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 FL3, 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.

**FL3 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.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)(Sections2.3 & 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 |  |
| LGE | Y | We prefer the PRACH occasion validation based only on CD-SSB. |
| Qualcomm |  | If PRACH occasion validation is based only on CD-SSB, proper gNB configuration (for the time offset between CD-SSB and NCD-SSB) is needed to avoid the cross-link interference mentioned for TDD in R1-1804456. Otherwise, it conflicts with the Ngap condition specified in Clause 8 of TS 38.213.Therefore, we think the following clarification is necessary for a valid PRACH occasion in the active UL BWP when NCD-SSB is configured in the active DL BWP: ***On unpaired spectrum, if the active DL BWP includes the SS/PBCH blocks provided by NonCellDefiningSSB and the active UL BWP is configured with a valid PRACH occasion for a UE, for a set of symbols of a slot corresponding to a valid PRACH occasion and Ngap symbols before the valid PRACH occasion, as described in clause 8.1, the UE does not expect the set of symbols of the slot and the Ngap symbols before the valid PRACH occasion to be indicated presence of SS/PBCH blocks by NonCellDefiningSSB.*** |

Based on the received responses to Question 1-2a, it seems that Case 1 (PRACH occasion validation) should be based at least on CD-SSB, but it may be worth asking whether it might be based on both CD-SSB and NCD-SSB.

### **FL3 High Priority Question 1-2b:**

**Please indicate the option for determination of Case 1 (PRACH occasion validation):**

* **Option 1: Only CD-SSB**
* **Option 2: Both CD-SSB and NCD-SSB**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option (1/2)** | **Comments** |
| vivo | Option 1 |  |
| Spreadtrum | Option 2? (Should check RAN2 conclusion firstly) | There could be something conflicting with RAN2 conclusion. RACH is not only for RRC IDLE/INACTIVE, but also for RRC CONNECTED, e.g. HO. In RAN2 agreement, UE can initiate RACH directly at active BWP in the target cell, and there is only NCD-SSB in the active BWP. Hence, maybe PRACH occasion validation can be based on NCD-SSB. Maybe RAN1 should check with RAN2.My RAN2 colleagues give me some conclusion from RAN2: From RAN2 perspective, handover scenario 1 is supported.         Scenario 1: Handover to a target cell’s specific Redcap BWP associated with NCD-SSB besides to the initial BWP associated with CD-SSB (i.e. UE directly sync to the NCD-SSB and perform RACH on that BWP)From RAN2 perspective, handover scenario 2 is not supported.         Scenario 2: Handover to a target cell’s initial BWP and further switch to the specific Redcap BWP to send the RACH (i.e. UE first sync to the CD-SSB and then autonomously switch to first active BWP to perform RACH) |
| Intel | Option 1 | Certainly, there is reliance on proper configuration by gNB for ROs and CD-/NCD-SSB occasions for Option 1 to work. However, we do not see this as a big challenge. To the case of handover case pointed out by Spreadtrum, this can also be addressed via proper gNB configuration – as long as the UE is aware of the CD-SSB occasions in the target cell (which we assume it should be even when NCD-SSB is configured in a target cell), it considers CD-SSB occasions for RO validation, and the rest relies on proper gNB configuration. |
| Samsung | Option 1 | We believe it is the only option to minimize UE and gNB impacts with a help of a proper gNB configuration.  |
| CATT | Option 1 | For HO to a target cell with NCD-SSB only BWP, we think it is no difference to the case of operating in serving cell. PRACH validation should still be based on CD-SSB of target cell. |
| DOCOMO | Option 1 | We still think RO validation should be based on CD-SSB. For the HO case raised by spreadtrum, at least the time domain configurations of NCD-SSB are associated with those for CD-SSB. In that sense, a UE can aware of CD-SSB and the same operation as in the serving cell can be supported. |
| MediaTek | Option 1 |  |
| Nokia, NSB. | Option 1 |  |
| Ericsson | Option 1 |  |
| Huawei, HiSilicon | Option 1 |  |

**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 |  |
| LGE | Y | Prefer the same handling as for the PRACH. |
| Qualcomm |  | Similar to our comments on PRACH occasion validation, we think a clarification is needed for proper gNB configuration in TDD, so that ***a UE does not expect a valid msgA PUSCH occasion in its active UL BWP and Ngap symbols before the valid msgA occasion to be indicated presence of NCD-SSB by NonCellDefiningSSB.*** |

Based on the received responses to Question 1-3a, it seems that Case 2 (MsgA PUSCH occasion validation) should be based at least on CD-SSB, but it may be worth asking whether it might be based on both CD-SSB and NCD-SSB.

### **FL3 High Priority Question 1-3b:**

**Please indicate the option for determination of Case 2 (MsgA PUSCH occasion validation):**

* **Option 1: Only CD-SSB**
* **Option 2: Both CD-SSB and NCD-SSB**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option (1/2)** | **Comments** |
| vivo | Option 1 |  |
| Spreadtrum | Option 2? (Should check RAN2 conclusion firstly) | Similar to **FL3 High Priority Question 1-2b**, UE may initiate MsgA directly at active BWP with NCD-SSB only in HO case. |
| Intel | Option 1 |  |
| Samsung | Option 1 | Same reason as for Question 1-2b |
| CATT | Option 1 |  |
| DOCOMO | Option 1 |  |
| MediaTek | Option 1 |  |
| Nokia, NSB. | Option 1 |  |
| Ericsson | Option 1 |  |
| Huawei, HiSilicon | Option 1 |  |

**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 |  |
| LGE | Y | Agree with CATT and vivo. |

Based on the received responses to Question 1-4a, it seems that Case 3 (Msg3 PUSCH repetition resource counting) should be based at least on CD-SSB, but it may be worth asking whether it might be based on both CD-SSB and NCD-SSB.

### **FL3 High Priority Question 1-4b:**

**Please indicate the option for determination of Case 3 (Msg3 PUSCH repetition resource counting):**

* **Option 1: Only CD-SSB**
* **Option 2: Both CD-SSB and NCD-SSB**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option (1/2)** | **Comments** |
| vivo | Option 1 |  |
| Spreadtrum | Option 2? (Should check RAN2 conclusion firstly) | Similar to **FL3 High Priority Question 1-2b**, UE may transmit Msg3 PUSCH directly at active BWP with NCD-SSB only in HO case. |
| Intel | Option 1 |  |
| Samsung | Option 1 | Same reason as for Question 1-2b |
| CATT | Option 1 | Specifically, in this case, not sure Spreadtrum’s example is valid. It looks like CFRA, which does not support Msg3 repetition. |
| DOCOMO | Option 1 |  |
| MediaTek | Option 1 |  |
| Nokia, NSB. | Option 1 |  |
| Ericsson | Option 1 |  |
| Huawei, HiSilicon | Option 1 |  |

**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. |
| LGE | N | Agree with most of the previous comments. |

Based on the received responses to Question 1-5a, it seems that Case 4 (PUCCH repetition resource counting) should be based on both CD-SSB and NCD-SSB, but it may be worth asking whether it might be based on only NCD-SSB.

### **FL3 High Priority Question 1-5b:**

**Please indicate the option for determination of Case 4 (PUCCH repetition resource counting):**

* **Option 1: Both CD-SSB and NCD-SSB**
* **Option 2: Only NCD-SSB**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option (1/2)** | **Comments** |
| vivo | Option 1 |  |
| Spreadtrum | Option 1 | As vivo mentioned, PUCCH repetition only happens in RRC CONNECTED. |
| Intel | Option 1 |  |
| Samsung | Option 1 | Share a view with vivo and Spreadtrum |
| CATT | Option 1 |  |
| DOCOMO | Option 1 |  |
| MediaTek |  | Two questions for clarification: 1. Is the PUCCH resource *dedicately* configured to UE in *connected mode only*?
2. Does Option 1 mean
	* (1) UE take both CD-SSB (outside BWP) and NCD-SSB (inside BWP) into account? *Or*
	* (2) UE only takes the SSB (CD-SSB or NCD-SSB) within the BWP into account?
	* We assume (2)
 |
| Nokia, NSB. | Option 1 |  |
| Ericsson | Option 1 |  |
| Huawei, HiSilicon |  | We share some view as MTK and consider only the referred SSB is needed. The current spec may not be a good reference for discussing the issue, as we introduce NCD-SSB late without good consideration of differentiation cases. |

**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 |  |
| LGE | FFS | Okay to further discuss.  |

Based on the received responses to Question 1-6a, it seems that Case 5 (CG-PUSCH occasion validation) should be based at least on CD-SSB, but it may be worth asking whether it might be based on both CD-SSB and NCD-SSB.

### **FL3 High Priority Question 1-6b:**

**Please indicate the option for determination of Case 5 (CG-PUSCH occasion validation):**

* **Option 1: Only CD-SSB**
* **Option 2: Both CD-SSB and NCD-SSB**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option (1/2)** | **Comments** |
| vivo | Option 1 | We prefer same SSB to CG-PUSCH occasion mapping between RedCap UEs and legacy UEs in RRC\_INACTIVE state.In addition, we found following agreements made in RAN1#106-e for CG-SDT**Agreement*** The following PUSCH occasion validation rule is applied for CG-SDT
	+ for unpaired spectrum and for SS/PBCH blocks with indexes provided by ssb-PositionsInBurst in SIB1 or by ServingCellConfigCommon
		- if a UE is provided tdd-UL-DL-ConfigurationCommon, the valid PO is the PO in UL part in a slot, or at least Ngap symbols after the end of the DL part in a slot or after the end of the SSB in a slot
		- if a UE is not provided tdd-UL-DL-ConfigurationCommon, the valid PO does not precede a SS/PBCH block in the PUSCH slot, starts at least *Ngap* symbols after a last SS/PBCH block symbol
		- *Ngap* is provided in Table 8.1-2 in TS 38.213
	+ FFS if any validation rule following the CG-PUSCH in RRC connected state is applicable, and whether and how to handle the overlapping between CG-PUSCH occasions for CG-SDT and any valid PRACH occasion or MsgA PUSCH occasion.
* FFS the rule for paired spectrum, and whether/how to support CG-SDT for UEs operating in Type-A HD-FDD.

For the yellow highlighted part, in the end RAN1 SDT session does not introduce additional validation rule for CG SDT although they also considered that CG SDT related configuration is kind of configuration configured when UE is in connected state.  |
| Samsung | Option 1 |  |
| CATT | Tend to Option 1 | Thanks HW, Ericsson and vivo for further discussion. Our starting point is making less difference to handle RedCap UE and R17 non-RedCap UE (and less spec change, if possible). Using NCD-SSB for SDT is only agreed for R17 RedCap UE so far. CG-SDT not only has ‘occasion validation phase’, but also has ‘association phase’, where valid CG-PUSCH will be associated to different SSBs (provided either in *sdt-SSB-Subset* or *SIB1*). With Option 1, gNB can detect CG-PUSCH in the same way, e.g. using the same Rx beam assumption for RedCap and non-RedCap UE in the same symbol/resource.With Option 2, not only occasion is different, the mapping relationship may also be different. gNB may need to use different Rx beam assumption for RedCap CG-PUSCH and non-RedCap CG-PUSCH in the same symbol/resource. This is difficult if not totally impossible. And this may only be resolved by proper NCD-SSB configuration (CD-SSB needs to totally cover NCD-SSB) eventually, which becomes the same with Option 1. Based on the analysis, we tend to keep spec unchanged, i.e. Option 1. @HW, in my understanding, CG-SDT is configured in initial BWP. In Clause 19.1 of 38.213:

|  |
| --- |
| A UE indicated to release a dedicated RRC connection can be provided one or more configurations by respective one or more *ConfiguredGrantConfig*, for configured grant Type 1 PUSCH transmissions on the initial UL BWP [12, TS 38.331]. |

Thus for non-RedCap UE, at least for FR1, it will only use CD-SSB. Not sure why normal UE would likely to be able to use NCD-SSB for this case. |
| DOCOMO | Option 1 |  |
| MediaTek | Option 1 |  |
| Ericsson | Option 2, if we go with same logic as for PUCCH repetition? |  |
| Huawei, HiSilicon |  | @CATTNCD-SSB is to be introduced for normal UE since Rel-18, because of a recent new WI. That’s to say, both RedCap and non-RedCap UE can use NCD-SSB, both can be in inactive state, and both inactive and connected state can use NCD-SSB as well. So we think there won’t be difference between RedCap and non-RedCap UEs as long as the specification is clear. However, if you are really talking about ‘legacy’ (preR17) UEs vs. RedCap UEs, then we agree the design could lead to difference of mapping if we choose e.g. option 2.On the other hand, for the mapping or validation, we may be ok with Option 1 but since it is UE specific, Option 2 may also work and up to gNB (normally only one NCD-SSB used for all UEs). |

# 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 |
| LGE | Y | Okay with the update from vivo. |

### **FL3 High Priority Proposal 2-2b:**

* **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.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| vivo | Y |  |
| Intel | Y |  |
| Samsung | Y |  |
| CATT | Y |  |
| NEC | Y |  |
| DOCOMO | Y |  |
| Nokia, NSB. | Y |  |
| Ericsson | Y |  |

# 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. |
| LGE | Y | Also fine with no spec change. |

Based on the received responses to Question 3-2a, the following proposal can be considered.

### **FL3 Medium Priority Proposal 3-2b:**

**Agree the following TP for 38.213 clause 17.1 in principle (for inclusion in a corresponding 38.213 CR):**

|  |
| --- |
| 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** |
| vivo | Y |  |
| ZTE, Sanechips |  | Thanks Ericsson for clarification.Per our understanding, the active DL BWP can refer to any used BWP, not only DL BWP provided by *BWP-DownlinkDedicated*. Based on the context, it may refer to the dedicated configured BWP. It also can refer to initial BWP if we slightly expand the interpretation. Of course, to avoid this kind of confusion, we may can consider to adjust the paragraph a little bit, like following:

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

Is it acceptable? |
| Intel |  | ZTE’s version (with minimal changes) could work as well.  |
| Samsung | N | Not sure.The first part, is duplicate with RAN2 CR on 331 to introduce the parameter, that the NCD-SSB will be used in case CD-SSB is not given for SDT; The second part, seems duplicated as well, since such QCL alignment is same for these NCD-SSB configuration. So what’s the extra benefits to have this? |
| CATT | N? | May reflect RAN2’s decision. But as Samsung said it seems nothing new and no need to change? In Rel-17 we do the same handling for Type2-PDCCH CSS for paging, i.e. totally removing the related part in TS 38.213 to avoid duplication with RAN2 spec. |
| NEC |  | In our understanding, active BWP is applicable only in RRC\_CONNECTED. So, the current specification of QCL properties only concerns RRC\_CONNECTED. We are fine to add description on QCL properties of NCD-SSB during SDT procedure in RRC\_INACTIVE. |
| DOCOMO | Y |  |
| MediaTek | Y | Agree with NEC’s comments |
| Ericsson | Y | With ZTE’s update we might not need the QCL alignment part in the TP (i.e., “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”). Therefore, this part can be removed. However, the rest of the text in TP is still 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 |
| LGE | N | Agree with vivo. |
| FL3 | Based on the received responses, it seems that the TP in Proposal 3-2b may 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 |
| LGE | N | Not essential. |
| FL3 | Potentially we can come back to this topic after Issue #4 has been resolved. |

# 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 conclusionConclusion: (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. |
| LGE | N |  |

Based on the received responses to Question 4-2a, the following proposal can be considered. Whether or not to support the case under discussion can potentially be left up to RAN2, but it is probably good for RAN2 to know that RAN1 has not identified any issue with this case.

### **FL3 Medium Priority Proposal 4-2b:**

* **Send an LS to RAN2 to inform them about the following RAN1 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.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| vivo | N | We do not see the necessity for sending this LS, it causes more discussions and spec efforts on whether/how to support such case in RAN2.  |
| ZTE, Sanechips | Y | Since in RAN1, no issue is identified for supporting this case and it should be nature to be supported in RAN1 like initial RACH procedure. However, considering the RAN2 may have some concern, sending an LS to inform RAN2 is more safer. If RAN2 think there is no need to consider this, we think we can stop the discussion, otherwise, it should be supported. |
| CATT | Y | OK to coordinate with RAN2. They can make decision, RAN1 we can take RAN2’s reply into consideration and make final decision. |
| DOCOMO | Y | We support this proposal. It would be good to clarify what is the exact concern from RAN2 perspective to support this case if any.For the proposal, it is a bit unclear that “without CD-SSB” intends “without CD-SSB but with NCD-SSB” and/or “without CD-SSB and NCD-SSB”. Thus we suggest to clarify it as follows;**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 and NCD-SSB.** |
| MediaTek | N | 1. Can the proponents please explain *why* and *how* gNB configures a RA-SDT without subsequent transmissions (or i.e. with only initial transmission) when a normal RACH is available to UE?
2. The most recent RAN2 agreements overrides the previous RAN1 conclusion. (Note: Option 3 w/o any SSB is no longer considered.)

|  |
| --- |
| *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.** Option 4 is no longer considered
* Option 3 is no longer considered
* Continue offline to check the details of option 2, including the impact on mobility, and if this can be included in R17 (offline 105)
 |

1. In addition, as FL clarified in email reflector, what RAN1 concluded was no issue was identified which is not equivalently saying RAN1 agrees to support …

We don’t need to send LS to RAN2. Current RAN2 specification is fine to us.  |
| Nokia, NSB. | Y | Let RAN2 decide.Support Docomo style wording clarification. |
| Ericsson | Y | The LS is needed. The LS is simply informing RAN2 about RAN1’s conclusion. We do not think Vivo’s concerns are justified. Nevertheless, if it helps, we are fine to add the following note: * **Send an LS to RAN2 to inform them about the following RAN1 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 any SSB.**
	+ **Note: Whether or not to support the above case can be up to RAN2.**
 |

# 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 $N\_{Tx-Rx}⋅T\_{c}$ [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 $N\_{Rx-Tx}⋅T\_{c}$ [4, TS 38.211] after a last symbol of the previous latest SS/PBCH block - SRS in symbols that would not be at least $N\_{Tx-Rx}⋅T\_{c}$ prior to a first symbol of the next earliest SS/PBCH block- SRS in symbols that would not be at least $N\_{Rx-Tx}⋅T\_{c}$ 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 $T\_{proc,2 }$ 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 $T\_{proc,2}$ 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.  $T\_{proc,2}$ is the PUSCH preparation time for UE processing capability 1 [6, TS 38.214] assuming $d\_{2,1}=1$ and $μ$ 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 | Option 2 | No spec changes are expected as the current text does not distinguish between PUSCH transmission in different RRC states.  |
| Nokia, NSB | Option 2 |  |
| LGE | Option 2 | Share the view with Ericsson. |

Based on the received responses to Question 5-2a, the following proposal can be considered.

### **FL3 Medium Priority Proposal 5-2b:**

**Conclusion:**

* **For collision handling between CG-SDT PUSCH and DL resources for HD-FDD UEs in inactive states, adopt the same rule as CG PUSCH in connected state.**
* **Note: No specification impact is expected.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| vivo | Y |  |
| ZTE, Sanechips |  | Just want to clarify a case:For paging and CG-PUSCH in inactive state, it may be different, since the UE is only required to receive the paging once in a time duration. As for the other paging occasions, the UE does not need to receive. Therefore, if paging and CG-PUSCH is overlapped, it seems to be fine, since the UE can drop this paging and monitor another paging.So, we are wondering may be this case could be further discussed. |
| Intel | Y |  |
| Samsung | Y |  |
| CATT | Y |  |
| DOCOMO | Y |  |
| Nokia, NSB. | Y |  |
| Ericsson | Y | Small typo: states 🡪 state |

# 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/FL3 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.  |
| LGE | FFS | Need further check.  |
| vivo2 | Y | @ZTE, the CR is trying to address two issue, 1st is center frequency alignment for SDT PUSCH transmissions and corresponding PDCCH monitoring in search spaces defined for SDT for RedCap UEs. From your comment, it seems your concern is about second correction, please see my replies to you and Ericsson below. @Ericsson @ZTE 2nd is about which BWP to use for CG-SDT transmission when a separate initial UL BWP is configured for RedCap UEs since RedCap UE can see two initial BWPs if the separate iniatil BWP for RedCap is configured. It is also aligned with TS 38.331, see below.

|  |
| --- |
| ***cg-SDT-ConfigInitialBWP-DL***Downlink BWP configuration for CG-SDT. If a UE is a RedCap UE and if the *initialDownlinkBWP-RedCap* is configured in *downlinkConfigCommon* in *SIB1*, this field is configured for *initialDownlinkBWP-RedCap*, otherwise it is configured for *initialDownlinkBWP*. |
| ***cg-SDT-ConfigInitialBWP-NUL***UL BWP configuration for CG-SDT on NUL carrier. If a UE is a RedCap UE and if the *initialUplinkBWP-RedCap* is configured in *uplinkConfigCommon* in *SIB1*, this field is configured for *initialUplinkBWP-RedCap*, otherwise it is configured for *initialUplinkBWP* for NUL. |

@Ericsson, for CG-SDT, the search space can be configured by USS, see following spec in 213 section 19.1 A UE can be provided a USS set by *SearchSpace*, or a CSS set by *sdt-SearchSpace*, to monitor PDCCH for detection of DCI format 0\_0 with CRC scrambled by C-RNTI or CS-RNTI for scheduling PUSCH transmission or of DCI format 1\_0 with CRC scrambled by C-RNTI for scheduling PDSCH receptions [12, TS 38.331].Considering that next May meeting, RAN1 will not handle nay Rel-17 CR, it is appreciated that companies can check as earlier as possible and solve it in this meeting.  |
| Spreadtrum | Y | It seems vivo’s understanding is correct |
| ZTE, Sanechips |  | Thanks vivo’s response. Our concern is regarding the first correction. As Ericsson indicates, in our understanding, the RA-based SDT and CG-based SDT are in initial BWP. Regardless it is separate initial BWP or not, the initial BWP would be configured with RACH procedure and the center frequency for the UL BWP and DL BWP are aligned. Since the SDT is also configured in the initial BWP, the corresponding DL and UL BWP are also aligned. So the correction may be not necessary.Additionally, for the second correction, actually, RedCap UE will reuse the procedure in 19.1.

|  |
| --- |
| Procedures for a RedCap UE are same as described for a UE in all other clauses of this document unless stated otherwise. In this clause, the term 'UE' refers to a RedCap UE. |

It seems fine if we do not have the change. We hope the necessity could be clarified, and then we would be fine. |
| vivo3 |  | @ZTE, Thanks a lot for ZTE’s follow up. In our view, the clause 17 in 38.213 should give a whole picture of the operation for RedCap UEs and better to be self-contained. Otherwise, people may get confused that for random access case, the center frequency needs to be aligned, then how about the SDT case? Based on your comments, there seems also no need to capture center frequency alignment for 2-step RACH case. But as you see, the specification already captured for MsgA. For the second correction, the intention is to say if the RedCap UE is provided the separate initial UL BWP and CG SDT configuration, the CG SDT should be performed in the separate initial UL BWP; otherwise, it uses legacy initial UL BWP for CG-SDT. I am not sure how by this sentence “Procedures for a RedCap UE are same as described for a UE in all other clauses of this document unless stated otherwise. In this clause, the term 'UE' refers to a RedCap UE.” and going to Clause 19.1 can derive above RedCap UE behavior.  |

# 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/FL3 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 | Option 1 |  |
| 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 | Option 1 | We also share the same view as CATT.  |
| Nokia, NSB |  | Leave it to implementation. |
| LGE |  | Share the same view with CATT. |
| ZTE, Sanechips 2 |  | If we leave this issue to gNB implementation, we have following observations.* The unicast PUSCH scheduling performance if PUSCH-config configured would be limited, since the part of TDRA table should be the same with TDRA from pusch-ConfigCommon or default TDRA table. Especially for Rel-18 RedCap UE, due to the RAR processing timeline limit, the available TDRA in pusch-ConfigCommon or default TDRA table is less, which would impact the unicast PUSCH scheduling more.
* The gNB implementation would be more complex, considering the Rel-17 RedCap UE and Rel-18 RedCap UE may have different appropriate TDRA value for PUSCH.
	+ In legacy, the gNB keep PUSCH-config contains common TDRA from pusch-ConfigCommon or default TDRA table, only for NR UE.
	+ In Rel-17, the gNB keep PUSCH-config contains common TDRA, for NR UE and Rel-17 RedCap UE.
	+ In Rel-18, the gNB keep PUSCH-config contains common TDRA, for NR UE, Rel-17 RedCap UE, Rel-18 RedCap UE.

Now we have a chance to avoid this before RedCap UE widely deployment. Hope this could be addressed which would be beneficial for both gNB and UE side. |
| Intel | Option 1 | Same view as CATT. |
| Samsung |  | Share a view with CATT. |

# 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) |