**3GPP TSG RAN WG1 #110 R1-22xxxxx**

**Toulouse, France, August 22th - 26th, 2022**

**Agenda Item: 8.17**

**Source: Moderator (ZTE)**

**Title: Summary on remaining physical layer issues of small data transmission**

**Document for: Discussion**

# Introduction

This document contains the summary of RAN2 LS related issues, editorial corrections, RedCap related issues and other remaining issues in RAN1#110 meeting. The following email thread is used:

[110-R17-Others] 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 – Ziyang (ZTE)

# RAN2 LS related issues

## Redundancy version

### First round discussion

In RAN2 LS [R1-2205736](file:///C%3A%5CUsers%5Cyounsun%5CDocuments%5C3GPP%20documents%5CRAN1%20tdocs%5CTSGR1_110%5CDocs%5CR1-2205736.zip), RAN2 has informed RAN1 that they made an agreement “For autonomous re-tx, fix the RV to be 0 for both the initial and retransmission of initial CG-SDT transmission” and asks RAN1 to consider corresponding impact on RAN1 spec.

In R1-2206079, ZTE thinks according to the RAN2 discussion in last meeting, it’s concluded that soft combination is not useful for autonomous re-transmission of initial SDT transmission, since the re-transmission is autonomously operated by UE if initial transmission fails, gNB is even not aware of whether the re-transmission happens or not. Therefore, during SDT procedure, redundancy version needs to be fixed to 0 for both initial and autonomous retransmission of initial CG-SDT transmission, which needs to be captured in TS 38.214 as shown in TP #2.1-1.

**TP#2.1-1**

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| --- |
| ***Reason for change:*** RAN2 agrees that during SDT procedure, redundancy version needs to be fixed to 0 for both initial transmission and autonomous retransmission of initial CG-SDT transmission***Summary of change:*** descriptions for fixing the RV to be 0 for both initial transmission and autonomous retransmission of initial CG-SDT transmission are added in section 6.1.2.3.1 and 6.1.2.3.2.***Consequences if not approved:*** RV for initial transmission and autonomous retransmission of initial CG-SDT transmission is not clear.**TS38.214****< Unchanged text omitted >**6.1.2.3.1 Transport Block repetition for uplink transmissions of PUSCH repetition Type A with a configured grant**< Unchanged text omitted >**The procedures described in this clause apply to PUSCH transmissions of PUSCH repetition Type A with a Type 1 or Type 2 configured grant. The higher layer parameter *repK-RV* defines the redundancy version pattern to be applied to the repetitions. If *cg-RetransmissionTimer* is provided, the redundancy version for uplink transmission with a configured grant is determined by the UE. If CG-SDT procedure is initiated as described in clause 5.27 of [10, TS 38.321], the redundancy version for initial transmission and autonomous retransmission of initial configured-grant based PUSCH transmission shall be set to 0. If the parameter *repK-RV* is not provided in the *configuredGrantConfig* and *cg-RetransmissionTimer* is not provided, the redundancy version for uplink transmissions with a configured grant shall be set to 0. If the parameter *repK-RV* is provided in the *configuredGrantConfig* and *cg-RetransmissionTimer* is not provided, for the *n*th transmission occasion among *K* repetitions, *n*=1, 2, …, *K*, it is associated with *(mod((n-mod(n, N))/N,4)+1)th* value in the configured RV sequence, where *N*=1. If a configured grant configuration is configured with *startingFromRV0* set to *'off'*, the initial transmission of a transport block may only start at the first transmission occasion of the *K* repetitions. Otherwise, the initial transmission of a transport block may start at - the first transmission occasion of the *K* repetitions if the configured RV sequence is {0,2,3,1},- any of the transmission occasions of the *K* repetitions that are associated with RV=0 if the configured RV sequence is {0,3,0,3},- any of the transmission occasions of the *K* repetitions if the configured RV sequence is {0,0,0,0}, except the last transmission occasion when *K≥8*. **< Unchanged text omitted >**6.1.2.3.2 Transport Block repetition for uplink transmissions of PUSCH repetition Type B with a configured grant**< Unchanged text omitted >**The procedures described in this Clause apply to PUSCH transmissions of PUSCH repetition type B with a Type 1 or Type 2 configured grant.For PUSCH transmissions with a Type 1 or Type 2 configured grant, the nominal repetitions and the actual repetitions are determined according to the procedures for PUSCH repetition Type B defined in Clause 6.1.2.1. The higher layer configured parameters *repK-RV* defines the redundancy version pattern to be applied to the repetitions. If CG-SDT procedure is initiated as described in clause 5.27 of [10, TS 38.321], the redundancy version for initial transmission and autonomous retransmission of initial configured-grant based PUSCH transmission shall be set to 0. If the parameter *repK-RV* is not provided in the *configuredGrantConfig*, the redundancy version for each actual repetition with a configured grant shall be set to 0. Otherwise, for the *n*th transmission occasion among all the actual repetitions (including the actual repetitions that are omitted) of the *K* nominal repetitions, it is associated with *(mod((n-mod(n, N))/N,4)+1)th* value in the configured RV sequence, where *N* = 1. If a configured grant configuration is configured with *startingFromRV0* set to 'off', the initial transmission of a transport block may only start at the first transmission occasion of the actual repetitions. Otherwise, the initial transmission of a transport block may start at - the first transmission occasion of the actual repetitions if the configured RV sequence is {0,2,3,1},- any of the transmission occasions of the actual repetitions that are associated with RV=0 if the configured RV sequence is {0,3,0,3},- any of the transmission occasions of the actual repetitions if the configured RV sequence is {0,0,0,0}, except the actual repetitions within the last nominal repetition when *K≥8*.  |

In R1-2206773, vivo also proposes a draft CR to capture the RAN2 agreement in clause 19.1 in TS 38.213 as shown below.

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| **------------------------------ TS 38.213-----------------------------------****< Unchanged text omitted >**19.1 Configured-grant based PUSCH transmissionA UE determines a power of a PUSCH transmission as described in clause 7.1.1, where the UE obtains $PL\_{b,f,c}(q\_{d})$ using a RS resource from an SS/PBCH block with index associated with the PUSCH transmission. A UE can be provided a USS set by *sdt-CG-SearchSpace*, or a CSS set by *sdt-SearchSpace*, to monitor PDCCH for detection of DCI format 0\_0 with CRC scrambled by C-RNTI or CS-RNTI for scheduling PUSCH transmission or of DCI format 1\_0 with CRC scrambled by C-RNTI for scheduling PDSCH receptions [12, TS 38.331]. The UE may assume that the DM-RS antenna port associated with the PDCCH receptions, the DM-RS antenna port associated with the PDSCH receptions, and the SS/PBCH block associated with the PUSCH transmission are quasi co-located with respect to average gain and quasi co-location 'typeA' or 'typeD' properties. The UE transmits a PUCCH with HARQ-ACK information associated with the PDSCH receptions as described in clause 9.2.1 using a same spatial domain transmission filter as for the last PUSCH transmission.For initial transmission or autonomous retransmission of an initial transport block provided for the PUSCH transmission, the UE encodes the transport block using redundancy version number 0.**< Unchanged text omitted >** |

#### *Discussion point 2.1-1*

Whether and how to capture the RAN2 agreement about redundancy version:

* Option 1: Adopt TP#2.1-1 for TS 38.214
* Option 2: Adopt draft CR in R1-2206773 for TS 38.213
* Option 3: Other versions?

Any comments?

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| --- | --- |
| Company | Comment |
| vivo | Option 2 is preferred.As is known, RV 0 restrictions of MsgA/Msg3 PUSCH is also specified in 38.213, therefore it would be better to capture such restriction for CG PUSCH in SDT in 38.213 as well.In addition, option 2 can be applied for both types of CG PUSCH repetitions or for the case without repetition. Note that in legacy for autonomous retransmission supported in NR-U, the RV is determined by the RV indicated by CG-UCI multiplexed on CG PUSCH which is not allowed in SDT. Thus, this CR is necessary. |
| Intel | We agree the intention to capture this in the spec. however, it is not clear to us the definition of autonomous retransmission in either proposed CR. This was not defined anywhere in the RAN1 spec.  |
| Qualcomm | Option 2 is preferred |
| ZTE | OK with either one. For autonomous retransmission, if needed, it can refer to RAN2 spec in 331. |
| InterDigital | In either TP, is it clear what “initial TB” or “initial configured-based PUSCH” means? Initial after the UE transitions to inactive state? |
| Xiaomi | We have the same concern on the wording “initial TB” as InterDigital. |
| Ericsson | We prefer Option 2 |

## SDT common search space

In RAN2 LS [R1-2205736](file:///C%3A%5CUsers%5Cyounsun%5CDocuments%5C3GPP%20documents%5CRAN1%20tdocs%5CTSGR1_110%5CDocs%5CR1-2205736.zip), RAN2 has informed RAN1 that RAN2 has implemented the signalling using a choice structure between configuration of a SearchSpace and SearchSpaceId. Thus network can either configure an existing search space (using searchSpaceId) or configure a new search space (using searchSpace). RAN2 requests RAN1 to kindly confirm whether this is aligned with RAN1 understanding.

### 2.2.1 First round discussion

Huawei and vivo think existing search space is enough, if needed, UE specific search space can be used.

Ericsson thinks SDT common search space should be a new search space, so no need to configure an existing search space id.

ZTE, Intel and Xiaomi think that using a choice structure between configuration of SearchSpace and SearchSpaceId, can be a good compromise to give network flexibility to configure the SDT common search space.

FL thinks that RAN1’s original intention is to define a new common search space dedicated for SDT, so it’s a new search space instead of an existing common search space. If only existing search space id is configured, that means one of these 4 search spaces below has to be replaced by SDT common search space, however, these 4 CSS are also essential during SDT procedure. So FL suggests to confirm current RAN2’s solution to use a choice structure.

|  |
| --- |
|  commonSearchSpaceList SEQUENCE (SIZE(1..4)) OF SearchSpace OPTIONAL, -- Need R searchSpaceSIB1 SearchSpaceId OPTIONAL, -- Need S searchSpaceOtherSystemInformation SearchSpaceId OPTIONAL, -- Need S pagingSearchSpace SearchSpaceId OPTIONAL, -- Need S ra-SearchSpace SearchSpaceId OPTIONAL, -- Need S |

#### *Discussion point 2.2-1*

Whether RAN1 confirms that using a choice structure between an existing search space or a new search space is aligned with RAN1’s understanding.

Any comments?

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| --- | --- |
| Company | Comment |
| vivo | Choice structure is not needed in our view. We think defining a search space ID is enough. Reusing the existing 4 candidate search spaces would not cause additional number of search spaces required for UE to monitor for SDT. |
| Intel | We are fine with the proposal. Some editorial change to make it clear:***Discussion point 2.2-1***~~Whether RAN1 confirms that~~ using a choice structure between an existing search space or a new search space is aligned with RAN1’s understanding. |
| Qualcomm | Support the proposal of FL |
| Samsung  | Just to clarify FL’s comment on “If only existing search space id is configured, that means one of these 4 search spaces below has to be replaced by SDT common search space,” we think in this case, it is not the old one replaced by SDT one, just the SDT shares the same SS as the old one, right? |
| ZTE | Support to confirm the choice structure.To Samsung, from our understanding, at the same time, it’s not possible to share the same search space for SDT and other purposes, e.g. paging, since the RNTI for different search spaces are also different. If SDT common search space is configured with the same search space id with paging search space, it seems not appropriate for UE to monitor both SDT related PDCCH and paging PDCCH simultaneously in the same resource. |
| Huawei, HiSilicon | For SDT purpose and for CSS there is not much need to introduce a new SS. |
| Sony | Support FL proposal. |
| Xiaomi | Support to confirm the choice structure. With this structure, if *existingSearchSpace* is configured, the *searchspaceId* can be shared with other common search space, such as paging, OSI, and etc., or it can be a different one from other search space, which is determined by gNB and no limitation is needed. Of course, it may be not a proper configuration if the existingsearchspace and Type 1 CSS share the same *searchspaceId.* |
| Ericsson | We do not see a need for the choice structure. As Vivo suggested, perhaps defining a new search space ID would be enough.Based on 38.213, for RA-SDT, if the UE is not provided *sdt-SearchSpace*, the UE monitors legacy *ra-SearchSpace*. For CG-SDT, the UE monitors either a CSS set by *sdt-SearchSpace* or a USS set by *sdt-CG-SearchSpace*. Hence, we think the choice structure could be removed and make clarification in the field description for *sdt-SearchSpace* that for RA-SDT if the UE is not provided with this parameter, the UE monitors *ra-SearchSpace*.  |

## UE specific search space for CG-SDT

In RAN2 LS [R1-2205736](file:///C%3A%5CUsers%5Cyounsun%5CDocuments%5C3GPP%20documents%5CRAN1%20tdocs%5CTSGR1_110%5CDocs%5CR1-2205736.zip), RAN2 has informed RAN1 that the parameter named sdt-CG-SearchSpace-r17 used in 3GPP TS 38.213 does not exist in the RAN2 signalling. Instead, RAN2 signalling uses the existing field names for the search space configuration. RAN2 kindly requests RAN1 to update the RAN1 specs to refer to the search space configured using the BWP-Uplink-Dedicated-SDT-r17 for the above parameter hence, instead of using the new name sdt-CG-SearchSpace-r17.

### First round discussion

It’s an editorial issue, ZTE, Huawei, vivo, Intel and Xiaomi have proposed corresponding revisions on USS set for CG-SDT, FL’s suggestion is to take the following TP from Huawei, since it’s more aligned with RAN2’s requirements.

TP#2.3-2

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| **------------------------------ TS 38.213-----------------------------------****< Unchanged text omitted >**- a USS set configured by - *SearchSpace* in *PDCCH-Config* with *searchSpaceType* = *ue-Specific* for DCI formats with CRC scrambled by C-RNTI, MCS-C-RNTI, SP-CSI-RNTI, CS-RNTI(s), SL-RNTI, SL-CS-RNTI, or SL Semi-Persistent Scheduling V-RNTI, or - *~~sdt-CG-SearchSpace~~ SearchSpace* in *BWP-DownlinkDedicatedSDT-r17* for DCI formats with CRC scrambled by C-RNTI or CS-RNTI as described in clause 19.1.**< Unchanged text omitted >**A UE can be provided a USS set by *~~sdt-CG-SearchSpace~~ SearchSpace* in *BWP-DownlinkDedicatedSDT-r17*, or a CSS set by *sdt-SearchSpace*, to monitor PDCCH for detection of DCI format 0\_0 with CRC scrambled by C-RNTI or CS-RNTI for scheduling PUSCH transmission or of DCI format 1\_0 with CRC scrambled by C-RNTI for scheduling PDSCH receptions [12, TS 38.331]. **< Unchanged text omitted >** |

#### *Discussion point 2.3-1*

Whether to adopt TP#2.3-1 for TS 38.213.

Any comments?

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| --- | --- |
| Company | Comment |
| vivo | For the first change, considering the bullet “*SearchSpace* in *PDCCH-Config* with *searchSpaceType* = *ue-Specific* for DCI formats with CRC scrambled by C-RNTI, MCS-C-RNTI, SP-CSI-RNTI, CS-RNTI(s), SL-RNTI, SL-CS-RNTI, or SL Semi-Persistent Scheduling V-RNTI” already covers the SDT USS which is also in *PDCCH-Config*, there’s no need to mention 2nd bullet*.*For the 2nd change, *SearchSpace* is enough as UE can only see it in *PDCCH-Config* in RRC release, so there’s no need to mention where the *SearchSpace* is.According to above, as we proposed in our contribution, following CR should be enough:**------------------------------ TS 38.213-----------------------------------****< Unchanged text omitted >**- a USS set configured by - *SearchSpace* in *PDCCH-Config* with *searchSpaceType* = *ue-Specific* for DCI formats with CRC scrambled by C-RNTI, MCS-C-RNTI, SP-CSI-RNTI, CS-RNTI(s), SL-RNTI, SL-CS-RNTI, or SL Semi-Persistent Scheduling V-RNTI~~, or~~ ~~-~~ *~~sdt-CG-SearchSpace~~* ~~for DCI formats with CRC scrambled by C-RNTI or CS-RNTI as described in clause 19.1.~~**< Unchanged text omitted >**A UE can be provided a USS set by *~~sdt-CG-SearchSpace~~ SearchSpace*, or a CSS set by *sdt-SearchSpace*, to monitor PDCCH for detection of DCI format 0\_0 with CRC scrambled by C-RNTI or CS-RNTI for scheduling PUSCH transmission or of DCI format 1\_0 with CRC scrambled by C-RNTI for scheduling PDSCH receptions [12, TS 38.331]. **< Unchanged text omitted >** |
| Intel | Do not support the proposal.We are fine with the proposed CR from Vivo. |
| Qualcomm | Support the proposal of FL |
| Samsung  | Fine with vivo’s change. |
| ZTE | Although vivo’s change is simple, it’s hard for readers to understand that SDT will use a different UE specific search space from legacy one, since SDT USS set is configured in a dedicated BWP level configuration. We’d better follow RAN2’s instruction to highlight that this search space is in *BWP-DownlinkDedicatedSDT-r17*  |
| Huawei, HiSilicon | Support. |
| Sony | Support FL proposal. |
| Xiaomi | Fine with vivo’s version. |
| Ericsson | Fine with Vivo’s proposal |

## Repetitions for CG-SDT

In RAN2 LS [R1-2205736](file:///C%3A%5CUsers%5Cyounsun%5CDocuments%5C3GPP%20documents%5CRAN1%20tdocs%5CTSGR1_110%5CDocs%5CR1-2205736.zip), RAN2 has informed RAN1 that for repetition for CG-SDT, the signalling in TS 38.331 reuses the existing ConfiguredGrantConfig and hence the signalling allows configuration of parameters related to repetition (i.e. repK, repK-RV (including repK-r17), pusch-RepTypeIndicator-r16 and frequencyHoppingPUSCH-RepTypeB-r16) within this IE.

### First round discussion

Given that RAN2 has agreed to allow repetitions for CG-SDT, the only left over issue it how to map the repetitions to SSBs. ZTE and Intel think that repetitions are considered as a bundle to map to the same SSB(s). While Xiaomi proposes to only associate the first repetition to SSB, the other repetitions have no relationship with SSBs.

FL suggests to consider repetitions as a bundle to map to the same SSBs, Xiaomi’s proposal seems to leave the rest of repetitions with arbitrary beam directions, no sure what is the benefit to do so.

The TP from Intel can be considered as a starting point:

TP#2.4-1

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| --- |
| **------------------------------ TS 38.213-----------------------------------**19.1 Configured-grant based PUSCH transmission**<Unchanged parts are omitted>**A UE indicated to release a dedicated RRC connection can be provided one or more configurations by respective one or more *ConfiguredGrantConfig*, for configured grant Type 1 PUSCH transmissions on the initial UL BWP [12, TS 38.331]. For the remaining of this clause, PUSCH transmissions refer to configured grant Type-1 PUSCH transmissions for a configuration provided by *ConfiguredGrantConfig*. A UE can be provided by *sdt-SSB-Subset* a number of SS/PBCH block indexes $N\_{PUSCH}^{SS/PBCH}$ to map to a number of valid PUSCH occasions for PUSCH transmissions over an association period. If the UE is not provided *sdt-SSB-Subset*, the UE determines $N\_{PUSCH}^{SS/PBCH}$ from the value of *ssb-PositionsInBurst* in *SIB1* or by *ServingCellConfigCommon*. A UE can be provided by *repK* a number of repetitions for a PUSCH transmission. The UE determines a redundancy version and RBs for each repetition as described in [6, TS 38.214]. A PUSCH occasion for a PUSCH transmission is defined by a time resource and a frequency resource and is associated with a DM-RS provided by *cg-DMRS-Configuration* for the configuration of PUSCH transmissions.An association period, starting from frame with SFN 0, for mapping $N\_{PUSCH}^{SS/PBCH}$ SS/PBCH block indexes, from the number of SS/PBCH block indexes, to valid PUSCH occasions and associated DM-RS resources is the smallest value in the set determined by the PUSCH configuration period provided by *periodicity* in *ConfiguredGrantConfig* according to Table 19.1-1 such that $N\_{PUSCH}^{SS/PBCH}$ SS/PBCH block indexes are mapped at least once to valid PUSCH occasions and associated DM-RS resources within the association period. A UE is provided a number of SS/PBCH block indexes associated with a PUSCH occasion and a DM-RS resource by *sdt-SSB-perCG-PUSCH*. If after an integer number of SS/PBCH block indexes to PUSCH occasions and associated DMRS resources mapping cycles within the association period there is a set of PUSCH occasions and associated DMRS resources that are not mapped to $N\_{PUSCH}^{SS/PBCH}$ SS/PBCH block indexes, no SS/PBCH block indexes are mapped to the set of PUSCH occasions and associated DMRS resources. An association pattern period includes one or more association periods and is determined so that a pattern between PUSCH occasions with associated DMRS resources and SS/PBCH block indexes repeats at most every 640 msec. PUSCH occasions and associated DMRS resources not associated with SS/PBCH block indexes after an integer number of association periods, if any, are not used for PUSCH transmissions.**<Unchanged parts are omitted>** |

#### *Discussion point 2.4-1*

For CG-SDT, the repetitions are considered as a bundle of transmission occasions that are mapped to the same SSB(s).

Whether to adopt TP#2.4-1

Any comments?

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| --- | --- |
| Company | Comment |
| vivo | Fine with the TP#2.4-1. Same SSB for all repetitions should be assumed in our view and no specification change is needed. |
| Intel | We are fine with the proposal.  |
| Qualcomm | There is an issue for the TP when repK is provided for the initial transmission and autonomous retransmission(s) of initial CG-SDT, which should always be set to RV0.  |
| Samsung | Before agreeing anything, we have a few comments:1. RAN2 just keeps the parameters, not sure intention to support all the repetition or just for simplicity.

Based on the parameters kept, for example, the repetition type B is supported as well. we wonder how to define the association now, since the repetition will be nominal or actual repetition, but our RAN1 decided association is done based on the valid PUSCH occasion, then what is the valid PUSCH occasion in this case? What is the connection of validation on PUSCH occasion to the repetitions?  |
| ZTE | Fine.  |
| Xiaomi | By leaving the rest of repetitions linked with the selected beam direction for the first repetition, more time-frequency domain resources can be saved and it is helpful to improve SE. |
| Ericsson | Fine with the proposal. |

# Editorial corrections

## Power control parameter name misalignment

In current spec, Power control parameters in TS 38.213, *p0-PUSCH, alpha,* parameter name is not consistent with TS 38.331. ZTE and Interdigital have proposed the same revision for correction of these 2 parameters. As for changing $P\_{O\\_NOMINAL,PUSCH,f,c}\left(1\right) $to $P\_{O\\_UE\\_PUSCH,b,f,c}\left(1\right) $, after further checking previous SDT CR, it seems editor incorrectly captures the parameter name when merging CRs from different topic, FL suggests to take the following TP.

TP from Interdigital:

### TP#3.1-1

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| **------------------------------ TS 38.213-----------------------------------****7.1.1 UE behaviour****< Unchanged text omitted >**- else, $P\_{O\\_NOMINAL,PUSCH,f,c}\left(1\right)$ $P\_{O\\_UE\\_PUSCH,b,f,c}\left(1\right)$ is provided by *p0* obtained from *p0-PUSCH-Alpha* in *ConfiguredGrantConfig* that provides an index *P0-PUSCH-AlphaSetId* to a set of *P0-PUSCH-AlphaSet*, or by *sdt-P0-PUSCH-r17* *~~p0-PUSCH~~* for a PUSCH (re)transmission as described in clause 19.1, for active UL BWP $b$ of carrier $f$ of serving cell $c$...- else $α\_{b,f,c}(1)$ is provided by *alpha* obtained from *p0-PUSCH-Alpha* in *ConfiguredGrantConfig* providing an index *P0-PUSCH-AlphaSetId* to a set of *P0-PUSCH-AlphaSet*, or by *sdt-Alpha-r17* *~~alpha~~* for a PUSCH (re)transmission as described in clause 19.1, for active UL BWP $b$ of carrier $f$ of serving cell $c$**< Unchanged text omitted >** |

Any comments?

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| --- | --- |
| Company | Comment |
| vivo | We propose that the parameters should not include “-17” when used in RAN1 spec. similar to what we did in Rel-16, i.e. following CR is proposed from our side instead:**------------------------------ TS 38.213-----------------------------------****7.1.1 UE behaviour****< Unchanged text omitted >**- else, $P\_{O\\_NOMINAL,PUSCH,f,c}\left(1\right)$ $P\_{O\\_UE\\_PUSCH,b,f,c}\left(1\right)$ is provided by *p0* obtained from *p0-PUSCH-Alpha* in *ConfiguredGrantConfig* that provides an index *P0-PUSCH-AlphaSetId* to a set of *P0-PUSCH-AlphaSet*, or by *sdt-P0-PUSCH* *~~p0-PUSCH~~* for a PUSCH (re)transmission as described in clause 19.1, for active UL BWP $b$ of carrier $f$ of serving cell $c$...- else $α\_{b,f,c}(1)$ is provided by *alpha* obtained from *p0-PUSCH-Alpha* in *ConfiguredGrantConfig* providing an index *P0-PUSCH-AlphaSetId* to a set of *P0-PUSCH-AlphaSet*, or by *sdt-Alpha* *~~alpha~~* for a PUSCH (re)transmission as described in clause 19.1, for active UL BWP $b$ of carrier $f$ of serving cell $c$**< Unchanged text omitted >** |
| Intel | Agree with Vivo that -r17 is not needed.  |
| Qualcomm | Fine with the suggestion of vivo. |
| ZTE | Fine with vivo’s revision. |
| InterDigital | Agree that -r17 is not needed (note that TP in R1-2206853 does not have it) |
| Huawei, HiSilicon | Support. |
| Xiaomi | Fine with vivo’s version. |

## RA-SDT parameter name misalignment

In TS 38.213, parameters *sdt-CB-PreamblesPerSSB-PerSharedRO* o*sdt-msgA-CB-PreamblesPerSSB-PerSharedRO, sdt-SSB-SharedRO-MaskIndex* and *sdt-msgA-SSB-SharedRO-MaskIndex* are not aligned with TS 38.331.

TP from vivo:

### TP#3.2-1

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| **------------------------------ TS 38.213-----------------------------------****< Unchanged text omitted >**8.1 Random access preamblePhysical random access procedure is triggered upon request of a PRACH transmission by higher layers or by a PDCCH order. A configuration by higher layers for a PRACH transmission includes the following: - A configuration for PRACH transmission [4, TS 38.211]. - A preamble index, a preamble SCS, $P\_{PRACH,target}$, a corresponding RA-RNTI, and a PRACH resource. A PRACH is transmitted using the selected PRACH format with transmission power $P\_{PRACH,b,f,c}(i)$,as described in clause 7.4, on the indicated PRACH resource.For Type-1 random access procedure, a UE is provided a number $N$ of SS/PBCH block indexes associated with one PRACH occasion and a number $R$ of contention based preambles per SS/PBCH block index per valid PRACH occasion by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB*. For Type-2 random access procedure with common configuration of PRACH occasions with Type-1 random access procedure, a UE is provided a number $N$ of SS/PBCH block indexes associated with one PRACH occasion by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB* and a number $Q$ of contention based preambles per SS/PBCH block index per valid PRACH occasion by *msgA-CB-PreamblesPerSSB-PerSharedRO*. The PRACH transmission can be on a subset of PRACH occasions associated with a same SS/PBCH block index within an SSB-RO mapping cycle for a UE provided with a PRACH mask index by *msgA-SSB-SharedRO-MaskIndex* according to [11, TS 38.321].For Type-2 random access procedure with separate configuration of PRACH occasions with Type-1 random access procedure, a UE is provided a number $N$ of SS/PBCH block indexes associated with one PRACH occasion and a number $R$ of contention based preambles per SS/PBCH block index per valid PRACH occasion by *msgA-SSB-PerRACH-OccasionAndCB-PreamblesPerSSB* when provided; otherwise, by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB*.For a random access procedure associated with a feature combination indicated by *FeatureCombinationPreambles*, a UE is provided a number $N$ of SS/PBCH block indexes associated with one PRACH occasion by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB* or *msgA-SSB-PerRACH-OccasionAndCB-PreamblesPerSSB* when provided and a number $S$ of contention based preambles per SS/PBCH block index per valid PRACH occasion by *startPreambleForThisPartition* and *numberOfPreamblesPerSSB-ForThisPartition*. The PRACH transmission can be on a subset of PRACH occasions associated with a same SS/PBCH block index within an SSB-RO mapping cycle for a UE provided with a PRACH mask index by *ssb-SharedRO-MaskIndex* according to [11, TS 38.321].<Unchanged text omitted>8.1A PUSCH for Type-2 random access procedureFor a Type-2 random access procedure, a UE transmits a PUSCH, when applicable, after transmitting a PRACH. The UE encodes a transport block provided for the PUSCH transmission using redundancy version number 0. The PUSCH transmission is after the PRACH transmission by at least $N$ symbols where $N=2$ for $μ=0$ or $μ=1$, $N=4$ for $μ=2$ or $μ=3$, $N=16$ for $μ=5$, $N=32$ for $μ=6$, and $μ$ is the SCS configuration for the active UL BWP.A UE does not transmit a PUSCH in a PUSCH occasion if the PUSCH occasion associated with a DMRS resource is not mapped to a preamble of valid PRACH occasions or if the associated PRACH preamble is not transmitted as described in clause 7.5 or clause 11.1. A UE can transmit a PRACH preamble in a valid PRACH occasion if the PRACH preamble is not mapped to a valid PUSCH occasion.A mapping between one or multiple PRACH preambles and a PUSCH occasion associated with a DMRS resource is per PUSCH configuration.A UE determines time resources and frequency resources for PUSCH occasions in an active UL BWP from *msgA-PUSCH-Config* or *separateMsgA-PUSCH-Config* for the active UL BWP. If the active UL BWP is not the initial UL BWP and *msgA-PUSCH-Config* or *separateMsgA-PUSCH-Config* is not provided for the active UL BWP, the UE uses the *msgA-PUSCH-Config* or *separateMsgA-PUSCH-Config* provided for the initial UL BWP.<Unchanged text omitted>19.2 Random-access based PUSCH transmissionA UE indicated to release a dedicated RRC connection can be provided a configuration for a Type-1 and/or a Type-2 random access procedure on the initial UL BWP [12, TS 38.331]. PRACH occasions can have either a common configuration as, or a separate configuration from, PRACH occasions for Type-1 or Type-2 random access procedure as described in clause 8.1. The UE procedure is as described in clause 8, including clauses 8.1 through 8.4. The UE transmits a PRACH preamble with a power determined as described in clause 7.4.For a common configuration of PRACH occasions and a Type-1 or a Type-2 random access procedure, a UE can be provided a number of contention based preambles per SS/PBCH block index per valid PRACH occasion by *startPreambleForThisPartition* and *numberOfPreamblesPerSSB-ForThisPartition* when *smallData* is present in corresponding *FeatureCombination ~~sdt-CB-PreamblesPerSSB-PerSharedRO~~* ~~or~~ *~~sdt-msgA-CB-PreamblesPerSSB-PerSharedRO~~*~~, respectively~~. A PRACH transmission can be on a subset of PRACH occasions associated with a same SS/PBCH block index within an SSB-RO mapping cycle as determined by a PRACH mask index provided by *~~sdt-SSB~~ssb-SharedRO-MaskIndex* ~~or~~ *~~sdt-msgA-SSB-SharedRO-MaskIndex~~*according to [11, TS 38.321].**< Unchanged text omitted >** |

TP from ZTE:

### TP#3.2-2

|  |
| --- |
| **------------------------------ TS 38.213-----------------------------------****< Unchanged text omitted >****19.2 Random-access based PUSCH transmission**A UE indicated to release a dedicated RRC connection can be provided a configuration for a Type-1 and/or a Type-2 random access procedure on the initial UL BWP [12, TS 38.331]. PRACH occasions can have either a common configuration as, or a separate configuration from, PRACH occasions for Type-1 or Type-2 random access procedure as described in clause 8.1. The UE procedure is as described in clause 8, including clauses 8.1 through 8.4. The UE transmits a PRACH preamble with a power determined as described in clause 7.4.For a common configuration of PRACH occasions and a Type-1 or a Type-2 random access procedure, a UE can be provided a number of contention based preambles per SS/PBCH block index per valid PRACH occasion by *numberOfPreamblesForThisPartition-r17 ~~sdt-CB-PreamblesPerSSB-PerSharedRO~~* ~~or~~ *~~sdt-msgA-CB-PreamblesPerSSB-PerSharedRO~~*~~, respectively~~. A PRACH transmission can be on a subset of PRACH occasions associated with a same SS/PBCH block index within an SSB-RO mapping cycle as determined by a PRACH mask index provided by *ssb-SharedRO-MaskIndex-r17 ~~sdt-SSB-SharedRO-MaskIndex~~* ~~or~~ *~~sdt-msgA-SSB-SharedRO-MaskIndex~~* according to [11, TS 38.321]. **< Unchanged text omitted >** |

TP from Huawei:

### TP#3.2-3

|  |
| --- |
| **------------------------------ TS 38.213-----------------------------------**19.2 Random-access based PUSCH transmission========================= Unchanged parts =========================For a common configuration of PRACH occasions and a Type-1 or a Type-2 random access procedure, a UE can be provided a number of contention based preambles per SS/PBCH block index per valid PRACH occasion by *numberOfPreamblesPerSSB-ForThisPartition-r17* in *RACH-ConfigCommon* or *RACH-ConfigCommonTwoStepRA*, respectively. A PRACH transmission can be on a subset of PRACH occasions associated with a same SS/PBCH block index within an SSB-RO mapping cycle as determined by a PRACH mask index provided by *ssb-SharedRO-MaskIndex-r17* in *RACH-ConfigCommon* or *RACH-ConfigCommonTwoStepRA* according to [11, TS 38.321].========================= Unchanged parts ========================= |

Which TP is preferred? Any comments?

|  |  |
| --- | --- |
| Company | Comment |
| vivo | TP#3.2-1 is preferred.In section 8.1, the feature combination indicated PRACH resource should be described in a separate paragraph using different parameter for the number of preambles allocated, similar to the situation when we introduce 2-step RACH on top of 4-step RACH. The RO determination will still use the same parameters as legacy, i.e. using *ssb-perRACH-OccasionAndCB-PreamblesPerSSB* or *msgA-SSB-PerRACH-OccasionAndCB-PreamblesPerSSB* according to current spec.. The preamble configuration should use the new parameters provided in Rel-17 and use “$S$” in order to be different from other parameters already used for indication of legacy number of preambles. Note these changes in this section can be applied to PRACH resource determination for indicating other features (RedCap/Coverage/RAN-slicing) as well.In section 8.1a, new parameters *separateMsgA-PUSCH-Config* for MsgA PUSCH configuration for RA SDT or RedCap with 2-step RACH should also be considered.In 19.1, new Rel-17 parameters should be used for SDT to align with RRC spec. |
| Intel | We are fine with TP#3.2-2. More concise and follow the current structure.  |
| Qualcomm | We prefer TP#3.2-2, and suggest to remove the suffix “r17” from the RRC parameters mentioned by the TP. |
| Samsung  | Slightly prefer TP#3.2-2 |
| ZTE | Fine with TP#3.2-2 and Qualcomm’s suggestion. |

## TDRA table determination for Type 1A CSS set

Xiaomi has noticed that, after introducing Type 1A CSS set, TDRA table 5.1.2.1.1-1 in TS 38.214 has not been revised accordingly, so the following TP is proposed:

TP from Xiaomi:

### TP#3.3-1

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **------------------------------ TS 38.214-----------------------------------****<Unchanged parts omitted>**5.1.2.1.1 Determination of the resource allocation table to be used for PDSCHTable 5.1.2.1.1-1 and Table 5.1.2.1.1-1A define which PDSCH time domain resource allocation configuration to apply. Either a default PDSCH time domain allocation A, B or C according to tables 5.1.2.1.1-2, 5.1.2.1.1-3, 5.1.2.1.1-4 and 5.1.2.1.1-5 is applied, or the higher layer configured *pdsch-TimeDomainAllocationList* or [*pdsch-TimeDomainAllocationListForMultiPDSCH-r17]* or *pdsch-TimeDomainAllocationListDCI-1-2* is applied. For operation with shared spectrum channel access in frequency range 1, as described in [16, TS 37.213], UE reinterprets *S* and *L* in row 9 of Table 5.1.2.1.1-2 as *S=6* and *L=7*.Table 5.1.2.1.1-1: Applicable PDSCH time domain resource allocation for DCI formats 1\_0, 1\_1, 4\_0, 4\_1 and 4\_2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **RNTI** | **PDCCH search space** | **SS/PBCH block and CORESET multiplexing pattern** | ***PDSCH-ConfigCommon* includes *pdsch-TimeDomainAllocationList*** | ***PDSCH-Config* includes *pdsch-TimeDomainAllocationList*** | ***PDSCH-Config-MCCH/PDSCH-Config-MTCH* includes *pdsch-TimeDomainAllocationList******Or*** ***pdsch-Config-Multicast* includes *pdsch-TimeDomainAllocationList*** | ***PDSCH-Config* includes *pdsch-TimeDomainAllocationListForMultiPDSCH-r17*** | **PDSCH time domain resource allocation to apply** |
| SI-RNTI | Type0 common | 1 | - | - | - | - | Default A for normal CP |
| 2 | - | - | - | - | Default B |
| 3 | - | - | - | - | Default C |
| SI-RNTI | Type0A common | 1 | No | - | - | - | Default A |
| 2 | No | - | - | - | Default B |
| 3 | No | - | - | - | Default C |
| 1,2,3 | Yes | - | - | - | *Pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon* |
| RA-RNTI, MSGB-RNTI, TC-RNTI | Type1 common | 1,2,3 | No | - | - | - | Default A |
| 1,2,3 | Yes | - | - | - | *Pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon* |
| C-RNTI | Type1A Common | 1,2,3 | No | - | - | - | Default A |
| 1,2,3 | Yes | - | - | - | *Pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon* |
| P-RNTI | Type2 common | 1 | No | - | - | - | Default A |
| 2 | No | - | - | - | Default B |
| 3 | No | - | - | - | Default C |
| 1,2,3 | Yes | - | - | - | *Pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon* |
| MCCH-RNTI  | Type 0/0B common for broadcast | 1 | No | - | No | *-* | Default A |
| 2 | No | - | No | *-* | Default B |
| 3 | No | - | No | *-* | Default C |
| 1,2,3 | Yes | - | No | *-* | *pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon* |
| 1,2,3 | No/Yes | - | Yes | *-* | *pdsch-TimeDomainAllocationList provided in pdsch-Config-MCCH* |
| G-RNTI for broadcast | Type 0/0B common for broadcast | 1 | No | - | No | *-* | Default A |
| 2 | No | - | No | *-* | Default B |
| 3 | No | - | No | *-* | Default C |
| 1,2,3 | Yes | - | No | *-* | *pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon* |
| 1,2,3 | No/Yes | - | Yes | *-* | *pdsch-TimeDomainAllocationList* provided in *PDSCH-Config-MTCH,* if configured, otherwise *TimeDomainAllocationList* provided in *PDSCH-Config-MCCH* |
| C-RNTI, MCS-C-RNTI, CS-RNTI | Any common search space associated with CORESET 0 | 1, 2, 3 | No | - | - | - | Default A |
| 1, 2, 3 | Yes | - | - | *-* | *pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon* |
| C-RNTI, MCS-C-RNTI, CS-RNTI | Any common search space not associated with CORESET 0UE specific search space | 1,2,3 | No | No | - | - | Default A |
| 1,2,3 | Yes | No | - | *-* | *pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon*  |
| 1,2,3 | No/Yes | Yes | - | *-* | *pdsch-TimeDomainAllocationList* provided in *PDSCH-Config* |
| 1,2,3 | No/Yes | - | - | Yes | *pdsch-TimeDomainAllocationListForMultiPDSCH-r17* provided in *PDSCH-Config (Note 2)* |
| G-RNTI, G-CS-RNTI (for multicast)  | Type-X common search space for multiast | 1,2,3 | No | - | No | - | *Default A* |
| 1,2,3 | Yes | - | No | - | *pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon (Note 1)* |
| 1,2,3 | No/Yes | - | Yes | - | *pdsch-TimeDomainAllocationList* provided in *pdsch-Config-Multicast**(Note 1)* |
| Note 1: For a UE that supports multicast, the same TDRA table applies to all G-RNTIs (configured for multicast) if configured on a given serving cell.Note 2: If *pdsch-TimeDomainAllocationListForMultiPDSCH-r17* is provided, it is applicable to DCI format 1\_1 only. |

**<Unchanged parts omitted>** |

Any comments?

|  |  |
| --- | --- |
| Company | Comment |
| vivo | The CR seems not necessary as the row for “Any common search space associated with CORESET 0” and the row for "Any common search space not associated with CORESET 0 UE specific search space" in the same table already cover type 1A search space case. |
| Intel | Agree with vivo that CR seems not needed.  |
| Qualcomm | No strong need for this TP. |
| Xiaomi | It is more clear to read if type 1A CSS is emphasized in this table. |

# RedCap related issues

Based on companies’ input, RedCap related issues can be summarized as following:

## Collision handling for RedCap UE supporting SDT

Relevant proposals:

|  |
| --- |
| [Xiaomi]:**Proposal 1: For collision handling between CG-SDT PUSCH and DL resources in inactive states, adopts the same rule as CG PUSCH in connected states.** |

FL comment: Not sure whether there is spec impact on this.

Any comments?

|  |  |
| --- | --- |
| Company | Comment |
| vivo | According to SDT agreement below, CG PUSCH overlapping with DL resource would still be valid and collision handling is needed. However, the detailed collision rules should be up to RedCap topic to discuss.**Agreement RAN1#108-e**The validation rule defined for CG-SDT in FD-FDD mode can be reused for RedCap UE performing CG-SDT in HD-FDD mode. |
| Intel | It is not clear to us whether this is for collision handling rule or validation rule. It may be good to clarify this first.  |
| Qualcomm | The existing rule for directional collision handling of HD-FDD (Clause 17.2 of TS 38.213) is sufficient to cover CG-SDT. |
| Samsung  | From validation perspective, these resource are valid; collision handling for HD-FDD UE is a different story and not handled by us.  |
| Xiaomi | From our point of view, collision handling should be further performed for CG-SDT in the valid POs. And, collision handling rules defined for CG PUSCH in connected states HD-FDD redcap can be reused, which is summarized as follows:1. if there is overlapping between SSB and CG-SDT PO in several symbols, SSB is prioritized over CG-SDT transmission; 2. a UE doesn’t except there is any overlapping between CSS/USS and CG-SDT POs; 3. If the time gap between SSB/CSS and CG-SDT PO is not sufficient, CG-SDT will be canceled; 4. Dynamic PDSCH is prioritized if it is overlapped with CG-SDT PUSCH. |

## SDT resource configuration for RedCap UE

Relevant proposal:

|  |
| --- |
| [Xiaomi]:**Proposal 2: Type 1A CSS set can be configured on the separate initial DL BWP for RedCap.****Proposal 3: RA-SDT resources can only be configured on separate initial BWP if it exists.****Proposal 4: Support to configure CG-SDT resources on either the separate initial BWP or the non-Redcap UE’s initial BWP in the case of both of them no larger than Redcap UE’s bandwidth.****Proposal 5: Don’t support BWP switch between legacy initial BWP and separate initial BWP during subsequent SDT procedure.****Proposal 6: UE doesn’t expect to be configured with CG-SDT resources on a separate initial BWP without CD-SSB.** |

FL comment: these proposals seem not essential correction, can be discussed as lower priority.

 Any comments?

|  |  |
| --- | --- |
| Company | Comment |
| vivo | Generally, we do not think these are essential issue in SDT topic, and they can be discussed in RedCap topic if needed.Specifically:For proposal 4, both initial and separate initial BWP can be configured with CG SDT in our view, no restriction is needed.For proposal 5, RedCap topic has already agreed that it's up to UE implementation to switch to initial DL BWP to measure CD-SSB before Msg1/A retransmission. The proposal is therefore not necessary in our view.*[RAN2 agreements]**From RAN2 perspective, if a RedCap UE in idle/inactive mode is configured with a separate initial BWP associated with no SSB (CD or NCD) for RACH, it is up to UE implementation to perform new RSRP measurement in a DL BWP associated with CD-SSB before Msg1/A retransmission.*For proposal 6, no such restriction seems necessary. CG SDT should not be that frequent meaning that some RF retuning is fine. |
| Intel | We do not think the proposals are essential given this is for maintenance phase. Suggest to deprioritize.  |
|  |  |
|  |  |

## Paging monitoring for RedCap UE in separate BWP

Relevant proposal:

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| --- |
| [Huawei]:***Observation 1:*** *A UE should attempt to monitor paging/SI update indication during SDT procedure, including RedCap UE in separate initial BWP.****Observation 2:*** *There will be significant scheduling constrain if paging/SI update indication monitoring is up to UE when separate initial DL BWP is configured for SDT procedure.* ***Observation 3:*** *There will be significant scheduling constrain for SSB measurement in the initial DL BWP for verifying the CG-SDT resources in the separate BWP.****Proposal 1:*** *If separate initial BWP does not include CD-SSB but configured for SDT, interruption time can be configured for paging/SI update indication monitoring or SSB measurement for CG-SDT resource validation.* |

FL comment: the issue is valid, paging or SSB measurement may require RF retuning from separate BWP to initial BWP, but it can be somehow alleviated by gNB scheduling and UE implementation on SDT triggering time, not sure whether interruption time can help more. Companies are encouraged to provide views on this issue.

Any comments?

|  |  |
| --- | --- |
| Company | Comment |
| vivo | Based on RAN2 agreements that UE monitors SI change indication in any paging occasion at least once per modification period，we think the modification period is long enough and redcap UE can select appropriate timing switching back to the initial DL BWP that contains the CD SSB for paging monitoring without impacting SDT procedure much. We do not think this is a big issue at least from RAN1 perspective. Given the agreements was made by RAN2 in RedCap topic, we prefer to let RAN2 to discuss this in RedCap topic if needed. |
| Intel | Our view is that configuration of interruption time may not be necessary at least from RAN1 perspective.  |
| Qualcomm | The issues above should be left to RAN2 and RAN4. No need to discuss them in RAN1. |
| Huawei, HiSilicon | The issue is about the timing that UE retune to another BWP for monitoring paging could be very long, not only the switching time but also the time for reception of paging plus further retuning (forth and back), and gNB does not know which PO the UE will use.If the majority prefer to discuss it in RAN2/RAN4, we suggest to send an LS to them as the need of potential resolution is from RAN1, they will not re-discuss it automatically unless RAN1 ask. |
| Sony | Leave it for RAN2. Companies can submit contributions, no need to send an LS to RAN2. |
| Xiaomi | Share the same view as vivo and Intel that the interruption time is not needed from RAN1 perspective. |

## CD-SSBs for RedCap UE

|  |
| --- |
| [vivo]:***Proposal 1:*** * ***RAN1 should conclude that only CD-SSBs in initial DL BWP is used for SSB to CG PUSCH mapping and further discuss whether any specification change is needed to explicitly restrict the SSBs to be only among the SSBs configured by ssb-PositionsInBurst in SIB1 or by ServingCellConfigCommon.***
 |

FL comment: It’s reasonable and companies are encouraged to discuss whether there is spec impact.

Any comments?

|  |  |
| --- | --- |
| Company | Comment |
| vivo | A conclusion as we discussed in last meeting is needed.In order to make this clear, it’s preferred to explicitly restrict the SSBs to be only among the SSBs configured by *ssb-PositionsInBurst* in SIB1 or by *ServingCellConfigCommon in* either RAN1 spec. or RAN2 field description of *sdt-SSB-Subset*. |
| Intel | Our understanding is that NCD-SSB is only configured for RRC connected UEs, which would not apply for SDT operation for RRC inactive mode. We do not think the discussion is needed.  |
| Qualcomm | We don’t see a need for this proposal. The use of CD-SSB by RedCap UE in RRC\_INACTIVE state is clear from RAN2 specs already. |
| Samsung | Share the view as Intel.  |
| Xiaomi | Share the same view as Intel. |

# Other remaining issues

## SDT search space on initial BWP

|  |
| --- |
| [Spreadtrum]:***Proposal x: Clarify that sdt-SearchSpace is only configured in the initial DL BWP. Consider the Text Proposal in Appendix A.1.******Proposal x: Clarify that sdt-CG-SearchSpace is only configured in the initial DL BWP. Consider the Text Proposal in Appendix A.1.*** **<Start of Text Proposal>**19.1 Configured-grant based PUSCH transmission**<Unchanged parts are omitted>**A UE can be provided a USS set by *sdt-CG-SearchSpace*, or a CSS set by *sdt-SearchSpace*, to monitor PDCCH on the initial DL BWP for detection of DCI format 0\_0 with CRC scrambled by C-RNTI or CS-RNTI for scheduling PUSCH transmission or of DCI format 1\_0 with CRC scrambled by C-RNTI for scheduling PDSCH receptions [12, TS 38.331]. The UE may assume that the DM-RS antenna port associated with the PDCCH receptions, the DM-RS antenna port associated with the PDSCH receptions, and the SS/PBCH block associated with the PUSCH transmission are quasi co-located with respect to average gain and quasi co-location 'typeA' or 'typeD' properties. The UE transmits a PUCCH with HARQ-ACK information associated with the PDSCH receptions as described in clause 9.2.1 using a same spatial domain transmission filter as for the last PUSCH transmission.**<Unchanged parts are omitted>**19.2 Random-access based PUSCH transmission**<Unchanged parts are omitted>**A UE can be provided by *sdt-SearchSpace* a CSS set to monitor, after contention resolution as described in clause 8.4, PDCCH on the initial DL BWP for detection of a DCI format 0\_0 or DCI format 1\_0 with CRC scrambled by C-RNTI for scheduling respective PUSCH transmissions or PDSCH receptions; otherwise, if the UE is not provided *sdt-SearchSpace*, the UE monitors PDCCH according to a Type1-PDCCH CSS set as described in clause 10.1. The UE may assume that the DM-RS antenna port associated with the PDCCH receptions, the DM-RS antenna port associated with the PDSCH receptions, and the SS/PBCH block associated with the PRACH transmission are quasi co-located with respect to average gain and quasi co-location 'typeA' or 'typeD' properties.**<Unchanged parts are omitted>** |

FL comment: It seems such revision may preclude separate initial BWP for RedCap UE. Actually, the restriction of initial BWP can be reflected by RRC configurations.

Any comments?

|  |  |
| --- | --- |
| Company | Comment |
| vivo | Agree with feature leader’s comment though we assume the separate initial BWP is still called initial BWP. |
| Intel | Do not support the proposal. |
| Spreadtrum | We failed to understand the FL comment of “such revision may preclude separate initial BWP for RedCap UE”. The separate initial BWP can be configured at least the RA search space (no matter when it include CORESET#0 or not). DCI format 0\_0 or DCI format 1\_0 can be carried by the RA search space. The RA search space can be configured in the separate initial DL BWP. Likely, the SDT related search space can be configured in the separate initial DL BWP. Why the restriction of SDT related search space on the initial DL BWP for detection of DCI format 0\_0 or DCI format 1\_0 will preclude the separate initial DL BWP?For RRC configuration, there is no any restriction for which BWP is used for the SDT related search space to our knowledge. It is important for UE implementation. If it is clarified that the SDT related search space is only monitored in the initial DL BWP, the UE implementation can be simplified. |
| Xiaomi | No spec change is needed. |

## Collision of PUCCH and PUSCH for SDT

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| [Sony]:**Proposal 1: RAN1 to discuss the following options for handling the collision/overlap between PUCCH carrying HARQ-ACK and PUSCH in time for SDT:**1. One of the overlapping channels should be dropped, i.e., either PUCCH or PUSCH is dropped
2. Multiplexing the HARQ-ACK on PUSCH
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FL comment: uci-on-PUSCH is not supported by RAN2, seems Option A is the only choice, maybe it can be up to UE implementation.

Any comments?

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| Company | Comment |
| vivo | This seems not a critical issue as the PUCCH for HARQ feedback is on the common PUCCH resource dynamically indicated by DCI.Note that RAN1 has already agreed to let RAN2 to discuss whether UCI on PUSCH is supported or not. Then, as also mentioned by FL, in RAN2 #118-e meeting, RAN2 agreed to not support uci-onPUSCH for SDT.Agreement RAN1#108-e:- It’s up to RAN2 to decide on whether to support uci-OnPUSCH for CG-SDT.- phy-PriorityIndex-r16 in ConfiguredGrantConfig is not applicable to CG-SDT.RAN2#118e agreements=> Do not support uci-onPUSCH for SDT |
| Intel | It can be avoided by gNB scheduler given that CG-PUSCH transmission and DL transmission during SDT would be not very frequent. In our view, UE is not expected to have overlapped PUSCH and PUCCH transmission during SDT.  |
| Qualcomm | We can live with this TP, if it is aligned with the majority view of other companies. |
| Sony | Either option is ok as long as it is clearly defined in the spec, because it has an impact on gNB expectation from the UE when collision occurs. |
| Xiaomi | Since SDT is infrequent, the overlapping between PUSCH and PUCCH can be handled by gNB’s scheduling. |
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## MsgA PUSCH occasion validation for 2-step RACH

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| [Huawei]:For R16 2-step RACH, A PUSCH occasion is valid if it does not overlap with the resource of any valid PRACH occasion. Within one BWP, a UE should consider resource for 2 RA types (2-step RACH and 4-step RACH if both are configured). In R17, as RedCap/SDT/CE/Slicing can be identified via RACH in combination or separately, the number of RACH resources configured within one BWP can be up to 256 as defined in TS38.331. Furthermore, one RACH configuration can contain PRACH resources for both 2-step RACH and 4-step RACH, so the total number of RACH resources within one BWP will arise up to 512. If all RACH resources has to be considered when verifying the PUSCH occasion, the porcessing complexity would be much higher, exceeding the supposed UE capability. As a matter of fact, since there would be at most one RACH procedure at a time, the UE does not necessarily verify all possible occasions configured for one of the feature combinations.8.1A PUSCH for Type-2 random access procedure========================= Unchanged parts =========================A PUSCH occasion is valid if it does not overlap in time and frequency with any valid PRACH occasion associated with either a Type-1 random access procedure or a Type-2 random access procedure, and the PUSCH occasion and PRACH occasion is provided in the same *AdditionalRACH-Config-r17* in *additionalRACH-ConfigList-r17* if configured. Additionally, for unpaired spectrum and for SS/PBCH blocks with indexes provided by *ssb-PositionsInBurst* in *SIB1* or by *ServingCellConfigCommon* ========================= Unchanged parts =========================19.1 Configured-grant based PUSCH transmission========================= Unchanged parts =========================A PUSCH occasion is valid if it does not overlap in time and frequency with any valid PRACH occasion associated with either a Type-1 random access procedure or a Type-2 random access procedure as described in clause 8.1, and the PUSCH occasion and PRACH occasion is provided in the same *AdditionalRACH-Config-r17* in *additionalRACH-ConfigList-r17* if configured.  |

FL comment: The intention of the validation is to avoid PUSCH transmission impact on PRACH(probably from other UEs), not sure whether the TP can guarantee the intention. Companies are encouraged to provide views on this issue.

Any comments?

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| Company | Comment |
| vivo | According following agreements, no such restriction is allowed, i.e. all ROs should be considered for CG PUSCH validation.Agreement RAN1 #106bis-eA CG PUSCH occasion is not valid if it overlaps with any valid PRACH occasion.• FFS overlapping between CG PUSCH occasions and MsgA PUSCH occasion |
| Intel | As mentioned by vivo, the spec text is based on the agreement. We do not think the update is needed. |
| Qualcomm | Agree with vivo. |
| Huawei, HiSilicon | The spec was generated based on SDT agreement while the issue is caused by SDT combined with other features including slicing, 2-step RACH, RedCap and CE, which is clearly not considered when the agreement was made.One of the intention is to keep the UE complexity reasonable since a normal UE is not supposed to be able to process all possible combinations of ROs with some of those intended for other features. |
| Xiaomi | Even if the separate overlapped RO belongs to other UE features, such as CE or slice, the PRACH transmission can also be prioritized since dedicated CG-SDT configuration is not known by other UEs with slice or CE, and simultaneous transmission should be restricted considering the interference. For MsgA PUSCH, it can also be deprioritized just following the legacy design.Thus, no spec change is needed.  |

## HARQ-ACK codebook for SDT

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| [Huawei]:When the Table Default A is used* If Type 1 HARQ-ACK codebook can be applied, which of the 3 bits can be feedback should be determined.
* If Type 2 HARQ-ACK codebook can be applied, no more than 2 bits of HARQ-ACK should be scheduled by gNB within one slot.

When the UE specific PDSCH time domain resource is configured: * If Type 1 HARQ-ACK codebook can be applied, gNB should consider the corresponding HARQ-ACK bits number, when configure time domain resource.
* If Type 2 HARQ-ACK codebook can be applied, no more than 2 bits of HARQ-ACK should be scheduled by gNB within one slot.

Thus, a simple and uniform solution is to apply Type 2 HARQ-ACK codebook only for SDT. The spec change in TS 38.213 can be as follows:========================= Unchanged parts =========================9.2.1 PUCCH Resource Sets========================= Unchanged parts =========================If a UE is not provided any of *pdsch-HARQ-ACK-Codebook*, *pdsch-HARQ-ACK-Codebook-r16*, or *pdsch-HARQ-ACK-OneShotFeedback*, the UE generates at most one HARQ-ACK information bit. Only type 2 HARQ-ACK codebook is applied during PUSCH transmission in RRC\_INACTIVE state. ========================= Unchanged parts =========================***Proposal 1:*** *Applying type2 HARQ-ACK codebook only during SDT procedure.*  |

FL comment: Such revision seems not essential.

Any comments?

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| Company | Comment |
| vivo | This seems to be a corner case which can be avoided by implementation, considering UE can not only use dedicated TDRA table, but also can use the SIB1 configured TDRA tables.Legacy has same issue if default A TDRA table is used for early channels like Msg4 for which the ACK feedback is also on common PUCCH resource.Therefore, this CR seems not necessary. |
| Intel | Seems not essential CR. |
| Qualcomm | We don’t think the CR is justified/needed. |
| Huawei, HiSilicon | SDT works as UE specific procedure which is not like Msg4 that is scheduled by CSS. More flexible TDRA is expected and not desirable to rely on implementation.  |

## QCL assumption for PDCCH and PDSCH

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| [Xiaomi]:Configured-grant based PUSCH transmission**<Unchanged parts omitted>**A UE can be provided a USS set~~by~~ *~~sdt-CG-SearchSpace~~*, or a CSS set by *sdt-SearchSpace*, to monitor PDCCH for detection of DCI format 0\_0 with CRC scrambled by C-RNTI or CS-RNTI for scheduling PUSCH transmission or of DCI format 1\_0 with CRC scrambled by C-RNTI for scheduling PDSCH receptions [12, TS 38.331]. The UE may assume that the DM-RS antenna port associated with the PDCCH receptions, the DM-RS antenna port associated with the PDSCH receptions, and the SS/PBCH block associated with the last PUSCH transmission or PRACH transmission are quasi co-located with respect to average gain and quasi co-location 'typeA' or 'typeD' properties. The UE transmits a PUCCH with HARQ-ACK information associated with the PDSCH receptions as described in clause 9.2.1 using a same spatial domain transmission filter as for the last PUSCH transmission.19.2 Random-access based PUSCH transmission**<Unchanged parts omitted>**A UE can be provided by *sdt-SearchSpace* a CSS set to monitor, after contention resolution as described in clause 8.4, PDCCH for detection of a DCI format 0\_0 or DCI format 1\_0 with CRC scrambled by C-RNTI for scheduling respective PUSCH transmissions or PDSCH receptions; otherwise, if the UE is not provided *sdt-SearchSpace*, the UE monitors PDCCH according to a Type1-PDCCH CSS set as described in clause 10.1. The UE may assume that the DM-RS antenna port associated with the PDCCH receptions, the DM-RS antenna port associated with the PDSCH receptions, and the SS/PBCH block associated with the last PRACH transmission are quasi co-located with respect to average gain and quasi co-location 'typeA' or 'typeD' properties.**<Unchanged parts omitted>** |

FL: Seems not needed.

Any comments?

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| Company | Comment |
| vivo | Agree with FL that this seems not necessary which is on how legacy RA resource is determined based on SSB. |
| Intel | Agree with FL. This is not needed.  |
| Qualcomm | Fine with the proposal of FL. |
| Xiaomi | If legacy RACH is initiated during SDT procedure, the selected SSB may be changed. Thus, the PDSCH and PDCCH can change the QCL relationship to the latest selected SSB associated with the legacy RO.  |

# Summary

The final proposals will be added later.

# References

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