**3GPP TSG-RAN WG1 Meeting #109-e R1-220xxxx**

**e-Meeting, May 9th - 20th, 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 remaining issues related to the physical layer aspects of small data transmission in RAN1#109-e meeting.

[109-e-NR-R17-SDT-01]  Email discussion on Rel-17 SDT maintenance by May 18 – Ziyang (ZTE)

* Issue#1 Association period determined by CG period less than 5ms
* Issue#2 SSBs for TA validation and mapping in HD-FDD
* Issue#3 Editorial correction on PRACH configuration for RA-SDT
* Issue#4 Editorial correction on USS set for CG-SDT
* Issue#6 Validation rule for CG-SDT overlapping with MsgA PUSCH
* Issue#11 Type 1A CSS set overlapping with Type 1 CSS set

The above 6 issues are summarized in section 2.1~2.6.

# Discussion on small data transmission

## Association period determined by CG period less than 5ms

In RAN1#108-e meeting, the table of association period between SSB and CG PUSCH has been defined in clause 19.1 in TS38.213 as shown below. However, the table only includes CG period value larger than or equal to 5ms, smaller values are still FFS as reflected in highlighted part as well.

Table 19.1-1: Mapping between PUSCH configuration period and SS/PBCH block to configured PUSCH resource association period

|  |  |
| --- | --- |
| PUSCH configuration period (msec) | Association period (number of PUSCH configuration periods except when PUSCH configuration period is less than 5 msec) |
| 5 | {1, 2, 4, 8,16, 32, 64, 128} |
| 8 | {1, 2, 4, 5, 8, 10, 16, 20, 40, 80} |
| 10 | {1, 2, 4, 8,16, 32, 64} |
| 16 | {1, 2, 4, 5, 8,10,20,40} |
| 20 | {1, 2, 4, 8,16, 32} |
| 32 | {1, 2, 4, 5, 10, 20} |
| 40 | {1, 2, 4, 8, 16} |
| 64 | {1, 2, 5, 10} |
| 80 | {1, 2, 4, 8} |
| 128 | {1, 5} |
| 160 | {1, 2, 4} |
| 320 | {1, 2} |
| 640 | {1 } |

In R1-2203244, ZTE has mentioned that there is no clear motivation to preclude CG period values smaller than 5ms and proposed to include these values in the Table 19.1-1. The proposed change is shown in TP#2.1-1.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Reason for change:*** The table of association period between SSB and CG PUSCH does not include CG period values less than 5ms, which is FFS.  ***Summary of change:*** Table 19.1-1 in TS 38.213 is revised to include CG period values less than 5ms.  ***Consequences if not approved:*** Table 19.1-1 would be incomplete and the sentence in bracket “except when PUSCH configuration period is less than 5 msec” cannot match the content of the table.  **------------------------------ TS 38.213-----------------------------------**  **< Unchanged text omitted >**  19.1 Configured-grant based PUSCH transmission  **< Unchanged text omitted >**  Table 19.1-1: Mapping between PUSCH configuration period and SS/PBCH block to configured PUSCH resource association period   |  |  | | --- | --- | | PUSCH configuration period (msec) | Association period (number of PUSCH configuration periods ~~except~~ when PUSCH configuration period is ~~less than 5~~ larger than 1 msec) | | ≦1 | {5, 8, 10, 16, 20, 32, 40, 64, 80, 128, 160, 320, 640}ms | | 2 | {4, 5, 8, 10, 16, 20, 40, 80, 160, 320} | | 4 | {2, 4, 5, 8, 10, 16, 20, 40, 80, 160} | | 5 | {1, 2, 4, 8,16, 32, 64, 128} | | 8 | {1, 2, 4, 5, 8, 10, 16, 20, 40, 80} | | 10 | {1, 2, 4, 8,16, 32, 64} | | 16 | {1, 2, 4, 5, 8,10,20,40} | | 20 | {1, 2, 4, 8,16, 32} | | 32 | {1, 2, 4, 5, 10, 20} | | 40 | {1, 2, 4, 8, 16} | | 64 | {1, 2, 5, 10} | | 80 | {1, 2, 4, 8} | | 128 | {1, 5} | | 160 | {1, 2, 4} | | 320 | {1, 2} | | 640 | {1 } |   **< Unchanged text omitted >** |

In R1-2203540, vivo thinks it would be good to send an LS to RAN2 to see whether it possible to not support such small CG period values.

In R1-2203885, Samsung suggests to preclude CG period less than 1ms and include 1, 2, 4ms into the table and adopts the following table.

Association period table from Samsung

|  |  |
| --- | --- |
| **CG period  (msec)** | **Association period (number of CG periods ~~except when CG period is less than 5 ms~~)** |
| 1 | {1,2,4,5,8,10,16,20,32,40,64,80,128,160,320,640} |
| 2 | {1, 2, 3, 4, 5, 8, 10, 16, 20, 32, 40, 80, 160, 320} |
| 4 | {1, 2, 4, 5, 8, 10, 16, 20, 32, 40, 80, 160} |
| 5 | {1, 2, 4, 8,16, 32, 64, 128} |
| 8 | {1, 2, 4, 5, 8, 10, 16, 20, 40, 80} |
| 10 | {1, 2, 4, 8,16, 32, 64} |
| 16 | {1, 2, 4, 5, 8,10,20,40} |
| 20 | {1, 2, 4, 8,16, 32} |
| 32 | {1, 2, 4, 5, 10, 20} |
| 40 | {1, 2, 4, 8, 16} |
| 64 | {1, 2, 5, 10} |
| 80 | {1, 2, 4, 8} |
| 128 | {1, 5} |
| 160 | {1, 2, 4} |
| 320 | {1, 2} |
| 640 | {1 } |

In R1-2204784, Intel thinks CG period less than 5ms may require further spec effort and it’s not desirable, so Intel proposes to not support CG period values less than 5ms.

### First round discussion

According to the 4 contributions, the main concern of introducing CG period less than 5ms for mapping is the spec effort, i.e. a number of rows need to be added in the association table, some companies think the corresponding spec effort is not desirable since smaller CG periods may not be the typical use cases of SDT. However, some companies think that smaller CG period values will lead to

Since the issue has been discussed for several times, Moderator suggests we can firstly use the following discussion point to collect companies’ initial views on how to deal with CG period values less than 5ms, then in second round discussion, detailed text proposal can be discussed focusing on the most preferred option.

#### ***Discussion point 2.1-1***

How to deal with CG period values less than 5ms for association period table:

* Option 1: Capture CG period values less than 5 ms in Table 19.1-1 in TS 38.213
  + TP#2.1-1 from ZTE in section 2.1 can be a starting point for further discussion
* Option 2: Capture CG period values {1, 2, 4}ms and preclude CG period values less than 1 ms in Table 19.1-1 in TS 38.213
  + Association period table from Samsung in section 2.1 can be a starting point for further discussion
* Option 3: Preclude CG period values less than 5 ms
  + Remove “except when PUSCH configuration period is less than 5 msec” in Table 19.1-1 in TS 38.213

Regarding whether to further send an LS to RAN2, Moderator thinks it’s not needed and the decision can be made in RAN1. Any other comments?

|  |  |
| --- | --- |
| Company | Comment |
| Qualcomm | We prefer to send an LS to RAN2 to confirm the new configurations |
| New H3C | We slightly prefer Option 3 and we are open to discuss about Option 1 and Option 2. |
| Intel | We prefer Option 3.  We also agree sending LS to RAN2 is not needed. |
| vivo | Option 3 is preferred. |
| Samsung | Although we do see some useful situation for short period (i.e., UE can have more timely resource then finish the SDT quickly), we can live with option 3 if that’s all the companies’ preference. Our preference is option 2 though. |
| Ericsson | Option 3.  We do not see a reason to support CG period values less than 5 ms for inactive state. For traffic with such low periodicities, it is better that the UE moves to connected state and be configured with CG Type 1/2. |

## SSBs for TA validation and mapping in HD-FDD

In R1-2203244, ZTE has the following statements:

In RedCap WI, for RedCap UE in idle/inactive state, two kinds of separate initial DL BWP may be configured. One is that separate initial DL BWP can include CORESET#0 and CD-SSB. The other is that separate initial DL BWP only includes CSS for RA, but does not include SSB, paging and SI reception. Then when the first kind of separate initial DL BWP is configured, CD-SSB can be used for mapping and TA validation. But for the second kind of separate initial DL BWP, since there is no SSB, CD-SSB in legacy initial BWP may be used for mapping and TA validation similar to RACH procedure in idle/inactive state.

***Proposal 2: For RedCap UE performing SDT, CD-SSB can be used for SSB to CG PUSCH mapping and TA validation.***

For Proposal 2, since CD-SSB is the only kind of SSBs that supported in RRC inactive state for RedCap UE no matter in separate initial BWP or initial BWP, there is no ambiguity even without any spec changes. However, for separate initial BWP not including SSBs, the behavior of RedCap UE performing SDT is different from legacy UE. So TP #2 can be adopted to specify which SSBs will be used for mapping if no SSBs are configured in separate initial BWP.

***Proposal 3: For RedCap UE performing SDT, if separate initial DL BWP does not include any SSBs, the SSBs associated with initial DL BWP can be used for SSB to CG PUSCH mapping.***

* ***Adopt TP#2 in Clause 19.1 for TS 38.213.***

### 2.2.1 First round discussion

ZTE has proposed 2 Issues for RedCap UEs performing SDT, the first is which type of SSBs(CD-SSB or NCD-SSB) will be used for SSB mapping and TA validation, since CD-SSB is the only kind of SSBs that can be configured in RRC inactive state, it might be good to clarify that CD-SSB can be used for CG PUSCH mapping and TA validation.

The second issue is if separate initial DL BWP does not include any SSBs, it may cause ambiguity on the behavior of RedCap UE performing SDT, which is different from legacy UE. In this case, the SSBs associated with initial DL BWP can be used for SSB to CG PUSCH mapping. TP#2.2-1 is also proposed to reflect the relevant spec change.

#### TP#2.2-1

|  |
| --- |
| ***Reason for change:*** for Redcap UE, associated SSB is not clear in case of no SSB associated with separate initial BWP.  ***Summary of change:*** if there is no SSB in separate initial BWP, CD-SSB in legacy initial BWP can be use for mapping.  ***Consequences if not approved:*** associated SSB is not clear.  **------------------------------ TS 38.213-----------------------------------**  **< Unchanged text omitted >** 19.1 Configured-grant based PUSCH transmission 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 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 from the value of *ssb-PositionsInBurst* in *SIB1* or by *ServingCellConfigCommon*. 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.  For a RedCap UE, if it is configured with a BWP indicated by *initialDownlinkBWP-RedCap-r17* which is not associated with any SS/PBCH block, CG resource can be associated with SS/PBCH blocks in the BWP indicated by *initialDownlinkBWP*.  **< Unchanged text omitted >** |

#### ***Proposal 2.2-1***

For RedCap UE performing SDT,

* CD-SSB can be used for SSB to CG PUSCH mapping and TA validation.
* if separate initial DL BWP does not include any SSBs, the SSBs associated with initial DL BWP can be used for SSB to CG PUSCH mapping.

Any comments?

|  |  |
| --- | --- |
| Company | Comment |
| Qualcomm | We are fine with the 1st bullet.  Regarding the 2nd bullet, clarification is needed for “the SSBs associated with initial DL BWP” and a “separate initial DL BWP does not include any SSBs.” |
| New H3C | In principal, we are fine with this proposal. Regarding second bullet, in my understanding, separate initial DL BWP is dedicated to redcap UE, is ti correct? |
| Intel | We are fine with the first bullet.  For the second bullet, we share similar view as QC that clarification is needed. |
| Spreadtrum | Share the similar view as QC |
| vivo | Fine with the proposal. |
| Samsung | Not sure if we get the issue correctly, as far as we know, even with separate initial DL BWP, the CD-SSB is common to both normal UE and Redcap UE. Even though there is case that separate initial DL BWP could cover CD-SSB or not.  So we don’t see the need for this. The first bullet is not wrong but it also seems no other choice for UE. |
| Ericsson | Fine. We think the proposal is consistent with the agreements in RedCap WI. |

## Editorial correction on PRACH configuration for RA-SDT

In R1-2203244, ZTE has proposed the following:

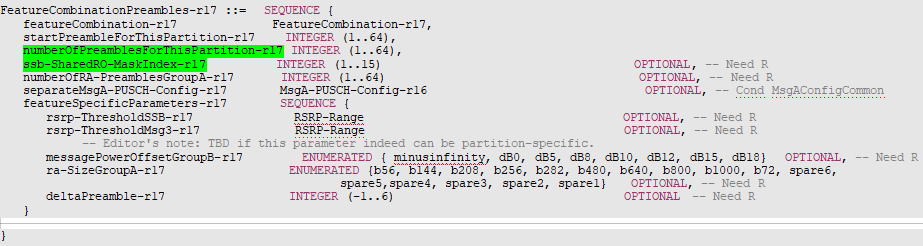
*msgA-CB-PreamblesPerSSB-PerSharedRO* is shown as below. However, this parameter is used to configure a number of preambles per SSB per shared RO, not a number of SSB indexes.

|  |
| --- |
| *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 SS/PBCH block indexes associated with one PRACH occasion by 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-SharedRO-MaskIndex or sdt-msgA-SSB-SharedRO-MaskIndex according to [11, TS 38.321].* |

The paragraph in section 19.2 mainly refers to 2-step RACH specified in section 8.1 as shown below, it’s clear that the definition of *msgA-CB-PreamblesPerSSB-PerSharedRO* should be number of preambles instead of number of SSBs.

|  |
| --- |
| For Type-2 random access procedure with common configuration of PRACH occasions with Type-1 random access procedure, a UE is provided a number of SS/PBCH block indexes associated with one PRACH occasion by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB* and a number 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]. |

Besides, in TS 38.331 v17.0.0, for each feature combination, preamble number per SSB per shared RO and shared RO mask are defined as marked in green. In order to align with definition of TS 38.331, some modifications are needed.



### First round discussion

#### TP#2.3-1

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| --- |
| ***Reason for change:*** Description error for parameter *sdt-CB-PreamblesPerSSB-PerSharedRO/sdt-msgA-CB-PreamblesPerSSB-PerSharedRO*. Parameter name is not consistent with TS 38.331.  ***Summary of change:*** a number of SSB indexes is replaced by a number of preambles. *sdt-CB-PreamblesPerSSB-PerSharedRO* or *sdt-msgA-CB-PreamblesPerSSB-PerSharedRO* is replaced by *numberOfPreamblesForThisPartition-r17*. *sdt-SSB-SharedRO-MaskIndex* or *sdt-msgA-SSB-SharedRO-MaskIndex* is replaced by *ssb-SharedRO-MaskIndex-r17.*  ***Consequences if not approved:*** description error and parameter misalignment.  **------------------------------ 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*~~SS/PBCH block indexes associated with one PRACH occasion by~~ *~~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 >** |

Since it’s an editorial issue, companies are encouraged to directly check whether TP#2.3-1 is acceptable.

Any comments?

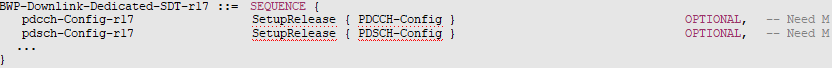
|  |  |
| --- | --- |
| Company | Comment |
| Qualcomm | OK with the TP |
| New H3C | We are fine with proposal TP. |
| Intel | For the TP, it seems to us only a single parameter is used to determine the number of preambles for both 4-step RACH and 2-step RACH. It may be good to clarify this. |
| vivo | Fine. |
| Samsung | Not sure if RAN2 has finished the design and ASN.1 coding for the RACH partitioning work, if not, we may look at the full picture on how it works. |
| Ericsson | Similar view as Samsung. Perhaps we should wait until RAN2 sends back the list of used RRC parameter names. |

## Editorial correction on USS set for CG-SDT

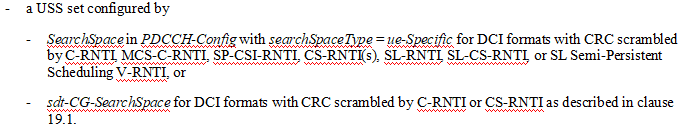
In R1-2203244, ZTE has proposed the following:

As agreed in RAN1 in previous meeting, UE specific search space set is supported for CG-SDT, in addition, RAN1 has sent RRC parameter list including sdt-CG-SearchSpace for this USS set for CG-SDT.

However, in TS 38.331 v17.0.0, the USS set for CG-SDT is configured by *pdcch-Config-r17* in *BWP-Downlink-Dedicated-SDT-r17*, which means that there is no specific parameter of USS set defined for CG-SDT, i.e. *sdt-CG-SearchSpace*. In order to align with definition in TS 38.331, *sdt-CG-SearchSpace* should be removed in the section 19.1 of TS 38.213.



In addition, in section 10.1 in TS 38.213, *sdt-CG-SearchSpace* is also used as below. Since the first sub-bullet has already included the second sub-bullet, it is feasible to remove the second bullet.



### First round discussion

#### TP#2.4-1

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| --- |
| ***Reason for change:*** *sdt-CG-SearchSpace* is not defined in TS 38.331.  ***Summary of change:*** in the section 10.1, the bullet including *sdt-CG-SearchSpace* is removed. In the section 19.1, *sdt-CG-SearchSpace* is removed.  ***Consequences if not approved:*** *sdt-CG-SearchSpace* is not found in TS 38.331.  **------------------------------ TS 38.213-----------------------------------**  **< Unchanged text omitted >** 10.1 UE procedure for determining physical downlink control channel assignment **< 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 >** 19.1 Configured-grant based PUSCH transmission **< Unchanged text 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 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 text omitted >** |

Although this issue is also editorial, some companies in prep phase have suggested to wait for formal RAN2 reply LS and then to discuss the details. From Moderator’s understanding, the RRC parameter structure defined in RAN2 is relatively stable, introducing the whole pdcch-config in RRC release message is another kind of implementation method of parameter for USS set for CG-SDT, it should be fine to start to discuss relevant spec impact in RAN1.

Q1: Do you support TP#2.4-1?

Q2: Do you think we should wait for RAN2 LS before we make any change on parameter *sdt-CG-SearchSpace?*

|  |  |
| --- | --- |
| Company | Comment |
| Qualcomm | Yes, let’s wait for the RAN2 LS. |
| New H3C | It is better to wait for RAN2 LS |
| Intel | We suggest to wait for RAN2 LS before any change on the parameter to avoid any discrepancy between RAN1 and RAN2. |
| Spreadtrum | Yes, wait for the RAN2 LS |
| vivo | Wait for RAN2. |
| Samsung | Ok to wait for ran2 further progress. |
| Ericsson | We should wait for RAN2 LS. |

## Validation rule for CG-SDT overlapping with MsgA PUSCH

Companies’ views from the submitted contributions are collected in the following table.

|  |  |
| --- | --- |
| Tdocs | Proposals |
| R1-2203540 vivo [2] | **Proposal 3:** **For a UE that supports both CG-SDT and 2-step RACH, CG PUSCH occasions for SDT are treated as invalid when overlapping with MsgA PUSCH occasion, i.e. MsgA PUSCH occasion should be prioritized.**  **Proposal 4:** **For a UE that supports CG-SDT but doesn’t support 2-step RACH, CG PUSCH occasions for SDT can be treated as valid when overlapping with MsgA PUSCH occasions.** |
| R1-2203637 Ericsson [3] | [Proposal 1 For UEs supporting both CG-SDT and 2-step RACH, a CG PUSCH occasion is not valid if it overlaps with MsgA PUSCH occasion.](#_Toc101780019) |
| R1-2203767 Xiaomi [7] | **Proposal 1：For UEs with 2-step RACH feature, the CG-SDT POs are invalid if they are overlapping with msgA PUSCH resources.** |
| R1-2204785 [6] | **Proposal 1**   * A CG PUSCH occasion is not valid if it overlaps with any valid MsgA PUSCH occasion. * Agree on TP#1 for validation of CG PUSCH occasion for CG-SDT. |

### First round discussion

Validation rule for CG-SDT overlapping with MsgA PUSCH has been discussed for several meetings, in this meeting, 4 companies have discussed this issue and think that CG occasion is invalid if overlapping with MsgA PUSCH, so Proposal 2.5-1 is shown below.

#### ***Proposal 2.5-1***

For UEs supporting both CG-SDT and 2-step RACH, a CG PUSCH occasion is not valid if it overlaps with MsgA PUSCH occasion.

Moderator would like to check whether companies could accept this proposal, if it’s still controversial, the only way might be a conclusion of no consensus.

Any comments?

|  |  |
| --- | --- |
| Company | Comment |
| Qualcomm | It is not necessary to have such a validation criterion, because:   1. For a given UE, it will not perform CG-SDT and 2-step RACH simultaneously. 2. Even if the CG PUSCH occasion selected by UE A overlaps with the msgA PUSCH occasion selected by UE B, NW can still differentiate/receive the transmissions of both UEs if they have separate DMRS resources and/or PUSCH scrambling IDs. 3. msgA PUSCH occasions may be configured in 2-step RA and/or RA-SDT. If a UE does not support SDT based on 2-step RA, it cannot apply such validation procedure when the CG-PUSCH occasion overlaps with msgA PUSCH occasions configured for RA-SDT. |
| New H3C | The motivation and scenario of this issue aren’t clear to us because 2-step RACH should be semi-static configured and NW can configure CG-SDT resource non- overlapping with msg-A PUSCH of 2-step RACH. |
| Intel | We support Proposal 2.5-1. |
| vivo | Fine. |
| Samsung | Did not see the motivation to have this invalid rule. |
| Ericsson | We support the proposal. |

## Type 1A CSS set overlapping with Type 1 CSS set

In R1-2204518, Spreadtrum has proposed the following:

For Rel-15/Rel-16, for single cell operation or for operation with carrier aggregation in a same frequency band, when the QCL-TypeD property of PDCCH in Type-0/0A/2/3 CSS or USS set are different from the QCL-TypeD property of PDCCH in Type-1 CSS and, and both PDCCHs or associated PDSCH are overlapping or partially overlapping in time, a UE does not expect to monitor the PDCCH in a Type-0/0A/2/3 CSS or USS set.

In Rel-17, Type-1A CSS is introduced to support small data transmission. In our understanding, although the type of SS of Type-1A is common, the scheduling behaviour is kind of UE specific data scheduling, for the sake of PDCCH in Type-1A CSS with CRC scrambled by a C-RNTI or a CS-RNTI. Thus, taking USS as reference, the priority of Type-1A CSS can be regarded as being lower than Type-1 CSS when referring to collision issue of the QCL-Type D property of overlapped PDCCHs each in Type-1 CSS or Type-1A CSS.

When the QCL-TypeD property of PDCCH in Type-1A CSS is different from the QCL-TypeD property of PDCCH in Type-1 CSS and, and both PDCCHs or associated PDSCH are overlapping or partially overlapping in time, a UE does not expect to monitor the PDCCH in a Type-1A CSS.

### 2.6.1 First round discussion

As mentioned in [5], since Type 1A CSS set is introduced for SDT, it should be clarified whether Type 1A CSS set has lower priority then Type 1 CSS set, if so, TP# 2.6-1 can be considered as a starting point.

#### TP#2.6-1

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| --- |
| ***Reason for change:*** For Rel-15/Rel-16, for single cell operation or for operation with carrier aggregation in a same frequency band, when the QCL-TypeD property of PDCCH in Type-0/0A/2/3 CSS or USS set are different from the QCL-TypeD property of PDCCH in Type-1 CSS and, and both PDCCHs or associated PDSCH are overlapping or partially overlapping in time, a UE does not expect to monitor the PDCCH in a Type-0/0A/2/3 CSS or USS set.  In Rel-17, Type-1A CSS is introduced to support small data transmission. In our understanding, although the type of SS of Type-1A is common, the scheduling behaviour is kind of UE specific data scheduling, for the sake of PDCCH in Type-1A CSS with CRC scrambled by a C-RNTI or a CS-RNTI. Thus, taking USS as reference, the priority of Type-1A CSS can be regarded as being lower than Type-1 CSS when referring to collision issue of the QCL-Type D property of overlapped PDCCHs each in Type-1 CSS or Type-1A CSS.  ***Summary of change:*** When the QCL-TypeD property of PDCCH in Type-1A CSS is different from the QCL-TypeD property of PDCCH in Type-1 CSS and, and both PDCCHs or associated PDSCH are overlapping or partially overlapping in time, a UE does not expect to monitor the PDCCH in a Type-1A CSS.  ***Consequences if not approved:*** The UE behavior is not clear, when the QCL-TypeD property of PDCCH in Type-1A CSS is different from the QCL-TypeD property of PDCCH in Type-1 CSS and, and both PDCCHs or associated PDSCH are overlapping or partially overlapping in time.  **------------------------------ TS 38.213-----------------------------------**  **< Unchanged text omitted >** 10.1 UE procedure for determining physical downlink control channel assignment **< Unchanged text omitted >**  For single cell operation or for operation with carrier aggregation in a same frequency band, a UE does not expect to monitor a PDCCH in a Type0/0A/0B/1A/2/3-PDCCH CSS set or in a USS set if a DM-RS for monitoring a PDCCH in a Type1-PDCCH CSS set is not configured with same *qcl-Type* set to 'typeD' properties [6, TS 38.214] with a DM-RS for monitoring the PDCCH in the Type0/0A/0B/1A/2/3-PDCCH CSS set or in the USS set, and if the PDCCH or an associated PDSCH overlaps in at least one symbol with a PDCCH the UE monitors in a Type1-PDCCH CSS set or with an associated PDSCH.  **< Unchanged text omitted >** |

#### ***Discussion point 2.6-1***

Whether Type1A CSS set has lower priority than Type1 CSS set

* If so, whether TP#2.6-1 is acceptable.

Any comments?

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| --- | --- |
| Company | Comment |
| Qualcomm | OK with TP#2.6-1 |
| New H3C | We are fine with this TP. |
| Intel | We do not think the TP is needed.  As commented during the preparation phase, our understanding is that for SDT in RRC\_INACTIVE mode, UE is expected to assume same QCL assumption for both PDCCH in Type-1A CSS and Type-1 CSS. Tx/Rx beam is always determined based on SSB to latest CG-PUSCH association. In addition, the overlapping between PDCCH in Type-1A CSS and Type-1 CSS can be avoided by gNB proper scheduling. |
| Spreadtrum | Agree with Type-1A CSS has lower priority than Type-1 CSS.  Support the TP.  Indeed, gNB proper scheduling is one way to avoid the overlapping between PDCCH in Type-1A CSS and Type-1 CSS. But actually it would set the restriction on gNB’s implementation. It can been seen that for Type-0/0A/2/3 CSS or USS set, we have already done collision handling rules, rather than up to gNB’s implementation. It would be very wired to only let Type-1A CSS up to gNB’s implementation. |
| vivo | There seems no QCL assumption issue as pointed out by Intel. If this is the common understanding, the TP may be not necessary. |
| Samsung | If type-1A is only for SDT, type 1 is for RACH related, if UE won’t have SDT procedure and RACH procedure at the same time, there is no chance UE will need to monitor both CSS at the same time. So there is no such collision from UE operation perspective. |
| Ericsson | Similar view as Intel and Vivo. Also, it is not clear to us why would a UE need to monitor Type1-PDCCH CSS if it is configured with Type1A-PDCCH CSS. |

## Others

If companies have any other comments, please provide that in the table below.

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| Company | Comment |
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# Summary

The final proposals will be added later.

# References

1. R1-2203244 Discussion on remaining physical layer issues of small data transmission ZTE Corporation
2. R1-2203540 Remaining issues for NR small data transmissions in RRC INACTIVE state and Tx switching enhancements vivo
3. R1-2203637 Maintenance issues for NR small data transmissions in inactive state Ericsson
4. R1-2203885 Maintenance on small data transmission Samsung
5. R1-2204518 Remaining issues on RAN1 aspects for small data transmission Spreadtrum Communications
6. R1-2204784 Remaining issues on physical layer aspects of small data transmission Intel Corporation
7. R1-2203767 Discussion on physical layer aspects of small data transmission xiaomi