: Implement agreements reached so far in the running CRs.

Intended outcome: Running CRs submitted to next meeting.

Please provide your inputs **before/by Tuesday September 19th EOD PST** to have few days afterwards to further review the report and updated CRs (as official email discussion deadline is Friday September 22nd, 2023).

The following are RAN2 agreements relevant to this discussion:

***Organizational***

***[RAN2#122]***

* *We will use the approach suggested by P1a above when implementing the running CRs and the rapporteurs will identify if there are issues with this approach and we can discuss further in later meetings.*

*Proposal 1a: In the R18 specification descriptions, the R17 legacy texts for RedCap UEs descriptions are NOT inherited/applied by default to the eRedCap UEs, i.e. we use following terminologies:*

*- “(e)RedCap UE” to describe the same behaviors for both RedCap and eRedCap UEs;*

*- “RedCap UE” to describe the RedCap UE only/specific behaviors;*

*- “eRedCap UE” to describe the eRedCap UE only/specific new behaviors.*

***RRC\_INACTIVE eDRX above 10.24 sec***

***[RAN2#121bis-e]***

* *Introduce an optional UE capability with signalling for Rel-18 enhanced eDRX in RRC\_INACTIVE.*
* *UE can support Rel-18 enhanced eDRX, only if it supports Rel-17 RRC\_IDLE eDRX. TBD if it must also support Rel-17 RRC\_INACTIVE eDRX.*

***[RAN2#122]***

* *UE can support Rel-18 INACTIVE eDRX (which comprises eDRX cycles and PTWs), even if it doesn’t support Rel-17 INACTIVE eDRX.*

***eRedCap UE***

***[RAN2#121bis-e]***

* *A Rel-18 eRedCap UE should be able to indicate its support via new UE capability signaling specific to Rel-18 eRedCap.*

***[RAN2#123]***

* *The support of Rel-18 eRedCap (FG 48-1 and 48-2) is defined as independently of Rel-17 RedCap (FG 28-1) understanding that RAN1 also agreed that UE supporting Rel-18 eRedCap feature(s) indicate support of this FG 48-1 instead of FG 28-1 (supportOfRedCap-r17).*
* *New UE capability (referred e.g., as supportOfEnhancedRedCap-r18) is defined to capture FG 48-1 (i.e., RedCap UE with reduced peak data rate and reduced baseband bandwidth in FR1) with the corresponding details explained in RAN1 feature list (R1-2306223).*
* *New UE capability (referred e.g., supportOfNotReducedBB-BW-r18) is defined to capture FG 48-2 (i.e., RedCap UE with reduced peak data rate without reduced baseband bandwidth in FR1) with the corresponding details explained in RAN1 feature list (R1-2306223).*
* *To remove from RAN2 running Capability CRs any reference to supportOfEnhancedRedCap-r18 as it is part of RAN1 feature list and its corresponding TP should be captured as part of Mega-Capability CRs. If so, to agree to the update done on UE capabilities running CR to 38.306 and 38.331 in R2-2307657 and R2-2307659.*
* *We will create a temporary CR for RAN1 eRedCap features*
* *To add in the list of functional components for the supportOfEnhancedRedCap-r18 the support of eRedCap early indication based on Msg3 and MsgA PUSCH.*
* *A Rel-18 eRedCap UE (both FG 48-1 and FG 48-2) can also support all RAN2-centric Rel-17 RedCap UE capabilities in the same manner.*
  + *Discuss during CR implementation how to capture this in TS 38.306: option 1) add in the field description of R18 eRedCap capability (i.e. supportOfEnhancedRedCap-r18) the following statement “all supportOfRedCap-r17 related capabilities specified in this specification remain applicable for Rel-18 RedCap UEs, unless indicated otherwise” or option 2) update the field description of the RAN2-centric Rel-17 RedCap UE capabilities to be applicable to (e)RedCap UEs.*
* *To include the following in “section 4.2.x.1 Definition of eRedCap UE” of TS 38.306:*

*eRedCap UE is the UE with reduced peak data rate and, with or without reduced baseband bandwidth in FR1:The maximum bandwidth is 20 MHz for FR1. UE features and corresponding capabilities related to UE bandwidths wider than 20 MHz in FR1 are not supported by eRedCap UEs. eRedCap UEs do not support operation in FR2. The specifications and capabilities of a RedCap UE are also applicable to eRedCap UEs unless stated otherwise.”*

* *Section 4 on “Supported max data rate for DL/UL” in TS 38.306 needs to be updated to include RAN1 agreement on the new value(s) of X for which the legacy constraint “vLayers·Qm·f ≥ 4” is relaxed by capturing the following TP: “For single carrier NR SA operation, the UE (except a UE indicating supportOfERedCap-r18) shall support a data rate for the carrier that is no smaller than the data rate computed using the above formula, with J=1 CC and component vLayers(j)⋅Qmj⋅fj is no smaller than 4. For UE indicating supportOfEnhancedRedCap-r18 in single carrier NR SA operation, the UE shall support a data rate for the carrier that is no smaller than the data rate computed using the above formula, with J=1 CC and component vLayers(j)⋅Qmj⋅fj is no smaller than 0.75 if UE does not indicate supportOfNotReducedBB-BW-r18 or 3.2 if UE also indicates supportOfNotReducedBB-BW-r18.”).*

The following are RAN1 agreements on feature list [1] relevant to this discussion (the latest inputs were provided in RAN1 LS [2]):

|  |  |  |
| --- | --- | --- |
| **Feature #** | **48-1** | **48-2** |
| **Group** | **RedCap UE with reduced peak data rate and reduced baseband bandwidth in FR1** | **RedCap UE with reduced peak data rate without reduced baseband bandwidth in FR1** |
| **Components** | The following components are the same as for *supportOfRedCap-r17* (28-1):  1. Maximum FR1 RedCap UE bandwidth is 20 MHz.  3. Early indication of RedCap UE in Msg.1 for 4-step RACH  4. Separate initial UL BWP for RedCap UEs  - It includes the configuration(s) needed for RedCap UE to perform random access  - Enabling/disabling of frequency hopping for common PUCCH resources  5. Separate initial DL BWP for RedCap UEs  - It includes CSS/CORESET for random access  - For separate initial DL BWP used for paging, CD-SSB is included  - For separate initial DL BWP only used for RACH, SSB may or may not be included  - For separate initial DL BWP used in connected mode as BWP#0 configuration option 1, CD-SSB is included  6. 1 UE-specific RRC configured DL BWP per carrier  7. 1 UE-specific RRC configured UL BWP per carrier  8. RRC reconfiguration of any parameters related to BWP  9. UE-specific RRC configured DL BWP with CD-SSB or NCD-SSB  10. NCD-SSB based measurements in RRC-configured DL BWP  The following components are new compared to *supportOfRedCap-r17* (28-1):  11. DL/UL peak data rate target of 10 Mbps corresponding to *vLayers*·*Qm*·*f* = 3.2  12. Maximum number of PDSCH/PUSCH PRBs that can be scheduled for unicast per slot of 25 PRBs for 15 kHz SCS and 12 PRBs for 30 kHz SCS  13. Relaxed processing timeline of 1/0.5 ms for 15/30 kHz SCS when the RAR PDSCH and MsgB PDSCH (if supported) is larger than 25/12 PRBs for 15/30 kHz SCS  14. Network-configurable additional separate early indication in Msg1 for Rel-18 eRedCap UEs  FFS whether to add additional components | Component 13 in FG 48-1 is supported by FG 48-2 during initial access.  The capabilities of FG 48-2 are the same as for FG 48-1 except that the following restriction does not apply:  12. Maximum number of PDSCH/PUSCH PRBs that can be scheduled for unicast per slot of 25 PRBs for 15 kHz SCS and 12 PRBs for 30 kHz SCS  Component 11 in FG 48-1 does not apply and DL/UL peak data rate target of 10 Mbps corresponding to *vLayers*·*Qm*·*f* = 0.75 when *vLayers* = 1 and *vLayers*·*Qm*·*f* = 0.8 when *vLayers* = 2 |
| **Pre-req.** |  | 48-1 |
| **Need for gNB to know if feature is supported** | Y | Y |
| **Consequence if the feature is not supported by the UE** | Network assumes the UE is not a RedCap UE with reduced peak data rate without reduced baseband bandwidth in FR1 | Network assumes the UE is not a RedCap UE with reduced peak data rate without reduced baseband bandwidth in FR1 |
| **Type** | Per UE | Per UE |
| **FDD/ TDD diff** | No | No |
| **FR1/ FR2 diff** | FR1 only | FR1 only |
| **Note** | A UE supporting this FG is not required to support FG 6-1.  A UE supporting this FG is not allowed to support FG 28-1.  The specifications for a UE supporting FG 28-1 (‘RedCap UE’) also apply for a UE supporting this FG (FG 48-1) unless stated otherwise.  It is up to RAN2 whether/how to capture the capabilities for early indication of RedCap UE in Msg 3 and Msg A.  It is up to RAN2 whether/how to capture the capabilities for additional separate early indication of Rel-18 eRedCap UE in Msg 3 and Msg A PUSCH. |  |
| **Mandatory/ Optional** | Optional with capability signaling  UEs supporting Rel-18 eRedCap UE complexity reduction feature(s) indicate support of this FG instead of FG 28-1 (supportOfRedCap-r17). | Optional with capability signaling |

In addition, RAN1 also provided inputs on their agreements on the reduced peak data rate for Rel-18 eRedCap UEs in LS [3] as it seems to have specification impacts at least on TS 36.306 clause 4.1.2 (‘Supported max data rate for DL/UL’):

* *The UE signals peak data rate related parameters vLayers, Qm and f corresponding to 10 Mbps.*
  + *No new values for the above parameters will be introduced for Rel-18 eRedCap.*
* *For UE peak data rate reduction with UE BB bandwidth reduction (i.e., FG 48-1),*
  + *The 10-Mbps peak rate target corresponds to a vLayers·Qm·f of 3.2.*
  + *25 PRBs for and 12 PRBs for for  is always assumed in the UE supported max data rate expression in TS 38.306 for any given band.*
* *For UE peak data rate reduction without UE BB bandwidth reduction (i.e., FG 48-2),*
  + *When vLayers = 1, the 10-Mbps peak rate target corresponds to a vLayers·Qm·f of 0.75.*
  + *When vLayers = 2, the peak rate target corresponds to a vLayers·Qm·f of 0.8.*
  + *106 PRBs for and 51 PRBs for for  is always assumed in the UE supported max data rate expression in TS 38.306 for any given band.*
* *In all cases, the same value for vLayers·Qm·f is used for DL and UL.*

On summary, considering above agreements/updates, this document aims to collect companies’ inputs on the suggested TPs for the temporary CRs on RAN1 lead features, and the draft CRs on RAN2 lead features/topics.

# Companies’ point of contact (PoC)

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| --- | --- | --- |
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# Discussion

## [RAN1 lead features] Temporary CRs to TS 38.306 and 38.331 on UE Capabilities for eRedCap

1. Do you agree with the way eRedCap terminology is updated in the description of **FG 48-1,** i.e. *enhRedCap-r18*(related TP is highlighted in pink on the temporary CR to TS 38.306 which captures the agreed details on **RAN1 lead features** of UE Capabilities for eRedCap)? If not, please indicate your suggested TP.

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| **Company’s name** | **Yes/No** | **Comments, if any** |
| Ericsson | Yes, but | *- enhRedCap-r18* should be replaced with *eRedCap-r18* as captured in the running 38.331 CR.  **[Rapp(v1)]** OK with using the term eRedCap (instead of enhRedCap) to align references across specification. If so, further changes might be needed to running CR to 38331 (R2-2309068) as this similar term (“*enhRedCap-r18*”) is used when defining the new value in *FeatureCombination-r17*. NOTE: an related editor’s note is added for discussion the name considering other related inputs (marked with [ref-1]).  - it would be better if we clarify what “separate” indicates in the statements below:  “Separate initial UL BWP for eRedCap UEs”  “Separate initial DL BWP for eRedCap UEs”  Is the initial BWP separate with respect to RedCap UEs, non-RedCap UEs or both?  **[Rapp(v1)]** The following editor’s note is added “*Editor’s note: FFS what RAN1 referred by “separate” in relation to eRedCap UEs vs RedCap UEs (update dependent to RAN1 input/confirmation).*”  - is the following a functional UE component?  “Enabling/disabling of frequency hopping for common PUCCH resources”  **[Rapp(v1)]** This text is based on RAN1 text provided in LS. If the preference is to remove this, this could be done and RAN2 could inform RAN1. The following editor’s note is added “*Editor’s note: FFS whether the following TP should be captured as part of the functional component list, i.e. “Enabling/disabling of frequency hopping for common PUCCH resources” (update dependent to RAN1 input/confirmation).*”  - It would be better if we clarify what “option 1” is in the following  “For separate initial DL BWP used in connected mode as BWP#0 configuration option 1, CD-SSB is included”  **[Rapp(v1)]** It is a valid point that option 1 should be included in the TP. The following editor’s note is added “*Editor’s note: FFS what RAN1 referred by “option 1” (update dependent to RAN1 input/confirmation).*” aiming to clarify whether anything needs to be added based on RAN1 related agreement or the reference of “option 1” could be just removed.  - it would be better if we capture what is applicable when an eRedCap UE does not support *notReducedBB-BW-r18*, in the following:  “- Maximum number of PDSCH/PUSCH PRBs that can be scheduled for unicast per slot of 25 PRBs for 15 kHz SCS and 12 PRBs for 30 kHz SCS.  - If eRedCap UE also supports *notReducedBB-BW-r18,* this component is not applicable”  **[Rapp(v1)]** Current TP aims to minimize duplication of the description text. On other hand, further changes are done due to un inter-related comment (marked with [ref-2]*).*”  *- enhRedCap-r18* should be replaced with *eRedCap-r18* as captured in the running TS 38.331 CR in the following:  “***notReducedBB-BW-r18***  Indicates that the UE is an eRedCap UE without reduced baseband bandwidth in FR1. UE supporting this feature shall indicate the support of *enhRedCap-r18*.”  **[Rapp(v1)]** OK with using the term eRedCap as explained in previous response [ref-1]. |
| Huawei, HiSilicon | Generally agree, see comment | 1. Suggest to split those descriptions for FG 48-1 into two parts, as in R1 UE feature list, i.e. components are the same as for *supportOfRedCap-r17* (28-1) and new components;   **[Rapp(v1)]** No strong view on whether to add this differentiation. Said this TP is updated as requested (unless other companies have different preference).   1. “eRedCap UEs” seems not necessary in following bullets, we can just remove:    * Maximum FR1 bandwidth is 20 MHz;   **[Rapp(v1)]** No strong view on whether to keep or remove “eRedCap UE” as the meaning seems the same. Said this TP is removed as requested (unless other companies have different preference).   1. Wording suggestion to “additional separate early indication in Msg1 for eRedCap UEs”: the “additional” is not clear in specification. Maybe we can just remove it and “separate early indication in Msg1 for eRedCap UEs” should be sufficient to refer the R18 new Msg1 identification.   **[Rapp(v1)]** The suggestion/justification seems reasonable. The suggested change is done and the following editor’s note is added “*Editor’s note: FFS whether not to remove “additional” from the following functional component, i.e. “Network-configurable ~~additional~~ separate early indication in Msg1 for eRedCap UEs (update dependent to RAN1 input/confirmation).*” to double check whether any company has a concern to change this text provided by RAN1. |
| MediaTek | Mostly yes | Agree with the use of eRedCap terminology.  **[Rapp(v1)]** See previous responses on this [ref-1].  A few comments on the actual text itself:  1. Suggest aligning parameter name with RedCap, i.e. ‘supportOfEnhRedCap-r18’  **[Rapp(v1)]** As this suggested change is different than the term used in other running CRs (as explained in one of the above comments marked with [ref-1]). The following editor’s note is added “*Editor’s note: FFS which name to use for the new UE capability considering eRedCap-r18, supportOfEnhRedCap-18 or supportOf-eRedCap-r18*”, highlighting that current TP is using the term *eRedCap-r18.*  2. Not necessary to add ‘eRedCap UE’ to all the sub-bullets as the main bullet defines the UE as an ‘eRedCap UE’. At the very least, should remove eRedCap from separate initial BWPs (as it could be read to imply that we’ve introduced new eRedCap specific initial BWPs)  **[Rapp(v1)]** The justification/motivation to remove eRedCap references seems reasonable as the field description is for *eRedCap-r18* capability (related inputs are marked with [ref-3]. TP is updated and the following editor’s note is added “*Editor’s note: FFS whether any of the references to eRedCap needs to be kept (or be even updated e.g. to RedCap or (e)RedCap) in the functional components that describe eRedCap-r18*”  3. Suggest stating peak data rate of 10Mbps, rather than peak data rate target of 10Mbps. A target of 10Mbps could imply that a UE may not achieve this target?  **[Rapp(v1)]** The justification/motivation to remove “target” seems reasonable. TP is updated and the following editor’s note is added “*Editor’s note: FFS whether not to remove “target” from the functional component that use the term “peak data rate ~~target~~ of 10Mbps.*” in case companies have different preference. |
| Vivo | Agree with comment | Agree with the use of eRedCap terminology.  **[Rapp(v1)]** See previous responses on this [ref-1].  A few comments on the actual text itself:   1. “Support of eRedCap early indication based on Msg1 for 4-step RACH” should be “Support of RedCap early indication based on Msg1 for 4-step RACH”. Because this sentence represents the case in which Rel-18 eRedCap specific RA resource isn’t configured and Rel-17 RedCap specific RA resource is configured, eRedCap UE will use Rel-17 RedCap specific RA resource.   While fthe case in which Rel-18 eRedCap specific RA resource is configured, the sentence “Network-configurable additional separate early indication in Msg1 for eRedCap UEs” represents it.  **[Rapp(v1)]** Rapp understanding is that from UE point of view, a Rel-18 eRedCap UE would use Msg1 EI to be differentiated but from network point of view, this Msg1 EI may not differentiate Rel-17 RedCap UE vs Rel-18 eRedCap UEs. The description of Rel-18 eRedCap capability should focus on UE’s point of view. Said this, this topic is inter-related with a previous comment which already has an editor’s note for discussion [ref-3].  2. the below statements, should be “RedCap”, instead of “eRedCap”, as there is no intention for RAN1 to introduce additional separate initial DL/UL BWP for eRedCap, while their meaning is to reuse legacy separate initial DL/UL BWP for Rel-17 RedCap.  - Separate initial UL BWP for eRedCap UEs;  - Separate initial DL BWP for eRedCap UEs;  **[Rapp(v1)]** Same editor’s note as in previous point also applies here [ref-3]. |
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1. Do you agree with the way proposed to capture **the differences between FG 48-1 and FG 48-2,** i.e. *enhRedCap-r18* and *notReducedBB-BW-r18* (related TP is highlighted in blue on the temporary CR to TS 38.306 which captures the agreed details on **RAN1 lead features** of UE Capabilities for eRedCap)? If not, please indicate your suggested TP.

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| **Company’s name** | **Yes/No** | **Comments, if any** |
| Ericsson |  | Please see our comments above in DP 1. |
| Huawei, HiSilicon | Generally agree, see comment | We support the intention from rapporteur.  Comment 1:  “instead, DL/UL peak data rate target of 10 Mbps corresponding to *vLayers*·*Qm*·*f* = 0.75 when *vLayers* = 1 and *vLayers*·*Qm*·*f* = 0.8 when *vLayers* = 2”  This text is suggest to move to field description of *notReducedBB-BW-r18*.  **[Rapp(v1)]** TP is updated as suggested and in addition, an editor’s note is added on this regard considering a previous inter-related input marked with [ref-2] (i.e., “*Editor’s note: FFS how to capture the field description when UE supports both eRedCap-r18 and notReducedBB-BW-r18 considering e.g., option 1) current TP which captures which components of eRedCap-r18 are not applicable when UE also supports notReducedBB-BW-r18, or option 2) duplication of the applicable components is done in order to capture which components of eRedCap-r18 are applicable when UE also supports notReducedBB-BW-r18. In addition, it is also discussed whether the related TP is added as part of the field description of notReducedBB-BW-r18 or eRedCap-r18)*”).  Comment 2:  “Relaxed RAR-PDSCH processing timeline of 1/0.5 ms for 15/30 kHz SCS when the RAR PDSCH and MsgB PDSCH (if supported) is larger than 25/12 PRBs for 15/30 kHz SCS.  - If eRedCap UE also supports *notReducedBB-BW-*r18, this component is only applicable during initial access and contention based random access. ”  “supported” is suggested to be changed as “applicable”. In addition, this should also be applied in “CBRA in connected mode” since NW does not know whether a UE is FG 48-1 or FG 48-1a during CBRA. See the above updates.  **[Rapp(v1)]** TP is updated to use “applicable” as suggested and the following Editor’s note is added “*Editor’s note: FFS whether “contention based random access” should also be added in relation to the following functional component “If eRedCap UE also supports notReducedBB-BW-r18, the component of “Relaxed RAR-PDSCH processing timeline” is only applicable during initial access and contention based random access”*” |
| MediaTek | Yes |  |
|  |  |  |

1. Please indicate if you have any other input/comments on the temporary CRs to TS 38.306 and 38.331 which captures the agreed details on **RAN1 lead features** of UE Capabilities for eRedCap.

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| --- | --- | --- | --- |
| **Company’s name** | **TS #** | **Section** | **Comments, if any** |
| Ericsson | 38.306 |  | Please see our comments above in DP 1. |
|  | 38.331 |  | - In section 6.3.3, in the marked text below *enhRedCap-r18* should be replaced with *eRedCap-r18* as captured in the running 38.331 CR:  “enhRedCap-r18 ENUMERATED {supported} OPTIONAL,”  **[Rapp(v1)]** See previous responses on this.  - In the same section, the parameter *notReducedBB-BW-r18* can be renamed to reflect that it is affiliated with an eRedCap UE. How about *eRedCapNotReducedBB-BW-r18* or *eRedCapReducedBB-BW-r18* and update the description of the parameter accordingly.  **[Rapp(v1)]** No strong view; both temp CRs are updated to use the term *eRedCapNotReducedBB-BW-r18* instead of n*otReducedBB-BW-r18.* An editor’s note is added to confirm RAN2 preference on the update capability name (“*Editor’s note: FFS which name to use for the new UE capability considering nonReducedBB-BW-r18, eRedCapNotReducedBB-BW-r18 or eRedCapReducedBB-BW-r18*”). |
| Huawei, HiSilicon | General |  | Do we need to combine the “tempCR” and “draftCR” into one document for easy review, at least for 38.306?  **[Rapp(v1)]** In our understanding is easier to keep them in separate documents. Note that tempCR will be submitted as a discussion TDoc and when the TP is stable, the TP will be merged in the UE capability mega CR and the review will continue there. |
| Huawei, HiSilicon | 38.331 |  | The new fields should be added in *RedCapParameters-r17* (or a new *EnhRedCapParameters-r18*), same place as R17 RedCap UE. Disagree to put those into *Phy-ParametersCommon*.  **[Rapp(v1)]** No strong preference. TP is updated as suggested, i.e. new *ERedCapParameters-r18* is defined and a corresponding proposal is added for RAN2 to confirm the updated TP on this. |
| Vivo | 38.306 | 4.2.x.2 | 1. Some details can be removed similar as in *supportOfRedCap-r17* which doesn’t include them. The specific details are as follows.  - It includes the configuration(s) needed for eRedCap UE to perform random access  - Enabling/disabling of frequency hopping for common PUCCH resources  It includes CSS/CORESET for random access  - For separate initial DL BWP used for paging, CD-SSB is included  - For separate initial DL BWP only used for RACH, SSB may or may not be included  - For separate initial DL BWP used in connected mode as BWP#0 configuration option 1, CD-SSB is included  **[Rapp(v1)]** No strong view; TP is updated as suggested and it is added an Editor’s notes to confirm companies’ preference as current points are flag in RAN1 LS suggest adding the following editor’s note on this for discussion “*Editor’s note: FFS whether the points above could be removed from the field description of eRedCap-r18 considering how related functional components are currently captured in supportOfRedCap-r17.*”   1. “Support of eRedCap early indication based on Msg3 and MsgA PUSCH” should be “Support of eRedCap early indication based on Msg3 and MsgA PUSCH (if UE indicated   support of twoStepRACH-r16)”.  **[Rapp(v1)]** OK with suggested input |

**[Rap(v1)] Summary report:** The UE capability tempCRs to 38.306 and 38.331 on the [RAN1 lead features] are updated with the inputs provided in this email discussion and identified editor’s notes are captured to list the points identified for further discussion.

1. To agree as baseline the UE capability tempCRs on the [RAN1 lead features] provided to TS 38.306 and 38.331 in R2-2xxxx and R2-2xxxx. The following sub-proposals summarize the changes done in current TP that might need confirmation or discussion:
   1. *eRedCap-r18* is the name used for the new Rel-18 eRedCap UE capabilities (instead of e.g., *supportOfEnhRedCap-18* or *supportOf-eRedCap-r18*).
   2. *eRedCapNotReducedBB-BW-r18* is the name used for the new Rel-18 eRedCap UE capabilities operating with no reduced Baseband Bandwidth (instead of e.g., *nonReducedBB-BW-r18,* or *eRedCapReducedBB-BW-r18*)*.*
   3. It is removed “additional” reference from the following functional component, i.e. “*Network-configurable ~~additional~~ separate early indication in Msg1 for eRedCap UEs*”.
   4. It is removed the references of eRedCap in the following functional components: (a) “*Support of ~~eRedCap~~ early indication based on Msg1 for 4-step RAC*H”, (b) “*Separate initial UL BWP ~~for eRedCap UEs~~*”, (c) “*Separate initial DL BWP ~~for eRedCap UEs~~*”, (d) “*It includes the configuration(s) needed ~~for eRedCap UE~~ to perform random access*”, € “Network-configurable separate early indication in Msg1 ~~for eRedCap UEs~~”, and (f) “*Support of ~~eRedCap~~ early indication based on MsgA PUSCH, if UE indicates the support of twoStepRACH-r16, and Msg3*”.
   5. It is removed “target” from the functional components that use the term “peak data rate ~~target~~ of 10Mbps.
   6. The field description of *eRedCap-r18* captures which components are not applicable when UE also supports *notReducedBB-BW-r18* and the field description of *eRedCapNotReducedBB-BW-r18* captures details of the component specific applicable to it.
   7. The new UE capabilities for Rel-18 eRedCap WI are defined as part of a new field *ERedCapParameters-r18* which is defined in same location as Rel-17 RedCap UE capability (i.e., *UE-NR-Capability-v1800*).
2. To discuss the following open points related to RAN1 feature list provided in R1-2308610 (as part of their latest LS R1-2308523) and consider whether there is need to ask RAN1 on any of those points:
   1. FFS what RAN1 referred by “separate” in relation to eRedCap UEs vs RedCap UEs for the following components “*Separate initial UL BWP for eRedCap UEs*” and “*Separate initial DL BWP for eRedCap UEs*”.
   2. FFS whether the above TP should be captured as part of the functional component list, i.e. “*Enabling/disabling of frequency hopping for common PUCCH resources*”.
   3. FFS what RAN1 referred by “option 1” in the following component “*For separate initial DL BWP used in connected mode as BWP#0 configuration option 1, CD-SSB is included*”.
   4. FFS whether “*contention based random access*” should be added in relation to the following functional component of “*Relaxed RAR-PDSCH processing timeline*” to indicate that is only applicable during initial access and contention based random access when eRedCap UE also supports *notReducedBB-BW-r18*.
   5. FFS whether the following points could be removed from the field description of *eRedCap-r18* considering how related functional components are currently captured in *supportOfRedCap-r17:* (a) *it includes the configuration(s) needed for eRedCap UE to perform random access, (b) enabling/disabling of frequency hopping for common PUCCH resources, (c) for separate initial DL BWP used for paging, CD-SSB is included, (d) for separate initial DL BWP only used for RACH, SSB may or may not be included and (e) for separate initial DL BWP used in connected mode as BWP#0 configuration option 1, CD-SSB is included*.

## [RAN2 lead features/topics] Drafted CRs to TS 38.306 and 38.331 on UE Capabilities for eRedCap

1. Do you agree with the way that it is captured that **Rel-18 eRedCap UE can support all RAN2-centric Rel-17 RedCap capabilities** (related TP is highlighted in pink on the drafted CRs to TS 38.306 which captures the agreed details on **RAN2 lead features** of UE Capabilities for eRedCap)? If not, please indicate your suggested preference/TP.

This question is related to the following RAN2#123 agreement:

* *A Rel-18 eRedCap UE (both FG 48-1 and FG 48-2) can also support all RAN2-centric Rel-17 RedCap UE capabilities in the same manner.*
  + *Discuss during CR implementation how to capture this in TS 38.306: option 1) add in the field description of R18 eRedCap capability (i.e. supportOfEnhancedRedCap-r18) the following statement “all supportOfRedCap-r17 related capabilities specified in this specification remain applicable for Rel-18 RedCap UEs, unless indicated otherwise” or option 2) update the field description of the RAN2-centric Rel-17 RedCap UE capabilities to be applicable to (e)RedCap UEs.*

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| --- | --- | --- |
| **Company’s name** | **Yes/No** | **Comments, if any** |
| Ericsson | Yes, but | - In section 4.1.2 in the marked text below *enhRedCap-r18* should be replaced with *eRedCap-r18* as captured in the running 38.331 CR:   * no smaller than 4 except for a UE supporting *enhRedCap-r18*. * 3.2 if UE supports *enhRedCap-r18* but does not support *notReducedBB-BW-r18.* * 0.75 if and UE supports *enhRedCap-r18* and *notReducedBB-BW-r18*. * 0.8 if and UE supports *enhRedCap-r18* and *notReducedBB-BW-r18*.   **[Rapp(v1)]** TP is updated in alignment to the response in previous related comments.  - In the same section for the marked text above, please see our comments above in DP 3 regarding the parameter *notReducedBB-BW-r18*.  **[Rapp(v1)]** TP is updated in alignment to the response in previous related comments.  - In section 4.2.6 for the marked description below:  “***extendedDRX-CycleInactive-r18***  Indicates whether UE supports the extended DRX in RRC\_INACTIVE with values above 1024 radio frames as specified in TS 38.331 [9]. The UE may indicate support of this capability only if it supports extended DRX in RRC\_IDLE.”  We should provide a reference to TS 38.306, so it can be either 38.306 or 38.306 and 38.331.  **[Rapp(v1)]** Suggested input/change aimed to add the reference of TS 38.304 (instead of 38.306). |
| Huawei, HiSilicon | Yes, but | The specifications and capabilities of a RedCap UE are also applicable to eRedCap UEs unless stated otherwise.  We suggest to change “specifications” as “features”.  This is because that RAN2 agree the spirit to check the specification text to add (e)RedCap explicitly, which means the specification text with only “RedCap” does not directly apply to eRedCap UE.  **[Rapp(v1)]** Huawei raises a valid point as RAN2 running CRs are introducing (e)RedCap to indicate that the corresponding statement is applicable to both R17 and R18. In addition, the term feature and capability refer to the same. TP is updated to remove that sentence which does not seemed necessary as all RedCap references are updated to (e)RedCap or eRedCap where it is applicable. |
| MediaTek | No | Having taken a look through the temp R1 and draft R2 CRs, the generic sentence ‘*specifications and capabilities of a RedCap UE are also applicable to eRedCap UEs unless stated otherwise*’ doesn’t seem to add any value and might hinder the spec from being future proof.  The temp R1 CR lists all the components of eRedCap including those inherited from RedCap. The draft R2 CR includes an update to the definitions from RedCap to (e)RedCap. With these two CRs, it looks like we have Option 2 in place, which is clean and forward compatible.  **[Rapp(v1)]** It is a valid point and aligned to previous comment. |
| vivo | Yes with comments | We think option 2 is better as it is clearer.  **However, similar to R17 RedCap, we think *ncd-SSB-ForRedCapInitialBWP-SDT-r17* should also apply to eRedCap, which was missing.**  **[Rapp(v1)]** TP is updated as suggested including a reference that UE shall also indicate the support of eRedCap when applicable. |

**[Rap(v1)] Summary report:** Considering above response the following TP is removed from section 4.2.x.1 “*A Rel-18 eRedCap UE (both FG 48-1 and FG 48-2) can also support all RAN2-centric Rel-17 RedCap UE capabilities in the same manner*” as the applicable capabilities are updated to use the term (e)RedCap in alignment to other RAN2 running CR and potentially easily agreeable changes are done directly in the updated TP.

1. Please indicate if you have any other input/comments on the drafted CRs to TS 38.306 and 38.331 which captures the agreed details on **RAN2 lead features/topics** of UE Capabilities for eRedCap during RAN2#123 meeting.

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| --- | --- | --- | --- |
| **Company’s name** | **TS #** | **Section** | **Comments, if any** |
| Ericsson | 38.306  38.331 |  | - Please see our comments above in DP 4.  - In section 6.3.3, regarding the marked text below:  extendedDRX-CycleInactive-r18 ENUMERATED {supported} OPTIONAL  It should be *extendedDRX-CycleInactive-v18xy* considering that parameter *extendedDRXCycleInactive* was introduced in Rel-17.  **[Rapp(v1)]** Rapp understanding is that the functionality for Rel-18 and Rel-18 eDRX in INACTIVE is different. Therefore it seems preferable that UE capabilities are dependently. Moreover it might be good to discuss whether the UE capability name should be different than Rel-17 one. The following editor’s note is added for discussion “*Editor’s note: FFS whether the name of* *extendedDRX-CycleInactive-r18 needs to be updated e.g.* *extendedDRX-CycleInactive-v18xy, or extendedDRX-CycleInactive-Above1024-r18*”. |
| Huawei, HiSilicon | 38.306 | 4.2.21.2 | ***ncd-SSB-ForRedCapInitialBWP-SDT-r17***  Indicates that the UE supports using RedCap-specific initial DL BWP associated with NCD-SSB for SDT. If absent, the UE only supports SDT in an initial DL BWP that includes the CD-SSB. UE supporting this feature shall indicate support of *supportOfRedCap-r17* or *enhRedCap-r18* and *ra-SDT-r17 and/or cg-SDT-r17*.  This capability also applies to eRedCap UE. We should clarify as above.  **[Rapp(v1)]** Updated as explained in previous comment. |
| Huawei, HiSilicon | 38.306 |  | We should also add “(e)RedCap UEs” for following parameters field descriptions:   * nr-CGI-Reporting-NPN-r16 * reportAddNeighMeasForPeriodic-r16 * nr-CGI-Reporting * eutra-CGI-Reporting * pdsch-256QAM-FR1 * supportedBandwidthUL, supportedBandwidthUL-v1710 * supportedBandwidthDL, supportedBandwidthDL-v1710 * channelBWs-UL * channelBWs-DL * bwp-SameNumerology, bwp-DiffNumerology * Rel-17 relaxed measurement for RRC\_IDLE/RRC\_INACTIVE in section 5.6 * “The number of DRBs that a UE shall support. 8 per UE, for RedCap UEs” in section 8   **[Rapp(v1)]** Updated in above list of items the reference of RedCap to (e)RedCap |
| MediaTek | 38.306 | 4.1.2 | RAN plenary agreed that peak data rate for eRedCap is 10Mbps (see revised WID RP-232671). However, current text in section 4.1.2 indicates that eRedCap UE peak data rate is ‘no smaller than’ 10Mbps. This needs to be clarified.  In addition, eRedCap UEs with reduced BW should use a different value of Nprbs (i.e. not use the channel BW value of 20MHz).  We therefore propose the following change:  *For single carrier NR SA operation, a UE that is not an eRedCap UE shall support a data rate for the carrier that is no smaller than the data rate computed using the above formula,* *with and* *component is no smaller than 4.*  *For single carrier NR SA operation, an eRedCap UE shall support a peak data rate of 10Mbps computed using the above formula, with and:*   * *if the UE does not support notReducedBB-BW-r18:*   + *component is 3.2, and;*  * + *is 25 if μ = 0;*   + *is 12 if μ = 1;* * *else:*   + *component is 0.75 if =1;*   + *component*  *is 0.8 if =2.*   **[Rapp(v1)]** No strong preference on which approach to take for this TP. Suggest adding a related editor’s note for discussion. |
| MediaTek | 38.306 | 4.1.2 | The reason for the change suggested above is not just on the approach, but that what is currently captured leads to incorrect data rate calculations.  As an example, if we have a BW-limited eRedCap UE operating with 15khz SCS, current text in the CR leads to the following result:  DL data rate = 10-6 \* (3.2 \* 948/1024 \* (100 \* 12)/(10-3/14) \* 0.86) = ~42Mbps  Therefore, if we follow the current text, it would read as:  *The eRedCap UE shall support a data rate no smaller than 42Mbps*  This is obviously incorrect as the eRedCap UE is meant to support 10Mbps, hence the suggested update above.  No strong opinion on the approach to capture this, but we should ensure that what is captured in this text is correct and reflects what was agreed in the plenary.  **[Rapp(v2)]** Share the view that the TP should capture/reflect the correct/expected behaviour. Follow-up responses:   * Section 4.1.2 currently captures the following general descriptions for  and :   + *“* *is the maximum RB allocation in bandwidth*  *with numerology* *, as defined in 5.3 TS 38.101-1 [2], 5.3 TS 38.101-2 [3], and 5.3 TS 38.101-5 [34], where*  *is the UE supported maximum bandwidth in the given band or band combination.”*   + *“* *is the numerology (as defined in TS 38.211 [6])”.*   TP describing the characteristics of *eRedCap-r18* new UE capability captures the information about  and , i.e. “*Maximum number of PDSCH/PUSCH PRBs that can be scheduled for unicast per slot of 25 PRBs for 15 kHz SCS and 12 PRBs for 30 kHz SCS*”. Similarly, it is also explained that this limitation is not applicable for and *eRedCapNotReducedBB-BW-r18.*  Depending on companies’ preference, it is possible to add the clause section that provide the description of these new UE’s capability or repeat the related limitation/setting in section 4.1.2 as suggested by MediaTek.   * In Rapp(v1) draftCR to 38.306, text of section 4.1.2 still has a reference to “no smaller than” which should not be applicable to Rel-18 eRedCap. This would need to be updated. |

**[Rap(v1)] Summary report:** The UE capability draftCRs to 38.306 and 38.331 on the [RAN2 lead features] are updated with the inputs provided in this email discussion and identified editor’s notes are captured to list the points identified for further discussion. **[Rap(v2)]** The possible options of the TP for section 4.1.2 “Supported max data rate for DL/UL” of TS 38.306 are shown below to easy discussion of this report:

1. Different sub-bullets are listed to explain legacy and eRedCap operation which would include references to the clauses that provide further details. TP of option 1 could look as follows:

*For single carrier NR SA operation, the UE shall support a data rate for the carrier that is:*

* *no smaller than the data rate computed using the above formula, with and component is no smaller than 4 except for a UE supporting eRedCap-r18, as defined in clause 4.2.x.2.*
* *the data rate computed using the above formula, with and component is:*
  + *3.2 if UE supports eRedCap-r18 but does not support eRedCapNotReducedBB-BW-r18, as defined in clause 4.2.x.2.*
  + *0.75 if and UE supports eRedCap-r18 and eRedCapNotReducedBB-BW-r18, as defined in clause 4.2.x.2.*
  + *0.8 if and UE supports eRedCap-r18 and eRedCapNotReducedBB-BW-r18, as defined in clause 4.2.x.2.*

1. A separate description is defined for eRedCap UE which would also add reference to ** is 25 if μ = 0 and ** is 12 if μ = 1 for *eRedCap-r18*. TP of option 2 could look as follows:

*For single carrier NR SA operation, a UE that is not an eRedCap UE shall support a data rate for the carrier that is no smaller than the data rate computed using the above formula, with and component is no smaller than 4.*

*For single carrier NR SA operation, an eRedCap UE shall support a peak data rate of 10Mbps computed using the above formula, with and:*

* *if the UE does not support eRedCapNotReducedBB-BW-r18:*
  + *component is 3.2, and;*
  + * is 25 if μ = 0;*
  + * is 12 if μ = 1;*
* *else:*
  + *component is 0.75 if =1;*
  + *component is 0.8 if =2.*

Both options aims to capture the same UE behaviour but with the last change to option 1, option 2 seems cleaner. Therefore, TP of the draft CR to 38.306 and Proposal 3.3 are both updated in alignment to option 2.

1. To agree as baseline the UE capability draftCRs on the [RAN2 lead features] provided to TS 38.306 and 38.331 in R2-2xxxx and R2-2xxxx. The following sub-proposals summarize the changes done in current TP that might need confirmation or discussion:
   1. To update RedCap references to (e)RedCap in the field descriptions of the following: (a) *supportedBandwidthDL / supportedBandwidthDL-v1710,* (b) *supportedBandwidthUL / supportedBandwidthUL-v1710*, (c) *pdsch-256QAM-FR1*, (d) *eutra-CGI-Reporting,* (f) *nr-CGI-Reporting,* (g) *reportAddNeighMeasForPeriodic-r16,* (h) *nr-CGI-Reporting-NPN-r16,* (i) *ncd-SSB-ForRedCapInitialBWP-SDT-r17,* (j) *supportOf16DRB-RedCap-r17*, (k) *longSN-RedCap-r17*, (l) *am-WithLongSN-RedCap-r17*, (m) *rrm-RelaxationRRC-ConnectedRedCap-r17*, (n) Rel-17 relaxed measurement for RRC\_IDLE/RRC\_INACTIVE, and (o) the number of DRBs that a UE shall support.
   2. To remove the following statement previously captured in section 4.2.x.1 – “*~~A Rel-18 eRedCap UE (both FG 48-1 and FG 48-2) can also support all RAN2-centric Rel-17 RedCap UE capabilities in the same manner~~*” (considering the changes of Proposal 3.1.1).
   3. The TP of section “*4.1.2 Supported max data rate for DL/UL*” creates a separate description for eRedCap UE which would also include details of ** is 25 if μ = 0 and ** is 12 if μ = 1 for *eRedCap-r18* not supporting *eRedCapNotReducedBB-BW-r18* (similar TP as in option 2 with some editorial updates).

# Conclusion

The proposals captured are the following:

**Proposal 1.** To agree as baseline the UE capability tempCRs on the [RAN1 lead features] provided to TS 38.306 and 38.331 in R2-2xxxx and R2-2xxxx. The following sub-proposals summarize the changes done in current TP that might need confirmation or discussion:

**Proposal 1.1.** *eRedCap-r18* is the name used for the new Rel-18 eRedCap UE capabilities (instead of e.g., *supportOfEnhRedCap-18* or *supportOf-eRedCap-r18*).

**Proposal 1.2.** *eRedCapNotReducedBB-BW-r18* is the name used for the new Rel-18 eRedCap UE capabilities operating with no reduced Baseband Bandwidth (instead of e.g., *nonReducedBB-BW-r18,* or *eRedCapReducedBB-BW-r18*)*.*

**Proposal 1.3.** It is removed “additional” reference from the following functional component, i.e. “*Network-configurable ~~additional~~ separate early indication in Msg1 for eRedCap UEs*”.

**Proposal 1.4.** It is removed the references of eRedCap in the following functional components: (a) “*Support of ~~eRedCap~~ early indication based on Msg1 for 4-step RAC*H”, (b) “*Separate initial UL BWP ~~for eRedCap UEs~~*”, (c) “*Separate initial DL BWP ~~for eRedCap UEs~~*”, (d) “*It includes the configuration(s) needed ~~for eRedCap UE~~ to perform random access*”, € “Network-configurable separate early indication in Msg1 ~~for eRedCap UEs~~”, and (f) “*Support of ~~eRedCap~~ early indication based on MsgA PUSCH, if UE indicates the support of twoStepRACH-r16, and Msg3*”.

**Proposal 1.5.** It is removed “target” from the functional components that use the term “peak data rate ~~target~~ of 10Mbps.

**Proposal 1.6.** The field description of *eRedCap-r18* captures which components are not applicable when UE also supports *notReducedBB-BW-r18* and the field description of *eRedCapNotReducedBB-BW-r18* captures details of the component specific applicable to it.

**Proposal 1.7.** The new UE capabilities for Rel-18 eRedCap WI are defined as part of a new field *ERedCapParameters-r18* which is defined in same location as Rel-17 RedCap UE capability (i.e., *UE-NR-Capability-v1800*).

**Proposal 2.** To discuss the following open points related to RAN1 feature list provided in R1-2308610 (as part of their latest LS R1-2308523) and consider whether there is need to ask RAN1 on any of those points:

**Proposal 2.1.** FFS what RAN1 referred by “separate” in relation to eRedCap UEs vs RedCap UEs for the following components “*Separate initial UL BWP for eRedCap UEs*” and “*Separate initial DL BWP for eRedCap UEs*”.

**Proposal 2.2.** FFS whether the above TP should be captured as part of the functional component list, i.e. “*Enabling/disabling of frequency hopping for common PUCCH resources*”.

**Proposal 2.3.** FFS what RAN1 referred by “option 1” in the following component “*For separate initial DL BWP used in connected mode as BWP#0 configuration option 1, CD-SSB is included*”.

**Proposal 2.4.** FFS whether “*contention based random access*” should be added in relation to the following functional component of “*Relaxed RAR-PDSCH processing timeline*” to indicate that is only applicable during initial access and contention based random access when eRedCap UE also supports *notReducedBB-BW-r18*.

**Proposal 2.5.** FFS whether the following points could be removed from the field description of *eRedCap-r18* considering how related functional components are currently captured in *supportOfRedCap-r17:* (a) *it includes the configuration(s) needed for eRedCap UE to perform random access, (b) enabling/disabling of frequency hopping for common PUCCH resources, (c) for separate initial DL BWP used for paging, CD-SSB is included, (d) for separate initial DL BWP only used for RACH, SSB may or may not be included and (e) for separate initial DL BWP used in connected mode as BWP#0 configuration option 1, CD-SSB is included*.

**Proposal 3.** To agree as baseline the UE capability draftCRs on the [RAN2 lead features] provided to TS 38.306 and 38.331 in R2-2xxxx and R2-2xxxx. The following sub-proposals summarize the changes done in current TP that might need confirmation or discussion:

**Proposal 3.1.** To update RedCap references to (e)RedCap in the field descriptions of the following: (a) *supportedBandwidthDL / supportedBandwidthDL-v1710,* (b) *supportedBandwidthUL / supportedBandwidthUL-v1710*, (c) *pdsch-256QAM-FR1*, (d) *eutra-CGI-Reporting,* (f) *nr-CGI-Reporting,* (g) *reportAddNeighMeasForPeriodic-r16,* (h) *nr-CGI-Reporting-NPN-r16,* (i) *ncd-SSB-ForRedCapInitialBWP-SDT-r17,* (j) *supportOf16DRB-RedCap-r17*, (k) *longSN-RedCap-r17*, (l) *am-WithLongSN-RedCap-r17*, (m) *rrm-RelaxationRRC-ConnectedRedCap-r17*, (n) Rel-17 relaxed measurement for RRC\_IDLE/RRC\_INACTIVE, and (o) the number of DRBs that a UE shall support.

**Proposal 3.2.** To remove the following statement previously captured in section 4.2.x.1 – “*~~A Rel-18 eRedCap UE (both FG 48-1 and FG 48-2) can also support all RAN2-centric Rel-17 RedCap UE capabilities in the same manner~~*” (considering the changes of Proposal 3.1.1).

**Proposal 3.3.** The TP of section “*4.1.2 Supported max data rate for DL/UL*” creates a separate description for eRedCap UE which would also include details of ** is 25 if μ = 0 and ** is 12 if μ = 1 for *eRedCap-r18* not supporting *eRedCapNotReducedBB-BW-r18* (similar TP as in option 2 with some editorial updates).

# Reference

1. R1-2308521, Updated RAN1 UE features list for Rel-18 NR after RAN1#114, August 2023.
2. R1-2308523, LS on Rel-18 RAN1 UE features list for NR after RAN1#114, From: RAN1, To: RAN2, Ccing: RAN4, August 2023.
3. R1-2308610, LS on reduced peak data rate for Rel-18 eRedCap UEs, Rel-18, From: RAN1, To: RAN2, Ccing: RAN4, August 2023.