3GPP TSG-RAN WG1 Meeting #112 Draft R1-2301883

Athens, Greece, 27th February – 3rd March 2023

**Agenda Item: 8.6**

**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_111/Docs/R1-2212530.zip), [4](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_111/Docs/R1-2212531.zip), [5](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_111/Docs/R1-2212532.zip), [6](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_111/Docs/R1-2212980.zip)], and a RAN1 agreement summary is available in [[7](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_111/Docs/R1-2212981.zip)].

This document summarizes contributions [8] – [25] submitted to agenda item 8.6 and the following email discussion:

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| --- |
| [112-R17-RedCap] To be used for sharing updates on online/offline schedule, details on what is to be discussed in online/offline sessions, Tdoc number of the moderator summary for online session, etc – Johan (Ericsson) |

The issues in this document are tagged and color coded with High Priority or Medium Priority. The issues that are in the focus of this discussion round are furthermore tagged FL4. The FLS for the initial round can be found in [31].

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 12 in [R1-2300003](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300003.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.

**FL4 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 |
| Qualcomm | Jing Lei | leijing@qti.qualcomm.com |
| Nokia, NSB | David Bhatoolaul | david.bhatoolaul@nokia.com |
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| NTT DOCOMO | Mayuko Okano | mayuko.okano.ca@nttdocomo.com |
| Spreadtrum | Huayu Zhou | huayu.zhou@unisoc.com |

# Issue #1: SDT operation

The previous RAN1 meeting made the following conclusions related to SDT operation for RedCap UEs [7]:

|  |
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| 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
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The previous RAN2 meeting agreed the following assumption [26]:

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| RAN2 Assumption:1. For CG-SDT purpose, RAN2 has basic assumption that SSB will be configured in initial BWP with CG-SDT. For RedCap FFS if SSB refers to CD-SSB or any SSB
 |

Some related earlier RAN1 agreements [27, 28]:

|  |
| --- |
| Conclusion:RA-SDT and CG-SDT can be supported for RedCap UEs without considering specific optimization for RedCap, at least when RedCap UE share both the initial DL BWP and initial UL BWP with non-RedCap UEs.Agreement:RAN1 confirms that the separate BWP in case of RedCap may still be considered as the initial BWP and SDT resources (both CG-SDT and RA-SDT) can hence be configured on this BWP for RedCap UEs.* Note: details can be further studied to ensure proper functionality of RedCap UE performing SDT.

Agreement:The validation rule defined for CG-SDT in FD-FDD mode can be reused for RedCap UE performing CG-SDT in HD-FDD mode. |

Some related earlier RAN2 agreements [29]:

|  |
| --- |
| Agreements:1. During the SDT procedure (i.e., while SDT timer is running), UE monitors SI change indication in any paging occasion at least once per modification period (i.e., same as legacy RRC\_CONNECTED).
2. During the SDT procedure (i.e., while SDT timer is running), ETWS or CMAS capable UEs monitors PWS notification in any paging occasion at least once every *defaultPagingCycle* (i.e., same as legacy RRC\_CONNECTED).
 |

Now, the following contributions have been submitted to this RAN1 meeting about SDT operation for RedCap UEs:

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| --- | --- | --- | --- |
| [8] | [R1-2300367](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300367.zip)(Section 2.1) | Discussion on RedCap remaining issues | ZTE, Sanechips |
| [10] | [R1-2300418](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300418.zip) | Remaining issues on SDT support for Rel-17 RedCap UE | Vivo |
| [11] | [R1-2300499](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300499.zip) | Support for SDT in a RedCap-specific initial DL BWP without SSB | Ericsson |
| [12] | [R1-2300542](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300542.zip) | Discussion on remaining details of RedCap SDT operation | Xiaomi |
| [13] | [R1-2300648](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300648.zip) | Discussion on SDT in separate initial BWP without CD-SSB | CATT |
| [15] | [R1-2300854](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300854.zip) | Remaining issue of Rel-17 RedCap UE | NEC |
| [16] | [R1-2300977](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300977.zip) | Discussion on SDT procedure related RedCap remaining issues | CMCC |
| [17] | [R1-2301148](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301148.zip) | RedCap support of SDT | Nokia, Nokia Shanghai Bell |
| [18] | [R1-2301328](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301328.zip) | On Small Data Transmission for Redcap UEs | Apple |
| [19] | [R1-2301387](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301387.zip)(Section 4) | Remaining Issues on UE Complexity Reduction | Qualcomm Incorporated |
| [21] | [R1-2301471](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301471.zip)(Section 2.2) | Discussion on corrections and SDT operations for RedCap UE | NTT DOCOMO, INC. |
| [23] | [R1-2301723](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301723.zip) | Remaining issues during SDT procedure for RedCap UEs | Huawei, HiSilicon |
| [24] | [R1-2301781](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301781.zip)(Section 2) | On RedCap remaining issues (revision of [R1-2301606](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301606.zip)) | MediaTek Inc. |

Many contributions express views on the following three cases which were identified in the previous RAN1 meeting:

* **Case A: Subsequent RA-SDT transmission in a RedCap-specific separate initial BWP without CD-SSB**
	+ Several contributions [8, 11, 13, 16, 17, 21] express that this case may be supported at least for RedCap UEs that support an optional capability (e.g., FG 28-1a).
	+ Several contributions [8, 13, 17, 19, 24] express that this case should not be supported at all or at least not by RedCap UEs that do not support an optional capability (e.g., FG 28-1a).
* **Case B: CG-SDT in a RedCap-specific separate initial BWP without any SSB**
	+ Several contributions [8, 11, 13, 15, 16, 17, 18, 21] express that this case may be supported at least for RedCap UEs that support an optional capability (e.g., FG 28-1a).
	+ Several contributions [8, 13, 15, 18, 19, 24] express that this case should not be supported at all or at least not by RedCap UEs that do not support an optional capability (e.g., FG 28-1a).
* **Case C: CG-SDT in a RedCap-specific separate initial BWP without CD-SSB but with NCD-SSB**
	+ Several contributions [8, 10, 11, 18, 19, 24] express that this case may be supported.
	+ Several contributions [13, 15, 16, 17, 21] express that this case should not be supported.
	+ One contribution [23] expresses that it should be left up to RAN2/RAN4 whether to support this case.

For RA-SDT-related Case A, the following subcases (analogous to CG-SDT-related Cases B and C) can be considered:

* **Case A1: Subsequent RA-SDT transmission in a RedCap-specific separate initial BWP without any SSB**
* **Case A2: Subsequent RA-SDT transmission in a RedCap-specific separate initial BWP without CD-SSB but with NCD-SSB**

Several contributions discuss how to handle, e.g., monitoring of paging and SI update notifications during SDT procedure in the above cases. Some contributions suggest that it may be left up to the NW and/or UE implementation. It can be expected that RAN2 will also discuss some of these aspects for these cases during this meeting. Nevertheless, it may be relevant to collect views on support of these cases from RAN1 perspective. Below, there is one question for each case.

**FL1 Question 1-1a: Should Case A1 (subsequent RA-SDT transmission in a RedCap-specific separate initial BWP without any SSB) be supported? Please elaborate on the motivation and potential conditions in the comment field.**

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| **Company** | **Y/N** | **Comments** |
| vivo | N | Firstly, given RAN2 already agreed that “RAN2 has basic assumption that SSB will be configured in initial BWP with CG-SDT” we think it is better for RAN1 to have aligned views with RAN2’s assumption to avoid the risk that RAN1 and RAN2 support different cases and developed different options. Although RAN2’s agreement is for CG-SDT, we think it should be applied to RA-SDT with subsequent transmission as well. Secondly, supporting SDT in a initial BWP without SSB is very difficult for RedCap UE to maintain the sync, meet UL transmission timing accuracy. RedCap UE needs to switch back and forth between the legacy initial BWP for CD-SSB measurement and separate initial BWP for SDT transmission. It increases RedCap UE power consumption, SDT transmission delay, defeating the SDT benefits.  |
| Qualcomm |  | It would be challenging or impossible for a RedCap UE to support Case A1, if the RedCap UE does not support FG 28-1a. |
| Nokia, NSB | Y with FG28.1a | During this maintenance phase, we would like to see SDT supported but with minimal impacts to both the specifications and/or the network and UE. For us, a good compromise, is to restrict the support of this case to UEs that support FG28.1a, provided it can be agreed that support of FG28.1a, means that for this scenario, that neither the network or UE, have to make special adjustments/assumptions (eg measurement gaps, different UE retuning times) for SDT scheduling. |
| CATT | N at least for non-FG 28-1a UE | 1) For RedCap UE not capable with FG 28-1a, this case is not supported by nature.2) For RedCap UE supporting FG 28-1a , we think this can be supported. But due to RAN2’s basic assumption on CG-SDT (seems no inner difference with RA-SDT on use of SSB), we are also OK to conclude that this case is not support. |
| Spreadtrum | Slightly prefer N | In general view, the separate initial DL BWP does not contain CD-SSB. It was agreed there could be no any SSB for RACH and initial transmission of RA-SDT. This implies that RedCap UE without FG 28-1a may process RACH and initial transmission of RA-SDT without processing any SSB. It is feasible, since the duration is short. However, for the subsequent RA-SDT, it may not be feasible. From UE vendor perspective, it is better NW can provide NCD-SSB for this case. Otherwise, the share initial DL BWP is expected for RA-SDT. |
| ZTE, Sanechips | N if Case A2 is supported | Actually the option that no SSB is configured for CG-SDT is also on the table of RAN2 discussion, they will further discuss 3 options in this meeting. From our understanding, we should firstly discuss Case A2, if NCD-SSB can be used for SDT, then there is no need to discuss the Case A1. |
| Nordic  | Y | We do not see this option being different to regular R17 RACH procedure on the separate initial BWP without SSB. UE may send small data in MSG3. Or is there some difference? |
| Intel | Y | Same view as Nordic – we do not see a difference compared to regular RA procedure or “initial RA-SDT”.  |
| NEC |  | N for a RedCap UE without FG28-1a assuming during RA-SDT procedure a RedCap UE needs to stay on a separate initial DL BWP without SSB.On the other hand, it would be feasible a RedCap UE with FG28-1a supports Case A1 because subsequent RA-SDT transmission on a separate initial BWP without SSB is similar to operation on an active BWP without SSB in RRC\_CONNECTED. RAN1 may discuss its feasibility.On RAN2 agreement of presence of SSB, a case without SSB is still on the table for CG-SSB in RAN2. So RAN1 should not conclude this due to RAN2 agreements. |
| DOCOMO | Y | This case can be supported without any RAN1 impact and can be handled by gNB implementation. |
| MediaTek | N | The time span of SDT (SDT timer T319a <= 4000ms) could be much larger than a RACH procedure (~<=100ms). How can one expect an Inactive-mode UE to be synchronized for 4000ms in a BWP w/o SSB? Unlike connected mode, there is no CSI-RS or TRS to be measured by UE for synchronization. SSB is what UE in Inactive mode can rely on for DL synchronization and UL timing adjustment. If UE has to continue switching back and forth between RedCap-specific initial BWP (containing no SSB) and legacy (i.e. non-Redcap) initial BWP during SDT, we wonder whether the shorter latency and less UE power consumption benefits claimed by SDT still hold. Our proposal is that for Rel-17, SDT should be only supported in an initial BWP with SSB. FFS: SSB only includes CD-SSB or both CD-SSB and NCD-SSB. |
| LGE | N | Share the view with vivo. No at least if FG 28-1a is not supported. |
| Ericsson | Y | This case should be supported at least for RA-SDT UEs supporting 28-1a. |
| CMCC |  | We are open to support this case. Since the subsequent transmission is controlled by gNB. When supported, additional UE capability is needed. |
| Xiaomi | N | When there is no CD-SSB in the separate initial BWP, the shared initial BWP associated with CD-SSB is used to perform RA-SDT transmission if possible, for example, for the case that the shared initial UL BWP is within 20MHz, or using the CORESET#0 to receive downlink control information or data for FDD case; Otherwise, the RA-SDT transmission (including both initial SDT transmission and subsequent SDT transmission, which should be taken as a whole procedure) shouldn’t be configured for RedCap UEs. |
| FL2 | Based on the received responses, the following proposal can be considered:**High Priority Proposal 1-1b:*** **A RedCap UE supporting FG 28-1 but not FG 28-1a does not expect to perform subsequent RA-SDT transmission in a RedCap-specific separate initial DL BWP that does not include CD-SSB or NCD-SSB.**
* **A RedCap UE supporting** **both FG 28-1 and FG 28-1a is able to perform subsequent RA-SDT transmission in a RedCap-specific separate initial DL BWP that does not include CD-SSB or NCD-SSB.**
 |
| FL3 | The following proposal was discussed in the Tuesday session without reaching agreement. Companies are invited to comment on the proposal and propose alternative wordings that may reach consensus.**High Priority Proposal 1-1b:*** **A RedCap UE supporting FG 28-1 but not FG 28-1a does not expect to perform subsequent RA-SDT transmission in a RedCap-specific separate initial DL BWP that does not include CD-SSB or NCD-SSB.**
* **A RedCap UE supporting both FG 28-1 and FG 28-1a is able to perform subsequent RA-SDT transmission in a RedCap-specific separate initial DL BWP that does not include CD-SSB or NCD-SSB.**
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| vivo |  | Following was agreed in RAN2-121 - NR-NTN-IoT-NTN-RedCap\_2023-02-28\_1030Draft chair notes:RedCap & SDTOption 1: CG/RA-SDT can only be performed if the initial DL BWP includes the CD-SSBOption 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 introducedOption 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 introducedOption 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)

From above, it is observed that in Rel-17, RedCap UE cannot support the SDT in the BWP without any SSB. So, we do not think the 2nd bullet of the proposal 1-1b is aligned with RAN2’s understanding. In addition, since RAN2 already work on the details for option 2, to be efficient, we prefer to hold RAN1 discussion for SDT issue and wait for RAN2’s decision.  |
| CATT |  | At least the 1st bullet can be supported.For the 2nd one, If FG 28-1a cannot be considered as reference to support RA-SDT in separate initial BWP without any SSB, we don’t know what can be referred to. A more direct way is to just conclude that this case is not supported. |
| Spreadtrum | Partially Y | Suggest removing:**A RedCap UE supporting both FG 28-1 and FG 28-1a is able to perform subsequent RA-SDT transmission in a RedCap-specific separate initial DL BWP that does not include CD-SSB or NCD-SSB.**To be honest, FG 28-1a is too complicated especially for SDT operation. May we postpone it after R17? |
| MediaTek | N | Based on RAN2’s agreements (see vivo’s inputs in the above), we don’t need to discuss this proposal anymore. The remaining discussion points are **whether/how to support NCD-SSB for SDT purpose** in Inactive mode.  |
| ZTE, Sanechips | No need to discuss | We share same understanding as MTK, the scenario without any SSBs does not exist, so we don’t need to make any conclusions on this case. |
| Qualcomm | N |  |
| DOCOMO | Y with comment | Need a clarification whether FG28-1a can be reused.In the current specification, FG-28-1a indicates the support of **RRC-configured DL BWP** without CD-SSB or NCD-SSB. However, this discussion is SDT in **separate initial DL BWP** without any SSB. Therefore, at least we need a clarification whether we can 1) simply reuse this FG28-1a or 2) add a description regarding SDT in separate initial DL BWP on FG28-1a or 3) specify new FG for separate initial BWP without SSB for SDT. |
| Nokia, NSB | N | It would seem the RAN2 agreements close this specific discussion.However, we would appreciate a RAN1/2? discussion/conclusion/alignment, on whether or not UEs supporting FG28.1a, can (or cannot) support SDT in SSB-less BWPs.  |
| Ericsson |  | Considering the agreement made by RAN2 on Tuesday, we would be fine with removing the second bullet.  |
| NEC |  | This scenario would not be supported according to RAN2 agreements. |
| Huawei | Y | The proposal does not have ran2 impact, thus can be supported in RAN1 without need of RAN2 consideration. |
| LGE |  | We could agree on this proposal if it is clarified that the proposal is from RAN1 perspective. But, we are okay to hold the discussion until RAN2 makes a progress if it is a majority view.  |
| FL4 | RAN2 has made the following agreements:

|  |
| --- |
| RedCap & SDTOption 1: CG/RA-SDT can only be performed if the initial DL BWP includes the CD-SSBOption 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 introducedOption 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 introducedOption 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.Agreements:* 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)
 |

Based on the received responses and the above RAN2 agreements, the following updated proposal can be considered:**High Priority Proposal 1-1c:*** **A RedCap UE does not expect to perform subsequent RA-SDT transmission in a RedCap-specific separate initial DL BWP that does not include any SSB.**
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| CMCC |  | We have made the following agreemeng during RAN#109e meeting, which means a connected UE supporting both FG 28-1 and FG 28-1a is able to operate in a separate initial DL BWP that does not include CD-SSB and the entire CORESET#0, and this BWP is BWP#0 configuration option 1, without any dedicated BWP configuration. We think it is very similar to this case, no NCD-SSB, no CSI-RS on this BWP, and UE with optional FG 28-1a can work on it. So from RAN1 perspective, it is feasible that *A RedCap UE supporting both FG 28-1 and FG 28-1a is able to perform subsequent RA-SDT transmission in a RedCap-specific separate initial DL BWP that does not include CD-SSB or NCD-SSB.* Agreement: [38.213]* For FR1, for BWP#0 configuration option 1,
	+ In connected mode, a RedCap UE supporting FG 28-1 but not FG 28-1a does not expect to operate in a separate initial DL BWP that does not include CD-SSB and the entire CORESET#0.
	+ In connected mode, a RedCap UE supporting both FG 28-1 and FG 28-1a is able to operate in a separate initial DL BWP that does not include CD-SSB and the entire CORESET#0.
* For FR2, for BWP#0 configuration option 1,
	+ In connected mode, a RedCap UE supporting FG 28-1 but not FG 28-1a does not expect to operate in a separate initial DL BWP that does not include CD-SSB.

In connected mode, a RedCap UE supporting both FG 28-1 and FG 28-1a is able to operate in a separate initial DL BWP that does not include CD-SSB. |
| Spreadtrum | Y | Seems low hanging fruit |
| vivo | Y | To align with RAN2’s agreement.  |
| CATT |  | OK |
| Nokia, NSB. | Y | This is based on RAN2 agreements and the understanding that RAN2 and RAN1 have concluded that support of FG28.1a makes no difference to this case. |
| NEC | Y |  |
| Xiaomi2 | Y |  |

**FL1 Question 1-2a: Should Case A2 (subsequent RA-SDT transmission in a RedCap-specific separate initial BWP without CD-SSB but with NCD-SSB) be supported? Please elaborate on the motivation and potential conditions in the comment field.**

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| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| vivo | Y | Separate initial BWP without CD-SSB is one typical use case for RedCap UEs. If SDT is supported for RedCap, it is necessary and more worthwhile to support Case A2. As long as network configures the separate initial BWP without CD-SSB, it is expected that there will be at least one connected RedCap UEs supporting basic functionality i.e., FG28-1 and NCD-SSB. NW overhead will not be increased and RedCap UE complexity can be reduced.  |
| Qualcomm | Y | * If NCD-SSB is configured in the RedCap-specific initial DL BWP on unpaired spectrum, NCD-SSB should only fall in DL/flexible symbols of a TDD slot.
* Similar to CD-SSB, a RedCap UE does not expect symbols of NCD-SSB to overlap with UL symbols of a TDD slot.
* To validate ROs used for RA-SDT, RedCap UE needs to consider both CD-SSB and NCD-SSB. Therefore, it is desirable for NW to configure *ssb-TimeOffset-r17* to be zero in a RedCap-specific initial DL BWP with NCD-SSB.
 |
| Nokia, NSB | Y with FG28.1a | Our initial answer, “Y with FG28.1a”, effectively ignores whether NCD-SSB is there or not, i.e. provided FG28.1a is supported, this case of SDT can be supported with or without NCD-SSB. Our current understanding is that NCD-SSB is only supported for connected mode UEs. If this is correct, then we ask supporters of this proposal, to clarify:(1) Is the assumption that NCD-SSB is always present if configured for connected mode UEs?(2) Is a new way to specify NCD-SSB for idle-inactive UEs required? If a new way is specified, do we need to ensure that 2x NCD-SSB aren’t created in the same BWP?  |
| CATT | N | We think this will lead to some RRC modification (e.g. adding NCD-SSB configuration IE in SIB). In this phase, we’d better avoid this kind of change. |
| Spreadtrum | Slightly prefer Y | Like **Question 1-1a** |
| ZTE, Sanechips | Y | Motivation: In separate initial BWP without CD-SSB, if NCD-SSB is not supported for SDT, UE has to switch to initial BWP to maintain the sync and timing, which increases the UE complexity.Spec impact: NCD-SSB configuration can be added in RRC release message dedicated for SDT operation, no other spec change is needed. If spec change is the main concern, we can send an LS to RAN2 for them to decide based on the required spec change.NW overhead: If separate initial BWP without CD-SSB is configured, it implies that there exists at least one connected UE is configured with NCD-SSB, then the same NCD-SSB can be configured for SDT UE in inactive state, NW overhead is not increased. |
| Nordic  | Y | This would work for sure. |
| Intel | Y (conditional) | This is assuming that NCD-SSB configuration is still limited to dedicated RRC signalling and does not imply any impact to SIB signalling. |
| NEC | N | NCD-SSB is not available in RRC\_INACTIVE and difficult to conclude whether case A2 is supported from RAN1 point of view at this late stage. On the other hand, case A2 is also on the table in RAN2. If RAN2 agrees to introduce NCD-SSB in RRC\_INACTIVE, support of case A2 would be feasible for a RedCap UE with FG28-1a, but not feasible for a RedCap UE without FG28-1a due to the same reason as question 1-1a. |
| DOCOMO | N | It was agreed at the previous RAN1 meeting that NCD-SSB is supported for a UE in RRC connected state and not for RRC idle/inactive state. This principle should not be revised. |
| MediaTek | Y | From UE implementation perspective, SDT should be only supported in an initial BWP that contains SSB. We think CD-SSB is sufficient but for progress we can also support NCD-SSB. However, to fully ease UE implementation, the following companion proposals to support NCD-SSB should be also considered. **Proposal:** UE is not required to monitor SI change indication and PWS notification during a SDT procedure in a RedCap-specific initial BWP that does not contain full CD-SSB and CORESET#0. Send LS to RAN2.  |
| LGE | Y (conditional) | Case A2 can be supported if the related signaling is supported in RAN2. |
| Ericsson | Y  | The NW would know whether the UE supports 28-1a or not up on Msg3 reception. Based on this information, the NW can either initiate the transmission of NCD-SSB (if the UE does not support 28-1a) or continue the operation of the UE in the initial BWP without SSB (if the UE supports 28-1a). |
| CMCC | N | NCD-SSB is only available for connected UEs. |
| Xiaomi | N  | Share the same view as CMCC |
| FL2 | Based on the received responses, the following proposal can be considered:**High Priority Proposal 1-2b:*** **A RedCap UE (i.e., a UE supporting at least FG 28-1) is able to perform subsequent RA-SDT transmission in a RedCap-specific separate initial DL BWP without CD-SSB but with NCD-SSB.**
 |
| FL3 | The following proposal was discussed in the Tuesday session without reaching agreement. Companies are invited to comment on the proposal and propose alternative wordings that may reach consensus.**High Priority Proposal 1-2b:*** **A RedCap UE (i.e., a UE supporting at least FG 28-1) is able to perform subsequent RA-SDT transmission in a RedCap-specific separate initial DL BWP without CD-SSB but with NCD-SSB.**
 |
| CATT | N | We don’t support to open the door for using NCD-SSB in RRC\_INACTIVE or RRC\_IDLE, at least from RAN1’s perspective. This has already been concluded in Rel-17. |
| Spreadtrum | Y |  |
| MediaTek | Y | Can the opponents elaborate why they don’t support NCD-SSB for SDT? Without understanding your real concerns, we won’t be able to make progress as a group.  |
| ZTE, Sanechips | Wait for RAN2 progress | Actually introducing NCD-SSB for SDT mainly requires RAN2 spec impact on RRC, it’s better for RAN2 to assess the spec effort to make decision.Based on RAN2 agreement, a separate capability may be defined for the case of supporting NCD-SSB for SDT, thus we suggest to wait for RAN2’s further progress on this issue. |
| Qualcomm | Y | We can live with this proposal, if the NCD-SSB configurations satisfy the following conditions:* NCD-SSB configured on unpaired spectrum falls only on DL or flexible symbols (similar to CD-SSB), and
* RedCap UE is not required to handle collisions between NCD-SSB and UL symbols if the UE is provided *tdd-UL-DL-ConfigurationCommon*
 |
| DOCOMO |  | It is unclear so far whether NCD-SSB is transmitted during only SDT procedure or during RRC inactive state. We still have concern from NW overhead perspective if NCD-SSB transmission is not limited to SDT procedure. Such concern should be addressed in RAN1 and we need conclusion from RAN1 perspective, thus we think we should not leave it to RAN2. |
| Nokia, NSB |  | Similar view to ZTE, though perhaps we can add an “FFS: Whether this is dependent on a separate UE capability”  |
| Ericsson |  | Although we support this proposal, we are fine with waiting for further progress in RAN2 on this issue.Note that the UE must first move to connected mode and be configured with NCD-SSB (e.g., in *RRCRelease* message) before the UE can use NCD-SSB for RA-SDT. For RA-SDT, the NW can initiate transmission of NCD-SSB up on reception of SDT-specific Msg1 or Msg3. Therefore, “always-ON” NCD-SSB can be avoided.  |
| NEC |  | Wait for RAN2 progress on NCD-SSB.We consider FG28-1a (like) capability would be required for monitoring paging during SDT procedure. |
| Huawei |  | RAN2/RAN4 need to check this. |
| LGE |  | From a technical point of view, we can support the proposal. But as it involves RAN2 spec impact, we think we need to wait for RAN2 progress.  |
| FL4 | Based on the received responses, it seems that companies prefer to come back to this proposal after further progress has been made in RAN2 on this issue.  |

**FL1 Question 1-3a:** **Should Case B (CG-SDT in a RedCap-specific separate initial BWP without any SSB) be supported? Please elaborate on the motivation and potential conditions in the comment field.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| vivo | N | Same comments as for Question1-1a for CaseA1. In addition, for CG resource validation, SSB measurement is also required. The periodicity of CG resource can be small, it increases more frequent switching to the legacy initial BWP for CD-SSB measurement. Such interruption is not desirable from NW perspective and the increased RedCap UE power consumption, SDT transmission delay also defeat the SDT benefits..  |
| Qualcomm |  | It would be challenging or impossible for a RedCap UE to support CG-SDT in a separate initial DL BWP without SSB, if the RedCap UE does not support FG 28-1a. |
| Nokia, NSB | Y with FG28.1a | See our question 1-1a response, plus a desire for simple consistency across the various cases. |
| CATT | N at least for non-FG 28-1a UE | Same comment as that of Case A1. |
| Spreadtrum | Slightly prefer N | RACH and initial transmission of RA-SDT is short in duration in general view. That is why we have agreed without any SSB in the previous meetings. However, it may not be true for CG-SDT, as mentioned by vivo CG-SDT is too dense and there is no gap for retuning RF to process SSB outside the separate initial DL BWP. |
| ZTE, Sanechips | N if Case C is supported | From our understanding, we should firstly discuss Case C, if NCD-SSB can be used for SDT, then there is no need to discuss the Case B. |
| Nordic  | N |  |
| Intel | N | Considering shorter periodicity values of CG-SDT resources, it may be challenging for a UE if SSB measurement is needed in between. |
| NEC |  | Same comment as Case A1. |
| DOCOMO | Y | Similar to case A1, this case can be supported without any RAN1 impact. |
| MediaTek | N | Similar view as our response to Question 1-1a. SDT should be only supported in an initial BWP with SSB. Otherwise, we are not sure the merits claimed by SDT such as lower latency and less UE power consumption remain.  |
| LGE | N | We also think supporting Case B is challenging for RedCap UE. |
| Ericsson | Y | Similar to the case of RA-SDT with subsequent transmission in a BWP without any SSB, CG-SDT can be supported in a BWP without any SSB, at least by those UEs supporting 28-1a.  |
| CMCC | N | According to RAN2 understanding, this is not supported. |
| Xiaomi | N  | Same comment as Case A1. |
| FL2/FL3 | Based on the received responses, there are mixed views regarding whether Case B should be supported or not. Therefore, the following proposal can be considered. A new Question 1-3c has also been added below.**High Priority Proposal 1-3b:*** **A RedCap UE supporting FG 28-1 but not FG 28-1a does not expect to perform CG-SDT in a RedCap-specific separate initial DL BWP that does not include CD-SSB or NCD-SSB.**
 |
| CATT | Y |  |
| MediaTek | N | This proposal can be deprioritized since RAN2 has agreed only Option 1 (with CD-SSB) and Option 2 (with NCD-SSB) will be considered for further discussion (for ALL RedCap UEs).  |
| ZTE, Sanechips | No need to discuss | We share same understanding as MTK, the scenario without any SSBs does not exist, so we don’t need to make any conclusions on this case. |
| Qualcomm | N |  |
| DOCOMO | Y | In our understanding, this case can be supported by gNB implementation, but fine with this proposal. |
| Nokia, NSB | Y | Understand other companies that consider this redundant given RAN2 agreements, but we find this useful as a RAN1 confirmation. One option is to note this as a conclusion given RAN2 agreements. |
| Ericsson |  | Considering the agreement made by RAN2 on Tuesday, this proposal may no longer be needed. Alternatively, the proposal could still be considered after removing “**supporting FG 28-1 but not FG 28-1a**”.  |
| NEC |  | This scenario would not be supported according to RAN2 agreements. |
| LGE | Y |  |
| FL4 | Based on the received responses and the agreement in RAN2, the following updated proposal can be considered:**High Priority Proposal 1-3c:*** **A RedCap UE does not expect to perform CG-SDT in a RedCap-specific separate initial DL BWP that does not include any SSB.**
 |
| CMCC |  | We can accept the proposal. Although according the agreements made during RAN1#109e meeting, it seem feasible for a RedCap UE with FG28-1a to support this.  |
| Spreadtrum | Y | Seems low hanging fruit |
| vivo | Y | To align with RAN2’s agreement.  |
| CATT |  | OK |
| Nokia, NSB. | Y |  |
| NEC | Y |  |
| Xiaomi2 | Y |  |

**FL2/FL3 High Priority Question 1-3c: Should Case B (CG-SDT in a RedCap-specific separate initial BWP without any SSB) be supported for RedCap UEs supporting both FG 28-1 and FG 28-1a? Please elaborate in the comment field.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| CATT |  | Same view with (or even worse than) RA-SDT case. |
| Spreadtrum | Y |  |
| MediaTek | Y in principle | Can opponents elaborate what their real concerns are for extending NCD-SSB for SDT purpose?  |
| ZTE, Sanechips | No need to discuss | According to RAN2 agreement, the scenario without any SSBs does not exist for SDT, so we don’t need to make any conclusions on this case. |
| Qualcomm | Y |  |
| DOCOMO |  | Same comment as Proposal 1-1b. |
| Nokia, NSB |  | This may require a LS to RAN2. It is not clear to us, if RAN2 have appreciated the potential options opened up by the support of FG28.1a. To agree this proposal, could lead to misalignment of understanding between RAN1 and RAN2. |
| Ericsson |  | Considering the agreement made by RAN2 on Tuesday, we would be fine with not supporting this case. |
| NEC |  | This scenario would not be supported according to RAN2 agreements. |
| Huawei | Y | We donot see issue to support it. |
| FL4 | Based on received responses and agreements in RAN2, this proposal may no longer be needed. |

**FL1 Question 1-4a: Should Case C (CG-SDT in a RedCap-specific separate initial BWP without CD-SSB but with NCD-SSB) be supported? Please elaborate on the motivation and potential conditions in the comment field.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| vivo | Y | Same comments as for Question 1-2a for Case A2. |
| Qualcomm | Y | * If NCD-SSB is configured in the RedCap-specific initial DL BWP on unpaired spectrum, NCD-SSB should only fall in DL/flexible symbols of a TDD slot.
* Similar to CD-SSB, a RedCap UE does not expect symbols of NCD-SSB to overlap with UL symbols of a TDD slot.
* To validate CG-PUSCH occasions used for CG-SDT (and ROs of RA procedure, if UE fall backs to 4-step or 2-step RA), RedCap UE needs to consider both CD-SSB and NCD-SSB. Therefore, it is desirable for NW to configure *ssb-TimeOffset-r17* to be zero in a RedCap-specific initial DL BWP with NCD-SSB.
 |
| Nokia, NSB | Y with FG28.1a | See our question 1-2a response. |
| CATT | N | We think this will lead to some RRC modification (e.g. adding NCD-SSB configuration IE in RRC release information). In this phase, we’d better avoid this kind of change. |
| Spreadtrum | Slightly prefer Y | Like **FL1 Question 1-3a** |
| ZTE, Sanechips | Y | Motivation: In separate initial BWP without CD-SSB, if NCD-SSB is not supported for SDT, UE has to switch to initial BWP to maintain the sync and timing, as well as SSB measurement for SSB to CG PUSCH mapping, which increases the UE complexity.Spec impact: NCD-SSB configuration can be added in RRC release message dedicated for SDT operation, no other spec change is needed. If spec change is the main concern, we can send an LS to RAN2 for them to decide based on the required spec change.NW overhead: If separate initial BWP without CD-SSB is configured, it implies that there exists at least one connected UE is configured with NCD-SSB, then the same NCD-SSB can be configured for SDT UE in inactive state, NW overhead is not increased. |
| Nordic  | Y |  |
| Intel | Y (conditional) | This is assuming that NCD-SSB configuration is still limited to dedicated RRC signalling and does not imply any impact to SIB signalling. |
| NEC |  | Same comment as Case A2. |
| DOCOMO | N | Similar to case A2, NCD-SSB cannot be transmitted for RRC inactive state, thus it should not be supported. |
| MediaTek | Y | Same comments as for Question 1-2a for Case A2. |
| LGE | Y (conditional) | Case C can be supported if the related signaling is supported in RAN2. |
| Ericsson | Y |  |
| CMCC | N | NCD-SSB is only available for connected UEs. Introducing NCD-SSB for inactive UEs will increase network overhead, since when there is no connected UEs or only connected UEs with FG28-1a, gNB does not need to transmit NCD-SSB. But if NCD-SSB is indicated to RRC inactive UEs, it means gNB has to keep NCD-SSB for CG-SDT even there is no connected UEs. |
| Xiaomi | N | Same comment as for Question 1-2a for Case A2. |
| FL2/FL3 | Based on the received responses, the following proposal can be considered:**High Priority Proposal 1-4b:*** **A RedCap UE (i.e., a UE supporting at least FG 28-1) is able to perform CG-SDT in a RedCap-specific separate initial DL BWP without CD-SSB but with NCD-SSB.**
 |
| CATT | N | We don’t support to open the door for using NCD-SSB in RRC\_INACTIVE or RRC\_IDLE, at least from RAN1’s perspective. This has already been concluded in Rel-17. |
| Spreadtrum | Y |  |
| MediaTek |  | @CATT, as Mr. Chair also clarified in today’s online session, the RAN/RAN2 agreements were about not using NCD-SSB for paging, cell reselection, etc. The agreements did not say that NCD-SSB would not be allowed for Inactive mode.  |
| ZTE, Sanechips | Wait for RAN2 progress | Actually introducing NCD-SSB for SDT mainly requires RAN2 spec impact on RRC, it’s better for RAN2 to assess the spec effort to make decision.Based on RAN2 agreement, a separate capability may be defined for the case of supporting NCD-SSB for SDT, thus we suggest to wait for RAN2’s further progress on this issue. |
| Qualcomm | Y | We can live with this proposal, if the NCD-SSB configurations satisfy the following conditions:* NCD-SSB configured on unpaired spectrum falls only on DL or flexible symbols (similar to CD-SSB), and
* RedCap UE is not required to handle collisions between NCD-SSB and UL symbols if the UE is provided *tdd-UL-DL-ConfigurationCommon*
 |
| DOCOMO | N | Same comment as Proposal 1-2b. |
| Nokia, NSB |  | Similar view to ZTE, though perhaps we can add an “FFS: Whether this is dependent on a separate UE capability” |
| Ericsson |  | Although we support this proposal, we are fine with waiting for further progress in RAN2 on this issue.Similar to RA-SDT, the NW must first configure the UE with NCD-SSB (while in connected state) before the UE can use them for CG-SDT. The NW would likely configure NCD-SSD for CG-SDT if it is already broadcasting NCD-SSB for connected mode UEs. Therefore, additional overhead due to NCD-SSB can be avoided.  |
| NEC |  | Wait for RAN2 progress on NCD-SSB.We consider FG28-1a (like) capability would be required for monitoring paging during SDT procedure. |
| Huawei | N | Again, this needs other WGs to consider.We want to emphasize that not only Ran2 but RAN4 may need to check the relevant measurement issues. |
| FL4 | Based on the received responses, it seems that companies prefer to come back to this proposal after further progress has been made in RAN2 on this issue.  |

# Issue #2: HD-FDD operation

The following contributions concern HD-FDD operation for RedCap UEs:

|  |  |  |  |
| --- | --- | --- | --- |
| [14] | [R1-2300649](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300649.zip)(38.213 CR) | Correction on impact of HD-FDD operation in Rel-17 | CATT |
| [20] | [R1-2301470](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301470.zip)(38.213 CR) | Correction on reference clauses for PDCCH repetition, UCI multiplexing/prioritization, and PUCCH transmission for HD-FDD operation | NTT DOCOMO, INC. |
| [21] | [R1-2301471](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301471.zip)(Section 2.1) | Discussion on corrections and SDT operations for RedCap UE | NTT DOCOMO, INC. |

The draft CRs add references to clause 17.2 (which concerns HD-FDD procedures) in several clauses in 38.213.

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

|  |  |  |
| --- | --- | --- |
| **Company** | **Priority** | **Comments** |
| vivo | H | We are OK to discuss it. |
| Nokia, NSB | M |  |
| CATT | H | We should add these references to complete the feature. |
| Spreadtrum | H |  |
| ZTE, Sanechips | M or L | I guess it also works if no correction. |
| Nordic | H | OK to discuss, but ZTE has point |
| Intel | M or L | Same view as ZTE and Nordic; may not be essential, but ok to discuss. |
| DOCOMO | H |  |
| LGE | M | Okay to discuss. |
| Ericsson | M | Fine with discussing further. |
| CMCC | M |  |
| FL2/FL3 | Most received responses suggest high or medium priority. The TP in [R1-2300649](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300649.zip) also includes the corrections proposed in [R1-2301470](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301470.zip). Based on the responses, the TP for 38.213 in [R1-2300649](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300649.zip) can be considered.**Medium Priority Proposal 2-1b: Agree the TP for 38.213 in** [**R1-2300649**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300649.zip)**.** |
| **Company** | **Y/N** | **Comments** |
| vivo |  | We may need a little bit more time to check all the affected clauses by the HD-FDD operation. For example, for following, we wondered whether it is necessary that Layer 1 may notify higher layers to suspend the corresponding power ramping counter due to the HD-FDD operation that RedCap UE does not transmit the PRACH? 7.4 Physical random access channel**<Unchanged parts are omitted>**If due to power allocation to PUSCH/PUCCH/PRACH/SRS transmissions as described in clause 7.5, or due to power allocation in EN-DC or NE-DC or NR-DC operation, or due to slot format determination as described in clause 11.1, or due to the PUSCH/PUCCH/PRACH/SRS transmission occasions are in the same slot or the gap between a PRACH transmission and PUSCH/PUCCH/SRS transmission is small as described in clause 8.1, or due to HD-UE operation in paired spectrum as described in clause 17.2, the UE does not transmit a PRACH in a transmission occasion, Layer 1 notifies higher layers to suspend the corresponding power ramping counter. If due to power allocation to PUSCH/PUCCH/PRACH/SRS transmissions as described in clause 7.5, or due to power allocation in EN-DC or NE-DC or NR-DC operation, the UE transmits a PRACH with reduced power in a transmission occasion, Layer 1 may notify higher layers to suspend the corresponding power ramping counter. |
| CATT | Y | @ZTE, thanks for the double check. The part quoted by ZTE may have a point, but the spirit is mainly quoting other clause for clause 17.1, i.e. RedCap UE procedure. But now the CR is quoting 17.2 in other clause. Without this CR, the feature in other clause does not consider HD-FDD, and even when they are quoted in 17.1, it is still incomplete. And we don’t see the harm to adopt it, right?@vivo, power control spec has many ‘may’s (unfortunately). But we think it is OK in the yellow part, since when UE does not transmit PRACH due to HD-FDD, it may not be considered as PRACH failure, so UE may tell higher layers no need to increase the power ramping counter.  |
| DOCOMO |  | We are fine with the TP in general. Regarding TP for section 10.3, it is behavior for CA operation and hence not relevant to RedCap. Therefore, TP for 10.3 should be removed. |
| Ericsson |  | We are fine in principle with the proposed changes but will check further until Thursday for all the clauses impacted. If the text from clauses 17 and 17.1 quoted by ZTE above would be enough, the (many) updates in the spec could be avoided.  |
| FL4 | Some of the received responses indicate that a specification change may not be needed due to the following general clause in 38.213:Some responses expressed that they need further time to check whether/what updates are needed Based on one of the responses, the following updated proposal can be considered.**Medium Priority Proposal 2-1c: Agree the TP for 38.213 in** [**R1-2300649**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300649.zip) **except for the proposed change in clause 10.3.** |
| vivo |  | We are fine with it if majority support it.  |
| CATT | Y | @Ericsson, further check is appreciated. Our view is provided in previous round, explaining why ZTE’s quoting does not fully address every issue.@DOCOMO, right, seems only RedCap UE will be HD-FDD, even for the future. We are OK to drop the change for clause 10.3. |
|  |  |  |
|  |  |  |

# Issue #3: Initial DL BWP configuration

The following contribution concerns initial DL BWP configuration for RedCap UEs:

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| --- | --- | --- | --- |
| [19] | [R1-2301387](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301387.zip)(Section 2) | Remaining Issues on UE Complexity Reduction | Qualcomm Incorporated |

The contribution proposes to revisit a RAN2 agreement which may conflict with RAN1 agreement and specification.

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

|  |  |  |
| --- | --- | --- |
| **Company** | **Priority** | **Comments** |
| Vivo | M or L | We have a different understanding for following RAN1 specification. “For an initial DL BWP provided by *initialDownlinkBWP-RedCap* in *DownlinkConfigCommonSIB*, if a UE in RRC\_IDLE state or in RRC\_INACTIVE state monitors PDCCH according to Type1-PDCCH CSS set and does not monitor PDCCH according to Type2-PDCCH CSS set, the UE does not expect the initial DL BWP to include SS/PBCH blocks and the CORESET with index 0.”Above specification just specifies that when RedCap UE does not monitor Type2-PDCCH CSS set, the UE does not expect the initial DL BWP to include SS/PBCH blocks + CORESET with index 0. But it cannot be interpreted that when RedCap UE monitors Type2-PDCCH CSS set, the initial DL BWP shall include SS/PBCH blocks + CORESET with index 0. From our understanding, when RedCap monitors Type2-PDCCH CSS set, the initial DL BWP shall include SS/PBCH blocks, not necessarily include CORESET#0. For legacy UE, the Type 2 PDCCH CSS set does not need to always associated with CORESET#0, SIB1 can configure another common CORESET for Type 2 PDCCH CSS set.  |
| Qualcomm | H | According to RAN1 agreements and R17 specifications (TS 38.213 and TS 38.331), a RedCap UE is not expected to be configured with a paging and OSI CSS when the RedCap-specific initial DL BWP does not include the entire CORESET#0. However, the following RAN2 agreement allows NW to configure separate CSS sets for paging/OSI, which contradicts with RAN1’s agreements and current specifications: * *“If paging and OSI search space are configured in the RedCap-specific initial DL BWP which contains CD-SSB, it is up to NW configuration whether the associated physical time/frequency domain resources can be the same as or different from the ones in the legacy initial DL BWP (FFS whether we need to update the field description).”*

Therefore, we propose to **send an LS to RAN2, and ask RAN2 to revisit the agreement inconsistent with TS 38.213 and TS 38.331**. We don’t think RAN1 needs to spend much time on discussing how to revise the agreement of RAN2. |
| Nokia, NSB | M |  |
| CATT | M or L |  |
| Spreadtrum | H (potential duplication and/or conflicting for RAN1/RAN2 spec) | As we mentioned in our previous contributions, we thought there were many RAN1 agreement tried to address CORESET#0, but we discussed it for SSB issues, so in our view CORESET#0 issues can be left to RAN2. Maybe we need to revisit the agreements mentioning both SSB and CORESET#0, and if necessary, we can remove some descriptions on CORESET#0 from RAN1 spec. In our memory, there are some texts on CORESET#0 have been captured in 38.331 for paging/SIB1/OSI/RACH search space configurations. |
| ZTE, Sanechips |  | No spec conflict is observed, even when separate paging CSS is configured, since NW will guarantee that it is configured in the BWP with CD-SSB and CORESET#0.If the motivation for sending the LS is clear, we would be open to discuss. Hope more necessity is presented. |
| Nordic | L | separate BWP not containing CORESET#0 should not contain paging SS, based on previous RAN1 agreements.for separate BWP containing CORESET#0, gNB could configure separate RedCap specific CommonCORESET, but gNB should make sure UE is not required to monitor more than 2 CORESETs In other words, 2CORESET restriction should solve the issue here. |
| Intel | L | We share the interpretation from vivo and do not see a contradiction between RAN1 specs and RAN2 decision. |
| DOCOMO | L | TS38.213 and 331 has been already addressed. Thus, we don’t see the strong need to clarify that RAN2 agreement intends that Type 2 CSS can be configured to be monitored when RedCap specific separate initial BWP contains CD-SSB and **entire CORESET#0**. |
| LGE | L | We share the view vivo and Intel. We also don’t see a direct contradiction b/w RAN1 and RAN2 agreements. |
| Ericsson | M | Good to sort out.  |
| CMCC | H | Common understanding is desired.For the UE feature 28-1, only CD-SSB is mentioned.5. Separate initial DL BWP for RedCap UEs- It includes CSS/CORESET for random access- For separate initial DL BWP used for paging, CD-SSB is included- For separate initial DL BWP only used for RACH, SSB may or may not be included- For separate initial DL BWP used in connected mode as BWP#0 configuration option 1, CD-SSB is includedFor the following agreements, for a RedCap UE in connected mode, paging can only be configured if it contains CD-SSB and the entire CORESET#0. So we think common understanding is needed that whether a initial DL BWP with paging needs to contain CORESET#0. Agreement: [38.213]* The following working assumptions from RAN1#107-e are NOT confirmed for idle/inactive mode and furthermore they are replaced by the agreements further down for connected mode.
	+ For FR1,
		- For a separate initial DL BWP (if it does not include CD-SSB and the entire CORESET#0) from RAN1 perspective,
			* Working assumption: If it is configured for paging, RedCap UE expects it to contain NCD-SSB for serving cell but not CORESET#0/SIB from RAN1 perspective
	+ For FR2,
		- For a separate initial DL BWP (if it does not include CD-SSB~~and the entire CORESET#0~~) from RAN1 perspective,
			* Working assumption: If it is configured for paging, RedCap UE expects it to contain NCD-SSB for serving cell but not CORESET#0/SIB from RAN1 perspective
* For BWP#0 configuration option 1,
	+ For FR1,
		- For a separate initial DL BWP, for a RedCap UE in connected mode, paging can only be configured if it contains CD-SSB and the entire CORESET#0.
	+ For FR2,
		- For a separate initial DL BWP, for a RedCap UE in connected mode, paging can only be configured if it contains CD-SSB ~~and the entire CORESET#0~~.
* Note: For BWP#0 configuration option 2,
	+ For FR1,
		- For a separate initial DL BWP in connected mode (if it does not include CD-SSB and the entire CORESET#0), if it is configured for paging,
			* A RedCap UE supporting mandatory FG 6-1 (but not optional FG 6-1a) expects it to contain NCD-SSB for serving cell but not CORESET#0/SIB
			* A RedCap UE supporting FG 6-1a does not expect it to contain SSB/CORESET#0/SIB
	+ For FR2,
		- For a separate initial DL BWP in connected mode (if it does not include CD-SSB~~and the entire CORESET#0~~), if it is configured for paging,
			* A RedCap UE supporting mandatory FG 6-1 (but not optional FG 6-1a) expects it to contain NCD-SSB for serving cell but not CORESET#0/SIB
			* A RedCap UE supporting FG 6-1a does not expect it to contain SSB/CORESET#0/SIB

 Once the separate initial DL BWP contains CORESET#0, shared CSS and associated CORESET is good for network overhead reduction. |
| FL2/FL3 | Most received responses suggest low or priority for this issue. Some companies observe that there is no contradiction between RAN1 specs and RAN2 decision. **Medium Priority Question 3-1b: Based on the clarification from companies (e.g., from Vivo) in the previous round, is there a need to send an LS to RAN2 asking them to revisit the following agreement?**

|  |
| --- |
| If paging and OSI search space are configured in the RedCap-specific initial DL BWP which contains CD-SSB, it is up to NW configuration whether the associated physical time/frequency domain resources can be the same as or different from the ones in the legacy initial DL BWP (FFS whether we need to update the field description). |

  |
| **Company** | **Y/N** | **Comments** |
| vivo | N | As also can be seen from RAN1 agreements/working assumption cited by CMCC (although this WA is overridden by RAN conclusion), our understanding is for paging monitoring, the separate initial BWP should contain SSB, but not necessarily contains the CORESET#0.* Working assumption: If it is configured for paging, RedCap UE expects it to contain NCD-SSB for serving cell but not CORESET#0/SIB from RAN1 perspective
 |
| CATT | N | Seems no need. |
| Spreadtrum | Y | We may miss some background, but according to current spec, e.g. 38.331-h30, CORESET#0 should be included in RAN2 conclusion. CORESET#0 was widely discussed in RAN2. In our view, RAN1 working assumption quoted by vivo may be out of date a little bit. Support to remind RAN2 to revisit. Narrowing down paging/OSI patterns (excluding corner cases as much as possible) is friendly for UE implementation.***pagingSearchSpace***ID of the search space for paging (see TS 38.213 [13], clause 10.1). If the field is absent, the UE does not receive paging in this BWP (see TS 38.213 [13], clause 10). This field is absent for the RedCap-specific initial downlink BWP, if it does not include CD-SSB and the entire CORESET#0. In that case, a RedCap UE in RRC\_IDLE or RRC\_INACTIVE shall monitor paging in the initial DL BWP that includes CORESET#0.***searchSpaceOtherSystemInformation***ID of the Search space for other system information, i.e., *SIB2* and beyond (see TS 38.213 [13], clause 10.1). If the field is absent, the UE does not receive other system information in this BWP. This field is absent for the RedCap-specific initial DL BWP, if it does not include CD-SSB and the entire CORESET#0. In that case, a RedCap UE in RRC\_IDLE or RRC\_INACTIVE shall monitor PDCCH to receive other system information using *searchSpaceOtherSystemInformation* in the initial DL BWP that includes CD-SSB and the entire CORESET#0.***searchSpaceSIB1***ID of the search space for *SIB1* message. In the initial DL BWP of the UE′s PCell, the network sets this field to 0. If the field is absent, the UE does not receive *SIB1* in this BWP. (see TS 38.213 [13], clause 10). This field is absent for the RedCap-specific initial DL BWP, if it does not include CD-SSB and the entire CORESET#0.Compared to RAN2 agreement:

|  |
| --- |
| If paging and OSI search space are configured in the RedCap-specific initial DL BWP which contains CD-SSB, it is up to NW configuration whether the associated physical time/frequency domain resources can be the same as or different from the ones in the legacy initial DL BWP (FFS whether we need to update the field description). |

Does it mean RRC CONNECTED state?  |
| Qualcomm | Y | Based on the discussion of last round, it is obvious that companies in RAN1 have quite different understandings for the RAN2#118 agreement, which suggests it is necessary for RAN1 to send an LS to RAN2 and ask RAN2 to clarify. As commented by Spreadtrum, CMCC and Ericsson, it is good to sort out the potential issues/consequences of the RAN2 agreement, and achieve a common understanding between NW and UE.Moreover, we don’t think the comments of Vivo are valid. The working assumption cited by Vivo was obsolete and is not agreed by 3GPP. Furthermore, we don’t think the argument for “paging traffic offloading” holds with a separate paging CSS, since generally the UE type (RedCap or non-RedCap) is not known to NW/RAN when the UE is in idle/ inactive state. As a result, gNB has to page an idle/inactive UE in two different paging CSS sets, if a separate paging CSS is configured for RedCap UE. In fact, duplicating PDCCH/paging messages for idle/inactive UEs in two different CORESETs or paging CSS sets increase the signaling overhead, and does not help with load balancing for paging. Similar observations can be made for OSI as well, especially when the SIBs are shared between different UE types.Finally, we’d like to encourage the opponents to our proposal to read our contribution [R1-2301387](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301387.zip) more carefully if they have any further questions.  |
| DOCOMO | N | We don’t see the strong need. |
| Ericsson |  | Since it is already captured in TS 38.331 (as also quoted by Spreadtrum above) that paging and OSI can only be configured in a RedCap-specific initial BWP if it contains CD-SSB and CORESET#0, an LS to RAN2 might not be necessary? |
| Huawei |  | “if it contains CD-SSB and CORESET#0,” the text in 331 already clarified that the condition should be the BWP containing all; otherwise, including the case mentioned by proponent, the current spec is already clear on the configuration. |
| LGE |  | We don’t see strong needs as well. |
| FL4 | Based on the received responses, the following updated question can be considered.**Medium Priority Question 3-1d: Based on the further clarifications from companies (e.g., from Spreadtrum) in the previous round, is there a need to send an LS to RAN2 asking them to revisit the following agreement?**

|  |
| --- |
| If paging and OSI search space are configured in the RedCap-specific initial DL BWP which contains CD-SSB, it is up to NW configuration whether the associated physical time/frequency domain resources can be the same as or different from the ones in the legacy initial DL BWP (FFS whether we need to update the field description). |

 |
| CMCC | Y | The field descriptions quoted by Spreadtrum mean RAN2 is aware of CORESET#0 presentation for paging and OSI,SIB1. However, it seem better for RAN2 to clarify what’s the intention for the agreement. |
| Spreadtrum | Y | By the way, when I’m checking RAN1 spec for CORESET#0, I suddenly find I get confused about the following text:For an active DL BWP not provided by *BWP-DownlinkDedicated*, if a UE does not indicate 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 and, for SS/PBCH block and CORESET multiplexing pattern 1, the CORESET with index 0.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*.The text in green means including CD-SSB and CORESET#0 (when multiplexing pattern 1), but text in read means including CD-SSR or NCD-SSB. Is there conflicting? Can someone clarify it for me?Back to ISSUE #3, is it relevant? Can we delete RAN1 spec to avoid mentioning CORESET#0 in RAN1 spec as much as possible?~~For an active DL BWP not provided by~~ *~~BWP-DownlinkDedicated~~*~~, if a UE does not indicate 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 and, for SS/PBCH block and CORESET multiplexing pattern 1, the CORESET with index 0.~~ |
| vivo |  | We do not see the strong need. But we are fine with Spreadtrum’s suggestion to either delete the “and, for SS/PBCH block and CORESET multiplexing pattern 1” in the green text or add “and, for SS/PBCH block and CORESET multiplexing pattern 1, the CORESET with index 0” for above red text as below to make the spec aligned:“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 and, for SS/PBCH block and CORESET multiplexing pattern 1, the CORESET with index 0 or the SS/PBCH blocks provided by *NonCellDefiningSSB*.” |
| CATT |  | Don’t feel the strong need. For RedCap UE, it only needs to consider RedCap related channels, and RedCap related rules. It does not need to care those for normal UE (if the resource is separated). Ericsson and HW’s comment in previous round does not solve the concern? |
| Qualcomm | Y | Based on the comments above and the relevant specs (TS 38.331 and TS 38.213), **it is obvious** **there are still ambiguities and confusions regarding the CORESET and paging/OSI CSS sets configuration for RedCap UE in idle, inactive and connected states**. Since the RAN2#118 agreement was the origin of such ambiguities/confusions and it is unclear which RRC state it referred to, it is necessary to send an LS to RAN2, and ask RAN2 to revisit/clarify their previous agreement so that the signaling of NW and implementation of RedCap UE will be consistent in all RRC states  |
| Nokia, NSB. |  | Qualcomm’s [R1-2301387](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301387.zip), does present RAN1 and RAN2 text extracts that do seem misaligned and justify a potential LS to RAN2. |
| Spreadtrum | Y | Agree QC and Nokia to initiate an LS to RAN2 for alignment. Furthermore, we can address my question about inconsistency within RAN1 spec.I try to remember the past discussion and recall how the inconsistency come from. In my bad memory, the following text may mean initial DL BWP in RRC CONNECTED:For an active DL BWP not provided by *BWP-DownlinkDedicated*, if a UE does not indicate 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 and, for SS/PBCH block and CORESET multiplexing pattern 1, the CORESET with index 0.Therefore, I think maybe we miss “initial” for it, and maybe we can change the two paragraphs to achieve consistency:For an active DL BWP with BWP index 0 not provided by *BWP-DownlinkDedicated*, if a UE does not indicate 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 and, for SS/PBCH block and CORESET multiplexing pattern 1, the CORESET with index 0.For an active DL BWP with BWP index not equal to 0 provided by *BWP-DownlinkDedicated*, ~~unless~~if a UE does not indicate~~s~~ 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*. |
| OPPO | Y | We think it would be beneficial to send the LS to RAN2 to revisit the agreement. |

# Issue #4: Separate CSS configuration

The following contribution concerns separate CSS configuration for RedCap UEs:

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| --- | --- | --- | --- |
| [19] | [R1-2301387](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301387.zip)(Section 3) | Remaining Issues on UE Complexity Reduction | Qualcomm Incorporated |

The contribution proposes to specify rules to ensure consistent CSS configuration for RedCap and non-RedCap UEs.

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

|  |  |  |
| --- | --- | --- |
| **Company** | **Priority** | **Comments** |
| Vivo |  | It would be good to have consistent CSS configuration that can be achieved by NW implementation. So, we are not sure whether it is essential or necessary.  |
| Qualcomm | H | We think consistent/shared CSS configurations are essential to avoid ambiguity of NW configuration and UE implementation due to the following reasons:* using the same time/frequency resources saves the system overhead of NW
* monitoring the same CSS sets associated with a common CORESET (e.g., CORESET#0, or the additional CORESET shared by the initial DL BWPs of RedCap and non-RedCap UEs) reduces the implementation complexity for all UEs
* shared CSS configurations comply with existing agreements and specifications for RedCap/non-RedCap UEs
* avoiding extra discussions and specification efforts on avoiding or handling the duplicates/collisions of broadcast information on different time/frequency resources
 |
| Nokia, NSB | M | We are OK to discuss. We have marked as M, as with initially see this more as an optimization/restriction. |
| CATT |  | We think current spec supports what the contribution is proposing, and probably a natural choice from NW’s view. Additional restriction seems unnecessary.  |
| Spreadtrum | Y (Combined to Issue #3) | We think RAN2 spec is more complete and RAN2 had more plenty of discussion for CORESET#0 related issues. Some corner cases had been excluded in RAN2 spec in our understanding. As for Issue #3, we think the texts for CORESET#0 in RedCap Section of 38.213 can be removed, and RAN2 spec is clear, e.g. 38.331. |
| ZTE, Sanechips | L | For the UE, separate configuration or shard configuration shows no difference. For the gNB, separate CSS, e.g., for paging, also has some benefits of offloading in some cases. We don’t see the necessity to revert RAN2’s conclusion. |
| Nordic | L | CSS can be either in RedCapCommonCORESET or in CORESET#0, it cannot be in nonRedCapCommonCORESET, because it would break the 2CORESET capability rule. We do not think there is an issue. |
| Intel | L | Same view as Nordic. |
| DOCOMO | L | In our understanding, it can be achieved by NW configuration with current specification, and hence the motivation is unclear for us. |
| LGE | L | Share the view with Nordic and Intel. |
| Ericsson | L |  |
| CMCC | L | Most of the issues can be solved by NW implementation. |
| FL2 | Most received responses suggest low priority for this issue. Some responses also indicate that there does not seem to be a need to specify new rules to ensure consistent CSS configuration for RedCap and non-RedCap UEs. FL suggests coming back to this issue at a later stage if needed. |

# Issue #5: PRACH/PUSCH occasion validation

The following contributions concern PRACH/PUSCH occasion validation for RedCap UEs:

|  |  |  |  |
| --- | --- | --- | --- |
| [24] | [R1-2301781](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301781.zip)(Section 3) | On RedCap remaining issues (revision of [R1-2301606](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301606.zip)) | MediaTek Inc. |
| [25] | [R1-2301782](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301782.zip)(38.213 CR) | Draft CR on validation of PRACH and PUSCH occasions with NCD-SSB (revision of [R1-2301607](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301607.zip)) | MediaTek Inc. |

PRACH/PUSCH occasion validation was also discussed in the previous RAN1 meeting, see Issue #4 in the FLS in [3].

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

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| --- | --- | --- |
| **Company** | **Priority** | **Comments** |
| Vivo | L or M | The correction may not be needed since current Clause 8.1 and 8.1A defines the valid PRACH/PUSCH is determined based on the SSB provided by *ssb-PositionsInBurst* in SIB1 or in *ServingCellConfigCommon*   |
| Qualcomm |  | * If NCD-SSB is configured in the initial/non-initial DL BWP of RedCap UE on unpaired spectrum, NCD-SSB should only fall in DL/flexible symbols. and do not fall in UL symbols of a TDD slot, which is similar to CD-SSB.
* Based on current spec (Clause 17.1 of TS 38.213), a RedCap UE should use both CD-SSB and NCD-SSB for RO validation on unpaired spectrum.
 |
| Nokia, NSB | Low | Similar view as Vivo.  |
| CATT | L | Similar view as vivo. |
| Spreadtrum | L | Pending after SDT issues are solved. |
| ZTE, Sanechips | M | We are OK to discuss this issue. If no correction is needed, we can have a conclusion. |
| Nordic | H | We think it should be fine to validate based on CD-SSB only, in RRC connected, UE may measure NCD-SSB before intended PRACH or PDCCH order. But lets discuss.  |
| Intel | L | Same view as vivo. |
| DOCOMO | L | Similar view as vivo. |
| MediaTek | H | About vivo’s comment, strictly speaking, Clause 8.1 and 8.1A mainly clarify that “the SSB candidate index” is from “the SSB index” indicated in ssbPositionInBurst in SIB1 or ServingCellConfigCommon. This clarifies about SSB candidate indices and SSB indices (Note: These two may be different in unlicensed operation). But this does not say the SSBs are CD-SSBs in our opinion. NCD-SSBs shares the exact same SSB indices with their corresponding CD-SSBs. With the TP in 17.1 on top of 8.1, some companies think UE configured with NCD-SSB should apply NCD-SSB instead From our offline discussion with companies, different companies have different understanding about which SSBs (CD-SSB, NCD-SSB, both, or none) should be applied for the new cases introduced by RedCap: BWP containing no SSB, and BWP containing NCD-SSB but not CD-SSB. * For example, with the TP in 17.1 on top of 8.1, some companies think UE configured with NCD-SSB should apply NCD-SSB instead CD-SSB, some companies think both NCD-SSB and CD-SSB should be applied, while others think only CD-SSB is applied. We have got three different answers for this case already!

We really think RAN1 should spend some time to align companies understanding on this issue. **Proposal 1:** For TDD, RAN1 clarifies **which SSBs** should be applied by UE for PRACH occasion validation per 8.1 and 17.1 in the following cases* Case 1-1: UE performing RACH in initial access in RedCap-specific initial BWP w/o any SSB
* Case 1-2: A connected RedCap UE configured with NCD-SSB in the RedCap-specific initial BWP w/o CD-SSB
* Case 2: A RedCap UE supporting both FG28-1 and 28-1a not configured with any SSB for all RRC states in the RedCap-sp

**Proposal 2:** For TDD, if it is agreed that a UE may apply different SSBs and hence may result in different *valid* RO-SSB association patterns for different RRC states, RAN1 further clarifies ***when exactly*** UE should apply which SSB-RO association pattern. |
| LGE | L | Share the view with vivo. |
| Ericsson | M | Fine with discussing further. |
| CMCC | L | Similar view as vivo. |
| FL2 | Most received responses suggest low priority for this issue. However, based on the received responses, it seems that companies are not aligned in their understanding with regards to which SSB should be used for PRACH/PUSCH occasion validation. Therefore, it may be beneficial to discuss the following separate cases (as suggested by MediaTek).**High Priority Proposal 5-1b: Discuss the need to clarify PRACH/PUSCH 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.**
 |
| FL3 | The following agreement was made in the Tuesday online session: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.

**High Priority Question 5-1c: Companies are invited to 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.**
 |
| **Company** | **Comments** |
| vivo | Firstly, we would like to clarify what is validation for PUCCH occasion? Except PUCCH occasion, for PRACH occasion and PUSCH occasion for Type 2 RA validation, our views are following: For issue 5.1: CD-SSB is used to validate the PRACH occasion and PUSCH occasion;For issue 5.2 and 5.3: from our understanding, CD-SSB is used to validate the PRACH occasion and PUSCH occasion. Since NW cannot distinguish whether connected or idle/inactive RedCap UE performing the contention-based RACH, it is better to use the same SSB for RO/PO validation. Otherwise it may have impacts on the SSB and RO association.  |
| CATT | In all cases, RO validation should only consider CD-SSB. This is clear in current spec. The reason behind is that only CD-SSB is cell-specific and always-on, and it is impossible for a TDD gNB to perform DL and UL at the same time, so it is impossible a RO is valid if it collide with CD-SSB.We agree that collision due to NCD-SSB can refer to CD-SSB, but this is no collision case. It is RO validation. |
| Spreadtrum | NCD-SSB is not always-on signal different from CD-SSB. Therefore, we think collision rule for NCD-SSB may not be needed like those for CD-SSB, and maybe gNB can resolve it. |
| MediaTek | Responding to vivo’s question on PUCCH, at least **Clause 9.2.6 in TS38.213** on PUCCH repetition occasion determination should be clarified.For PUCCH repetition occasion determination, the identified questions are similar to PRACH/PUSCH occasion validation in clauses 8.1 and 8.1A. In the following figure, we assume both CD-SSB and NCD-SSB have a periodicity of 10ms while the time offset between them is 5ms. 1. For RedCap UE in RedCap-specific initial BWP (light green) that is configured with NCD-SSB, does it take the CD-SSB outside its active BWP for PUCCH repetition occasion determination?
	1. *If CD-SSB is not considered, RedCap UE may tranmit PUCCH on occasions that collide with CD-SSB. This actually may cuase interference to legacy non-RedCap UEs that are receiving CD-SSB.*
2. For normal (non-RedCap) UE in non-RedCap initial BWP (pink) who does not know NCD-SSB and will not take NCD-SSB into consideration, then it will therefore transmit PUCCH even when the PUCCH symobls collide with NCD-SSB.

Finally, in our view, to simply UE’s implementation, UE should always take only CD-SSB for PRACH/PUSCH/PUCCH occasion validation. **Proposal**: For TDD, UE always applies CD-SSB but not NCD-SSB from *NonCellDefiningSSB* to determine valid PRACH occasions (in Clause 8.1), valid PUSCH occasions (in Clause 8.1A), and the 𝑁\_PUCCH^repeat slots for a PUCCH transmissionin, regardless of whether/which SSB is configured in the BWP.* Note: This implies gNB should configure NCD-SSB in a way that it can only invalidate PRACH/PUSCH occasions that are already invalidated by CD-SSB in TDD.

 |
| Qualcomm | If time allows, we are fine to discuss the validation procedures for PRACH/PUSCH for unpaired spectrum.However, if the RO validation rule based on “Ngap” (Clause 8.1of TS 38.213) is due to the concerns of NW deployment (e.g., large RTT vs small CP of SSB), it is a common issue for CD-SSB and NCD-SSB. Therefore, when the time offset between CD-SSB and NCD-SSB is not zero in TDD band, both CD-SSB and NCD-SSB may need to be considered for PRACH/PUSCH occasion validation (based on TS 38.211, NTA=0 is assumed by UE for both PRACH and msgA PUSCH transmission).To minimize the spec. impacts and RAN1 efforts for PRACH/PUSCH validation w.r.t. SSB, if the NCD-SSB configured in the active DL BWP always has a zero time offset w.r.t. the CD-SSB in TDD, then the PRACH/PUSCH occasion validation in the active UL BWP can also be based on CD-SSB. The zero time offset also alleviates the concerns of NW deployment regarding Ngap. The restriction on zero time offset is mainly for an UL BWP configured with PRACH/msgA resources and the associated DL BWP configured with NCD-SSB. It will not violate the previous agreements on time offset configuration for NCD-SSB. |
| DOCOMO | We share the similar view with companies that validation should be based on CD-SSB for all the cases.  |
| Ericsson | For issues 5.1 and 5.3, PRACH and PUSCH occasion validation should be based on CD-SSB as it is unlikely that the UE would know the time-domain positions of NCD-SSB (if any in the cell). For Issue 5.2, although we are fine in principle to also use CD-SSB but will check further until Thursday.  |
| LGE | In the spirit of minimizing spec impact in CR phase, we think there is no critical issue if we follow what is already written in the spec which is to validate PRACH/PUSCH occasions based only on CD-SSB. |
| FL4 | Based on the received responses, the following proposal can be considered. The remaining case (Issue 5.2) is addressed in new Question 5-2a further down in this document.**High Priority Proposal 5-1d:****No issues with the PRACH/PUSCH/PUCCH occasion validation have been identified 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 5.3: A RedCap UE in connected state operating in a DL BWP without CD-SSB or NCD-SSB.**
 |
| **Company** | **Y/N** | **Comments** |
| CMCC | Y | If validation is based on CD-SSB, there will be no different validation results for such UEs, so no issues.  |
| vivo | Y |  |
| CATT | Y | Although we think the same principle shall be applied to all cases, we are OK to confirm it in a step by step way. |
| Qualcomm | Y |  |
| Nokia, NSB. | Y | Should this be reflected as a conclusion, given no expected spec impacts? |
| OPPO | Y | The 2 cases have not ambiguity as it should be based on CD-SSB |

**FL4 High Priority Question 5-2a:**

**Are there any issues with the PRACH/PUSCH/PUCCH occasion validation for the following case?**

* **Issue 5.2: A RedCap UE in connected state operating in a DL BWP without CD-SSB but with NCD-SSB.**

**If yes, please describe the issue and propose solutions in the comment field.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| CMCC |  | Common understanding is needed for such UEs about the reference SSB used for PRACH/PUSCH/PUCCH occasion validation. If the common understanding is that CD-SSB is used, then no issues. |
| vivo |  | For this case, we think CD-SSB should be used for validation for PRACH/PUSCH. But on one hand, we also understand QC’s points on the there may not be sufficient time for UE to switch between NCD-SSB reception and PRACH/MSGA PUSCH transmission if only CD-SSB is taken into account for PRACH/MSG A PUSCH validation. On the other hand, this issue can also be handled by NW proper configuration.For PUCCH occasion validation, thanks MTK for the detailed explanation. We think for PUCCH repetition, the collision should consider the SSB within the active BWP. So only NCD-SSB should be considered for this case. It is also aligned with following spec in 213 clause 17.1 and the Clause 9.2.6 in TS38.213 cited by MTK.“For a RedCap UE indicated presence of SS/PBCH blocks within an active DL BWP by *NonCellDefiningSSB*, collision handling between downlink receptions or uplink transmissions and the SS/PBCH blocks are same as described for a UE indicated presence of SS/PBCH blocks by *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon* described in all other clauses, unless otherwise stated.” |
| CATT |  | We think there is no issue, only CD-SSB should be taken into account… Just think that, only CD-SSB is always-on and cell-common, and it is for sure that the TDD gNB cannot receive any UL at this time. A RO can be valid only if it does not collide with CD-SSB. |
| Qualcomm |  | If a RedCap UE operating on unpaired spectrum is provided RRC-configured NCD-SSB in connected state and the time offset between CD-SSB and NCD-SSB is not zero, the UE should consider both CD-SSB and NCD-SSB for PRACH/PUSCH occasion validation. Otherwise, the PRACH/PUSCH occasions validated by CD-SSB alone will not meet the guard period of “Ngap symbols” specified in Clause 8.1 and Clause 8.1A of TS 38.213, and incur interference between UL and DL (of serving/neighbor cells).   |
| Nokia, NSB. |  | Similar position to CATT, i.e. only CD-SSB should be used for validation.  |
| OPPO |  | We prefer to clarify the understanding to be based on CD-SSB. The spec is not very clear about this.But, then, the spec. may check with other Gap rules.  |

# Issue #6: PUSCH TDRA misalignment

The following contributions concern PUSCH TDRA misalignment for RedCap UEs:

|  |  |  |  |
| --- | --- | --- | --- |
| [8] | [R1-2300367](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300367.zip)(Section 2.2) | Discussion on RedCap remaining issues | ZTE, Sanechips |
| [9] | [R1-2300368](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300368.zip)(38.214 CR) | Correction on TDRA misalignment of PUSCH for RedCap | ZTE, Sanechips |

PUSCH TDRA misalignment was also discussed in the previous RAN1 meeting, see Issue #3 in the FLS in [3].

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

|  |  |  |
| --- | --- | --- |
| **Company** | **Priority** | **Comments** |
| Vivo | L | Not needed. It can be handled by gNB implementation/proper configuration |
| Qualcomm | M | OK to discuss if time allows. |
| Nokia, NSB | L |  |
| CATT | L | This issue may be valid, but we are not sure it is essential since many gNB implementation methods can address it.  |
| Spreadtrum | M | CORESET#0 may be updated in 38.214 to “initial DL BWP”? We think CORESET#0 in the TDRA table means initial DL BWP. It is OK for legacy, but is not so correct for RedCap. |
| ZTE, Sanechips | H | This issue is better to be addressed before widely deployed, since it would limit the gNB configuration for PUSCH if it is left to gNB implementation and finally cause the lower system efficiency. |
| Nordic | L |  |
| Intel | L |  |
| DOCOMO | L | NW can avoid the misalignment issue. Thus we don’t see the need to discuss it in this meeting. |
| LGE | L | Okay to discuss if time allows, but don’t see an urgency on this issue. |
| Ericsson | L |  |
| CMCC | L |  |
| FL2 | Most received responses suggest low priority for this issue. FL suggests coming back to this issue at a later stage if needed. |

# Issue #7: PUSCH repetition type B

The following contribution concern PUSCH repetition type B for RedCap UEs:

|  |  |  |  |
| --- | --- | --- | --- |
| [22] | [R1-2301542](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301542.zip)(38.214 CR) | Corrections on invalid symbol determination for PUSCH repetition Type B transmission for RedCap UE | Sharp, Vivo |

PUSCH repetition type B for HD-FDD was addressed by the agreed CR in [30], and now this draft CR addresses TDD.

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

|  |  |  |
| --- | --- | --- |
| **Company** | **Priority** | **Comments** |
| Vivo | H | As FL mentioned, PUSCH repetition type B for HD-FDD was addressed by the agreed CR in [30], and now this draft CR is to addresses for TDD case. |
| Qualcomm | M | OK to discuss if time allows. |
| Nokia, NSB | M |  |
| CATT | M | OK. |
| Spreadtrum | M |  |
| ZTE, Sanechips | L | It seems to be covered by the following:For a RedCap UE indicated presence of SS/PBCH blocks within an active DL BWP by *NonCellDefiningSSB* in unpaired spectrum, collision handling between uplink transmissions and the SS/PBCH blocks are same as described for a UE indicated presence of SS/PBCH blocks by *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon* described in all other clauses, unless otherwise stated. |
| Nordic  | M |  |
| Intel | M/H | OK to discuss. |
| DOCOMO | H | This CR should be applied same as PUSCH repetition type B for HD-FDD. Thus, we are fine to discuss it in this meeting. |
| Sharp | H | The description quoted by ZTE is from TS38.213. We cannot interpret that the description in TS 38.213 can also cover TS38.214 without a specific reference to TS38.214. In our view, without adding a spec reference, “all other clauses” refers to the document TS38.213 itself and cannot extent to other documents. Therefore, comparing to adding references, for example, “in all other clauses of the document and [6, TS 38.214]”, correction in the draft CR is a simple way to address for TDD case. |
| LGE | M | Okay to discuss. |
| Ericsson | M | Fine with discussing further. |
| CMCC | M | The description quoted by ZTE can solve this, and we are also OK to clearly state it. |
| FL2/FL3 | Majority of the companies suggest medium priority for this issue. Based on the received responses, the following proposal can be considered.**Medium Priority Proposal 7-1b: Agree the TP for 38.214 in** [**R1-2301542**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301542.zip)**.** |
| **Company** | **Y/N** | **Comments** |
| vivo | Y |  |
| CATT | Y |  |
| Qualcomm |  | This proposal has lower priority than the other FL-3 proposals above. |
| DOCOMO | Y |  |
| Ericsson | Y |  |
| LGE | Y |  |
| FL4 | Based on the received responses, it seems that the proposal may be accepted.**Medium Priority Proposal 7-1b: Agree the TP for 38.214 in** [**R1-2301542**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301542.zip)**.** |
| CMCC | Y |  |
| vivo | Y |  |
| CATT | Y |  |
| Qualcomm | N | Agree with the comments of ZTE. It is not necessary to have this TP. |
| Nokia, NSB. | Y |  |

# 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] | [R1-2212530](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_111/Docs/R1-2212530.zip) | FL summary #1 on Rel-17 RedCap maintenance | Moderator (Ericsson) |
| [4] | [R1-2212531](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_111/Docs/R1-2212531.zip) | FL summary #2 on Rel-17 RedCap maintenance | Moderator (Ericsson) |
| [5] | [R1-2212532](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_111/Docs/R1-2212532.zip) | FL summary #3 for Rel-17 RedCap maintenance | Moderator (Ericsson) |
| [6] | [R1-2212980](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_111/Docs/R1-2212980.zip) | FL summary #4 for Rel-17 RedCap maintenance | Moderator (Ericsson) |
| [7] | [R1-2212981](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_111/Docs/R1-2212981.zip) | RAN1 agreements for Rel-17 NR RedCap | Rapporteur (Ericsson) |
| [8] | [R1-2300367](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300367.zip) | Discussion on RedCap remaining issues | ZTE, Sanechips |
| [9] | [R1-2300368](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300368.zip) | Correction on TDRA misalignment of PUSCH for RedCap | ZTE, Sanechips |
| [10] | [R1-2300418](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300418.zip) | Remaining issues on SDT support for Rel-17 RedCap UE | Vivo |
| [11] | [R1-2300499](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300499.zip) | Support for SDT in a RedCap-specific initial DL BWP without SSB | Ericsson |
| [12] | [R1-2300542](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300542.zip) | Discussion on remaining details of RedCap SDT operation | Xiaomi |
| [13] | [R1-2300648](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300648.zip) | Discussion on SDT in separate initial BWP without CD-SSB | CATT |
| [14] | [R1-2300649](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300649.zip) | Correction on impact of HD-FDD operation in Rel-17 | CATT |
| [15] | [R1-2300854](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300854.zip) | Remaining issue of Rel-17 RedCap UE | NEC |
| [16] | [R1-2300977](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2300977.zip) | Discussion on SDT procedure related RedCap remaining issues | CMCC |
| [17] | [R1-2301148](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301148.zip) | RedCap support of SDT | Nokia, Nokia Shanghai Bell |
| [18] | [R1-2301328](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301328.zip) | On Small Data Transmission for Redcap UEs | Apple |
| [19] | [R1-2301387](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301387.zip) | Remaining Issues on UE Complexity Reduction | Qualcomm Incorporated |
| [20] | [R1-2301470](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301470.zip) | Correction on reference clauses for PDCCH repetition, UCI multiplexing/prioritization, and PUCCH transmission for HD-FDD operation | NTT DOCOMO, INC. |
| [21] | [R1-2301471](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301471.zip) | Discussion on corrections and SDT operations for RedCap UE | NTT DOCOMO, INC. |
| [22] | [R1-2301542](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301542.zip) | Corrections on invalid symbol determination for PUSCH repetition Type B transmission for RedCap UE | Sharp, Vivo |
| [23] | [R1-2301723](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301723.zip) | Remaining issues during SDT procedure for RedCap UEs | Huawei, HiSilicon |
| [24] | [R1-2301781](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301781.zip) | On RedCap remaining issues (revision of [R1-2301606](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301606.zip)) | MediaTek Inc. |
| [25] | [R1-2301782](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301782.zip) | Draft CR on validation of PRACH and PUSCH occasions with NCD-SSB (revision of [R1-2301607](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112/Docs/R1-2301607.zip)) | MediaTek Inc. |
| [26] | [R2-2213001](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_120/Docs/R2-2213001.zip) | Report from Break-out session on NR-NTN, IoT-NTN, RedCap, and CE | Vice Chairman (ZTE Corporation) |
| [27] | [R1-2200002](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_107b-e/Docs/R1-2200002.zip) | Report of RAN1#107-e meeting | ETSI MCC |
| [28] | [R1-2205193](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2205193.zip) | Report of RAN1#108-e meeting | ETSI MCC |
| [29] | [R2-2202102](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202102.zip) | RAN2#116bis-e Meeting Report | ETSI MCC |
| [30] | [R1-2210630](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Docs/R1-2210630.zip) | 38.214 CR0356 (Rel-17, F) Correction on invalid symbol determination for PUSCH repetition type B for HD-FDD | Moderator (Ericsson), Vivo, Sharp, Intel, Nokia, Nokia Shanghai Bell, Ericsson, Samsung |
| [31] | [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) |