3GPP TSG RAN WG1 Meeting #102-e R1-200xxxx

eMeeting, August 17 – 28, 2020

Agenda Item: 7.2.4.2.1

Source: Moderator (Ericsson)

Title: Resource allocation for NR sidelink Mode 1 – Thread 1

Document for: Discussion, Decision

# 1 List of issues for discussion

[102-e-NR-5G\_V2X\_NRSL-Mode-1-01] Email discussion/approval covering:

* Remaining issues for configured grant
  + Whether clarifications for the formula determining the granted slots are necessary and whether the issue should be left to RAN2.
  + Clarifications on signalling for number of retransmissions
  + Editorial corrections and clarifications for configured grant (if any).
* DCI aspects
  + Alignment of DCI format 3\_0 with other DCI formats.
  + Cells on which the UE monitors DCI formats 3\_0 and 3\_1, including discussion on PUCCH cell.
  + Editorial corrections and clarifications for DCI (if any).

By 8/20, followed by potential TPs by 8/25 – Ricardo (Ericsson)

# Discussion

## 1.1 Remaining issues for configured grant

### Issue 1.1-1 Clarifications on the formula for determining the granted slots

**Regarding the formula for determining the granted slots for a configured grant:**

1. **A correction is necessary (please provide details in your reply).**
2. **No correction is necessary in RAN1 (Note: RAN2 can determine whether a correction is necessary and apply it.)**

**(For other answers, please explain)**

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| **Company** | **View** |
| Intel | B (tentative)  We are not yet aware of any corrections needed from RAN1 perspective. We are open to consider corrections if companies can highlight the issues. |
| OPPO | A.  1. *numberOfSLSlotsPerFrame* is not a constant value per frame. How many slots per 10ms can be used for SL is determined by TDD-UL-DL-ConfigCommon, which can configure two patterns within 20ms. The number of UL slot per 10ms is independently configurable.  2. The slot determined by the formula may not belong to the resource pool that the configured grant is associated to. Some specification is needed to specify how to deal with that case. |
| vivo | A.  Same view as OPPO. *numberOfSLSlotsPerFrame* which represents the number of logical slots in a frame is not matched with 20ms in the conversion formula. And the CG resources determined based on the formula may be outside the corresponding pool as the period converted on top of the conversion formula is not dependent on pool configuration. |
| LG Electronics | We are open that the necessary correction, if any, is resolved by RAN2. |
| ZTE, Sanechips | B.  We agree RAN2’s interpretation (in 38.321, sec. 5.8.3) of “*numberOfSLSlotsPerFrame*” as number of logical slots per frame is problematic. However, this parameter is not used in RAN1 spec 38.214. So unless RAN1 spec contains certain UE behaviors depending on this parameter, the correction should be discussed in RAN2. |
| Apple | B.  We think the issue can be discussed and addressed in RAN2. |
| Sharp | A.  As discussed in our contribution, the item “numberOfSLSlotsPerFrame” is not a constant if two patterns with both periodicities as 10ms in tdd-UL-DL-ConfigurationCommon are configured with different number of UL slots. In RAN1#101e, it was agreed to use logical slots in determining resources of CG type 1 and the conversion from physical time duration P\_rsvpTX to logical slots is decided by RAN1. Thus, from our perspective, it is better to address the issue on logical slots in RAN1.  Since the item “N” which denotes the number of SL slots within 20ms has already been specified in 8.1.7, TS38.214, and P+P2 is always divided by 20ms, we propose to use “N” instead of “numberOfSLSlotsPerFrame” in the formula and please find the details of change as follows,  After a sidelink grant is configured for a configured grant Type 1, the MAC entity shall consider sequentially that the first slot of the Sth sidelink grant occurs in the logical slot for which:  [( × N) + logical slot number in the two consecutive frames] =  ( × N ++ sl-TimeOffsetCGType1+ S × PeriodicitySL) modulo (512 × N).  where , and *N* refers to the number of logical slots that can be used for SL transmsission in 20ms, as specified in clause 8.1.7 of TS 38.214 [7]. The first frame of the two consecutive frames is an even frame. If is an even frame, ; Otherwise, refers to the number of logical slots that can be used for SL transmission in an even frame. |
| CMCC | Similar view with OPPO that the“numberOfSLSlotsPerFrame” is problematic when dual patterns are configured. We are ok to address it in RAN1 or RAN2. |
| CATT | A.  Same view with OPPO and vivo. The correction can be done by RAN2 based on RAN1’s agreements. |
| Huawei, HiSilicon | B.  As the determination of configured grant slot are specified in 38.321, we think it can be further discussed and corrected in RAN2 if there is problem. |
| Samsung | B.  We have similar view with ZTE that the interpretation of “*numberOfSLSlotsPerFrame*” may be problematic but should be fixed by RAN2, since the parameter is not present in RAN1 specifications. |
| Ericsson | B. If there is any issue, it should be RAN2 solving it. |
| Nokia, NSB | B.  The current text in 38.321 is problematic, as pointed out by OPPO and others, but this can be fixed by RAN2. |
| Futurewei | B. Up to RAN2 to correct, if needed |

### Issue 1.1-2 Clarifications on signalling the number of retransmissions

**A few contributions discuss how to signal the number of retransmissions in Mode 1 and set the corresponding TDRA and FDRA fields in SCI (e.g., R1-2005797, R1-2006434). This does not seem to be covered in the specification, which currently refers only to Mode 2 (see TS 38.213, Clause 16.4).**

**For Mode-1, the following two agreements determine how to set the TDRA and FDRA fields in DCI/SCI.**

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| Agreements:   * For dynamic grant, DCI indicates the time-frequency resource allocation with the signalling format used for SCI.   + In addition, the starting sub-channel for initial transmission is signalled in DCI.   Agreements:   * At least the following parameters are part of a SL configured grant configuration:   + Configuration index of the CG   + Time offset (for type-1 only)   + Time-frequency allocation (for type-1 only)     - Using the same format as in DCI.   + Periodicity   + The configured grant is associated with a single transmit resource pool.   + RAN2 can add other parameters if deemed necessary by RAN2 * A UE in mode 1 is configured at least with one transmit resource pool * For type-2 CG, the time-frequency allocation and the configuration index of the CG are indicated in DCI.   + All parameters for CG type 2 for activation DCI re-use the same respective parameters configured for CG type 1, when applicable |

**Proposal:**

* **Capture how to set the TDRA and FRDA fields in the specification based on the above agreements.**

**(For other answers, please explain)**

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| **Company** | **View** |
| NTT DOCOMO | Agree |
| Intel | Agree  We expect a UE is instructed to copy FDRA and TDRA fields from DCI 3\_0. |
| OPPO | Agree |
| vivo | Agree. |
| LG Electronics | **We are supportive of FL’s proposal**. Note that for Mode 1 operation, it should be specified that the information of time/frequency resource assignment configured/scheduled by the network (e.g., activation DCI for CG Type 2, RRC signalling for CG Type 1, re-TX DG for CG Type 1 and DG) is inherited by SCI format 1-A. |
| ZTE, Sanechips | Agree. |
| Apple | Agree |
| Sharp | Agree in principle  On top of the above agreements, we think further clarification is needed to set TDRA/FDRA fields. For the first transmission scheduled by DCI 3\_0 or indicated in CG, it is natural to copy both fields. While for the second transmission(if any), e.g. N\_max=2, since backward signalling is not supported, the SCI only needs to indicate the second transmission itself(i.e. TRIV in TDRA field is set as 0). Thus, it is incorrect to simply copy the fields of TDRA/FDRA from DCI 3\_0. Briefly, the SCI associated with the first transmission indicates 1st and 2nd SL resource and the SCI associated with the second transmission indicates only the 2nd SL resource. Accordingly to the above discussions, we propose the following clarification:  A UE that transmits a PSCCH with SCI format 1-A corresponding to the -th ()resource indicated by the SL grant using sidelink resource allocation mode 1 [6, TS 38.214] sets  - the values of the frequency resource assignment field and the time resource assignment field to indicate -th , ( +1)-th,…, N-th resource as described in [6, TS 38.214]. |
| Qualcomm | We agree with the proposal and think the that issue brought up by Sharp is also a valid one |
| CMCC | Agree FL’s proposal with Sharp’s clarification. |
| CATT | Agree. |
| Huawei, HiSilicon | Agree in principle, but only according to the agreements above, the resource configuration are not complete.  For configured grant, the time-frequency allocation uses the same format as in DCI, thus the higher layer parameters *SL-ConfiguredGrantConfig* for configured grant type 1 can only provide three resources at the most. However, due to the configuration of the maximum number of times for configured grant, one TB can be transmitted up to 32 time using the resources provided by the CG. Therefore, the current CG resource configuration and existing higher-layer parameters cannot support such scheduling. Furthermore, RAN2 has agreed that it is not allowed to use CG resource in next period for a TB retransmission. So in order to support max 32 times transmission and provide enough flexibility on CG retransmission resources configuration, we can further discuss the following question in addition to the proposal:  ***Whether to support resource repetition within a period? If yes, how to configure the repetition, i.e. whether new RRC parameters are needed.***    For the issue, we think the repetition of the existing three CG resources regarded as a group could be applied. A new higher layer parameter which indicates the interval between the groups of resources configured by the existing higher layer parameters should be added in *SL-ConfiguredGrantConfig* information element in TS 38.331. |
| Samsung | Agree FL’s proposal. Sharp’s clarification also make sense. |
| Ericsson | We are fine with the proposal and Sharp’s clarification |
| Nokia, NSB | Agree with FL’s proposal + Sharp’s point. |
| Futurewei | We support the proposal. Sharp’s clarification is also valid |

## 1.2 DCI aspects

### Issue 1.2-1 Alignment of DCI format 3\_0 with other DCI formats

**In the past, RAN1 made the following agreement and WA**

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| Agreements:   * Existing DCI size budget is maintained when the UE is configured with SL * (working assumption): The size of the new DCI format and the size of one of the existing NR DCI formats are aligned. |

**Which DCI format should be used for size alignment of DCI format 3\_0?**

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| **Company** | **View** |
| NTT DOCOMO | Basically DCI format 0\_1.  But the following two cases should be discussed:  - when DCI format 0\_1 is not configured  - when there is no DCI format configured with larger payload size than 3\_0 |
| Intel | First, we think there could be cases when the DCI budget is respected without alignment.  When alignment is necessary, we prefer the closest larger DCI format from 0\_x, 1\_x by zero-padding 3\_0 to the closest format.  If 3\_0 turns out the largest format itself   * + - * Option 1: UE does not expect such configuration       * Option 2: Align 0\_1 by zero-padding to 3\_0 |
| vivo | The reference DCI should be a non-fallback DCI(DCI format x-1/ x-2). And we prefer to avoid zero-padding to x-2 which are introduced in R16.  Case1. SL DCI has a smaller size than some non-fallback DCI (e.g., x-1/x-2). To avoid too many inserted bits, the size of SL DCI should be aligned to a non-fallback DCI format with the smallest value among the NR Uu non-fallback DCI format that has a larger size than SL DCI before the padding.  Case2. If sizes of DCI format 0-1/1-1 are smaller than SL DCI, a DCI format with the larger size among the non-fallback DCI 0-1/1-1 is padded to align with SL DCI.  Case3. If no non-fallback DCI x-1 is configured on the serving cell configured with SL DCI, it is considered as an error case. So, the proposal is:   * ***If UE is configured to monitor DCI format 3\_0 on a serving cell and there is at least one non-fallback DCI with size larger than DCI format 3\_0, the size of DCI format 3\_0 is zero-padded to the same size as a DCI format with the smallest value among the NR Uu non-fallback DCI formats that has a larger size than DCI formats 3\_0 prior to the padding on the serving cell.*** * ***If UE is configured to monitor DCI format 3\_0 on a serving cell and the size of DCI format 3\_0 is larger than NR Uu non-fallback DCI format 1\_1/0\_1 on the serving cell, the Uu non-fallback DCI with the larger size between DCI format 1\_1/0\_1 is padded to align with DCI format 3\_0.*** * ***At least one non-fallback DCI format 1\_1/0\_1 is configured for the serving cell configured with DCI format 3\_0 or 3\_1***   Apart from the reference DCI format for size alignment, we also need to determine the cell of the reference DCI. If the serving cell (e.g. cell#1) configured with SL DCI can schedule another Scell (e.g. cell#2), there would be two DCI format groups on the Pcell, i.e., one group for DCI for cell#1 self-scheduling and the other for DCI for cross-carrier scheduling cell#2. In this case, it is unclear which DCI group provides the reference DCI format that should be considered for SL DCI size alignment. Since the configuration between the two cells can be quite different, the difference in size between the non-fallback DCI for self-scheduling or the non-fallback DCI for cross-carrier scheduling can be substantial. To keep it simple, we prefer to align SL DCI to non-fallback DCI for Uu self-scheduling.   * ***If UE is configured to monitor DCI format 3\_0 on a serving cell, DCI format 3\_0 size should be aligned to a non-fallback DCI scheduling the same serving cell*** |
| LG Electronics | First of all, we don’t think that it is necessary to limit “Uu DCI format of USS” used for size alignment of DCI format 3\_0. Details of our proposal are as follows:   * **If the DCI format size budget is not fully used, no size alignment for DCI format 3\_0 is done. On the other hand, if the DCI format size budget is fully used, DCI format 3\_0 size is aligned to one of “Uu DCI formats of USS” such that the number of padded zeros is minimized.** |
| ZTE, Sanechips | Our preference is NOT to confirm the WA. The impact of DCI 3\_x to overall DCI size budget can be left as gNB implementation, similar to the case of DCI Format 2\_x (eg. DCI Format 2\_0). This preference is based on following considerations.   * The DCI sizes of fall-back DCIs (i.e., DCI 0\_0 and DCI 1\_0) should not be changed due to adding of SL operations. * The UE may have no configurations relating to detection of DCI 0\_1 and DCI 1\_1, e.g., the UE is not configured to use DCI 0\_1 and 1\_1. * In case DCI 3\_x size is larger than the size of target alignment DCI, shortening DCI 3\_x by removing most significant bits in frequency assignment field may not work due to inclusion of multiple Tx occasions in one DCI. |
| Apple | If NR DCI format 3\_0 is not the largest DCI format to be monitored, then it is zero padded to the smallest NR Uu DCI format which is larger than DCI format 3\_0.  If NR DCI format 3\_0 is the largest DCI format to be monitored in a search space, then the largest NR Uu DCI format is zero padded to DCI format 3\_0. |
| Sharp | It should be first clarified whether the size alignment is done Case 1: as part of the “DCI size alignment” procedure (section 7.3.1.0 in 38.212) or Case 2: after the DCI size alignment procedure. Case 1 complicates the existing DCI size alignment procedure a lot and is undesirable in our eyes. If Case 2 is adopted, it would be most efficient and future-proof to pad 3\_0 to whatever is the closest larger NR Uu DCI size for the cell, and we don’t see any technical reason why the target format should be restricted to 0\_x or 1\_x (as proposed by some other companies). If 3\_0 is the largest among all DCI sizes, it OK to either specify it as an error configuration, or zero-pad the largest NR Uu DCI size to align with 3\_0. |
| Qualcomm | DCI 3-0 and the next largest of DCI 0-1 and DCI 1-1 are size aligned.  If none of the above Uu DCI formats is configured or are all smaller than DCI 3-0 and the DCI size budget would be exceeded otherwise, DCI 3-0 and DCI 0-0 or 1-0 are size aligned. |
| CMCC | DCI format 0\_1. If UE is not configured to monitor DCI format 0\_1, the DCI format with minimum size different between DCI format 3\_0 and the selected DCI format is used for size alignment by zero padding the format with smaller size. |
| CATT | DCI format 0\_1 as baseline for the size alignment. |
| Huawei, HiSilicon | According to the agreements in RAN1#99, on a given scheduling cell and a given PDCCH monitoring occasion, either PDCCH carrying a DL grant or PDCCH carrying a SL DG is configured. Thus gNB will avoid scheduling a Uu DCI and SL DCI together, and the network configuration can ensure the blind decoding not to exceed the maximum number of monitored PDCCH candidates. So it is no need to align DCI 3\_0 with another Uu format size. |
| Samsung | At first, if size budget is not exceeded, no DCI alignment is necessary. Otherwise DCI format 3\_0 is aligned with one existing DCI format.  Then we consider DCI format 0\_1 as reference DCI format size. If UE is not configured configured with DCI format 0\_1:   * If DCI format 3\_0 is not the largest DCI format size, DCI format 3\_0 is padded to align with existing DCI format with closest larger size. * Otherwise if DCI format 3\_0 is the largest DCI format size, one existing DCI format with largest size is padded to align with DCI format 3\_0. |
| Ericsson | DCI format 0\_1 |
| Futurewei | DCI format 0\_1 |

### Issue 1.2-2 Cells on which the UE monitors DCI formats 3\_0 and 3\_1

**One contribution proposes to clarify that the UE monitors DCI formats 3\_0/3\_1 (if configured) only in PCell** (**R1- 2006769). Another contribution discusses PUCCH cell as well (R1-2006694).**

**Proposal:**

* **DCI formats 3-0 and 3-1 are only monitored on PCell.**
* **PUCCH carrying SL HARQ-ACK reports is transmitted on PCell.**

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| **Company** | **View** |
| NTT DOCOMO | For 1st bullet, we are not sure the restriction is needed.  - For example, if SL is operated on a shared carrier and the carrier is SCell, then it seems that SL scheduling from the same cell is more feasible.  For both bullets, we would like to clarify whether NR-CA with PUCCH SCell or NR-DC is considered for this discussion or not.  - If not considered, discussion on the 1st bullet is only above our comment and the 2nd bullet is unnecessary since PUCCH can be transmitted on PCell only.  - If considered, restriction on cross-FR/band/PUCCH-group scheduling shall be discussed since it would not be OK from UE implementation perspective. Otherwise, any scheduling combination among PDCCH/SL-resource/PUCCH is allowed, e.g. PDCCH is band X in FR1, SL is band Y in FR1, and PUCCH cell is FR2. Note that, PUCCH SCell or PSCell is the other candidate for PUCCH cell, in this case. So the 2nd bullet needs to be discussed.  - We believe that ‘NR-CA with PUCCH SCell or NR-DC’ should be considered in RAN1. Current RAN4 spec does not support, but would support in future. In the timing, time for RAN1 discussion is not guaranteed. |
| Intel | Neutral. If there is no much specification effort to support non-PCell scheduling and PUCCH, we are open. |
| OPPO | No necessary for this proposal.  For the first bullet, similar view as DOCOMO  For the second bullet, PUCCH in NR Uu can be transmitted in PCell or PScell. Follow existing PUCCH mechanism is enough. |
| vivo | * Regarding 1st bullet.   We think the first bullet is not necessary. We don’t see the necessity of introducing such restrictions. From the perspective of scheduling, there are no big differences between Scell scheduling and Pcell scheduling, thus enabling a SL DCI transmission on a scell does not introduce additional complexity compared with Pcell scheduling SL case. Additionally, allowing Scell scheduling SL has some benefits. For example, when the Pcell is in a heavy load and the PDCCH capacity of Pcell is limited, gnb can offload the SL scheduling to a Scell with less PDCCH transmissions to reduce the burden of Pcell.   * Regarding the second bullet   Generally fine to define the PUCCH cell for SL HARQ-ACK reporting, we prefer to change ‘Pcell’ to ‘PUCCH Pcell’.  For PDSCH scheduling, an IE PUCCH-cell is included in PDSCH-ServingCellConfig to indicate whether HARQ-ACK for the PDSCH is transmitted on PUCCH SPcell or PUCCH scell. If IE PUCCH-cell is absent, HARQ-ACK should be transmitted on PUCCH Pcell by default.   |  | | --- | | ***pucch-Cell***  The ID of the serving cell (of the same cell group) to use for PUCCH. If the field is absent, the UE sends the HARQ feedback on the PUCCH of the SpCell of this cell group, or on this serving cell if it is a PUCCH SCell. |   Since there is no such PUCCH-cell IE defined for SL scheduling so far, we can follow the behavior similar to the case where PDSCH-ServingCellConfig is configured without PUCCH-cell indication, i.e., PUCCH carrying SL HARQ-ACK reports should be transmitted on PUCCH Pcell. Alternatively, we can introduce a PUCCH-cell IE for SL configuration and follow the existing mechanism. |
| LG Electronics | To our understanding, in the current RAN2 specification (i.e., TS 38.331), there is no RRC parameter indicating a cell used for monitoring DCI format 3\_0/3\_1. Also as per RAN2 agreement, the scenario where SL is controlled/configured by Secondary Node is not considered in Rel-16 NR V2X. As a result, **we are supportive of FL’s proposal** that is also aligned with the principle of LTE V2X. Note that even in case when DCI format 3\_0 is only monitored on PCell, the relevant SL TX can be performed in “another Cell (e.g., SCell)” or “one of ITS dedicated frequencies”. So, **we need to introduce “Carrier Indicator Field” in DCI format 3\_0**. |
| ZTE, Sanechips | **Support FL’s proposal.** Our main concern comes from timing. PCell and SCell may have different timing, and the earlier RAN1 discussion did not assume different timings to be applicable to DCI detection and PUCCH transmission carrying SL HARQ-ACK. This is to say it is better to limit the DCI detection and PUCCH transmission on the same cell. Further, NR Uu does not support ACK/NACK on PUCCH belonging to SCell. Then the choice is left between PCell and PSCell. We think it is safer to pick PCell where the UE normally obtains SIB information for SL configurations (“safer” means that the other way around may not be soly decided by RAN1). |
| Apple | For the first bullet, we think it is not necessary to restrict to monitor DCI 3\_0 only on PCell, especially for the case where sidelink shares the carrier of SCell.  For the second bullet, SL HARQ-ACK report can be transmitted in PCell or PScell, like PUCCH in NR Uu. |
| Sharp | We support the FL proposal. |
| Qualcomm | Docomo brings up a valid point about self-scheduling in a shared carrier that we did not address in our contribution. In this case, we think the proposal needs to be updated so that when cross-carrier scheduling is enabled for the sidelink carrier, DCI 3-0 and 3-1 are only monitored on PCell, while self-scheduling on an SCell is used when configured.  For the second proposal on PUCCH cell, our understanding is that this is the current behavior in specifications, but we’re ok with having an explicit agreement for clarity. |
| CATT | We are neutral on this issue. |
| Huawei, HiSilicon | The monitoring space for DCI formats 3-0 and 3-1 can follow the LTE principle, where the restriction of PCell on DCI format 5A is not specified. |
| Samsung | For the 1st bullet, we are neutral on introducing Scell scheduling, but some further issues, e.g. how to configure the cell used to monitor DCI format 3\_0 and DL pathloss of which cell is used for SL PC, needs to be carefully discussed to reduce specification impact.  For the 2nd bullet, we prefer to reuse existing mechanism that PUCCH can be transmitted in PCell or PScell. |
| Ericsson | We don’t see the need for the first bullet |
| Nokia, NSB | We are not convinced of the need for the restriction on the cell where DCI is received. |
| Futurewei | First bullet: unclear what benefit there would be in putting such a restriction  Second bullet: while we do not have any strong view, we do not see why the behaviour would be different than for the Uu link where either Pcell or PScell can be used |

## Other comments

NOTE: I will prepare TPs or list of TPs for editorial aspects. I will share it in a later iteration.

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