3GPP TSG-RAN WG1 Meeting #112bis-e Draft R1-2303928

e-Meeting, 17th – 26th April 2023

**Agenda Item: 7.2**

**Title: FL summary #1 on Rel-17 RedCap maintenance**

**Source: Moderator (Ericsson)**

**Document for: Discussion, Decision**

# Introduction

This feature lead (FL) summary (FLS) concerns the Rel-17 work item (WI) for support of reduced capability (RedCap) NR devices [[1](https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_95e/Docs/RP-220966.zip), [2](https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_96/Docs/RP-221163.zip)]. FLSs from the previous RAN1 meeting can be found in [[3](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112/Docs/R1-2301882.zip), [4](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112/Docs/R1-2301883.zip), [5](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112/Docs/R1-2301884.zip)], and the resulting agreed RAN1 CRs can be found in [[6](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112/Docs/R1-2302207.zip), [7](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112/Docs/R1-2302208.zip)], and the latest RAN1 agreement summary is available in [[8](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112/Docs/R1-2301881.zip)].

This document summarizes contributions [9] – [21] submitted to agenda item 7.2 and the following email discussion:

|  |
| --- |
| [112bis-e-R17-RedCap-01] Email discussion on Rel-17 RedCap maintenance by April 21 – Johan (Ericsson) |

The issues that are in the focus of the initial round of the discussion are tagged FL1.

Follow the naming convention in this example:

* *RedCapFLS1-v000.docx*
* *RedCapFLS1-v001-CompanyA.docx*
* *RedCapFLS1-v002-CompanyA-CompanyB.docx*
* *RedCapFLS1-v003-CompanyB-CompanyC.docx*

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

* Assume CompanyC wants to update *RedCapFLS1-v002-CompanyA-CompanyB.docx*.
* CompanyC uploads an empty file named *RedCapFLS1-v003-CompanyB-CompanyC.checkout*
* CompanyC checks that no one else has created a checkout file simultaneously, and if there is a collision, CompanyC tries to coordinate with the company who made the other checkout (see, e.g., contact list below).
* CompanyC then has 30 minutes to upload *RedCapFLS1-v003-CompanyB-CompanyC.docx*
* If no update is uploaded in 30 minutes, other companies can ignore the checkout file.
* Note that the file timestamps on the server are in UTC time.

In file names, please use the hyphen character (not the underline character) and include ‘v’ in front of the version number, as in the examples above and in line with the general recommendation (see slide 16 in [R1-2302258](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112b-e/Docs/R1-2302258.zip)), otherwise the sorting of the files will be messed up (which can only be fixed by the RAN1 secretary).

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

**FL1 Question 0-1a: Please consider entering contact info below for the points of contact for this email discussion.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Point(s) of contact** | **Email address(es)** |
| vivo | Lihui Wang | wanglihui@vivo.com |
| CMCC | Lijie Hu | hulijie@chinamobile.com |
| CATT | Yongqiang Fei | feiyongqiang@catt.cn |
| Ericsson | Sandeep Narayanan Kadan Veedu | sandeep.narayanan.kadan.veedu@ericsson.com |
| LG Electronics | Jay KIM | jaehyung.kim@lge.com |
| MediaTek | Chiou-Wei Tsai | [cw.tsai@mediatek.com](mailto:cw.tsai@mediatek.com) |
| Intel | Debdeep Chatterjee | [debdeep.chatterjee@intel.com](mailto:debdeep.chatterjee@intel.com) |
| NEC | Takahiro Sasaki | takahiro.sasaki@nec.com |
| Qualcomm | Jing Lei | leijing@qti.qualcomm.com |
| NTT DOCOMO | Mayuko Okano | mayuko.okano.ca@nttdocomo.com |

# Issue #1: TDD UL validation in BWP with NCD-SSB

RAN1#112 discussed TDD UL validation in BWP with NCD-SSB for RedCap UEs [[5](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112/Docs/R1-2301884.zip)] and made this conclusion [[8](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112/Docs/R1-2301881.zip)]:

|  |
| --- |
| Agreement:  Discuss the need to clarify PRACH/PUSCH/PUCCH occasion validation for the following cases:   * Issue 5.1: A RedCap UE performing random access in idle/inactive state in RedCap-specific initial DL BWP without CD-SSB or NCD-SSB * Issue 5.2: A RedCap UE in connected state operating in a DL BWP without CD-SSB but with NCD-SSB. * Issue 5.3: A RedCap UE in connected state operating in a DL BWP without CD-SSB or NCD-SSB. |

The following contributions to this meeting concern TDD UL validation in BWP with NCD-SSB for RedCap UEs:

|  |  |  |  |
| --- | --- | --- | --- |
| [9] | [R1-2302297](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302297.zip) (Issue 2.2) | Maintenance issues for Rel-17 NR RedCap | Ericsson |
| [11] | [R1-2302650](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302650.zip) (Sections 2.3 & 2.4) | Discussion on PRACH/PUSCH/PUCCH occasion validation | CATT |
| [12] | [R1-2302651](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302651.zip) (38.213 CR) | Correction on collision handling between valid PRACH occasion and NCD-SSB in Rel-17 | CATT |
| [13] | [R1-2302942](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302942.zip) (Section 2.1) | Discussion on RedCap remaining issues | ZTE, Sanechips |
| [14] | [R1-2302958](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302958.zip) (Section 2.1) | Discussion on RedCap SDT operation | Xiaomi |
| [16] | [R1-2303210](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303210.zip) | Discussion on RedCap remaining issues | CMCC |
| [17] | [R1-2303211](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303211.zip) (38.213 CR) | Draft CR on collision handling between PRACH and NCD-SSB | CMCC |
| [18] | [R1-2303347](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303347.zip) | On UL resource validation with SSB | MediaTek Inc. |
| [19] | [R1-2303348](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303348.zip) (38.213 CR) | Draft CR for 38.213 on UL resource validation with SSB | MediaTek Inc. |
| [21] | [R1-2303690](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303690.zip) (Section 2.1) | Discussion on remaining issues for RedCap UE | NTT DOCOMO, INC. |

The above contributions bring up the following cases for TDD UL validation in BWP with NCD-SSB for RedCap UEs:

* **Case 1: PRACH occasion validation (38.213 [**[**22**](https://www.3gpp.org/ftp/Specs/archive/38_series/38.213/38213-h50.zip)**] clause 8.1)**
  + Contributions [9, 11, 16, 18, 21] argue that it should be based on CD-SSB.
  + Contribution [13] argues that it should be based on NCD-SSB but also expresses that either way the potential problems can be avoided by careful configuration.
  + Contribution [14] argues that is should be based on NCD-SSB (at least when NCD-SSB is used for SDT in RRC inactive state) and proposes to insert a corresponding paragraph in 38.213 clause 17.1.
  + Draft CRs for 38.213 are provided in contributions [12, 17] for clause 11.1 and [19] for clause 17.1.
* **Case 2: MsgA PUSCH occasion validation (38.213 [**[**22**](https://www.3gpp.org/ftp/Specs/archive/38_series/38.213/38213-h50.zip)**] clause 8.1A)**
  + Contributions [9, 11, 16, 18, 21] argue that it should be based on CD-SSB.
  + Contribution [13] argues that it should be based on NCD-SSB but also expresses that either way the potential problems can be avoided by careful configuration.
  + Draft CR for 38.213 clause 17.1 is provided in contribution [19].
* **Case 3: Msg3 PUSCH repetition resource counting (38.213 [**[**22**](https://www.3gpp.org/ftp/Specs/archive/38_series/38.213/38213-h50.zip)**] clause 8.3)**
  + Contribution [18] argues that it should be based on CD-SSB.
  + Draft CR for 38.213 clause 17.1 is provided in contribution [19].
* **Case 4: PUCCH repetition resource counting (38.213 [**[**22**](https://www.3gpp.org/ftp/Specs/archive/38_series/38.213/38213-h50.zip)**] clause 9.2.6)**
  + Contribution [9] argues that it should be based on CD-SSB.
  + Contributions [11, 16] argue that it should be based on both CD-SSB and NCD-SSB according to the current specification text and that no specification change is needed.
  + Contribution [13] argues that it should be based on NCD-SSB but also expresses that either way the potential problems can be avoided by careful configuration.
  + Contribution [21] argues that it should be based at least on NCD-SSB, possibly also on CD-SSB.
* **Case 5: CG-PUSCH occasion validation (38.213 [**[**22**](https://www.3gpp.org/ftp/Specs/archive/38_series/38.213/38213-h50.zip)**] clause 19.1)**
  + Contributions [9, 18] argue that it should be based on CD-SSB.
  + Contribution [14] argues that is should be based on NCD-SSB (at least when NCD-SSB is used for SDT in RRC inactive state) and proposes to insert a corresponding paragraph in 38.213 clause 17.1.
  + Draft CR for 38.213 clause 17.1 is provided in contribution [19].

**FL1 Question 1-1a: Companies are invited to provide comments and suggested priority (Low/Medium/High).**

|  |  |  |
| --- | --- | --- |
| **Company** | **Priority** | **Comments** |
| vivo | H |  |
| CMCC | H | This issue has been discussed for several meetings, with 5.1 and 5.3 solved during last meeting, 5.2 also needs to be solved, then common understanding can be achieved for gNB and UE.  For the UL validation, we prefer legacy UEs and R18 RedCap UEs to use the same CD-SSB for RO and PUSCH occasion validation. If different UEs use CD-SSB and NCD-SSB for RO validation respectively, and there is offset between CD-SSB and NCD-SSB, RO overlapping with NCD-SSB is valid for one kind of UEs but invalid for another kind of UEs, the valid results will be different, as a result, different UEs may have different SSB and RO mapping association. Similarly, if different UEs use different SSB for PUSCH occasion validation, different UEs may have different RO and PUSCH occasion mapping association.  Therefore, CD-SSB based validation is proposed. |
| CATT | H | Share similar understanding with CMCC, although the potential detailed discussion should be the next step. |
| ZTE, Sanechips | H |  |
| Ericsson | H | The TDD UL validation for most of the listed cases should be based on CD-SSB.  For PUCCH, perhaps it makes sense to also base it on NCD-SSB. |
| LGE | H | Okay to discuss this issue in this meeting. |
| MediaTek | H | We think all five cases should be discussed. For most cases, CD-SSB should be used and specification changes are needed. |
| Nokia, NSB | H |  |
| Intel | H |  |
| NEC | H |  |
| Qualcomm | H |  |
| DOCOMO | H | SSB(s) which is applied for occasion validation and collision handling should be discussed separately. |
| Samsung | H | Share other company’s view that CD-SSB based validation is used. |

# Issue #2: TDD UL validation in BWP without any SSB

RAN1#112 discussed TDD UL validation in BWP without any SSB for RedCap UEs [[5](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112/Docs/R1-2301884.zip)] and made this conclusion [[8](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112/Docs/R1-2301881.zip)]:

|  |
| --- |
| Agreement:  Discuss the need to clarify PRACH/PUSCH/PUCCH occasion validation for the following cases:   * Issue 5.1: A RedCap UE performing random access in idle/inactive state in RedCap-specific initial DL BWP without CD-SSB or NCD-SSB * Issue 5.2: A RedCap UE in connected state operating in a DL BWP without CD-SSB but with NCD-SSB. * Issue 5.3: A RedCap UE in connected state operating in a DL BWP without CD-SSB or NCD-SSB.   Conclusion:  For TDD, RedCap UE in a BWP without any SSB should apply CD-SSB for determining the following in all RRC states:   * PRACH occasion validation (in Clause 8.1, TS38.213), * MsgA PUSCH occasion validation (in Clause 8.1A, TS38.213)   Note: No specification impact is expected. |

The following contributions to this meeting concern TDD UL validation in BWP without any SSB for RedCap UEs:

|  |  |  |  |
| --- | --- | --- | --- |
| [9] | [R1-2302297](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302297.zip) (Issue 2.1) | Maintenance issues for Rel-17 NR RedCap | Ericsson |
| [11] | [R1-2302650](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302650.zip) (Section 2.2) | Discussion on PRACH/PUSCH/PUCCH occasion validation | CATT |
| [21] | [R1-2303690](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303690.zip) (Section 2.1) | Discussion on remaining issues for RedCap UE | NTT DOCOMO, INC. |

Contribution [9] has the following proposal:

* Proposal 2: Make a similar conclusion for PUCCH repetition as for PRACH and MsgA PUSCH:
  + For TDD, RedCap UE in a BWP without any SSB should apply CD-SSB for determining the following in all RRC states:
    - the *N\_PUCCH^repeat* slots for a PUCCH transmission (in Clause 9.2.6, TS38.213)
  + Note: No specification impact is expected.

Contribution [11] has a similar proposal, whereas contribution [21] proposes to study this case further.

**FL1 Question 2-1a: Companies are invited to provide comments and suggested priority (Low/Medium/High).**

|  |  |  |
| --- | --- | --- |
| **Company** | **Priority** | **Comments** |
| vivo | H | We support proposal 2. |
| CMCC | H | It is reasonable for UE to determine the PUCCH repetition slots based on CD-SSB, since only CD-SSB can be recognized by UE. |
| CATT | H | We propose a similar proposal in [11]. OK to go with this Proposal 2 in [9]. |
| ZTE, Sanechips | H | Similar conclusion can be made. |
| Ericsson | H |  |
| LGE | H | Okay to discuss this proposal in this meeting. |
| MediaTek | H | The current specification text (see below) cannot distinguish between NCD-SSB and CD-SSB. NCD-SSB shares the exact parameter *ssb-PositionsInBurst* as CD-SSB. Hence, some specification changes are needed.  A SS/PBCH block symbol is a symbol of an SS/PBCH block with candidate SS/PBCH block index corresponding to the SS/PBCH block index indicated to a UE by *ssb-PositionsInBurst* in SIB1 or *ssb-PositionsInBurst* in ServingCellConfigCommon |
| Nokia, NSB | H | Ok with proposal 2 |
| Intel | H |  |
| NEC | H |  |
| Qualcomm | H |  |
| DOCOMO | H |  |
| Samsung | H | OK with proposal 2 |

# Issue #3: SDT operation in BWP with NCD-SSB

RAN1#111 discussed SDT operation in BWP with NCD-SSB for RedCap UEs [[25](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_111/Docs/R1-2212980.zip)] and made this conclusion [[8](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112/Docs/R1-2301881.zip)]:

|  |
| --- |
| Agreement:  Discuss the necessary UE behavior of the following cases in this meeting:   * Issue 5.1: RA-SDT without subsequent transmission in BWP without CD-SSB * Issue 5.2: RA-SDT with subsequent transmission in BWP without CD-SSB * Issue 5.3: CG-SDT in BWP without CD-SSB * Issue 5.4: NCD-SSB can be used for CG-SDT   Conclusion:  The following cases can be revisited in RAN1#112:   * Subsequent RA-SDT transmission in a RedCap-specific separate initial BWP without CD-SSB * CG-SDT in a RedCap-specific separate initial BWP without any SSB * CG-SDT in a RedCap-specific separate initial BWP without CD-SSB but with NCD-SSB |

RAN2#121 discussed the following options [[23](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_121/Docs/R2-2301901.zip)], decided on Option 2, and agreed corresponding RAN2 CRs [[24](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_99/Docs/RP-230693.zip)].

|  |
| --- |
| RedCap & SDT   * Option 1: CG/RA-SDT can only be performed if the initial DL BWP includes the CD-SSB * Option 2: CG/RA-SDT can also be performed if the initial DL BWP does not include the CD-SSB but a NCD-SSB (to be signalled to the UE). A corresponding UE capability is introduced * Option 3: CG/RA-SDT can be performed even if the initial DL BWP does not include any SSB. It’s up to UE implementation whether to perform a new RSRP measurement on CB-SSB before CG transmission. A corresponding UE capability could be introduced * Option 4: If the network configures a REDCAP-specific initial DL BWP that does not include the CD-SSB, the UE monitors PDCCH on initialDownlinkBWP during the CG/RA-SDT procedure. |

The following contributions to this RAN1 meeting concern SDT operation in BWP with NCD-SSB for RedCap UEs:

|  |  |  |  |
| --- | --- | --- | --- |
| [9] | [R1-2302297](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302297.zip) (Issue 1) | Maintenance issues for Rel-17 NR RedCap | Ericsson |
| [15] | [R1-2303172](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303172.zip) | Maintenance of Rel-17 RedCap | NEC |
| [21] | [R1-2303690](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303690.zip) (Section 2.2) | Discussion on remaining issues for RedCap UE | NTT DOCOMO, INC. |

Contribution [9] has the following TP for 38.213 [[22](https://www.3gpp.org/ftp/Specs/archive/38_series/38.213/38213-h50.zip)] clause 17.1:

|  |
| --- |
| For a RedCap UE indicating a capability to use an initial DL BWP associated with NCD-SSB for SDT, if the UE is provided *NonCellDefiningSSB* in *ncd-SSB-RedCapInitialBWP-SDT*, then during SDT procedure (as described in clause 19) the UE may use the SS/PBCH blocks provided by *NonCellDefiningSSB* instead of the SS/PBCH blocks that the UE used to obtain SIB1, and these SS/PBCH blocks and the SS/PBCH blocks that the UE used to obtain SIB1 have the same QCL properties, if they have the same index*.* |

Contribution [15] has the following proposals:

* Proposal 1: For RedCap UE which indicates a capability *ncd-SSB-ForRedCapInitialBWP-SDT-r17* is not required a capability of BWP operation without restriction (FG28-1a) for SDT operation on a separate initial DL BWP without CD-SSB but with NCD-SSB.
* Proposal 2: NCD-SSB for SDT in RRC\_INACTIVE should have the same values for properties of CD-SSB, as in the case of RRC\_CONNECTED.
* Proposal 3: The field description of *ncd-SSB-RedCapInitialBWP-SDT* needs the same text as that of *nonCellDefiningSSB* that “The NCD-SSB has the same values for the properties (e.g., *ssb-PositionsInBurst*, *PCI*, *ssb-periodicity*, *ssb-PBCH-BlockPower*) of the corresponding CD-SSB apart from the values of the properties configured in the *NonCellDefiningSSB-r17* IE.”
* Proposal 4: NCD-SSB in RRC\_INACTIVE and CD-SSB have the same QCL properties if they have the same index.
* Proposal 5: PUSCH resource selection for SDT on a separate initial DL BWP configured with NCD-SSB is based on NCD-SSB of the same index as CD-SSB.

Contribution [21] has the following proposal:

* Proposal 3: NCD-SSB is transmitted only for the subsequent SDT if RA-SDT is configured in a separate initial BWP which does not include CD-SSB but include NCD-SSB.
  + FFS: Whether the detailed timing on NCD-SSB reception for subsequent SDT should be further clarified.

**FL1 Question 3-1a: Companies are invited to provide comments and suggested priority (Low/Medium/High).**

|  |  |  |
| --- | --- | --- |
| **Company** | **Priority** | **Comments** |
| vivo | H for [15]  L for [21] | For proposals in contribution [15], we think they are high priority to make the spec complete and aligned with RAN2’s understanding.  For proposal 3 in contribution [21], we think it contradicts with RAN2’s agreements and specification. |
| CMCC | M | This needs to be solved. It seems natural that the NCD-SSB in RRC inactive state has the same QCL properties as CD-SSB if they have the same SSB index. |
| CATT | M |  |
| ZTE, Sanechips | M | Open to discuss. |
| Ericsson | M | We think the TP in contribution [9] can be considered. It resolves some of the issues brought up in contribution [15]. |
| LGE | M | Okay to further discuss in this meeting. |
| MediaTek | M~H | Open for discussion |
| Nokia, NSB | M |  |
| Intel | M | OK to discuss |
| NEC | M or H |  |
| Qualcomm | M |  |
| DOCOMO | H |  |
| Samsung | L | When RAN2 reaches the agreement for the corresponding CR for option2, they conclude there is no impact to RAN1. And the procedure is complete according to RAN2’s CR.  [R2-2302305](file:///C:\Data\3GPP\RAN2\Docs\R2-2302305.zip)Corrections for SDT operation for REDCAP without CD-SSB         ZTE Corporation, Sanechips, Vivo, Mediatek, China Unicom, China Telecom   CR        Rel-17   38.331  17.3.0   3817     2          F   NR\_redcap-Core  **ð  It is not expected that the CR has any impact to RAN1 or RAN4 from RAN2 standpoint**  **ð  Agreed** |

# Issue #4: SDT operation in BWP without any SSB

RAN1#111 discussed SDT operation in BWP without any SSB for RedCap UEs [[25](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_111/Docs/R1-2212980.zip)] and made this conclusion [[8](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112/Docs/R1-2301881.zip)]:

|  |
| --- |
| Agreement:  Discuss the necessary UE behavior of the following cases in this meeting:   * Issue 5.1: RA-SDT without subsequent transmission in BWP without CD-SSB * Issue 5.2: RA-SDT with subsequent transmission in BWP without CD-SSB * Issue 5.3: CG-SDT in BWP without CD-SSB * Issue 5.4: NCD-SSB can be used for CG-SDT   Conclusion:   * No issue is identified for RedCap UEs supporting RA-SDT to support initial (non-subsequent) RA-SDT transmission in a RedCap-specific separate initial BWP without CD-SSB.   Conclusion:  The following cases can be revisited in RAN1#112:   * Subsequent RA-SDT transmission in a RedCap-specific separate initial BWP without CD-SSB * CG-SDT in a RedCap-specific separate initial BWP without any SSB * CG-SDT in a RedCap-specific separate initial BWP without CD-SSB but with NCD-SSB |

The following contributions to this RAN1 meeting concern SDT operation in BWP without any SSB for RedCap UEs:

|  |  |  |  |
| --- | --- | --- | --- |
| [14] | [R1-2302958](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302958.zip) (Section 2.3) | Discussion on RedCap SDT operation | Xiaomi |
| [20] | [R1-2303394](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303394.zip) | RedCap support of SDT | Nokia, Nokia Shanghai Bell |

Contribution [14] has the following proposal:

* Proposal 3: Both CG-SDT and RA-SDT must be performed on the separate RedCap-specific initial BWP if configured. If both CD-SSB and NCD-SSB can’t be obtained in this separate initial BWP, SDT is disabled for the RedCap in this serving cell.

Contribution [20] has the following proposal:

* Proposal 1: RAN1 discuss if the restriction to not support initial (non-subsequent) RA-SDT transmission in a RedCap-specific separate initial BWP without SSB is correct and acceptable.

**FL1 Question 4-1a: Companies are invited to provide comments and suggested priority (Low/Medium/High).**

|  |  |  |
| --- | --- | --- |
| **Company** | **Priority** | **Comments** |
| vivo | M or L | Our understanding is aligned with contribution [14]. No further discussion is also OK for us based on current RAN2 specification. |
| CMCC | M | RAN1 has identify no issue to support initial (non-subsequent) RA-SDT transmission in a RedCap-specific separate initial BWP without CD-SSB, there is no need to change the agreement. The gNB still has freedom not to configure NCD-SSB for inactive UEs on separate initial BWP. Then it can still support initial (non-subsequent) RA-SDT transmission. |
| CATT | L | Is this contradictory to RAN2’s agreement? |
| ZTE, Sanechips | M | Open to discuss. |
| Ericsson | M | RAN1 has concluded that “No issue is identified for RedCap UEs supporting RA-SDT to support initial (non-subsequent) RA-SDT transmission in a RedCap-specific separate initial BWP without CD-SSB”, but RAN2 did to our understanding not make any agreement to support this case, so some clarification of the situation seems to be needed. |
| LGE | M | Okay to further discuss in this meeting. |
| MediaTek | L-M | On[20], we understand previous RAN1 had the conclusion on RA-SDT without initial transmission. But isn’t this case basically a normal RACH procedure? We can hence accept the restriction that initial RA-SDT transmission is not supported in a BWP w/o SSB to align with RAN2’s agreements.  On [14], open for discussion. |
| Nokia, NSB | L | In response to CATTs comment, in our view, the most recent RAN2 agreements, overlook the earlier RAN1 conclusion below:  Conclusion:   * No issue is identified for RedCap UEs supporting RA-SDT to support initial (non-subsequent) RA-SDT transmission in a RedCap-specific separate initial BWP without CD-SSB. |
| Intel | M/L | OK to discuss. |
| NEC | M or L | OK to discuss. |
| DOCOMO | M | Regarding [20], it can be further discussed whether NCD-SSB is required even for initial RA-SDT transmission. |
| Samsung | L | RAN2 already exclude the case SDT without any SSB. |

# Issue #5: SDT operation and HD-FDD collision handling

The following contribution concerns SDT operation and HD-FDD collision handling for RedCap UEs:

|  |  |  |  |
| --- | --- | --- | --- |
| [14] | [R1-2302958](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302958.zip) (Section 2.2) | Discussion on RedCap SDT operation | Xiaomi |

Contribution [14] has the following proposal:

* Proposal 2: For collision handling between CG-SDT PUSCH and DL resources for HD-FDD UEs in inactive states, adopts the same rule as CG PUSCH in connected states.

**FL1 Question 5-1a: Companies are invited to provide comments and suggested priority (Low/Medium/High).**

|  |  |  |
| --- | --- | --- |
| **Company** | **Priority** | **Comments** |
| vivo | H |  |
| CMCC | M |  |
| CATT | M |  |
| ZTE, Sanechips |  | If there is no spec impact, we can deprioritize this discussion. |
| Ericsson | M | Both options brought up in Section 2.2. of the contribution [14] can be discussed. |
| LGE | M | Same handling is preferred, but open to further discuss during this meeting. |
| Nokia, NSB | M |  |
| Intel | M |  |
| DOCOMO | M |  |
| Samsung | L | Same view as ZTE, no spec impact, no need further discussion. |

# Issue #6: SDT operation and TDD center frequency

The following contribution concerns SDT operation and TDD center frequency for RedCap UEs:

|  |  |  |  |
| --- | --- | --- | --- |
| [10] | [R1-2302465](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302465.zip) (38.213 CR) | Correction for SDT operation the in separate initial BWP for RedCap | Vivo |

RAN1#111 also discussed this topic, and the discussion is captured under Issue #6 in the FLS in [[25](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_111/Docs/R1-2212980.zip)].

**FL1 Question 6-1a: Companies are invited to provide comments and suggested priority (Low/Medium/High).**

|  |  |  |
| --- | --- | --- |
| **Company** | **Priority** | **Comments** |
| vivo | H | There are two corrections, first is about center frequency alignment between PUSCH transmission and corresponding search space monitoring for SDT which is critical for RedCap UEs in unpaired spectrum for low complexity. Note that the same center frequency between Msg1/Msg3, or MsgA trasmissions and PDCCH monitored in Type1-PDCCH CSS set is already captured in current specification for RedCap.  2nd correction is the same as contribution [14] that when a separate initial UL BWP is configured for RedCap UEs, SDT should be performed on the separate initail BWP. |
| CMCC | M |  |
| CATT | L |  |
| ZTE, Sanechips |  | If SDT operation is the in initial BWP for RedCap, the PRACH resources would be configured in this BWP. If the SDT operation is not in the initial BWP, I guess we have a need to discuss this issue. |
| Ericsson | M |  |
| LGE | M | Open to discuss. |
| Nokia, NSB | M |  |
| Intel | M |  |
| NEC | M |  |
| Qualcomm | M |  |
| DOCOMO | M |  |
| Samsung | M |  |

# Issue #7: PUSCH TDRA misalignment

The following contribution concerns PUSCH TDRA misalignment for RedCap UEs:

|  |  |  |  |
| --- | --- | --- | --- |
| [13] | [R1-2302942](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302942.zip) (Section 2.2) | Discussion on RedCap remaining issues | ZTE, Sanechips |

RAN1#112 also discussed this topic, and the discussion is captured under Issue #6 in the FLS in [[5](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112/Docs/R1-2301884.zip)].

**FL1 Question 7-1a: Companies are invited to provide comments and suggested priority (Low/Medium/High).**

|  |  |  |
| --- | --- | --- |
| **Company** | **Priority** | **Comments** |
| vivo | L | Handled by gNB implementation. |
| CATT | L | Same comment in [5]. |
| ZTE, Sanechips | M or High | To avoid misunderstanding between UE and gNB especially for separate initial BWP case, it is better to solve this issue in Rel-17. Otherwise, the Rel-17 RedCap UE and Rel-18 RedCap UE faces the same problem, which brings the gNB implementation complexity. |
| LGE | M | Okay to discuss. |
| Nokia, NSB | L | NW can avoid the misalignment issue. |
| Intel | L | Not an essential issue; can be addressed by implementation. |
| Qualcomm | M |  |
| DOCOMO | L | It can be handled by NW. |
| Samsung | L | Leave it as a NW implementation. |

# References

|  |  |  |  |
| --- | --- | --- | --- |
| [1] | [RP-220966](https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_95e/Docs/RP-220966.zip) | Revised WID on support of reduced capability NR devices | Ericsson |
| [2] | [R1-221163](https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_96/Docs/RP-221163.zip) | Summary of WI on support of reduced capability (RedCap) NR devices | Ericsson |
| [3] | [R1-2301882](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112/Docs/R1-2301882.zip) | FL summary #1 on Rel-17 RedCap maintenance | Moderator (Ericsson) |
| [4] | [R1-2301883](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112/Docs/R1-2301883.zip) | FL summary #2 on Rel-17 RedCap maintenance | Moderator (Ericsson) |
| [5] | [R1-2301884](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112/Docs/R1-2301884.zip) | FL summary #3 for Rel-17 RedCap maintenance | Moderator (Ericsson) |
| [6] | [R1-2302207](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112/Docs/R1-2302207.zip) | 38.213 CR0454 (Rel-17, F) Corrections on impact of HD-FDD operation for RedCap UE | Moderator (Ericsson), CATT, NTT DOCOMO, Ericsson |
| [7] | [R1-2302208](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112/Docs/R1-2302208.zip) | 38.214 CR0412 (Rel-17, F) Corrections on invalid symbol determination for PUSCH repetition Type B transmission for RedCap UE | Moderator (Ericsson), Sharp, Vivo, Ericsson |
| [8] | [R1-2301881](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112/Docs/R1-2301881.zip) | RAN1 agreements for Rel-17 NR RedCap | Rapporteur (Ericsson) |
| [9] | [R1-2302297](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302297.zip) | Maintenance issues for Rel-17 NR RedCap | Ericsson |
| [10] | [R1-2302465](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302465.zip) | Correction for SDT operation the in separate initial BWP for RedCap | Vivo |
| [11] | [R1-2302650](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302650.zip) | Discussion on PRACH/PUSCH/PUCCH occasion validation | CATT |
| [12] | [R1-2302651](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302651.zip) | Correction on collision handling between valid PRACH occasion and NCD-SSB in Rel-17 | CATT |
| [13] | [R1-2302942](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302942.zip) | Discussion on RedCap remaining issues | ZTE, Sanechips |
| [14] | [R1-2302958](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302958.zip) | Discussion on RedCap SDT operation | Xiaomi |
| [15] | [R1-2303172](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303172.zip) | Maintenance of Rel-17 RedCap | NEC |
| [16] | [R1-2303210](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303210.zip) | Discussion on RedCap remaining issues | CMCC |
| [17] | [R1-2303211](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303211.zip) | Draft CR on collision handling between PRACH and NCD-SSB | CMCC |
| [18] | [R1-2303347](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303347.zip) | On UL resource validation with SSB | MediaTek Inc. |
| [19] | [R1-2303348](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303348.zip) | Draft CR for 38.213 on UL resource validation with SSB | MediaTek Inc. |
| [20] | [R1-2303394](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303394.zip) | RedCap support of SDT | Nokia, Nokia Shanghai Bell |
| [21] | [R1-2303690](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303690.zip) | Discussion on remaining issues for RedCap UE | NTT DOCOMO, INC. |
| [22] | [TS 38.213 V17.5.0](https://www.3gpp.org/ftp/Specs/archive/38_series/38.213/38213-h50.zip) | NR; Physical layer procedures for control (Release 17) | 3GPP |
| [23] | [R2-2301901](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_121/Docs/R2-2301901.zip) | Report from Break-out session on NR-NTN, IoT-NTN and RedCap | Vice Chairman (ZTE Corporation) |
| [24] | [RP-230693](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_99/Docs/RP-230693.zip) | RAN2 CRs to SDT operation for RedCap without CD-SSB | RAN2 |
| [25] | [R1-2212980](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_111/Docs/R1-2212980.zip) | FL summary #4 on Rel-17 RedCap maintenance | Moderator (Ericsson) |