**3GPP TSG RAN meeting #93e RP-21xxxx**

**Electronic Meeting, September 13 - 17, 2021**

## Status Report to TSG

**Agenda item:** 9.3.1.7

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| --- | --- |
| **WI / SI Name** | Support of reduced capability NR devices |
| included in this status report | Study Item: No | Core part: Yes | Performance part:Yes | Testing part:No |
| **Acronym** | NR\_redcap |
| **Unique ID** | 900062 |
| **TSG Tdoc of latest approved WI/SI description (if any)** | [RP-211574](https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_92e/Docs/RP-211574.zip) |
| **Target Completion Date****(indicate if changed)** | Study Item:  | Core part:03/2022 | Performance part:09/2022 | Testing part:  |
| **Overall Completion level** | Study Item:  | Core part:50% | Performance Part:0% | Testing part:  |

**Source:**

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| **Leading WG** | RAN1 |
| **Rapporteur** | **Name** | Johan BERGMAN |
| **Company** | Ericsson |
| **Email** | johan.bergman@ericsson.com |

## 1 Work plan related evaluation

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| **Do you want to modify the time budget for this WI/SI compared to what was endorsed at the last RAN meeting?** | No |

## 2. Detailed progress in RAN WGs

## 2.1 RAN1

#### 2.1.1 Agreements

##### 2.1.1.1 RAN1#106-e

Before the meeting, 148 contributions were submitted (for details see agenda item 8.6 in [Tdoc list](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_106-e/Docs/TDoc_List_Meeting_RAN1%23106-e.xlsx)), including an updated WI work plan in [R1-2107286](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2107286.zip).

RAN1 carried out online (GTW) discussions and the following offline email discussions documented in the listed documents:

* [106-e-NR-R17-RedCap-01] Email discussion regarding aspects related to reduced maximum UE bandwidth

* + [R1-2108267](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108267.zip), [R1-2108268](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108268.zip), [R1-2108269](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108269.zip), [R1-2108270](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108270.zip), [R1-2108497](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108497.zip), [R1-2108498](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108498.zip), [R1-2108632](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108632.zip)
* [106-e-NR-R17-RedCap-02] Email discussion regarding aspects related to reduced number of Rx branches
	+ [R1-2107747](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2107747.zip), [R1-2108319](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108319.zip), [R1-2108351](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108351.zip)
* [106-e-NR-R17-RedCap-03] Email discussion regarding aspects related to duplex operation
	+ [R1-2108252](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108252.zip), [R1-2108327](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108327.zip), [R1-2108328](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108328.zip), [R1-2108477](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108477.zip), [R1-2108478](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108478.zip)
* [106-e-NR-R17-RedCap-04] Email discussion regarding other aspects of UE complexity reduction
	+ [R1-2108316](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108316.zip), [R1-2108524](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108524.zip)
* [106-e-NR-R17-RedCap-05] Email discussion regarding RAN1 aspects for RAN2-led features
	+ [R1-2107868](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2107868.zip), [R1-2108341](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108341.zip), [R1-2108369](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108369.zip), [R1-2108483](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108483.zip), [R1-2108552](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108552.zip), [R1-2108614](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108614.zip), [R1-2108630](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108630.zip)

After the meeting, an updated RAN1 agreement summary was provided in [R1-2108271](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106-e/Docs/R1-2108271.zip), and a post-meeting email discussion on a draft initial RRC parameter list for L1 configuration parameters was held:

* [Post-106-e-Rel17-RRC-06] REDCAP
	+ Tdoc number TBD

RAN1 made the following agreements related to **reduced maximum UE bandwidth**:

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| Agreements:Replace the RAN1#104bis-e working assumption with the following agreement:* During initial access, the bandwidth of the initial DL BWP for RedCap UEs is not expected to exceed the maximum RedCap UE bandwidth.
	+ RedCap UEs and non-RedCap UEs can share the same MIB-configured initial DL BWP (including the bandwidth and location).
	+ This does not preclude a SIB-configured initial DL BWP for non-RedCap UEs only with a wider bandwidth than the maximum RedCap UE bandwidth.
	+ This does not preclude separate or additional bandwidth and location for initial DL BWP for RedCap UEs.

Agreements: Confirm the following working assumptions from RAN1#105-e:* After initial access (i.e., after RRC Setup, RRC Resume, or RRC Reestablishment), for BWP#0 configuration option 1 (as in 38.331, Appendix B2), a RedCap UE is not expected to operate with an initial DL BWP wider than the maximum RedCap UE bandwidth.
* After initial access (i.e., after RRC Setup, RRC Resume, or RRC Reestablishment), for BWP#0 configuration option 2 (as in 38.331, Appendix B2), a RedCap UE is not expected to operate with an initial DL BWP wider than the maximum RedCap UE bandwidth.

Agreements:Confirm the following working assumption from RAN1#105-e regarding RACH occasions.* For enabling/supporting that the RACH occasion (RO) associated with the best SSB falls within the RedCap UE bandwidth, support separate initial UL BWP for RedCap UEs (which is not expected to exceed the maximum RedCap UE bandwidth), and this separate initial UL BWP for RedCap includes ROs for RedCap UEs.
	+ Note: these ROs can be dedicated for RedCap UEs or shared with non-RedCap UEs.

Agreements:* In case a separate initial UL BWP is configured for RedCap UEs, it is supported that the network can enable/disable intra-slot PUCCH frequency hopping within the separate initial UL BWP in the PUCCH resource for HARQ feedback for Msg4/MsgB for RedCap UEs.
	+ Working assumption: The frequency hopping is enabled/disabled at least via SIB.

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RAN1 made the following agreements related to **duplex operation**:

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| Agreements:* For Case 5 of SSB overlaps with in configured UL transmission, re-use the existing collision handling principles of Rel-15/16 for NR TDD that SSB is prioritized over configured UL transmission
	+ The configured UL transmission includes CG-PUSCH, or SRS
	+ FFS: Confirm that PUCCH is included

Agreements:* For Case 5 of SSB overlaps with configured UL transmission, the configured UL transmission includes PUCCH transmission configured by higher layers
* Note: The UL transmission indicated by DCI is supposed to be dynamic UL transmission.

Agreements:* For Type-A HD-FDD UEs, all ROs applicable to RedCap UEs are valid, and for the case of SSB overlapping with valid RO from cell specific point of view, leave it to UE implementation whether to receive SSB or transmit PRACH
* No support of differentiating of ROs for Type-A HD-FDD Redcap UEs and FD FDD RedCap UEs

Agreements:* For Case 8 of valid RO overlapping with PDCCH in Type 0/0A/1/2 CSS set, leave it to UE implementation whether to receive configured PDCCH or transmit PRACH
* Note: For valid RO intended for PRACH triggered by PDCCH order, it has been covered in Case 2.

Agreements:* For Case 8 of valid RO overlapping with UE-dedicated configured DL reception (e.g. PDCCH in USS, SPS PDSCH, CSI-RS or DL PRS), leave it to UE implementation whether to receive the DL or transmit PRACH
* Note: For valid RO intended for PRACH triggered by PDCCH order, it has been covered in Case 2.

Agreements:* For Case 5 of dynamically scheduled UL transmission vs. SSB, one or both of the following options to be determined till next meeting:
	+ Option 1: Dynamically scheduled UL transmission is prioritized over SSB
	+ Option 2: Reuse the existing collision handling principles of Rel-15/16 for NR TDD that SSB is prioritized over dynamically scheduled UL transmission

Agreements:* For Case 8 of valid RO overlapping with dynamically scheduled DL reception, downselect one of following options in next meeting
	+ Option 2: Leave to UE implementation whether to receive the dynamically scheduled DL or transmit PRACH
	+ Option 3: Follow the handling of Case 1 (dynamically scheduled DL reception vs. semi-statically configured UL transmission)
	+ Option 4: Valid RO is prioritized over dynamic DL reception
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RAN1 made the following agreements related to **RAN2-led objectives**:

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| Agreements:Confirm the following working assumption with the modifications in red:* For 4-step RACH, support the early indication of RedCap UEs at least in Msg1.
	+ The early indication in Msg1 can be configured to be enabled/disabled via SIB
		- ~~FFS how to support enable/disable the early indication~~
	+ ~~FFS details e.g.:~~ From RAN1 perspective, the following methods can be used for early indication both for shared initial UL BWP and separate initial UL BWP (if supported)
		- separate PRACH resource
		- PRACH preamble partitioning
		- ~~FFS: whether/how to address RA-RNTI overlapping issue~~
	+ ~~FFS the possibility of supporting Msg3 for the early indication~~

Whether/how to support early indication of RedCap UEs in Msg3 in Rel-17 is up to RAN2.Conclusion* Whether there is RA-RNTI overlapping issue and how to address RA-RNTI overlapping issue in the early indication of RedCap UEs in Msg1 in Rel-17 is up to RAN2.

Conclusion* There is no consensus in RAN1 on whether to have the access barring indication in DCI scheduling SIB1, and RAN1 can come back if triggered by RAN2.

Agreements:* For the RedCap UE capabilities, current definition of Rel-15/16 L1 UE capabilities mandatory without capability signalling in TR38.822 is reused by default, unless any update is agreed
	+ Note: UE capabilities related to CA, DC and wider max UE bandwidth are not applicable to RedCap UEs
	+ FFS: whether any L1 UE capabilities mandatory/optional with capability signalling are not applicable to RedCap UEs

Agreements:* A RedCap UE type from RAN1 point of view supports a maximum bandwidth of 20MHz for FR1 and 100MHz for FR2
* Further discuss whether to capture also one or more of the following capabilities to RedCap UE type description
	+ Supports either 1 or 2 Rx branches and corresponding maximum DL MIMO layers
	+ Supports either FD-FDD or Type A HD-FDD operation for FR1 FDD bands
	+ Supports either DL up to 64 QAM or up to 256 QAM for FR1
	+ Does not support CA/DC

Agreements:* Send an LS to RAN2 informing RAN2-related agreements in AI8.6 in RAN1#106-e
	+ FFS details
	+ Draft LS in [R1-2108615](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_105-e/Docs/R1-2108615.zip) which is approved, with final LS in [R1-2108631](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_105-e/Docs/R1-2108631.zip).
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#### 2.1.2 Remaining Open issues

* Remaining physical layer aspects of reduced maximum UE bandwidth
* Remaining physical layer aspects of half-duplex FDD operation
* Remaining physical layer aspects of RAN2-led objectives
* Providing RRC parameter list and UE feature list to RAN2
* Responding to LSs from other WGs

## 2.2 RAN2

#### 2.2.1 Agreements

##### 2.2.1.1 RAN2#115-e

84 contributions were submitted to this meeting (for details see agenda item 8.12 in [Tdoc list](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/TDoc_List_Meeting_RAN2%23115-e.xlsx))

RAN2 carried out online (GTW) discussions and the following offline email discussions:

* [AT115-e][104][RedCap] Identification, access and camping (Ericsson)
	+ Summarized in [R2-2108892](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_115-e/Docs//R2-2108892.zip) and [R2-2109131](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_115-e/Docs//R2-2109131.zip)
* [AT115-e][105][RedCap] eDRX cycles (Vivo)
	+ Summarized in [R2-2108881](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_115-e/Docs//R2-2108881.zip), [R2-2109117](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_115-e/Docs//R2-2109117.zip) and [R2-2109194](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_115-e/Docs//R2-2109194.zip)
* [AT115-e][109][RedCap] Capabilites (Intel)
	+ Summarized in [R2-2108891](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_115-e/Docs//R2-2108891.zip) and [R2-2109129](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_115-e/Docs//R2-2109129.zip)
* [AT115-e][110][RedCap] RRM relaxation (Huawei)
	+ Summarized in [R2-2108894](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_115-e/Docs//R2-2108894.zip) and [R2-2109133](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_115-e/Docs//R2-2109133.zip)

RAN2 made the following agreements related to **definition of RedCap UE type and reduced capabilities:**

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| Agreements:* The number of DRBs supported by RedCap UEs is less than legacy value (which is 16). There will be a single mandatory value (FFS if 4 or 8). FFS if it will be possible to have an optional capability
* “RRC processing delay” is not relaxed for RedCap UE
* PDCP/RLC AM 12 bits SN is mandatory for RedCap UE, and PDCP/RLC AM 18bits SN is optional supported by RedCap UE; FFS on how to capture this in specification
* NE-DC, and (NG)EN-DC are not supported by RedCap UE; FFS on how to capture it in the specification
* DAPS and CAPC related capabilities are not applicable for RedCap UE; [8/20] FFS on CHO. FFS on how to capture this in the specification;

Agreements via email - from offline 109:* Maximum 8 DRBs is mandatory supported by RedCap UEs.
* From RAN2 perspective, inter RAT mobility related capabilities are applicable for RedCap UE;
* From RAN2 perspective, measurement related capabilities are applicable for RedCap UE;
* From RAN2 perspective, URLLC related capabilities are applicable for RedCap UE except those affected by CA/DC;
* From RAN2 perspective, IAB related capabilities are not applicable for RedCap UE, i.e. the RedCap UE is not expected to act as IAB node;
* Do not introduce capability signalling on the supported Rx number for RedCap UE since the number of Rx branches for RedCap is implicitly indicated by the corresponding capability parameter maxNumberMIMO-LayersPDSCH in the existing UE capability framework;
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RAN2 approved LS on RedCap capabilities to RAN1 and RAN4 in [R2-2109218](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_115-e/Docs//R2-2109218.zip).

RAN2 approved LS on L2 buffer size reduction to RAN1 in [R2-2109198](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_115-e/Docs//R2-2109198.zip).

RAN2 made the following agreements related to **identification, access and camping restrictions:**

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| Agreements:* Msg1 identification which can be configured to be enabled/disabled can be specified from RAN2 point of view.
* Solution for early identification for 2-step RACH will be specified.
* Specify separate indications in SIB1 for barring RedCap UEs with 1 Rx chain and 2 Rx chains.
* Specify a RedCap specific IFRI in SIB1.

Agreements via email - from offline 104:* IFRI for RedCap UEs in SIB1 is common for UEs with 1 Rx or 2 Rx branches.
* If RedCap-specific IFRI is absent from broadcast SI, the UE considers the cell does not support RedCap.

Agreements online:* A Msg3 early identification based on dedicated LCID is supported (if SA3 confirms there is no problem)

Agreements:* RedCap UE applies the existing cellBarred field in MIB
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RAN2 made the following agreements related to **eDRX cycles:**

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| Agreements:* When IDLE eDRX cycle is longer than 10.24s, PH calculation formula defined in LTE is re-used, i.e.

PH\_CN: H-SFN mod TeDRX,\_CN,H= (UE\_ID\_H mod TeDRX\_CN,H)* + where TeDRX\_CN,H is equal to IDLE eDRX cycle.
* When IDLE eDRX cycle is longer than 10.24s, CN PTW\_end calculation formula defined in LTE is re-used, i.e.

PTW\_end is radio frame satisfying SFN = (PTW\_start + L\*100 - 1) mod 1024, * + where L is PTW length configured by upper layers.
* For RRC\_IDLE UE, when eDRX cycle is no longer than 10.24s, T is determined by IDLE eDRX cycle. When eDRX cycle is longer than 10.24s, during the CN PTW, T is determined by the shortest of UE specific DRX cycle, if configured by upper layer, and default paging cycle.
* For RRC\_INACTIVE UE, when IDLE eDRX cycle is longer than 10.24s and Inactive eDRX cycle is not configured, during CN PTW, T is determined by the shortest of UE specific DRX cycle, if configured by upper layer, RAN paging cycle and default paging cycle.
* For RRC\_INACTIVE UE, when IDLE eDRX cycle is longer than 10.24s and Inactive eDRX cycle is no longer than 10.24s, outside CN PTW, T is determined by INACTIVE eDRX cycle.

Agreements via email - from offline 105 second round:* RAN2 considers the configuration as an invalid case, where INACTIVE eDRX cycle is configured but IDLE eDRX cycle is not configured. FFS whether to capture this restriction in RAN2 spec.
* RAN2 considers the configuration as invalid case, where INACTIVE eDRX cycle is longer than IDLE eDRX cycle. FFS whether to capture this restriction in RAN2 spec.
* The maximum PTW length is 40.96s when IDLE eDRX cycle is longer than 10.24s.
* The minimum PTW length is 1.28s and the step length/granularity of PTW length is 1.28 when IDLE eDRX cycle is longer than 10.24s.
* Introduce an additional new IE for INACTIVE eDRX to contain all values of INACTIVE eDRX cycles (also include values >10.24, if agreed in future).
* For RRC\_INACTIVE UE, when IDLE eDRX cycle is no longer than 10.24s and INACTIVE eDRX cycle is no longer than 10.24s, T is determined by the shortest of IDLE eDRX cycle and INACTIVE eDRX cycle.
* For RRC\_INACTIVE UE, when IDLE eDRX cycle is longer than 10.24s and INACTIVE eDRX cycle is no longer than 10.24s, during CN PTW, T is determined by the shortest of UE specific DRX cycle, if configured by upper layer, INACTIVE eDRX cycle and default paging cycle.
* eDRX feature is optional for any UE (including RedCap and non-RedCap UEs).

Agreements via email - from offline 105 third round * eDRX is optional for any gNB (either supporting RedCap or not), which means it is up to gNB implementation whether to support eDRX

Working Assumption:* When IDLE eDRX cycle is longer than 10.24s, CN PTW\_start calculation formula defined in LTE is re-used as the baseline, as below. FFS whether CN PTW\_start position could be configurable by network and in case which node decides the N value. Note: this formula would be revisited if INACTIVE eDRX cycle can be above 10.24s

PTW\_start denotes the first radio frame of the PH that is part of the PTW and has SFN satisfying the following equation: SFN = 1024/N\* ieDRX, where ieDRX = floor(UE\_ID\_H /TeDRX,H) mod N FFS N = 4 or 8, FFS if N can take other valuesAgreements online:* For RRC\_INACTIVE UE, when IDLE eDRX cycle is no longer than 10.24s and INACTIVE eDRX cycle is not configured, FFS which option below is adopted for paging monitoring:

 Option 1: T is determined by the shortest of RAN paging cycle, IDLE eDRX cycle, and default paging cycle. Option 2: T is determined by the shortest of RAN paging cycle and IDLE eDRX cycle.* For RRC\_INACTIVE UE, when IDLE eDRX cycle is longer than 10.24s and INACTIVE eDRX cycle is not configured, outside CN PTW, FFS which option below is adopted for paging monitoring:

 Option 1: T is determined by the shortest of RAN paging cycle and default paging cycle. Option 2: T is determined by RAN paging cycle. |

RAN2 approved LS to RAN4 on eDRX in [R2-2109196](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_115-e/Docs//R2-2109196.zip).

RAN2 made the following agreements related to **RRM relaxation:**

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| Agreements:* + Do not introduce nor reuse not-at-cell-edge threshold for R17 RRC\_CONNECTED UEs

Agreements via email - from offline 110:* + Do not introduce beam change based criterion in Rel-17.
	+ The network provides the configuration of stationarity criterion to the UE via dedicated signalling (e.g. RRCReconfiguration message) in RRC\_CONNECTED.
	+ Send LS to RAN4 to inform RAN2 conclusions for RRM relaxation.
	+ The LS to RAN4 includes the agreed RAN2 conclusions and “For RRC\_IDLE/INACTIVE, RAN4 is asked to study and define corresponding R17 RRM relaxation method” .

Agreements:* Introduce separate Rel-17 not-at-cell-edge threshold, and the new threshold is only associated with Rel-17 stationary criterion (if configured). If configured with a not-at-cell-edge criterion, the R17 stationary criterion can only be configured together with the R17 not-at-cell-edge criterion, not with the R16 one
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RAN2 approved LS to RAN4 on RRM relaxation in [R2-2109197](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_115-e/Docs//R2-2109197.zip).

RAN2 agreed to hold the following post-meeting email discussion:

* [Post115-e][106][RedCap] Running CRs (Ericsson)

 Scope: draft 38.331 and 38.304 running CRs based on meeting agreements

 Intended outcome: Endorsable 38.331 and 38.304 running CRs

 Deadline: Long

* [Post115-e][107][RedCap] Stage 2 Running CR (Nokia)

 Scope: draft 38.300 running CR based on meeting agreements

 Intended outcome: Endorsable 38.300 running CR

 Deadline: Long

* [Post115-e][108][RedCap] 38.306 Running CR (Intel)

 Scope: draft 38.306 running CR based on meeting agreements, also trying to resolve structural open issues from [R2-2108891](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108891.zip) (e.g. reusing existing sections/fields vs introducing new ones, etc.)

 Intended outcome: Endorsable 38.306 running CR

 Deadline: Long

#### 2.2.2 Remaining Open issues

* Details of definition of UE type including capabilities for identifying and constraining RedCap UEs
* Details of functionality that will enable RedCap UEs to be explicitly identifiable, including possible early identification
* Necessary updates to UE capabilities in TS 38.306 and TS 38.331
* Support for extended DRX enhancements
* RRM measurement relaxation for stationary devices for neighboring cells

## 2.3 RAN3

#### 2.3.1 Agreements

##### 2.3.1.1 RAN3#113-e

28 contributions were submitted to this meeting (for details see agenda item 11 in [Tdoc list](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_113-e/Docs/TDoc_List_Meeting_RAN3%23113-e.xlsx)).

RAN3 has discussed the following topics: 1) General and 2) Support for the Extended DRX enhancements for RedCap UEs.

**Topic #1: General**

Based on the summary document [R3-214147](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_113-e/Docs/R3-214147.zip) regrouping the offline e-mail discussion, RAN3 discussed general aspects of RedCap:

* A work plan has been submitted and noted in R3-213844
* RAN3 discussed the LS from RAN2 on the coordination between gNBs for the cell access/control of RedCap UEs. Some options were discussed for a potential solution. The solution down-selection is postponed to next meeting.
* **RAN3 agreed sending a LS with questions to RAN2 in** [**R3-214422**](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_113-e/Docs/R3-214422.zip)

**Topic #2: Support for the Extended DRX enhancements for RedCap UEs**

Based on the summary document [R3-214148](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_113-e/Docs/R3-214148.zip) regrouping the offline e-mail discussion, RAN3 discussed Support for the Extended DRX enhancements for RedCap UEs and made the following agreements:

Agreement:

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| * Encode the Idle eDRX Cycle sent in NGAP Paging message with one of the following 3 solutions (still FFS also dependent on SA2 outcome):
	+ Introduce one new Redcap eDRX Cycle IE for eDRX < 10.24s and one new Redcap eDRX Cycle IE for eDRX > 10.24s
	+ Extend the existing *Paging eDRX Cycle* IE in TS 38.413 section 9.3.1.154.
	+ Introduce only one new Redcap eDRX Cycle IE (for both > 10.24s and < 10.24s).
* WA: need to transfer the above Idle eDRX Cycle for Redcap UEs in NGAP *Core Network Assistance Information for RRC\_INACTIVE* IE.
 |

#### 2.3.2 Remaining Open issues

* Which Paging eDRX Cycle information is passed over XnAP
* Which Paging eDRX Cycle information is passed over F1AP
* Whether and which assistance information is exchanged between NG-RAN and 5GC
* Whether DU should inform CU of an early RedCap identification in Msg1/Msg3
* Whether NG-RAN needs to inform 5GC after identifying that the UE is a RedCap UE (e.g., support subscription validation)
* Whether to introduce new RedCap specific UAC over F1
* Whether CU is allowed to change the bar information in the DU

## 2.4 RAN4

#### 2.4.1 Agreements

##### 2.4.1.1 RAN4#100-e

62 contributions were submitted to this meeting (for details see agenda item 9.20 in [Tdoc list](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_99-e/Docs/TDoc_List_Meeting_RAN4%2399-e.xlsx))

RAN4 carried out the following offline email discussions:

* [100-e][142] NR\_RedCap
	+ Summarized in [R4-2115042](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_100-e/Docs/R4-2115042.zip)
* [100-e][234] NR\_redcap\_RRM\_1
	+ Summarized in [R4-2115409](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_100-e/Docs/R4-2115409.zip)
* [100-e][235] NR\_redcap\_RRM\_2
	+ Summarized in [R4-2115410](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_100-e/Docs/R4-2115410.zip)

RAN4 made the following agreements related to **RF impacts**:

|  |
| --- |
| Agreements:* The WF for FR1 RF requirement is agreed in [R4-2115096](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_100-e/Docs/R4-2115096.zip).
* The WF for FR1 REFSENS is agreed in [R4-2114995](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_100-e/Docs/R4-2114995.zip).
* The LS on HD-FDD RedCap UE switching time is agreed in [R4-2114996](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_100-e/Docs/R4-2114996.zip).
 |

RAN4 made the following agreements related to **RRM impacts**:

|  |
| --- |
| Agreements:**Simulation assumptions:*** + Simulation assumptions for RedCap cell detection performance in [R4-2115359](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_100-e/Docs/R4-2115359.zip)
	+ Simulation assumptions for RedCap SSB based RRM measurement performance in [R4-2115360](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_100-e/Docs/R4-2115360.zip)
	+ Simulation assumptions for RedCap RLM and BFD performance in [R4-2115361](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_100-e/Docs/R4-2115361.zip)
	+ Simulation assumptions for RedCap L1 RSRP measurement performance in [R4-2115362](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_100-e/Docs/R4-2115362.zip)
	+ Simulation assumptions for RedCap PBCH detection in [R4-2115363](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_100-e/Docs/R4-2115363.zip)

**Inter-frequency support:*** + RAN4 to develop intra-frequency and inter-frequency requirements for release 17 RedCap with equal priority.

**Inter-RAT 2G/3G in IDLE/INACTIVE and CONNECTED states:*** + Do not define inter-RAT RRM requirements on 2G/3G for RedCap UE in Rel-17

**Inter-RAT LTE in IDLE/INACTIVE and CONNECTED states:*** + Define inter-RAT LTE RRM requirements in IDLE/INACTIVE and CONNECTED states
		- For 2RX capable RedCap UEs
			* Use 2RX inter-RAT LTE requirements defined in TS 38.133 as baseline
		- For 1RX capable RedCap UEs
			* Use LTE Cat1bis requirements in TS 36.133 as baseline
	+ FFS whether and how to define inter-RAT NR RRM requirements for LTE UEs with RedCap capabilities in IDLE/INACTIVE and CONNECTED states

**SUL support:*** + Whether to support SUL for RedCap in RRM depends on RF agreement.

**Consideration of LTE cat-M1 or NB-IoT for RedCap in TS 36.133:*** + No need to consider LTE cat-M1 or NB-IoT for RedCap in TS 36.133

**V2X requirements for Rel-17 RedCap:*** + V2X is not within the scope of RedCap WID. Thus no more discussions are needed on this topic.

**Combination of features:*** + When discussing possible combinations of Rel-16 features and RedCap, we should by default assume that the features are not applicable and then identify which features (such as R16 CSI-RS based L3 measurement, L1-SINR measurement, SFTD measurement, CGI reading, 2-step RACH, and PL-RS change, etc.) can be combined with RedCap case by case based on justification.

**Assumptions on UE for defining RRM requirements*** + Define separate set of requirements for 1RX and 2RX capable RedCap UEs
		- For RedCap UEs using 2 RX branches
			* Use Release 15 NR UE measurement requirements for single carrier operation as baseline
			* Single searcher is assumed
		- For RedCap UE using 1 RX branches
			* Define a new set of RRM requirements for single carrier operation
			* Single searcher is assumed
		- Note: the changes related to reduced BW and HD-FDD shall be further discussed

**RLM related agreements:*** + The number of RLM-RS is determined by RAN1 in TS38.213. RAN4 shall follow the RAN1 conclusion on the number of RLM -RS.
	+ Impact on bandwidth of CSI-RS for RLM with 60 kHz SCS in FR1 is identified. How to address that impact is FFS. Following options are discussed:
		- * Option 1: Set BW of CSI-RS to 24 PRBs for 60 kHz SCS in FR1
			* Option 2: Exclude 60 kHz SCS in FR1
			* Option 3: other options are not precluded.
	+ Impact on parameters for IN/OOS due to BW reduction and 1 Rx is expected.
	+ SNR thresholds for OOS/IS impacted due to 1 rx. The detailed SINR threshold to be discussed under performance part.

**Link recovery related agreements:*** + Impact on bandwidth of CSI-RS for BFD with 60 kHz SCS in FR1 is identified. How to address that impact is FFS. Following options are discussed:
		- * Option 1: Set BW of CSI-RS to 24 PRBs for 60 kHz SCS in FR1
			* Option 2: Exclude 60 kHz SCS in FR1
			* Option 3: other options are not precluded.
	+ Impact on SINR thresholds setup in test cases can be discussed in the performance part of the WI at later stage.
	+ L1 RSRP measurement accuracy is to be discussed under performance part of the WI.
	+ RAN4 to study the impact using the simulation assumptions to decide whether existing requirements can be reused.

**HD-FDD UE related agreements:*** + New RRM core requirements or clarifications are needed for HD-FDD type A RedCap UEs.

**Measurement capability related agreements*** + FFS whether to reduce the number cells/layers/frequencies/SSBs to be monitored/measured by RedCap UEs.

**CONNECTED mode related agreements:*** + To simplify UE complexity, RedCap UE won’t support ‘NeedForGap’ and ‘NCSG’ measurement capabilities if single path and single searcher is assumed for RedCap.

**Other agreements:*** + No RRM impact due to Maximum number of DL MIMO layers and Relaxed maximum modulation order.
	+ FFS and discuss the cat-1bis requirements case by base.

**Specification impact:*** + In addition to the specification impact identified in [[R4-2108359](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_99-e/Docs/R4-2108359.zip)], following additional impact were identified:
		- Handover (section 6.1)
		- RRC re-establishment (6.2.1)
		- RRC Connection release with redirection (6.2.3)

**Extended DRX related agreements:*** + Only consider defining the RRM requirement with eDRX in IDLE/INACTIVE mode only.
	+ RAN4 to define eDRX requirements for FR1
	+ FFS whether to define eDRX requirements for FR2
	+ RAN4 to classify eDRX into different groups based on eDRX length when defining requirements)
	+ RAN4 to study the RRM relaxation without eDRX first for low mobility and not-at-cell edge criteria

**RRM measurement relaxation related agreements:*** + RAN4 agrees to not postpone discussions on relaxation methods for IDLE/INACTIVE states until more progress in reached in RAN2
	+ Regarding RAN2’s progress, RAN4 starts discussion from stationary and not-cell-edge relaxation criterion for RRC\_IDLE/INACTIVE as high priority
	+ RAN4 to reuse the same mechanism as Rel-16 RRM measurement relaxation in IDLE/Inactive mode
		- Method 1: Using scaling factors (value for FFS)
		- Method 2: Using a period of time (value for FFS)
		- Criteria for using Method 1 and/or 2 are FFS
		- Note: EMR is not supported by RedCap UEs and the relaxation mechanisms related to EMR carriers do not apply to RedCap
	+ RAN4 agrees to wait for RAN2 until more progress on RRM relaxation in CONNECTED mode.
	+ RAN4 agrees to not consider EMR in RRM measurement relaxation for RedCap UE in IDLE/Inactive mode or not.
 |

#### 2.4.2 Remaining Open issues

RRM/demod:

* Continue discussion on RRM impacts from UE complexity reduction features
* Discuss and align the simulation results, and update simulation assumptions (if needed)
* Initial discussions on CRs
* Discuss draft CRs and agree on the CRs for the core part
* Initial discussions on demodulation work including time plan
* Initial discussions on RRM performance work

RF:

* FFS on the frequency bands support on RedCap UE in FR1, e.g., SUL band and its combination, n46 and n96, etc.
* FFS on FR2 band support

The work with the performance part has not started yet.

## 4. References

RAN1#106-e

148 contributions (for details see agenda item 8.6 in [Tdoc list](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_106-e/Docs/TDoc_List_Meeting_RAN1%23106-e.xlsx))

RAN2#115-e

84 contributions (for details see agenda item 8.12 in [Tdoc list](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/TDoc_List_Meeting_RAN2%23115-e.xlsx))

RAN3#113-e

28 contributions (for details see agenda item 11 in [Tdoc list](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_113-e/Docs/TDoc_List_Meeting_RAN3%23113-e.xlsx))

RAN4#100-e

62 contributions (for details see agenda item 9.20 in [Tdoc list](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_100-e/Docs/TDoc_List_Meeting_RAN4%23100-e.xlsx))