**3GPP TSG RAN WG1 Meeting #101-e R1-200XXXX**

**eMeeting, May 25-June 5, 2020**

**Agenda Item: 7.2.4.7**

**Source: Moderator (FUTUREWEI)**

**Title: FL summary #1 on NR Uu scheduling LTE sidelink**

**Document for: Discussion and decision**

# Introduction

A WID on NR-V2X was approved at RAN#83, with one of the objectives as follows:

2. *Specify support for NR Uu to provide control for LTE sidelink*

* *Sidelink mode 4 as per the study outcome [RAN2, RAN1]; and*
* *Sidelink mode 3-like RRC-configured SPS scheduling with either RRC-based activation/deactivation as per the study outcome or DCI-based activation/deactivation [RAN1, RAN2].*
  + *RAN1 to make a decision on which option is supported until RAN#84.*

9 companies submitted contributions for this AI ([1]-[9]).

# Proposals for email thread:

Thread #1:

* ***Have an email discussion to discuss how to capture (e.g., whether in a TP or conclusion in the Chairman’s notes) that SL index is present in DCI 3\_1 only for cases with TDD configurations 0-6 and to discuss if any clarification is needed for SPS index and activation/release in DCI format 3\_1***

Thread#2

* ***From RAN1 perspective, discuss whether DL pathloss based OLPC is supported and which of following cases are addressed:***
  + ***NR Uu scheduling LTE sidelink with NR Uu and LTE SL carriers overlapping in frequency to compensate for the gNB-UE pathloss***
  + ***LTE V2X mode-4 resource allocation on a carrier overlapping with NR Uu to compensate for the gNB-UE pathloss***
* ***Note: This does not imply that RAN4 supports one of these scenarios in Rel-16***
* ***Note: For the shared carrier case, in Rel-16, RAN1 will not address any aspect other than power control***

# Issues listed by companies

The list of issues brought by companies is summarized here. The issues are summarized in Table 1, along with the proposals for each of them. Then, in following subsections, each issue is discussed in more detail.

Table 1. Summary of issues.

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| --- | --- | --- |
| Issue | Description | FL Proposal |
| Issue 1 | **Power control**: whether open loop power control should be supported on the sidelink when NR Uu schedules LTE sidelink | Email discussion |
| Issue 2 | **SL index**: whether SL index should always be present in DCI 3\_1 | Email discussion to discuss whether a TP is necessary (no need for new agreement) |
| Issue 3 | **SPS configuration index and activation fields**: whether the description in format 3\_1 should refer to 36.213 instead of 36.212 | No email discussion |
| Issue 4 | **Units for timing of the grant**: whether the formula indicating the timing of a grant should be in seconds or milliseconds | No email discussion |

## Issue 1: Power control

This issue is brought in 7 contributions ([1], [3], [5]-[9]). It was discussed at RAN1#100b-e, with no consensus achieved. The issue is whether on a shared Uu/SL carrier, open loop power control should be applied to protect the eNB/gNB, as it is for LTE.5 companies are in favor of solving the issue, ([3], [5], [6], [8], [9]), 2 advocate no change ([1], [7]).

RAN4 has not (yet) produced specifications for the shared carrier. However, as pointed out by several companies, RAN1 specification does not usually consider operational scenarios when writing RAN1 specification. RAN4 usually puts additional restrictions on top of RAN2/1 specification. Besides, as pointed out by Docomo [8], should RAN4 decide to standardize a shared scenario in the future, RAN1 will have to solve this issue at that time. Thus there is value in solving the issue especially if reuse of LTE can make it straightforward.

***FL suggestion: have an email discussion to discuss OLPC for the shared carrier case using the following as the starting point:***

* ***From RAN1 perspective, discuss whether DL pathloss based OLPC is supported and which of following cases are addressed:***
  + ***NR Uu scheduling LTE sidelink with NR Uu and LTE SL carriers overlapping in frequency to compensate for the gNB-UE pathloss***
  + ***NR Uu scheduling LTE sidelink with LTE Uu and LTE SL carriers overlapping in frequency to compensate for the eNB-UE pathloss***
  + ***LTE V2X mode-4 resource allocation on a carrier overlapping with NR Uu to compensate for the gNB-UE pathloss***
* ***Note: This does not imply that RAN4 supports one of these scenarios in Rel-16***
* ***Note: For the shared carrier case, in Rel-16, RAN1 will not address any aspect other than power control***

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| Company | View |
| Futurewei | Discuss OLPC at this meeting and adopt the LTE-like OLPC for each scenario |
| NTT DOCOMO | Support FL suggestion. RAN1 should have discussion and make agreements on OLPC for the above cases. |
| ZTE, Sanechips | Agree with FL’s suggestion. |
| vivo | Ok to discuss this issue. |
| Huawei, HiSilicon | Ok in principle to have this discussion for NR Uu and LTE SL sharing the carrier. OPPO made a good point on needing clarification of the proposal’s intention, the same carrier or the same band?  In addition, we hesitate to further optimize at maintenance stage the case of LTE Uu and LTE SL sharing the same carrier when gNB controls the LTE SL especially when involving much spec impact, and any potential changing to 36.xx is also a concern.  FL’s response: the intent was to cover the shared carrier case, but to include the case where the two carriers are not the same bandwidth (e.g., 10MHz LTE with 20 MHz NR). Modified to ‘overlapping carriers’.  On the second point, duly noted. Wording from the main bullet to make it clerar to discuss which cases, if any, will be addressed |
| CATT | OK to discuss this issue. |
| Nokia, NSB | OK to discuss this issue; but the wording in the FL suggestion with supporting all cases of OLPC “as the starting point” seems to almost pre-determine the outcome of the discussion.  FL’s response: fair comment. First bullet point language was modified to be neutral |
| Ericsson | Agree with FL proposal |
| OPPO | Regarding FL’s suggestion, it is mentioned that the intended OLPC is for the shared carrier case, which in our understanding is co-channel operation between NR Uu and LTE SL. But in the 3 sub-bullets, it is mentioned that “***NR Uu and LTE SL on the same band***”, for which in our understanding could be co-channel operation or they are separate carriers (e.g. adjacent carriers) but within the same band. Could the FL please first clarify which specific scenario is intended for discussion?  FL’s response: see response to Huawei  OPPO: This is actually more confusing to say Uu and SL carriers are separated (but overlapping). I believe we have ever considered and discussed the case when two carriers are overlapped, i.e. are they partially or fully overlapped. In any case, it is already clarified that the intention is to cover the “shared carrier” case.  Overall, we do not agree to discuss this issue 1 in general, as the described operation scenarios have either already been explicitly ruled out by RAN1 for Rel-16 (R1-1911720) or unrealistic by nature in our view. Furthermore, these scenarios / use cases are not justified or even out of scope of this WI. And even if they are justified later-on, other technical aspects more than just power control will need to be discussed together and supported in RAN1/2/4 in order to enable these scenarios. Therefore, it is actually pre-mature to discuss this power control at this stage. Lastly, it is also misleading and untrue to say these OLPC schemes are already supported in LTE for these scenarios.  FL’s response: At this stage, the goal of the proposal is to make sure that we do not have to come back and solve this issue later, should RAN4 decide to support a shared carrier case, but there is no appetite to do extensive work on the shared carrier. My understanding of R1-1911720 was a little bit narrower than yours: assuming you are referring to Q3, the question was explicitly asked for **LTE-UL/NR-SL and LTE-SL/NR-UL prioritization**, and in my view, the response can only be read within the context of prioritization.  OPPO: Although the context was asking about SL/UL prioritization, but the answer from RAN1 was clear “RAN1 has so far not considered such operating scenario where UL and SL transmissions from different RAT are in the shared/same carrier, and RAN1 has no plan to discuss this in Rel-16.” This effectively ruled out the scenario(s) described in the first and third sub-bullets.  Could you also clarify what aspects other than power control would need to be addressed? In any case, to limit the scope, would OPPO be okay with a note such as “For the shared carrier case, in Rel-16, RAN1 will not address any aspect other than power control’?”  OPPO: Beside RF requirements need to be completed by RAN4, from RAN1/2 perspectives, other technical aspects include at least UL/SL prioritization, power sharing for simultaneous UL/SL transmissions, control of LTE SL operation comes from two separate eNB/gNB (for the second sub-bullet scenario), signaling exchange / scheduling coordination between two separate eNB/gNB, LTE SL resource configuration, BWP / resource pool alignment, timing alignment, synchronization between the two NBs and etc. In our view, there are many different things need to be considered and supported before the intended scenarios can work in practice. And some of them may have impacts to power control. So in order to support these scenarios, extensive work is expected and it is best to discuss all relevant aspects together to enable a holistic design when later-on we are ready to support these scenarios.  Also, we want echo HW and Qualcomm’s comments on the second scenario where LTE Uu and LTE SL are on a shared carrier but LTE SL is controlled by a NR gNB. |
| LG Electronics | Assuming that the following scenarios will be also discussed, we are okay to have an email discussion for this issue:   * LTE SL scheduled by NR Uu is performed in ITS dedicated carrier * LTE SL Mode 4 configured by NR Uu is performed in LTE licensed carrier and UE have eNB as serving/camping cell for that carrier |
| Qualcomm | We don’t think that this discussion is needed as these are not supported scenarios. If they become supported in a later release, RAN1 can do the necessary changes to specifications then.  The second case, (NR Uu scheduling LTE SL on an LTE Uu band) hasn’t been supported in LTE V2X (there is no band that has both LTE Uu and LTE SL). For this case, it would also be more straightforward to have LTE Uu control LTE SL. |

## Issue 2: SL index of DCI field

This issue is brought up in [1] and [4]. SL index is listed in DCI format 3\_1:

- SL index – 2 bits as defined in 5.3.3.1.9A of [11, TS 36.212]

TS 36.212 in turn specifies the following for “SL index”:

- SL index – 2 bits as defined in clause 14.2.1 of [3] (this field is present only for cases with TDD operation with uplink-downlink configuration 0-6).

This brings the question of whether SL index is always present or only for case with TDD configurations 0-6.

Previous agreements make it clear that SL index is not always present. At RAN1#97, the following was agreed:

* *DCI-based activation/deactivation is supported* 
  + *Support of LTE PC5 scheduling by NR Uu (mode 3-like ) is based on UE capability*
  + *NR DCI provides the fields of DCI 5A in LTE-V that are related to SPS scheduling*

Given that the DCI 5A does not always contain the SL index, the same applies for DCI 3\_1. Furthermore, at RAN1#100b, the following was agreed:

* *For NR Uu scheduling LTE sidelink, the subframe of the first sidelink transmission is the first SL subframe of the corresponding resource pool that starts not earlier than* *, where TDCI is the start timing of the slot carrying DCI format 3\_1, NTA and Tc are defined in TS 38.211, X is the value indicated by Timing offset field in DCI format 3\_1, m is the value indicated by SL index in DCI format 3\_1 if SL index is present, otherwise m=0.*

Companies have different views on whether a spec change is needed to capture the fact that SL index is not always present. Therefore, RAN1 should discuss if a TP is necessary.

**FL’s proposal:**

* ***Have an email discussion to discuss how to capture (e.g., whether in a TP or conclusion in the Chairman’s notes) that SL index is present in DCI 3\_1 only for cases with TDD configurations 0-6***

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| Company | View |
| Futurewei | We do not view the TP as indispensable, but are okay with a TP to explicitly capture when the SL index is present if the group is leaning that way. |
| ZTE, Sanechips | We prefer to discuss this issue and explicitly capture the conclusion in a TP if a consensus is reached. |
| vivo | In our view issue 2 and 3 are quite similar and can be discussed together. |
| CATT | The current spec seems clear to us. There is no necessary to discuss this issue. |
| Nokia, NSB | Support to discuss this issue. We are fine to also include issue 3 in the same discussion, since for both issues the underlying potential ambiguity is whether the reference to 36.213 is only for the description of the field or for both description and presence condition of the field. |

## Issue 3: SL SPS configuration index

This issue is listed in [2]. DCI format 3\_1 refers to DCI format 5A for the fields *SL SPS configuration index* and *activation/release*. In [2], it is stated that “ clause 5.3.3.1.9A of DCI format 5A in which the SPS configuration index and activation/release indication exist only when an LTE V2X SPS RNTI (i.e., SL-SPS-V-RNTI) is used to scramble to the DCI. Consequently, these fields will be absent in DCI format 3\_1 as there is no such RNTI specified in NR.”

In the Feature Lead’s opinion, there is no ambiguity . The RNTI condition does not apply, we would not refer to the description there if the field was never included.

***FL’s proposal: This is not a critical issue. No action taken***

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| Company | View |
| vivo | It is not clear to us why for the same DCI format 3\_1, a description in LTE for “SL index” is automatically applicable to NR, while another description in LTE for “SPS index and activation/release” are automatically not applicable to NR. If the RNTI condition is not applicable to NR, it should be clearly captured instead of leaving an incorrect reference.  FL’ response: let see if other companies have the same view |

## Issue 4: Units for timing of the grant

This issue is brought in [4]. In the formula: **, ZTE argues that since Tc is defined in second, the formula should be expressed in seconds.

This is not an essential correction since there is no ambiguity. It was agreed to be left up to the Editor as to whether to correct it

***FL’s suggestion: The change is left up to the TS38.213 Editor.***

# Conclusion

Remaining issues on cross-RAT scheduling were listed and discussed.

# Decisions at previous meetings

## RAN1#96

*Agreements:*

* *Scheduling by gNB using RRC for LTE sidelink scheduled mode is supported from RAN1 perspective under the premise that there is sufficient time for coordination between the NR and LTE modules. No DCI to activate/release*
  + *RRC message delivers the SPS grant configuration and releases the SPS configuration.*
  + *Support of this scheduling mode is subject to UE capability (may or may not have capability for both LTE & NR)*
  + *Note: some specification LTE change is needed to support the reception of a grant through RRC*
    - *RRC message contains mode 3 grant content and timing*
    - *Up to the Editor to capture it as mode 3 or new LTE sidelink mode*
  + *No intention to have additional NR & LTE specification change (other than those described above) for this function in Rel-16*
* *RAN1 studied the feasibility of SPS scheduling by gNB for LTE sidelink with DCI activation/release, but there is no consensus to support it*

## RAN1#96bis

*Agreements:*

*Regarding RRC-based versus DCI-based activation/release of LTE sidelink SPS, RAN1 agrees to make the choice on the basis of at least:*

* *Spec impact*
* *Flexibility*
* *Performance, including latency*
* *Implementation complexity*
* *Timing of the activation/deactivation*

## RAN2#105bis

*Agreements:*

* *For scheduling LTE SL UEs, the gNB uses RRC messages to deliver the SPS grant configuration.*
* *Separate system information block should be designed to support LTE resource pool configuration via NR Uu. It will be defined as a container (OCTET STRING) and actual information follows what defined in LTE RRC.*
* *gNB should be able to configure the LTE V2X mode 4 sidelink resource pool via dedicated signalling. In addition, gNB should be able to configure mode3 SL resources via dedicated signaling. It will be defined as a container (OCTET STRING) and actual information follows what defined in LTE RRC.*

## RAN1#97

*Agreements:*

* *DCI-based activation/deactivation is supported* 
  + *Support of LTE PC5 scheduling by NR Uu (mode 3-like ) is based on UE capability*
  + *NR DCI provides the fields of DCI 5A in LTE-V that are related to SPS scheduling*
  + *The size of DCI for activation/deactivation is one of the DCI size(s) that will be defined for NR Uu scheduling NR V2V*
    - *FFS whether the DCI format is the same as one of the DCI formats that will be defined for NR Uu scheduling NR V2V*
  + *Activation/deactivation applies to the first LTE subframe after Z+X ms after receiving the DCI*
    - *Z is the same timing offset in current LTE V2X specs*
    - *X>0. FFS value(s) of X, and if one or multiple values of X are possible*

## RAN1#98

*Agreements:*

* *A new RNTI is introduced to scramble the NR DCI used for scheduling LTE PC5.*
* *X is dynamically indicated using a field in the DCI*
  + *FFS whether the DCI field provides an index to a table or the value of X*
  + *The minimum value of X is subject to UE capability*
    - *UE reports a single value subject to UE capability*

## RAN1#98b

*Agreements:*

* *The NR DCI field to indicate X provides an index to a table of values*
  + *The table of values is configurable, and has 8 values*
  + *The size of the DCI field is fixed at 3 bits*

## RAN1#99

*Agreements****:***

* *Use a separate PDCCH monitoring configuration (as configured in Rel-15) for NR DCI scheduling LTE SL*
  + *The per-CC and across-CC blind decoding budget and the maximum number of non-overlapped CCEs for channel estimation are not increased.*
  + *The per-CC and across-CC maximum number of search spaces is not increased.*
  + *The per-CC and across-CC maximum number of CORESETs is not increased*
    - *When in the same slot, there is both PDCCH monitoring for Uu SL and PDCCH monitoring for SL for the same CC, the search space(s) for LTE SL is configured to be the same or a subset of those for Uu for the same CC or vice versa*

*Agreements:*

* *The minimum value of X signalled in the UE capability is one of the values (excluding spare values) that can be signalled in DCI 3\_1*

*Agreements:*

*The supported values of X signaled in the DCI are:*

* *0.75ms, 1ms, [1.25ms], [1.5ms], 2ms, 4ms, 5ms, 8ms, 10ms, 20 ms*
  + *Additional value(s) can be discussed during the Feb. meeting*
* *Spare values are reserved for future deployments*

## RAN1#100

*Agreements*

* *For NR Uu scheduling LTE sidelink, the subframe of the first sidelink transmission is the first SL subframe of the corresponding resource pool that starts not earlier than , where TDCI is the start timing of the slot carrying DCI format 3\_1, NTA and Tc are defined in TS 38.211, X is the value indicated by Timing offset field in DCI format 3\_1, m is the value indicated by SL index in DCI format 3\_1 if SL index is present, otherwise m=0.*

*Agreements*

* *If UE is configured to monitor DCI 3\_0, the sizes of DCI 3\_1 and DCI 3\_0 are aligned by zero padding.*
* *If UE is not configured to monitor DCI 3\_0, the mechanism for size alignment between DCI 3\_0 and Uu DCI is reused for size alignment between DCI 3\_1 and Uu DCI*

*Agreements:*

* *The set of possible values for X is: 0ms, 0.25ms, 0.5ms, 0.625ms, 0.75ms, 1ms, 1.25ms, 1.5ms,1.75ms, 2ms, 2.5ms, 3ms, 4ms, 5ms, 6ms, 8ms, 10ms, 20 ms*

# References

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *No.* | *Tdoc* | *Type* | *Source* | *Title* | *Status* |
| 1 | R1-2003315 | discussion | Nokia, Nokia Shanghai Bell | Remaining details of Support of NR Uu controlling LTE sidelink | present |
| 2 | R1-2003385 | discussion | vivo | Remaining issues on support of NR Uu controlling LTE sidelink | present |
| 3 | R1-2003500 | discussion | Huawei, HiSilicon | Remaining details of NR Uu control for LTE sidelink | present |
| 4 | R1-2003554 | discussion | ZTE, sanechips | Remaining issues on NR Uu control LTE sidelink | present |
| 5 | R1-2003568 | discussion | LGE | Discussion on NR Uu controlling LTE sidelink | present |
| 6 | R1-2003808 | decision | Futurewei | Remaining details of cross-RAT scheduling | present |
| 7 | R1-2004078 | discussion | OPPO | Open loop power control for NR Uu controlling LTE sidelink | present |
| 8 | R1-2004388 | discussion | NTT DoCoMo | Remaining issues on NR Uu controlling LTE SL | present |
| 9 | R1-2004550 | decision | Ericsson | NR UU controlling LTE sidelink transmissions | present |