3GPP TSG RAN WG2 Meeting #118-e Draft R2-2206200

**Electronic meeting, 9- 20 May, 2022**

**Agenda item:** 6.12.4.1

**Source:** Intel Corporation

**Title:** Report of [AT118-e][110][RedCap] UE capabilities (Intel)

**Document for:**  Discussion and decision

# Introduction

This is the report of following offline discussion:

**[AT118-e][110][RedCap] UE capabilities (Intel)**

Initial scope: discuss incoming LSs on UE capabilities and other UE capabilities aspects based on contributions in 6.12.4 (and in other AIs, e.g. [R2-2204619](file:///C:\Data\3GPP\Extracts\R2-2204619%20Discussion%20on%20RAN4%20LS%20on%20FR2%20RedCap%20UE.docx), [R2-2205637](file:///C:\Data\3GPP\Extracts\R2-2205637-RedCap-PC7-331.docx), [R2-2205638](file:///C:\Data\3GPP\Extracts\R2-2205638-RedCap-PC7-306.docx))

Initial intended outcome: Summary of the offline discussion with e.g.:

         List of proposals for agreement (if any)

         List of proposals that require online discussions

         List of proposals that should not be pursued (if any)

Deadline (for companies' feedback): Wednesday 2022-05-11 1400 UTC

Deadline (for rapporteur's summary in [R2-22](file:///C:\Data\3GPP\archive\RAN2\RAN2%23117\Tdocs\R2-2204031.zip)06200): Wednesday 2022-05-11 1500 UTC

Proposals marked "for agreement" in R2-2206200 not challenged until Thursday 2022-05-12 0300 UTC will be declared as agreed via email by the session chair (for the rest the discussion will continue online).

# Annex: companies’ point of contact

|  |  |  |
| --- | --- | --- |
| **Company** | **Point of contact** | **Email address** |
| Intel Corporation | Yi Guo | Yi.guo@intel.com |
| Samsung | Seungbeom Jeong | s90.jeong@samsung.com |
| Qualcomm | Linhai He | linhaihe@qti.qualcomm.com |
| MediaTek | Pradeep Jose | pradeep dot jose at mediatek dot com |
| vivo | Chenli | chenli5g@vivo.com |

# Discussion

**Following issues were raised in this meeting based on companies’ contribution:**

**1 At RAN2#117-e, based on [1], RAN2 discussed RedCap capabilities. But following issues are still open:**

At117-Proposal 3.2.2-1: [online discussion] [9 vs 7] a UE supports eDRX, must support Edrx in RRC\_IDLE and RRC\_INACTIVE simultaneously;

* Come back in the next meeting

At117-Proposal 3.2.2-2: [online discussion] [10] Assuming a UE supports eDRX, must support Edrx in RRC\_IDLE and RRC\_INACTIVE simultaneously, the eDRX in RRC\_INACTIVE is introduced together with eDRX in RRC\_IDLE as

| Definitions for feature |
| --- |
| Rel-17 extended DRX in RRC\_IDLE and RRC\_INACTIVE  It is optional for UE to support Rel-17 extended DRX cycle values up to 10485.76 seconds for RRC\_IDLE and up to 10.24 seconds for RRC\_INACTIVE, and paging in extended DRX in RRC\_IDLE and RRC\_INACTIVE as specified in TS 38.331 [9] and TS 38.304 [21]. |

* Come back in the next meeting

At117-Proposal 3.2.2-3: [online discussion] [7/8] Assuming a UE supports eDRX, may not support Edrx in RRC\_IDLE and RRC\_INACTIVE simultaneously, for extended long DRX for RRC\_INACTIVE, introduce a new capability bit extendedDRX-r17 covering DRX values of 2.56s, 5.12s and 10.24s;

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| --- | --- | --- | --- | --- |
| Definitions for parameters | Per | M | FDD-TDD DIFF | FR1-FR2 DIFF |
| extendedDRX-Cycle-r17  Indicates whether UE in RRC\_INACTIVE supports the extended DRX values of 256, 512 and 1024 radio frames as specified in TS 38.331 [9]. | UE | No | No | No |

* Come back in the next meeting

At117-proposal 3.2.3-1: [online discussion] RAN2 to decide which option should be agreed:

Option 1: 13 companies (Qualcomm, Samsung, Vivo, Nokia, Sequans, LGE, Apple, Ericsson, BT, KDDI, Spreadtrum, CATT, Interdigital)

Rel-17 RRM relaxation for RRC\_CONNECTED Ues is captured in TS38.306 as optional feature with capability ignaling, i.e. introduce a capability bit on this;

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| --- | --- | --- | --- | --- |
| Definitions for parameters | Per | M | FDD-TDD DIFF | FR1-FR2 DIFF |
| rrm-RelaxationRRC-ConnectedRedCap-r17  Indicates whether UE supports Rel-17 relaxed RRM measurements in RRC\_CONNECTED as specified in TS 38.331 [9]. | UE | No | No | No |

Option 2: 6 companies (Huawei, MediaTek, OPPO, ZTE, Futurewei, T-Mobile )

Rel-17 RRM relaxation for RRC\_CONNECTED Ues is captured in TS38.306 as optional feature with capability ignaling, i.e. introduce a capability bit on this;

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| --- | --- | --- | --- | --- |
| Definitions for parameters | Per | M | FDD-TDD DIFF | FR1-FR2 DIFF |
| rrm-RelaxationRRC-ConnectedRedCap-r17  Indicates whether UE supports UE assistance reporting of fulfilment status for RRM measurement relaxation criterion in RRC\_CONNECTED as specified in TS 38.331 [9]. | UE | No | No | No |

* Mediatek thinks we should link the capability to a feature.
* Come back online in the final CB session on Thursday (if time allows)
* Come back in the next meeting

At117-proposal 4.1.3-1: [online discussion] RAN2 to decide which option should be agreed:

Option 1 (6 companies, ZTE, Sequans, Intel, Futurewei, OPPO, Huawei ): keep the sentence “RedCap UE shall always report “1”.

Option 2 (9 companies, MediaTek, Interdigital, LGE, Ericsson, Intel, vivo, Samsung, Apple, Qualcomm): Do nothing, i.e. the capability is mandatory with IoT bit for RedCap UE;

* Come back in the next meeting

**2 RAN1 sent updated UE feature list in [2], including Full duplex FDD capability (optional or not)**

**At RAN#95-e, RAN plenary discussed RedCap UE capability based on [3] and agreed:**

- FG 28-1 is reported per UE, and FG 28-3 is reported per band" is agreed

- It is not pursued to support RRM relaxation for non-RedCap UE in Rel-17

**3 RAN4 sent LS on Rx/MIMO in [6] (FR2 Rx/MIMO handling and new UE power class).**

**4 Other issues.**

## eDRX capability for RRC\_INACTIVE Ues

**The discussion in [1] was**

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| **1** Regarding the question **whether a UE must support both Edrx in RRC\_IDLE and RRC\_INACTIVE simultaneously?1 company is fine to go with majority;**  **Yes : 9 companies (Huawei, Vivo, OPPO, Nokia, LGE, Apple, BT, Futurewei, Spreadtrum); 1 company is fine to go with majority;**  **No: 7 companies ( Qualcomm, Samsung, MediaTek, Sequans, ZTE, Ericsson, CATT)**  **Companies who have concern on this “must”, believe**   * IDLE and INACTIVE Edrx includes different functionality and therefore it would be natural to have separate capabilities for them. * There is no case that a UE supports RAN Edrx but does not support CN Edrx. But there can be case that UE not supports RAN E-drx but support CN Edrx;   Rapporteur would suggest to conclude this during online discussion:  **At117-Proposal 3.2.2-1: [online discussion] [9 vs 7] a UE supports eDRX, must support Edrx in RRC\_IDLE and RRC\_INACTIVE simultaneously;**  **2 Assuming a UE supports eDRX, must support Edrx in RRC\_IDLE and RRC\_INACTIVE simultaneously; 10 companies agreed to capture eDRX in RRC\_INACTIVE together with RRC\_IDLE;**  **At117-Proposal 3.2.2-2: [online discussion] [10] Assuming a UE supports eDRX, must support Edrx in RRC\_IDLE and RRC\_INACTIVE simultaneously, the eDRX in RRC\_INACTIVE is introduced together with eDRX in RRC\_IDLE as**   | Definitions for feature | | --- | | **Rel-17 extended DRX in RRC\_IDLE and RRC\_INACTIVE**  It is optional for UE to support Rel-17 extended DRX cycle values up to 10485.76 seconds for RRC\_IDLE and up to 10.24 seconds for RRC\_INACTIVE, and paging in extended DRX in RRC\_IDLE and RRC\_INACTIVE as specified in TS 38.331 [9] and TS 38.304 [21]. |   **3 Assuming a UE supports eDRX, may not support Edrx in RRC\_IDLE and RRC\_INACTIVE simultaneously; 7 companies agreed to capture eDRX in RRC\_INACTIVE as (remove “long” from field name);**  **At117-Proposal 3.2.2-3: [online discussion] [7/8] Assuming a UE supports eDRX, may not support Edrx in RRC\_IDLE and RRC\_INACTIVE simultaneously, for extended long DRX for RRC\_INACTIVE, introduce a new capability bit extendedDRX-r17 covering DRX values of 2.56s, 5.12s and 10.24s;**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Definitions for parameters | Per | M | FDD-TDD DIFF | FR1-FR2 DIFF | | ***extendedDRX-Cycle-r17***  Indicates whether UE in RRC\_INACTIVE supports the extended DRX values of 256, 512 and 1024 radio frames as specified in TS 38.331 [9]. | UE | No | No | No | |

**In this meeting:**

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| Intel R2-2204925 | We have sympathy for companies who would like to introduce separate eDRX capability for IDLE and INACTIVE since they are different functions, and the UE may support CN-eDRX only. However we also observed that only additional efforts are needed to support eDRX in RRC\_INACTIVE if a UE can support eDRX in RRC\_IDLE. And therefore it should not be big burden for a UE who is willing to support eDRX in RRC\_INACTIVE.  Therefore, we propose:  **Proposal 1: a UE supports eDRX, must support eDRX in RRC\_IDLE and RRC\_INACTIVE simultaneously;**  If proposal 1 is agreeable, then  **Proposal 2: the eDRX in RRC\_INACTIVE is introduced together with eDRX in RRC\_IDLE as**   | Definitions for feature | | --- | | **Rel-17 extended DRX in RRC\_IDLE and RRC\_INACTIVE**  It is optional for UE to support Rel-17 extended DRX cycle values up to 10485.76 seconds for RRC\_IDLE and up to 10.24 seconds for RRC\_INACTIVE, and paging in extended DRX in RRC\_IDLE and RRC\_INACTIVE as specified in TS 38.331 [9] and TS 38.304 [21]. | |
| Nokia R2-2205787 | IOT testing may not be available for IDLE and INACTIVE eDRX at the same time and therefore separate capabilties are needed. In addition IDLE and INACTIVE eDRX includes different functionality and therefore it would be natural to have separate capabilities for them.  **Proposal 1: Separate UE capabilities are introduced for eDRX in RRC\_IDLE and RRC\_INACTIVE.**  **Proposal 2: Support for eDRX in RRC\_INACTIVE is optional with capability signaling.**  **Proposal 3: Support for eDRX in RRC\_IDLE is optional without capability signaling.** |
| Vivo R2-2204819 | a UE supporting IDLE eDRX is not mandatory to support INACTIVE eDRX.  **Proposal 1: An optional UE AS capability bit is introduced for INACTIVE eDRX.**  **Proposal 2: Two indications are included in SIB1, one indicates whether IDLE eDRX is enabled, and the other indicates whether INACTIVE eDRX is enabled.** |

The issue was discussed in last meeting, we would like to check companies’ view again.

**Discussion point 3.1: which option is prefer?**

**Option 1:** Assuming a UE supports eDRX, must support Edrx in RRC\_IDLE and RRC\_INACTIVE simultaneously, the eDRX in RRC\_INACTIVE is introduced together with eDRX in RRC\_IDLE as

| Definitions for feature |
| --- |
| **Rel-17 extended DRX in RRC\_IDLE and RRC\_INACTIVE**  It is optional for UE to support Rel-17 extended DRX cycle values up to 10485.76 seconds for RRC\_IDLE and up to 10.24 seconds for RRC\_INACTIVE, and paging in extended DRX in RRC\_IDLE and RRC\_INACTIVE as specified in TS 38.331 [9] and TS 38.304 [21]. |

**Option 2:** Assuming a UE supports eDRX, may not support Edrx in RRC\_IDLE and RRC\_INACTIVE simultaneously, for extended long DRX for RRC\_INACTIVE, introduce a new capability bit extendedDRX-r17 covering DRX values of 2.56s, 5.12s and 10.24s; And separate bits in SIB1 to indicate whether IDLE eDRX and/or INACTIVE eDRX are enabled.

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| Definitions for parameters | Per | M | FDD-TDD DIFF | FR1-FR2 DIFF |
| ***extendedDRX-Cycle-r17***  Indicates whether UE in RRC\_INACTIVE supports the extended DRX values of 256, 512 and 1024 radio frames as specified in TS 38.331 [9]. | UE | No | No | No |

**Note: Nokia raised a good point, i.e. whether IOT testing could be available for IDLE and INACTIVE eDRX at the same time? It would be good if companies can confirm this in your response.**

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| **Company’s name** | **Option 1 or**  **Option 2** | **Comments, if any** |
| Samsung | Option 1 | Since we don't think the capabilities for Idle eDRX and Inactive eDRX are different, we can live without new capability bit for Inactive eDRX as follows:   gNB can configure RAN eDRX, only if UE is configured with Idle eDRX. This means gNB knows whether UE is configured with Idle eDRX or not. Therefore, if UE is configured with Idle eDRX, gNB can understand the UE supports Inactive eDRX as well, and determine whether to configure Inactive eDRX. |
| Qualcomm | Option 2 | We would like to point out that support for RRC Inactive is an optional UE capability. Therefore, it is possible that a UE may support eDRX for RRC Idle but does not support the entire feature of RRC Inactive. Therefore, it does not make sense to require UE must support Idle and Inactive eDRX at the same time.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | ***inactiveState***  Indicates whether the UE supports RRC\_INACTIVE as specified in TS 38.331 [9]. | UE | Yes | No | No | |
| MediaTek | Option 2 | Also agree with the arguments raised by Nokia |
| vivo | Option 2 | It is more flexible to configure separate capabilities for Idle eDRX and Inactive eDRX. The case that UE supports Idle eDRX but not supports Inactive eDRX should be allowed. |

## RRM relaxation for RRC\_CONNECTED UEs

**The discussion in [1] was**

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| **At117-proposal 3.2.3-1: [online discussion] RAN2 to decide which option should be agreed:**  **Option 1: 12 companies (Qualcomm, Samsung, Vivo, Nokia, Sequans, LGE, Apple, Ericsson, BT, KDDI, Spreadtrum, CATT)**  **Rel-17 RRM relaxation for RRC\_CONNECTED Ues is captured in TS38.306 as optional feature with capability ignaling, i.e. introduce a capability bit on this;**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Definitions for parameters | Per | M | FDD-TDD DIFF | FR1-FR2 DIFF | | ***rrm-RelaxationRRC-ConnectedRedCap-r17***  Indicates whether UE supports Rel-17 relaxed RRM measurements in RRC\_CONNECTED as specified in TS 38.331 [9]. | UE | No | No | No |   **The main argument is “**This capability includes not only stationarity status reporting, but also RRM relaxation methods to be defined by RAN4. Besides, we may need to specify RAN4 spec as well, according to RAN4’s decision.”  **Option 2: 6 companies (Huawei, MediaTek, OPPO, ZTE, Futurewei, T-Mobile )**  **Rel-17 RRM relaxation for RRC\_CONNECTED Ues is captured in TS38.306 as optional feature with capability ignaling, i.e. introduce a capability bit on this;**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Definitions for parameters | Per | M | FDD-TDD DIFF | FR1-FR2 DIFF | | ***rrm-RelaxationRRC-ConnectedRedCap-r17***  Indicates whether UE supports UE assistance reporting of fulfilment status for RRM measurement relaxation criterion in RRC\_CONNECTED as specified in TS 38.331 [9]. | UE | No | No | No |   **The main argument** is “Option 2 is aligned with the current status in RAN2.” In addition, Futurewei commented that “change of” shall be deleted; |

**In this meeting:**

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| Intel R2-2204925 | We tend to agree that the detailed mechanisms have been captured in RAN2 (criterion and reporting) and RAN4 specification (what can be relaxed). If a UE supports RRM relaxation measurement, it should support all the corresponding related configuration, reporting procedure and criteria for RRM relaxation but we should avoid to describe what RRC procedure the UE supported for RRM relaxation in RRC\_CONNECTED under UE capability description.  **Proposal 3:** **Rel-17 RRM relaxation for RRC\_CONNECTED UEs is captured in TS38.306 as optional feature with capability signaling, i.e. introduce a capability bit on this;**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Definitions for parameters | Per | M | FDD-TDD DIFF | FR1-FR2 DIFF | | ***rrm-RelaxationRRC-ConnectedRedCap-r17***  Indicates whether UE supports Rel-17 relaxed RRM measurements in RRC\_CONNECTED as specified in TS 38.331 [9]. | UE | No | No | No | |
| Vivo, R2-2204818 | Per our understanding, option 1 is safer since it contains the scope of option2, and is not only limited to only UE report of RRM relaxation status. Considering RAN4 may continue to discuss the RRM relaxation behaviour which may be different from legacy behaviour, or extend the RRM relaxation behaviour in future, if we agree with option2, it may lead to the unexpected condition that we have to introduce another RRM relaxation capability on other procedures in future. Furthermore, it’s very clear in WID this feature should be relaxed RRM measurement. Hence, option1 is more exact on connected RRM relaxation.  **Proposal 1：RAN2 to agree to add the correction in TS 38.306 as follows:**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Definitions for parameters** | **Per** | **M** | **FDD-TDD DIFF** | **FR1-FR2 DIFF** | | ***rrm-RelaxationRRC-ConnectedRedCap-r17***  Indicates whether UE supports Rel-17 relaxed RRM measurements in RRC\_CONNECTED as specified in TS 38.331 [9]. | UE | No | No | No | |

The issue was discussed in last meeting, we would like to check companies’ view again.

**Discussion point 3.2: which option is prefer?**

**Option 1:** Rel-17 RRM relaxation for RRC\_CONNECTED Ues is captured in TS38.306 as optional feature with capability ignaling, i.e. introduce a capability bit on this;

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| Definitions for parameters | Per | M | FDD-TDD DIFF | FR1-FR2 DIFF |
| ***rrm-RelaxationRRC-ConnectedRedCap-r17***  Indicates whether UE supports Rel-17 relaxed RRM measurements in RRC\_CONNECTED as specified in TS 38.331 [9]. | UE | No | No | No |

**The main argument is “**This capability includes not only stationarity status reporting, but also RRM relaxation methods to be defined by RAN4. Besides, we may need to specify RAN4 spec as well, according to RAN4’s decision.”

**Option 2:** Rel-17 RRM relaxation for RRC\_CONNECTED Ues is captured in TS38.306 as optional feature with capability ignaling, i.e. introduce a capability bit on this;

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| --- | --- | --- | --- | --- |
| Definitions for parameters | Per | M | FDD-TDD DIFF | FR1-FR2 DIFF |
| ***rrm-RelaxationRRC-ConnectedRedCap-r17***  Indicates whether UE supports UE assistance reporting of fulfilment status for RRM measurement relaxation criterion in RRC\_CONNECTED as specified in TS 38.331 [9]. | UE | No | No | No |

**The main argument** is “Option 2 is aligned with the current status in RAN2.”

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| **Company’s name** | **Option 1 or**  **Option 2** | **Comments, if any** |
| Samsung | Option 1 | Prefer more general description, as Vivo mentions in R2-2204818. |
| Qualcomm | Option 1 | If Option 2 is adopted, there is the ambiguity whether a UE which does not support status reporting is capable of evaluating relaxation criteria or not.  Under the current agreement, all pieces in RRM relaxation in RRC Connected (i.e. relaxation criteria, evaluation of relaxation criteria based on measurements, status reporting) have to be supported in order for the feature to work. Therefore, UE capability should be for the entire feature, not just for the status reporting alone. |
| MediaTek | Option 2 | We would like to see capabilities clearly mapped to features. Option 2 correctly maps to RAN2’s current status. If RAN4 introduces new mechanisms (unlikely as it is), we can update this description accordingly. |
| vivo | Option 1 | We share the same view as Qualcomm. Option 2 means all UEs will apply the configuration of RRM relaxation and perform evaluation on the relaxation criteria.  Usually, we donot describe the detailed procedure in capability definition, but just to indicate the specific feature. Option 1 is safer and could avoid introducing more UE capabilities on RRM relaxation. |
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## Handling of the definition of shorts and am-WithShortSN

**The discussion in [1] was**

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| **Phase 1-Proposal 3.3.2-1: [for agreement] [9/15] Follow RAN2 agreement, i.e. keep the following sentence “RedCap UE shall always report “1”.” In the definition of shorts and am-WithShortSN? .**  The main concern from companies who do not like the sentence “RedCap UE shall always report “1” is, the capability is already mandatory with IoT bit for non-RedCap Ues. This new statement for RedCap Ues does not add new information. We should avoid to change existing capability if it is common for Redcap and Non-RedCap Ues;  The main concern from companies who would like to keep the sentence “RedCap UE shall always report “1”. They want to make it “pure” mandatory for RedCap Ues instead of mandatory with IOT bit;  **Option 1**: keep the sentence “RedCap UE shall always report “1”.  **Option 2**: Do nothing, i.e. the capability is mandatory with IoT bit for RedCap UE;  **Summary:** 14 companies provided view.  Option 1:6 (ZTE, Sequans, Intel, Futurewei, OPPO, Huawei )  Option 2: 9 (MediaTek, Interdigital, LGE, Ericsson, Intel, vivo, Samsung, Apple, Qualcomm  **Companies who support option 2 think: definition part is clear as**  RedCap UE is the UE with reduced capability:   * The maximum bandwidth is 20 MHz for FR1, and is 100 MHz for FR2. UE features and corresponding capabilities related to UE bandwidths wider than 20 MHz in FR1 or wider than 100 MHz in FR2 are not supported by RedCap Ues; * The maximum mandatory supported DRB number is 8; * The mandatory supported PDCP SN length is 12 bits while 18 bits being optional; * The mandatory supported RLC AM SN length is 12 bits while 18 bits being optional;   **Companies who support option 1 think: the RedCap UE must indicate the support of 12 bits SN (set to 1) since 18 bits are optional.** |

**In this meeting:**

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| Intel R2-2204925 | We tend to agree that the description on RedCap definition is clear enough, and therefore option 2 is desirable.  **Proposal 4: Remove “A RedCap UE shall set the field to supported. Editor's Note: FFS on whether the change is needed.” From the field description of shorts and am-WithShortSN.** |
| Vivo, R2-2204818 | We don’t think we need to introduce any additional limitations on the above parameters since the current definition of RedCap has already mentioned this. Hence, we prefer remove the following sentence “RedCap UE shall always report “1”.” in the definition of shorts and am-WithShortSN.  **Proposal 2: Removing the following sentence “RedCap UE shall always report “1”.” in the definition of shorts and am-WithShortSN.** |

The issue was discussed in last meeting, we would like to check companies’ view again.

**Discussion point 3.3: which option is prefer?**

**Option 1:**  Remove “A RedCap UE shall set the field to supported. Editor's Note: FFS on whether the change is needed.” From the field description of shorts and am-WithShortSN.

**Option 2:** keep “A RedCap UE shall set the field to supported.” And only remove Editor's Note: FFS on whether the change is needed.” From the field description of shorts and am-WithShortSN.

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| **Company’s name** | **Option 1 or**  **Option 2** | **Comments, if any** |
| Samsung | Option 2 | As the moderator summarized, the current text already captures all the agreements correctly, so no additional clarification would be required. |
| Qualcomm | Option 2 | Our view is the same as in last meeting. |
| MediaTek | Option 1  (i.e. Option 2 from earlier disc) | The capability is already mandatory so the statement is meaningless and can be removed |
| vivo | Option 1 | The current definition of RedCap that “The mandatory supported PDCP SN length is 12 bits while 18 bits being optional;  The mandatory supported RLC AM SN length is 12 bits while 18 bits being optional;” is clear. No need to introduce any additional limitations on *am-WithShortSN* or *ShortSN.* |
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## Impact due to RAN1 latest UE feature list

**In this meeting, Intel R2-2204925 mentioned:**

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| RAN1 added new components in [2] as:  1. Maximum FR1 RedCap UE bandwidth is 20 MHz.  2. Maximum FR2 RedCap UE bandwidth is 100 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  - FFS: 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  FFS whether to add any other basic features for RedCap UE  We propose to capture high level descriptions for component 4 and 5 in the field description of supportOfRedCap-r17 as  **Proposal 5: To add Separate initial UL BWP for RedCap UEs and Separate initial DL BWP for RedCap Ues in the field description of *supportOfRedCap-r17***   |  |  |  |  | | --- | --- | --- | --- | | ***supportOfRedCap-r17***  Indicates that the UE is a RedCap UE with comprised of at least the following functional components:   * Maximum FR1 RedCap UE bandwidth is 20 MHz; * Maximum FR2 RedCap UE bandwidth is 100 MHz; * Support of RedCap early indication based on Msg1, MsgA and Msg3 for random access; * Separate initial UL BWP for RedCap UEs; * Separate initial DL BWP for RedCap UEs .   A RedCap UE shall set the field to *supported*. | UE | No | No | |

**Discussion point 3.4-1: Do you agree to add Separate initial UL BWP for RedCap UEs and Separate initial DL BWP for RedCap Ues in the field description of *supportOfRedCap-r17* as below*?***

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| ***supportOfRedCap-r17***  Indicates that the UE is a RedCap UE with comprised of at least the following functional components:   * Maximum FR1 RedCap UE bandwidth is 20 MHz; * Maximum FR2 RedCap UE bandwidth is 100 MHz; * Support of RedCap early indication based on Msg1, MsgA and Msg3 for random access; * Separate initial UL BWP for RedCap UEs; * Separate initial DL BWP for RedCap UEs .   A RedCap UE shall set the field to *supported*. | UE | No | No |

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| **Company’s name** | **Yes or No?** | **Comments, if any** |
| Samsung | Yes | We support to capture it here as no additional capability is needed for these. |
| Qualcomm | Yes |  |
| MediaTek | Yes |  |
| vivo | Yes |  |
|  |  |  |

**Regarding full duplex:**

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| OPPO R2-2204738 | Based on RAN1 feature list, [28-3] is used to indicate half-duplex FDD operation (instead of full-duplex FDD operation) type A for RedCap UE, which is an optional feature with capability signalling. If UE includes feature [28-3] in UE capability reporting, it means the UE supports half-duplex FDD operation instead of full-duplex FDD operation. If UE does not include feature [28-3] in UE capability report, it means the UE supports full-duplex FDD operation. That is, a RedCap UE may support either half-duplex FDD or full-duplex FDD. So in our view, full-duplex FDD should be an optional feature for RedCap UEs.   1. Full-duplex FDD should be an optional feature for RedCap UEs. 2. Keep the field halfDuplexRedCapAllowed-r17 in SIB1 and remove the corresponding FFS.   -- FFS whether halfDuplexRedCapAllowed is kept, remove also from related procedure |
| Nokia R2-2205785 | According to RAN1 feature list [1], [28-3] is used to indicate Half-duplex FDD operation (instead of full-duplex FDD operation) type A for RedCap UE. According to this the UE can support either full-duplex FDD operation or half-duplex FDD operation:    Based on that we propose the following:  Proposal 1: *halfDuplexRedCapAllowed-r17* is kept in SIB1 and corresponding FFS is removed. |

Nokia and OPPO’s proposal is same. We could like to check companies’ view on this.

**Discussion point 3.4-2: Do you agree that Full-duplex FDD should be an optional feature for RedCap UEs and therefore halfDuplexRedCapAllowed-r17 is kept in SIB1 and corresponding FFS “-- FFS whether halfDuplexRedCapAllowed is kept, remove also from related procedure” is removed*?***

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| **Company’s name** | **Yes or No?** | **Comments, if any** |
| Samsung | Yes/No | We agree that FD-FDD should be an optional feature for RedCap UEs as RAN1 agreed.  However, we are not sure whether *halfDuplexRedCapAllowed-r17­*–which is about support from network side–is needed. Network may handle all types of RedCap UEs as FD-FDD before having capability information from the UE (which may result some delay if TX/RX collision occurs but it would not be a problem from RAN1 discussion from our understanding), and network can decide what to do after having it (e.g. handover).  If RAN2 wants to keep the *halfDuplexRedCapAllowed-r17*, we wonder whether similar information has to be provided to SIB4 for the completeness. Assuming we do not optimize the case, we think to allow access to the network (i.e. by removing the *halfDuplexRedCapAllowed-r17* from SIB1) seems a better option. |
| Qualcomm | Yes | FD-FDD should be an optional feature for RedCap UE, as indicated in RAN1’s UE feature list.  In our understanding, it is possible that a gNB may choose not to support or accept HD-FDD. Therefore, it is necessary to include the indicator halfDuplexRedCapAllowed-r17 in SIB1. |
| MediaTek | Yes |  |
| vivo | Yes | Since UE can support either full-duplex FDD operation or half-duplex FDD operation, keep the halfDuplexRedCapAllowed in SIB1 is more flexible. |
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## Impact due to RAN4 LS

In [6], RAN4 indicated

* Define new power class: Power class 7
* Not reduce the number of Rx branches, i.e. 2 Rx branches assumed for FR2 RedCap UE

RAN4 also agree the # of DL layers is not mandated for FR2 RedCap UE

* 2-layer DL MIMO is not mandated

During capability CR review, a RIL was raised for it as

**[RIL]**: FW001 **[Delegate]**: Futurewei (Yunsong)  **[WI]**: NR\_redcap-Core **[Class]**: 1 **[Status]**: ToDo **[TDoc]**: R2-22xxxxx **[Proposed Conclusion]**:

**[Description]**: According to RAN4 LS R2-2204193 (R4-2206545), RAN4 has decided the following for FR2 RedCap UE:

• Not reduce the number of Rx branches, i.e. 2 Rx branches assumed for FR2 RedCap UE

• 2-layer DL MIMO is not mandated

Therefore, the highlighted sentence no longer applies to FR2 RedCap UEs.

**[Proposed Change]**: Replace the sentence with the following:

For FR 1, 1 DL MIMO layer if 1 Rx branch is supported, and 2 DL MIMO layers if 2 Rx branches are supported; for FR2, either 1 or 2 DL MIMO layers can be supported, while 2 Rx branches are always supported.

**Regarding Rx/MIMO for FR2**:

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| Intel R2-2204925 | We tend to agree the suggestion from Futurewei, and would like to update it accordingly.  **Proposal 7: Update the description on Rx/MIMO layer for FR2 as**   * For FR 1, 1 DL MIMO layer if 1 Rx branch is supported, and 2 DL MIMO layers if 2 Rx branches are supported; For FR2, either 1 or 2 DL MIMO layers can be supported, while 2 Rx branches are always supported. UE features and corresponding capabilities related to more than 2 UE Rx branches and more than 2 DL MIMO layers, as well as UE features and capabilities related to more than 2 UE Tx branches and more than 2 UL MIMO layers are not supported by RedCap UEs; |
| Apple  R2-2205638 | For FR1, 1 DL MIMO layer if 1 Rx branch is supported, and 2 DL MIMO layers if 2 Rx branches are supported. For FR2, the support of 2Rx branches is mandatory, and 1 or 2 DL MIMO layers supported is optional and signalled by the RedCap UE. UE features and corresponding capabilities related to more than 2 UE Rx branches and more than 2 DL MIMO layers, as well as UE features and capabilities related to more than 2 UE Tx branches and more than 2 UL MIMO layers are not supported by RedCap UEs; |
| FutureWei  R2-2204619 | **Proposal 1: RAN2 adopt one of the following options to resolve the conflict between RAN2 and RAN4 decisions on Rx and MIMO for FR2 RedCap:**   * **Option 1: RAN2 send an LS to RAN4, explaining the rationales behind RAN2’s decisions,** **reminding them that the WID does not include 1 MIMO layer 2 Rx branch devices, and requesting RAN4 to reconsider allowing 1 Rx branch for FR2 RedCap UE and/or to reconsider mandating support of 2-layer DL MIMO for FR2 RedCap UE with 2 Rx branches.** * **Option 2: RAN2 accept RAN4’s design for FR2 RedCap UE and make changes in RAN2 specification(s), where needed, to highlight the differences between FR1 Redcap UE and FR2 RedCap UE, without changing the design for FR1 RedCap UE.** * **Option 3. RAN2 accept RAN4’s decision that FR2 will have 2 Rx branches, but do not introduce 1 MIMO layer 2 Rx branch devices. RAN2 send an LS to RAN4, reminding them that the WID does not include 1 MIMO layer 2 Rx branch devices, and requesting RAN4 to mandate the support of 2 MIMO layers for FR2 RedCap UEs, which will always support 2 Rx branches.**   **Proposal 4. If Option 2 is adopted, capture the following in the Chair’s note to clarify the previous RAN2 agreements on Rx and MIMO, in light of RAN4’s decisions on FR2 RedCap UE:**   * **The previous RAN2 agreements on Rx and MIMO still apply to FR1 RedCap UE.** * **For FR2 RedCap UE, the UE has 2 Rx branches; when *maxNumberMIMO-LayersPDSCH* is absent, it implies that the UE doesn’t support DL MIMO; and when *maxNumberMIMO-LayersPDSCH* is present and set to 2-layers, it indicates that the UE supports 2-layer DL MIMO.**   **Proposal 5: If Option 3 is adopted, capture the following in the Chair’s note to clarify the previous RAN2 agreements on Rx and MIMO:**   * **The previous RAN2 agreements on Rx and MIMO still apply to FR1 RedCap UE.**   **For FR2 RedCap UE, the UE has 2 Rx branches and *maxNumberMIMO-LayersPDSCH* is present and set to 2-layers.** |

Considering the capability of Rx/MIMO is RAN1/RAN4 feature, we do not see the point to object RAN4 agreement from RAN2 perspective. We may update accordingly if RAN1 has different view on this. Therefore we would like to check companies’ view on:

**Discussion point 3.5-1: Do you agree to capture RAN4 agreements as**

* For FR 1, 1 DL MIMO layer if 1 Rx branch is supported, and 2 DL MIMO layers if 2 Rx branches are supported; For FR2, either 1 or 2 DL MIMO layers can be supported, while 2 Rx branches are always supported. UE features and corresponding capabilities related to more than 2 UE Rx branches and more than 2 DL MIMO layers, as well as UE features and capabilities related to more than 2 UE Tx branches and more than 2 UL MIMO layers are not supported by RedCap UEs;

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| **Company’s name** | **Yes or No?** | **Comments, if any** |
| Samsung | Yes | - |
| Qualcomm | Yes |  |
| MediaTek | Yes |  |
| Vivo | Yes |  |
|  |  |  |

**Regarding “Define new power class: Power class 7**”, in this meeting, Apple R2-2205637/R2-2205638 and Ericsson R2-2206026 proposed to introduce new power class.

**Discussion point 3.5-2: Do you agree the TP on new power class (Apple R2-2205637/R2-2205638 )?**

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| **TP on TS38.331:** – *Phy-Parameters* maxNumberSRS-PosSpatialRelationsAllServingCells-r16 ENUMERATED {n0, n1, n2, n4, n8, n16} OPTIONAL  ]],  [[  ue-FR2-PowerClass-7-r17 ENUMERATED {supported} OPTIONAL  ]]  **TP on TS38.306:** 4.2.7.10 *Phy-Parameters*  | ***ue-FR2-PowerClass-7***  Indicates whether the UE supports power class 7 with the requirements as specified in TS 38.101-2 Table 6.2.1.0-1. | UE | No | No | FR2 only | | --- | --- | --- | --- | --- | |

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| **Company’s name** | **Yes or No?** | **Comments, if any** |
| Samsung | Yes | - |
| Qualcomm | Yes |  |
| MediaTek | Yes |  |
| Vivo | Yes |  |
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**Regarding the potential impact on TS38.304**, Ericsson R2-2206025 proposed

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| 5.3.1 Cell status and cell reservations  Cell status and cell reservations are indicated in the *MIB or SIB1* message as specified in TS 38.331 [3] by means of following fields:  - *cellBarred* (IE type: "barred" or "not barred")  Indicated in *MIB* message. In case of multiple PLMNs or NPNs indicated in *SIB1*, this field is common for all PLMNs and NPNs.  - *cellBarredRedCap1Rx* (IE type: "barred" or "not barred") Indicated in *SIB1* message. In case of multiple PLMNs or NPNs indicated in *SIB1*, this field is common for all PLMNs and NPNs. This field is only applicable to RedCap UEs for a cell operating in FR1.  **Ericsson: If we decide to not go for repurposing this barring parameter for FR2, then we can keep this change. Otherwise, the change is probably not needed considering that the description in 38.304 is high level and would then be valid for both FR1 and FR2 without this change.** |

**Discussion point 3.5-3: Do you agree the TP on new power class (Ericsson R2-2206025 )?**

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| **Company’s name** | **Yes or No?** | **Comments, if any** |
| Samsung | No strong view but | Perhaps changes on 306 would be sufficient? |
| Qualcomm | No strong view | Same view as Samsung. |
| MediaTek | No strong view |  |
| vivo | No strong view | Same view as Samsung. |
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## Others

Intel R2-2204925 also discussed issues:

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| We also received offline comments as:  **Issue 1:** We may need to delete this. This capability has nothing to do with ANR, right?   |  |  |  |  |  | | --- | --- | --- | --- | --- | | ***reportAddNeighMeasForPeriodic-r16***  Defines whether the UE supports periodic reporting of best neighbour cells per serving frequency, as defined in TS 38.331 [9]. It is optional for RedCap UEs. | UE | Yes | No | No |   We think this was introduced for SON/MDT. Would like to hear companies’ view.  **Proposal 8: RAN2 to discuss whether *reportAddNeighMeasForPeriodic-r16* is applied for RedCap UE or not.** |

**Discussion point 3.6-1: Is reportAddNeighMeasForPeriodic-r16 applied for RedCap UE or not, i.e. if reportAddNeighMeasForPeriodic-r16 is applied for RedCap UE, then “It is optional for RedCap UEs” should be kept.**

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| **Company’s name** | **Yes or No?** | **Comments, if any** |
| Samsung | Optionally yes as agreed before | So, the sentence can be kept. |
| Qualcomm | See comment. | ANR is optional for RedCap, as agreed before. But the sentence may not be needed, because if a feature is an optional UE capability, then by default it should be optional for both non-RedCap and RedCap UEs. |
| MediaTek | Optional (and change from Yes to CY for mandatory field) | The sentence can be kept. Similar to Discussion point 3.6-3, we should update the mandatory field from ‘Yes’ to ‘CY’ |
| vivo | Yes | First, *reportAddNeighMeasForPeriodic-r16* could be applied for RedCap UEs.  We share the same view as Qualcomm, if we remove this sentence, there is no problem? |
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| **Issue 2:** CPAC, Abbreviation is missing.  We think it is a good point, and would like to add CPAC as abbreviation in TS38.306.  **Proposal 9: Add abbreviation CPAC in TS38.306.** |

**Discussion point 3.6-2: Do you agree to add abbreviation CPAC in TS38.306.?**

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| **Company’s name** | **Yes or No?** | **Comments, if any** |
| Samsung | Yes | - |
| Qualcomm | Yes |  |
| MediaTek | Yes |  |
| Vivo | Yes |  |
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| **Issue 3:** Do we need to change this as “CY”?   |  |  |  |  | | --- | --- | --- | --- | | ***supportOfRedCap-r17***  Indicates that the UE is a RedCap UE with comprised of at least the following functional components:   * Maximum FR1 RedCap UE bandwidth is 20 MHz; * Maximum FR2 RedCap UE bandwidth is 100 MHz; * Support of RedCap early indication based on Msg1, MsgA and Msg3 for random access;   A RedCap UE shall always set the capability to “supported”. | UE | No | No |   We tend to agree that a RedCap UE must support this capability, and therefore “CY” looks good.  **Proposal 10: Update No to CY for  *supportOfRedCap-r17.*** |

**Discussion point 3.6-3: Do you agree to update No to CY for*supportOfRedCap-r17*.? i.e.**

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| ***supportOfRedCap-r17***  Indicates that the UE is a RedCap UE with comprised of at least the following functional components:   * Maximum FR1 RedCap UE bandwidth is 20 MHz; * Maximum FR2 RedCap UE bandwidth is 100 MHz; * Support of RedCap early indication based on Msg1, MsgA and Msg3 for random access;   A RedCap UE shall always set the capability to “supported”. | UE | ~~No~~ CY | No |

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| **Company’s name** | **Yes or No?** | **Comments, if any** |
| Samsung | Yes | - |
| Qualcomm | Yes |  |
| MediaTek | Yes |  |
| Vivo | Yes |  |

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| In addition, the EN in 4.2.21.1 can be removed.  Editor's Note: May be updated based on latest RAN1 and RAN4 agreements.  **Proposal 11: Remove the EN “Editor's Note: May be updated based on latest RAN1 and RAN4 agreements”*.*** |

**Discussion point 3.6-4: Do you agree to remove the EN “Editor's Note: May be updated based on latest RAN1 and RAN4 agreements. “, considering anyway we will update specification accordingly whenever receiving RAN1/4 LS.**

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| **Company’s name** | **Yes or No?** | **Comments, if any** |
| Samsung | Yes | - |
| Qualcomm | Yes |  |
| MediaTek | Yes |  |
| Vivo | Yes |  |

# Summary report and proposals

**For agreement:**

**Online discussion:**

# Reference

1. R2-2203563 [offline-107] UE caps open issues - second round Intel
2. R1-2202928 - Updated RAN1 UE features list for Rel-17 NR after RAN1 108-e
3. RP-220891 Moderator's summary for discussion [95e-31-R17-RedCap-WI] RAN1 VC (CMCC)
4. R2-2204040 Running 38.306 CR for the RedCap capablities Intel Corporation
5. R2-2203560 Updated Running 38.331 CR for the RedCap capablities Intel Corporation
6. R4-2206545 Support of reduced capability NR devices (NR\_redcap) RAN4
7. R2-2204738 Clarification on HD-FDD support for RedCap OPPO
8. R2-2204818 Discussion on capability for RedCap vivo, Guangdong Genius
9. R2-2204925 Open issues on RedCap capabilities Intel Corporation discussion
10. R2-2204926 Draft 38.306 CR for the RedCap capablities Intel Corporation
11. R2-2204927 Draft 38.331 CR for the RedCap capablities Intel Corporation
12. R2-2205787 On RedCap UE capabilities Nokia, Nokia Shanghai Bell
13. R2-2206025 Introduction of FR2 RedCap UE Ericsson
14. R2-2206026 Introduction of FR2 RedCap UE Ericsson
15. R2-2206027 Introduction of FR2 RedCap UE Ericsson
16. R2-2204619 Discussion on RAN4 LS on FR2 RedCap UE Futurewei Technologies
17. R2-2205637 RedCap UE power class 7 signaling Apple
18. R2-2205638 RedCap UE power class 7 signaling Apple