3GPP TSG-RAN WG1 Meeting #112bis-e Draft R1-2303929

e-Meeting, 17th – 26th April 2023

**Agenda Item: 7.2**

**Title: FL summary #2 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 initial discussion is captured in the FLS in [26]. The issues that are in the focus of this round of the discussion are tagged FL2, and the issues are furthermore tagged with High Priority, Medium Priority, and Low Priority.

Follow the naming convention in this example:

* *RedCapFLS2-v000.docx*
* *RedCapFLS2-v001-CompanyA.docx*
* *RedCapFLS2-v002-CompanyA-CompanyB.docx*
* *RedCapFLS2-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 *RedCapFLS2-v002-CompanyA-CompanyB.docx*.
* CompanyC uploads an empty file named *RedCapFLS2-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 *RedCapFLS2-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 |
| Intel | Debdeep Chatterjee | 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 |
| Spreadtrum | Huayu Zhou | [huayu.zhou@unisoc](mailto:huayu.zhou@unisoc).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. |

### **FL2 High Priority Question 1-2a:**

**Should the determination of the following case be based on CD-SSB? If the answer is no, please elaborate in the comment field.**

* **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.

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| MTK | Y | NCD-SSB from NonCellDefiningSSB should not be applied for RO validation. |
| CATT | Y | We should be very careful if the discussion is going to touch legacy common channels. The answer should be yes. This is also the current situation/baseline as already specified in the spec 38.213.  Firstly, we agree that by gNB proper configuration, this issue can be avoided (e.g. NCD-SSB has same periodicity and zero offset to CD-SSB). Perhaps this is most useful implementation-based solution for all remaining issues in Issue#1.  Secondly, TDD gNB has to do reception/blind detection in PRACH occasion symbols validated by CD-SSB, using the Rx beam of the associated CD-SSB, for the sake of legacy UE. A RedCap UE will never get the chance to receive other DL (including NCD-SSB) in these symbols other than CLI from legacy Ues. So using CD-SSB for PO validation is in fact a simple and natural choice.  Lastly, as CMCC commented, if PO validation can be based on NCD-SSB, Ues using CD-SSB (only) and Ues using NCD-SSB will have different result in RO-to-SSB mapping, which makes gNB blind detection design quite difficult, if not totally impossible. |
| Vivo | Y | CD-SSB should be used for RO validation for all Ues in any RRC state. |
| OPPO | Y | We prefer CD-SSB should be assumed for the validation PRACH occasion validation. |
| NEC | Y |  |
| ZTE, Sanechips | Y | We are also OK with PRACH occasion validation based on CD-SSB. In this case, the NCD-SSB configuration may need to be adapted to avoid overlapping with PRACH.  If PRACH occasion validation based on CD-SSB and NCD-SSB, it also works but would cause some potential resources wasting.  If PRACH occasion validation is based on NCD-SSB, it works for RedCap UE in connected mode and inactive mode. However, non-RedCap UE does not know the NCD-SSB position, the PRACH may collide with NCD-SSB. In this case, the NCD-SSB configuration also requires limitation on gNB in order to avoid collision with PRACH. It also can work.  Therefore, gNB configuration for NCD-SSB, which is anyway needed, is a method to avoid this issue. We are fine with either way. |
| DOCOMO | Y |  |
| CMCC | Y | Based on CD-SSB provides a common validation result for R18 RedCap UE and other Ues. |
| Spreadtrum | Y |  |
| Huawei, HiSilicon | OK to use CD-SSB |  |
| Ericsson | Y |  |
| Nokia, NSB. | Y |  |

### **FL2 High Priority Question 1-3a:**

**Should the determination of the following case be based on CD-SSB? If the answer is no, please elaborate in the comment field.**

* **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].

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| MTK | Y |  |
| CATT | Y | Same reason in 1-2a. |
| vivo | Y |  |
| OPPO | Y | Should be consistent to Msg1. |
| NEC | Y |  |
| ZTE, Sanechips | Y |  |
| DOCOMO | Y |  |
| CMCC | Y |  |
| Spreadtrum | Y |  |
| Huawei | Y |  |
| Ericsson | Y |  |
| Nokia, NSB. | Y |  |

### **FL2 High Priority Question 1-4a:**

**Should the determination of the following case be based on CD-SSB? If the answer is no, please elaborate in the comment field.**

* **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].

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| MTK | Y | Similar to RO and MsgA PUSCH occasion validation, resource counting for Msg3 PUSCH repetition also takes SSB into account. We need to clarify whether NCD-SSB from NonCellDefiningSSB should be considered. |
| CATT | Y | In my memory as participant in R17 CE discussion, Msg3 PUSCH repetition is only supported in CBRA case. So the answer should naturally be YES. |
| vivo | Y | Since for CBRA, NW cannot distinguish the UE, the cell-specific signal, i.e, only CD-SSSB should be considered in Msg3 PUSCH repetition resource counting. NCD-SSB should not be considered.  And CATT is correct that Msg3 PUSCH repetition is only supported in CBRA case in Rel-17 CE. |
| OPPO | Y |  |
| NEC | Y |  |
| ZTE, Sanechips | Y |  |
| DOCOMO | Y |  |
| CMCC | Y |  |
| Spreadtrum | Y |  |
| Huawei | Y |  |
| Ericsson | Y |  |
| Nokia, NSB. | Y |  |

### **FL2 High Priority Question 1-5a:**

**Should the determination of the following case be based on CD-SSB? If the answer is no, please elaborate in the comment field.**

* **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.

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| MTK | Y |  |
| CATT | N | According to current spec, it is already captured that both CD-SSB and NCD-SSB should be used (see [11] if interested in the detailed text). In short, for PUCCH occasion determination, CD-SSB is always used, while NCD-SSB is used when provided.  Different from common UL channels (like PRACH occasion), PUCCH is UE-specific, controllable, and perceivable (typically in RRC\_CONNECTED state). So it is reasonable to consider NCD-SSB for this case. |
| vivo |  | Currently, PUCCH repetition is only supported for connected UE. We think for such case, if the active BWP contains the NCD-SSB, both CD- and NCD-SSB should be considered for PUCCH repetition resource counting. |
| OPPO | N | We see the proposal intend to say “only” CD-SSB is based. But the NCD-SSB based should be also possible. |
| NEC | N | Agree with CATT, vivo and OPPO. |
| ZTE, Sanechips |  | Either way is fine with us. |
| DOCOMO | N | For PUCCH repetition resource counting, it is not clear for us from the current spec whether CD-SSB should be considered as well in addition to NCD-SSB. If it is common understanding from current spec that both CD-SSB and NCD-SSB should be applied, we are fine to keep as it is, i.e., no specification change is required. |
| CMCC | N | Similar view as other companies, NCD-SSB should also be considered. |
| Huawei | N |  |
| Ericsson |  | Fine with determination based on both CD-SSB and NCD-SSB, as suggested by CATT above. |
| Nokia, NSB. |  | Ok with “both CD-SSB and NCD-SSB should be used”. Would appreciate a conclusion to close this if there are no spec. impacts. |

### **FL2 High Priority Question 1-6a:**

**Should the determination of the following case be based on CD-SSB? If the answer is no, please elaborate in the comment field.**

* **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].

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| MTK | Y |  |
| CATT | Y | It seems clear that current spec only supports CD-SSB for PUSCH validation: ‘SS/PBCH blocks with indexes provided by *ssb-PositionsInBurst* in *SIB1’.*  Don’t want to create different SSB to CG-PUSCH occasion mapping between RedCap UEs and legacy UEs in RRC\_INACTIVE state. |
| vivo | Y |  |
| OPPO | Y |  |
| NEC | Y |  |
| ZTE, Sanechips | Y |  |
| DOCOMO | Y |  |
| CMCC | Y |  |
| Spreadtrum | Y |  |
| Huawei | FFS | Since NCD-SSB would likely to be used in INACTIVE and normal UE would likely to be able to use NCD-SSB (from Rel-18), it is desirable to have a comprehensive consideration to avoid changes in future. At least in these cases, we don’t see there could be any difference between RedCap UE and normal UE anymore. Then considering NCD-SSB can be UE specifically configured and known by UE, this is more like PUCCH. |
| Ericsson | FFS | @CATT the existing text in TS 38.213 Clause 19.1 had been written before RAN2 agreed that NCD-SSB will be available for SDT. Therefore, some updates may be needed to the text based on RAN2 decision. |
| Nokia, NSB. | Y |  |

# 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 |

### **FL2 High Priority Question 2-2a:**

**Can the following proposal from [**[**9**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302297.zip)**] be accepted?**

* **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.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| MTK |  | We think this case should be clarified and support CD-SSB.  However, we don’t agree to the Note. We think specification impact is expected and can be discussed further. Hence, we suggest remove the Note. |
| CATT | Y | To MTK, we think the current spec is clear as the same meaning as the proposed conclusion. If removing the note can make others comfortable we are OK. |
| vivo | Y with modification | We do not think PUCCH repetition is supported for RRC idle/inactive state.  Suggest following:   * **For TDD, RedCap UE in a BWP without any SSB should apply CD-SSB for determining the following in ~~all~~ RRC-CONNECTED state~~s~~:**   + **the *N\_PUCCH^repeat* slots for a PUCCH transmission (in Clause 9.2.6, TS38.213)** * **Note: No specification impact is expected.**   We tend to agree that no specification impact since NCD-SSB is only valid and can be known by RedCap UE when the active BWP is configured with NCD-SSB, given the NonCellDefiningSSB is configured under BWP-DownlinkDedicated. |
| OPPO | Y |  |
| NEC | Y | Fine with vivo’s update. |
| ZTE, Sanechips | Y |  |
| DOCOMO | Y |  |
| CMCC | Y |  |
| Ericsson | Y | We are also fine with Vivo’s update. |
| Nokia, NSB. | Y | Also, fine with Vivo’s update |

# 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 option 2, they conclude there is no impact to RAN1. And the procedure is complete according to RAN2’s CR.   |  | | --- | | [R2-2302305](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_121/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  ** It is not expected that the CR has any impact to RAN1 or RAN4 from RAN2 standpoint**  ** Agreed** | |

### **FL2 Medium Priority Question 3-2a:**

**Can the following TP for 38.213 clause 17.1 be accepted?**

|  |
| --- |
| 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*.* |

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| MTK | Y |  |
| CATT |  | OK to discuss, but is the CR contradictory to Samsung’s quoting in previous round? |
| vivo | Y |  |
| NEC | Y |  |
| ZTE, Sanechips |  | Given the RAN2 agreement, we need to be careful whether we should introduce the spec change.  Additionally, it seems the following text in the spec can cover this?   |  | | --- | | For an active DL BWP provided by *BWP-DownlinkDedicated*, unless a UE indicates a capability to operate in the active DL BWP without receiving an SS/PBCH block, the UE in RRC\_CONNECTED state assumes that the active DL BWP includes the SS/PBCH blocks that the UE used to obtain SIB1 or the SS/PBCH blocks provided by *NonCellDefiningSSB*. If the active DL BWP includes the SS/PBCH blocks that the UE used to obtain SIB1, for SS/PBCH block and CORESET multiplexing pattern 1, the UE expects the active DL BWP to include the CORESET with index 0. If the active DL BWP includes the SS/PBCH blocks provided by *NonCellDefiningSSB*, 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*.* | |
| DOCOMO | Y |  |
| Spreadtrum |  | Share similar view as ZTE |
| Ericsson | Y | @ZTE The “active DL BWP” in the highlighted text is referring to DL BWP provided by *BWP-DownlinkDedicated*. Therefore, the existing text would not cover the case addressed in the TP. |
| Nokia, NSB. |  | Similar view to ZTE/RAN2 – not convinced the TP is even needed. |

### **FL2 Medium Priority Question 3-3a:**

**Are some additional specification changes desired to address any of the following proposals brought up in [**[**15**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303172.zip)**]?**

* **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.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| vivo | N | The TP provided in **FL2 Medium Priority Question 3-2a** is sufficient. |
| NEC |  | We are fine with TP in **FL2 Medium Priority Question 3-2a** without additional specification changes. |
| ZTE, Sanechips |  | We have the following initial understanding:  P2, P3, P4 are based on RAN2 discussion for those properties.  For P5, in SDT paragraph, SSB can refer to CD-SSB or NCD-SSB.  For P1, it seems to be related to the UE capability discussion. If the UE with ncd-SSB-ForRedCapInitialBWP-SDT-r17 require a capability of BWP operation without restriction (FG28-1a), we think no spec impacts are foreseen. |
| DOCOMO |  | Similar view as vivo. |
| Ericsson | N | P1: Not needed. The field description for *ncd-SSB-ForRedCapInitialBWP-SDT-r17* states “UE supporting this feature shall indicate support of *supportOfRedCap-r17* and *ra-SDT-r17 and/or cg-SDT-r17*”. That is, it is already clear that the UE needs to indicate support for only 28-1 and not 28-1a.  P2, P3, P4: Not needed. *ncd-SSB-ForRedCapInitialBWP-SDT-r17* is the UE capability whereas *NonCellDefiningSSB* is the configuration parameter. It is enough to have the proposed text in the configuration parameter (which is already there).  P5: The TP in Question 3-2a is enough. |
| Nokia, NSB. | N | Previous TP should be sufficient |

### **FL2 Medium Priority Question 3-4a:**

**Are some additional specification changes desired to address any of the following proposals brought up in Section 2.2 in [**[**21**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303690.zip)**]?**

* **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.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| vivo | N |  |
| NEC | N |  |
| ZTE, Sanechips |  | If new timing on NCD-SSB reception is defined, the spec change may be expected. However, the PRACH validation issue is also discussed in **Question 1-2a.** RA-Based SDT can follow the same conclusion and no need to define the new timing relationship. |
| DOCOMO |  | For initial RA-SDT without subsequent transmission, there is no difference from RACH procedure for RedCap UE and no SSB is required. Therefore, gNB is not required to transmit NCD-SSB for initial RA-SDT even if NCD-SSB is configured for the initial BWP. We would like to clarify whether this is common understanding. After the initial RA-SDT, gNB schedules subsequent SDT with dynamic grant, then a UE expects to receive NCD-SSB. |
| Ericsson | N | Not essential |

# 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. |

### **FL2 Medium Priority Question 4-2a:**

**Should RedCap UEs support initial (non-subsequent) RA-SDT transmission in a RedCap-specific separate initial BWP without CD-SSB? If the answer is yes, please comment on whether you see a need for some RAN1/RAN2 specification update to support it.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| MTK | N | Without subsequent transmissions, we don’t see much difference between RA-SDT and a normal RACH procedure. |
| CATT |  | @Nokia, right, that’s exactly what we are concerning. Sorry if we did not write it clearly.  The previous RAN1 conclusion is still valid in our view. |
| vivo | N |  |
| NEC | N |  |
| ZTE, Sanechips |  | We already have the conclusion  Conclusion: (no spec impact)   * 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.   No need for spec change. |
| DOCOMO |  | For the case without CD-SSB but with NCD-SSB, initial RA-SDT in a separate initial BWP is supported.  For the case without CD-SSB and NCD-SSB, initial RA-SDT in a separate initial BWP is not supported based on RAN2 agreement. |
| CMCC | Y | We think the quoted conclusion is valid. Whether specification update is needed can be discussed.  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. |
| Ericsson |  | As we commented in the previous round, although 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”, RAN2 did to our understanding not make any agreement to support this case, so some clarification of the situation seems to be needed.  We propose to send an LS to ask RAN2 to take RAN1 conclusion into account in their work and, if needed, make necessary clarifications in their specifications. |
| Nokia, NSB. |  | In our view, current RAN2 agreements/specs, prohibit this initial (non-subsequent) RA-SDT operation without any form of SSB.   Given RAN1’s earlier conclusion, the possibility that initial (non-subsequent) RA-SDT transmission could form the bulk of SDT usage and a desire to minimize unnecessary NCD-SSB transmissions, we feel that we should at least inform RAN2 that this is an unnecessary and undesirable restriction and let them decide. |

# 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. |

### **FL2 Medium Priority Question 5-2a:**

**Companies are invited to express their preferences regarding the options in Section 2.2 in [**[**14**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302958.zip)**].**

* **Option 1: Follows the same rule as MsgA PUSCH occasions, i.e., if there is any overlapping between SSB/PDCCH/DG PDSCH and CG-SDT PO in some symbols, it’s up to UE implementation to prioritize the DL reception or CG-SDT PUSCH transmission.**
* **Option 2: Follows the same rule as dedicated CG PUSCH in connected states as below: 1. if there is overlapping between SSB and CG-SDT PO in several symbols, SSB is prioritized over CG-SDT transmission; 2. a UE doesn’t except there is any overlapping between CSS/USS and CG-SDT POs; 3. If the time gap between SSB/CSS and CG-SDT PO is not sufficient, CG-SDT will be canceled; 4. Dynamic PDSCH is prioritized if it is overlapped with CG-SDT PUSCH.**
* **Option 3: Other (please elaborate in the comment field).**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option (1/2/3)** | **Comments** |
| CATT |  | OK with Option 2 if there is no additional spec impact. |
| vivo | Option 2 | We also think there is no spec impact. |
| ZTE, Sanechips |  | **Seems current spec can cover option2.**  **SSB and CG-SDT PO, CSS/USS and CG-SDT PO, SSB/CSS and CG-SDT PO**   |  | | --- | | A HD-UE does not expect to receive both dedicated higher layer parameters configuring transmission in a set of symbols and dedicated higher layer parameters configuring reception in the set of symbols. A HD-UE does not expect to receive both a Type-0/0A/1/2-PDCCH CSS set configuration for PDCCH reception in a set of symbols and dedicated higher layer parameters configuring transmission in the set of symbols.  If a HD-UE would transmit a PUSCH, or PUCCH, or SRS based on a configuration by higher layers and the HD-UE is indicated presence of SS/PBCH blocks within the active DL BWP by *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon* or by *NonCellDefiningSSB*, the HD-UE does not transmit  - PUSCH or PUCCH if a last symbol of the PUSCH or PUCCH transmission would not be at least [4, TS 38.211] prior to a first symbol of the next earliest SS/PBCH block  - PUSCH or PUCCH if a first symbol of the PUSCH or PUCCH transmission would not be at least [4, TS 38.211] after a last symbol of the previous latest SS/PBCH block  - SRS in symbols that would not be at least prior to a first symbol of the next earliest SS/PBCH block  - SRS in symbols that would not be at least after a last symbol of the previous latest SS/PBCH block |   **Dynamic PDSCH and CG-SDT PUSCH**   |  | | --- | | If a HD-UE is configured by higher layers to transmit SRS, or PUCCH, or PUSCH in a set of symbols and the UE detects a DCI format indicating to the HD-UE to receive CSI-RS or PDSCH in a subset of symbols from the set of symbols, then  - the HD-UE does not expect to cancel the transmission of the PUCCH or PUSCH in the set of symbols if the first symbol in the set occurs within relative to a last symbol of a CORESET where the HD-UE detects the DCI format; otherwise, the HD-UE cancels the PUCCH, or the PUSCH, or an actual repetition of the PUSCH [6, TS 38.214], determined from clauses 9 and 9.2.5 or clause 6.1 of [6, TS 38.214].  - the HD-UE does not expect to cancel the transmission of SRS in symbols from the subset of symbols that occur within relative to a last symbol of a CORESET where the HD-UE detects the DCI format. The HD-UE cancels the SRS transmission in remaining symbols from the subset of symbols.  is the PUSCH preparation time for UE processing capability 1 [6, TS 38.214] assuming and corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH carrying the DCI format and the SCS configuration of the SRS, PUCCH, PUSCH. |   Additionally, for paging vs uplink SDT, according to the current spec, it is left to gNB configuration to avoid this collision. However, since a UE is required to monitor paging once in a time duration, actually the other paging occasions are not needed and the SDT transmission may can be prioritized. Therefore, we suggest to further discuss this case: paging and SDT collision. |
| DOCOMO | Option 2 |  |
| Ericsson | 2 | No spec changes are expected as the current text does not distinguish between PUSCH transmission in different RRC states. |
| Nokia, NSB. | Option 2 |  |

# 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 |  |

### **FL2 Medium Priority Question 6-2a:**

**Can the change proposed in the draft 38.213 CR in [**[**10**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302465.zip)**] be accepted?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| vivo | Y | The same center frequency between Msg1/Msg3, or MsgA transmissions and PDCCH monitored in Type1-PDCCH CSS set is already captured in current specification for RedCap. So, for SDT, center frequency alignment between the PUSCH transmission and corresponding search space monitoring should also be captured for RedCap UEs in unpaired spectrum. |
| ZTE, Sanechips |  | SDT operation is the in initial BWP for RedCap, and the RACH resource must be configured in this BWP. Is there a case that the initial BWP for SDT is not configured with RACH? |
|  |  |  |
| Ericsson | FFS | 1st correction (related to center frequency alignment): The correction seems to be ok for RA-SDT (after removing “or a USS set by *SearchSpace*” as USS set is not applicable for RA-SDT).  But for CG-SDT, we need to check this further as the RedCap UE could be operating in the legacy initial DL/UL BWP and may jump to the RedCap-specific initial DL/UL BWP only while initiating RA procedure. That is the UL BWP where the UE transmits CG PUSCH and the UL BWP where the UE transmits Msg1/Msg3/MsgA may be different.  2nd correction (related to *configuredGrantConfig*): We do not think this correction is needed. Nevertheless, we will check further the necessity. |

# 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 H | 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. |

### **FL2 Low Priority Question 7-2a:**

**Companies are invited to express their preferences regarding the options in Section 2.2 in [**[**13**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302942.zip)**].**

* **Option 1: gNB implementation**
  + **Option 1-1: In separate initial DL BWP without CORESET#0 and SSB or in dedicated DL BWP, *pusch-TimeDomainAllocationList* would not be provided in *pusch-Config.***
  + **Option 1-2: *pusch-TimeDomainAllocationList* provided in *pusch-Config* is the same with *pusch-TimeDomainAllocationList* provided in *pusch-ConfigCommon.***
  + **Option 1-3: At least one common SLIV in dedicated TDRA table, and the gNB only indicates the common SLIV.**
* **Option 2: Spec corrections**
  + **Option 2-1: In separate initial DL BWP without CORESET#0 and SSB, the type-1 CSS is configured. The applicable PUSCH TDRA list scheduled by DCI in common search space not associated with CORESET 0 is determined by Default A or *pusch-TimeDomainAllocationList* provided in *pusch-ConfigCommon.***
  + **Option 2-2: In any active DL BWP for RedCap UE, if the type-1 CSS is configured and not associated with CORESET#0, the applicable PUSCH TDRA list scheduled by DCI scrambled by TC-RNTI in common search space is determined by Default A or *pusch-TimeDomainAllocationList* provided in *pusch-ConfigCommon.***
* **Option 3: Other (please elaborate in the comment field).**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option (1/2/3 or one of the sub-options)** | **Comments** |
| CATT |  | Prefer to leave it to implementation (possible ways as in Option 1 or even others not listed here) |
| vivo |  | Same views as CATT. |
| OPPO | Option1 |  |
| NEC |  | Agree with CATT. |
| ZTE, Sanechips | Option 2 | According to the current spec, the gNB can configure pusch-Config in the separate initial BWP and the UE would expect the PUSCH scheduling based on pusch-Config. However, the gNB can not distinguish whether the UE is connected mode or idle mode, and then the gNB may only can use the common TDRA between pusch-Config and pusch-ConfigCommon or default TDRA table. In this case, **the UE specific PUSCH scheduling would be impacted** since the pusch-Config should always contains some TDRA from pusch-ConfigCommon or default TDRA table.  Moreover, for the Rel-18 RedCap UE, the available TDRA table may be more limited due to the peak data requirement or the RAR processing. In this case, **the UE specific PUSCH scheduling would be impacted** **more seriously**.  In summary, gNB implementation is a method to avoid misalignment between gNB and UE. However, it would have negative impacts on UE specific PUSCH scheduling performance. And now we have a chance to avoid the negative impacts for both Rel-17 RedCap UE and (especially for) Rel-18 RedCap UE.  Therefore, we propose to have a clarification for RedCap UE, which could be beneficial for both Rel-17 and Rel-18 RedCap UE, since at least the performance of UE specific PUSCH other than msg3 could be guaranteed. Unlike NR UE, due to the NBC issue, the correction would not be helpful for the legacy UE.  Based on option 2-1, the PUSCH TDRA scheduled by DCI in CSS would be determined by Default A or pusch-TimeDomainAllocationList provided in pusch-ConfigCommon, and the UE specific PUSCH scheduling would not be impacted. Option 2-1 can guarantee the UE specific PUSCH performance in separate initial BWP.  Based on option 2-2, besides the separate initial BWP, any active BWP can flexibly apply the TDRA table by pusch-Config and the UE specific PUSCH scheduling performance can be maximally guaranteed. |
| DOCOMO |  | We share the same view as CATT. |
| Ericsson | 1 | We also share the same view as CATT. |
| Nokia, NSB. |  | Leave it to 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) |
| [26] | [R1-2303928](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112b-e/Docs/R1-2303928.zip) ([Inbox](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_112b-e/Inbox/R1-2303928.zip)) | FL summary #1 on Rel-17 RedCap maintenance | Moderator (Ericsson) |