**[103-e-NR-Rel-16-V2X-07]: Email discussion/approval regarding clarification on the sidelink slot index**

* **Issue PP-7: Interpretation of sidelink slot for TRIV and resource reservation period**
* **Issue M2-6: Interpretation of sidelink slot for sensing and resource selection procedure**

**till 10/29, with a potential CR by 11/4 – Hanbyul (LGE)**

**Issue PP-7: Interpretation of sidelink slot for TRIV and resource reservation period**

Q1: If a UE transmits a SCI format 1-A in slot n in a resource pool, and if “Time resource assignment” in the SCI format 1-A indicates ti, what is UE’s understanding?

* Option 1: ti is counted in (i.e. The number of slots in the resource pool between slot n and slot n+ti is always the same as ti (including slot n+ti itself).
* Option 2: ti is counted in (i.e. The number of slots in the resource pool between slot n and slot n+ti can be less than ti).

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| LGE | Option 1 | In case when we go to Option 2, there are several problems as below. * First of all, resource pool configuration should ensure that all the slots indicated by TRIV belong to the resource pool. Or, resources need to be selected so that all the reserved resources belongs to a resource pool. Both cases will degrades flexibility on scheduling or configuration. Note that in Rel16, RAN4 defined the requirement for the case when NR V2X operates on the licensed band. So, the above stated problem will be worse than the LTE V2X case which has the requirement only for the case when the LTE V2X operates on ITS-dedicate band.
* Next, depending on the resource pool configuration, the effective window size for TRIV could be much smaller than 32 slots. For this case, it will degrades the benefits of NR V2X time-domain assignment mechanism which was introduced to make inter-resource collision probability low by indicating more resources within a wider range of slots compared to LTE V2X.

In our understanding, there is no case when different resource pools are fully or partially overlapped in time-and-frequency domain. With this understanding, when a UE receives SCI from another UE in a slot belonging to its TX resource pool, there is no ambiguity on the TRIV interpretation.  |
| Ericsson | Option 1 | We also agree with LGE’s point of view here. Given that there are no overlapping transmission pools, there cannot be any ambiguity on TRIV interpretation. To avoid limit the flexibility of NR SL, ti should be counted in . |
| Apple | Option 1 | TRIV should indicate the resources in a resource pool.  |
| Qualcomm | Option 1 | Option 2 may limit future resource indication.We support option 1. |
| Sharp | Option 1 | TS38.214 reads “ denotes i-th resource time offset in logical slots of a resource pool with respect to the first resource…” and we do not see anything incorrect. |
| Samsung | Option 1 | Given that there is no overlapping transmission SL resource pools, we agree with LGE that for “time resource assignment” in SCI Format 1-A, the slots indicated should be counted over the slots of the SL resource pool. Hence ti is counted over  |
| NTT DOCOMO | Option 1 | Same view with LGE. Option 2 is not good way. |
| OPPO | Option 2 | Either option 1 or option 2 is used depends on whether overlapped transmission resource pool is possible. If TX RP overlapping is possible, option 2 should be used, otherwise option 1 should be used.From LTE-V2X to NR-V2X, we don’t have the agreement that overlapped resource pool is not possible. In my view, we should not preclude that possibility. gNB should have the flexibility to configure fully or partially overlapped TX RP to different UEs.  |
| ZTE,Sanechips | Option 1 | The following CR to 38.213 is needed.16.4 UE procedure for transmitting PSCCH \*\*\*Unchanged Part Omitted\*\*\*- each resource, from the set of resources, corresponds to contiguous sub-channels and a slot in a set of slots , where is the number of sub-channels available for PSSCH/PSCCH transmission in a slot\*\*\*Unchanged Part Omitted\*\*\* |
| Vivo | Option1 | Option2 is not a good way as it brings unnecessary restrictions on the Uu configuration. |
| Panasonic | Option1 | We agree with LGE’s view. logical slot is reasonable. |
| Nokia, NSB | Option 1 | Agree with Sharp that 38,214 already seems clear on that point (“time offset in logical slots of a resource pool”). Regarding OPPO’s argument, it is true that LTE V2X sidelink supported mode 2 operation over resource pools with overlaps in time and with option 1 we are losing that feature; however, I am not convinced that the usefulness of such resource pool overlap outweighs the drawbacks listed by LGE. |
| Huawei/HiSilicon | Option 1 | Option 2 may limit resource indication. |
| CATT | Option 2 | We share the same views with OPPO, there is no clear agreement on whether resource pool overlapping is allowed or not. If option 1 is used, there is a potential ambiguous issue. Furthermore, with the consideration of UE complexity, if we use option 1, and UE need to perform reception in multiple resource pool, the buffer size will depend on the number of logical slots, not on the slots within a resource pool. Therefore, we prefer to follow LTE principle, and support option 2.  |

Q2: If a UE transmits a SCI format 1-A in slot n in a resource pool, and if “Resource reservation period” in the SCI format 1-A indicates P, what is UE’s understanding?

* Option 1: P is counted in (i.e. The number of slots in the resource pool between slot n and slot n+P is always the same as P (including slot n+P itself)).
* Option 2: P is counted in (i.e. The number of slots in the resource pool between slot n and slot n+P can be less than P).

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| LGE | Option 1 | As answered in Q1, the similar problem will occur in the case when Option 2 is used.  |
| Ericsson | Option 1 | We also agree with LGE’s point of view here. Given that there are no overlapping transmission pools, there cannot be any ambiguity on resource reservation period interpretation. To avoid limit the flexibility of NR SL, P should be counted in . |
| Apple | Option 1 | The resource reservation should only be restricted to the available resources of a resource pool. |
| Option 2 | Neither | P is always in millisecond. P needs to be in physical slot to align with packet arrival time. If n+P is not in the pool, it’s already specified that n+P will be mapped to the next logical slot in the pool.  |
| Sharp | Option 2 | We support to keep P as it is in current specs, i.e. slots that can be used for SL transmission which is specified in clause 8.1.7 of TS38.214, which means clause 8.1.7 does not need further change. For the case when may not belong to the resource pool, some restrictions in the specs can be added, e.g. “UE expects belong to the set of slots assigned to the sidelink resource pool”. |
| Samsung | Option 1 | Similar to the answer of Q1. P should be converted to logical slots. |
| NTT DOCOMO | Option 1 | If option 2 is adopted, periodic reservation does not work as we assumed. Logical slot should be used. |
| OPPO  | Option 2 | P is in unit of millisecond. It should be changed to the number of logical slots which can be used for a resource pool, i.e., scaled by N/20ms.Similar view as Q1. If overlapped TX RP is possible, option 2 should be used, otherwise, the sensing UE does not know the TX RP of other UE when decoding SCI from another UE.  |
| ZTE,Sanechips | Option 2 | Current specification already assumed the resource reservationperiod as option 2. The guarantee of and could be left to implementation. |
| vivo | Option2 | The formula for logical-physical transformations does not consider aspects such as resource pool bitmaps, so is a set of slots that might be used for SL. If does not belong to the resource pool, which means the will not be used for SL TX/RX and other UE will not monitor the slot as UE performs sensing within the pool, it can be considered as an invalid reservation and no addition change is needed.If option1 is used, the effective reservation period in the physical unit can be much longer than expected and there will be a higher risk that the effective period cannot satisfy the requirements of periodical services. |
| Panasonic | Option1 | Same as Q1. logical slot is reasonable. |
| Nokia, NSB | Strictly speaking neither, option 2 in a wide sense | The “Resource reservation period” in the SCI format 1-A indicates an index into sl-ResourceReservePeriodList, which gives a period in ms.This is then converted to logical slots according to 38.214 8.1.7 – where logical slots here are slots which can be in a resource pool (resource pool bitmap is not taken into account in the conversion).This seems quite clear in 38.214, and changing to option 1 would require changes in several places in 38.214 |
| Huawei/HiSilicon | See comment | According to TS 38.331, *sl-ResourceReservePeriodList*provides the set of possible resource reservation period allowed in the resource pool in the unit of ms. This is mainly to match the packet arrival interval. Current PHY specification will convert this value to logical slots. We think the current specification on this issue is clear, no need for any specification change. |
| CATT | Option 2 | Similar views mentioned in Q1.The resource reservation period indicates the periodicity in ms and convert it into logical slot gap. the current spec is clear and no need ot change.  |

**Issue M2-6: Interpretation of sidelink slot for sensing and resource selection procedure**

Q3: When a UE performs PSSCH resource selection procedure in sidelink resource allocation mode 2, over which slots does the UE monitor SCIs for sensing operation?

* Option 1: in the sensing window.
* Option 2: in the sensing window.

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| LGE | Option 1 | We think that it is desirable to perform the sensing operation for slots belonging to the TX resource pool considering that it is unclear whether/how to measure sidelink interference outside the TX resource pool, which is used for TX resource (re)selection procedure.  |
| Ericsson | Option 1 | We agree with LGE. There is no need to sense on slots which does not belong to the TX resource pool.  |
| Apple | Option 1 | Sensing operation is needed only on the slots of a resource pool. |
| Qualcomm | 1 | No change in spec is expected.  |
| Sharp | Option 1 | We share the view as LGE and no major change in sensing procedure is expected, i.e. “” |
| Samsung | Option 1 | Given that there is no overlapping transmission SL resource pools, it would seem unnecessary to perform sensing over slots that don’t belong to the SL resource pool. Hence, we support sensing over .Same principle applies in questions 1, 2 and 3. |
| NTT DOCOMO | Option 1 |  |
| OPPO | Option 2 | The sensing UE can sense all the resource within the configured RX resource pool. The RX RP configured to a UE should cover all the TX RP of other UEs so that the UE can receive all the transmitted data from all other UEs. In LTE-V2X spec (36.213), there is the following description of sensing procedure:The set  is defined as the slot that may belong to a resource pool, which corresponds to option 2 above, not option 1.In our view, we should follow the same mechanism as LTE-V2X, unless it cannot work or there is big issue for existing mechanism.  |
| ZTE,Sanechips | Option 2 | Q to Qualcomm. No question seems to imply option 2?Current spec is similar to LTE and could work without any change (opt 2). However, if sensing on the slots in the RP is preferred by majority, we could accept the compromise as follows,2) The sensing window is defined by the range of slots [) where is defined above and is defined in slots in Table 8.1.4-1 where is the SCS configuration of the SL BWP. The UE shall monitor slots which ~~can~~ belong to a sidelink resource pool within the sensing window except for those in which its own transmissions occur. The UE shall perform the behaviour in the following steps based on PSCCH decoded and RSRP measured in these slots. |
| vivo | Option1 | First of all, according to the description in 38.331, it is clear UE should perform sensing in the TX pool:*if a result of sensing on the resources configured in sl-TxPoolSelectedNormal for the concerned frequency in SIB12 is not available in accordance with TS 38.214 [19]*Secondly, may include slots that do not belong to any pool, using option2 means UE has to monitor these slots, which is not correct. |
| Panasonic | Option1 | Sensing is needed only on the slots of a resource pool. |
| Nokia, NSB | Option 1 | If, as discussed in Q1, we accept that we lose the LTE feature of mode 2 operation with resource pools overlapping in time then there is no need to monitor slots outside the current TX resource pool. |
| Huawei/HiSilicon | Option 1 | There is no need to sense slots which do not belong to the sidelink resource pool. |
| CATT | Option 1 | There is no need to perform sensing on the resources which is not belong to the Tx resource pool. |

**Others**

Q4: If there are any other aspects that need to be considered in the scope of this email discussion, please specify them.

|  |  |
| --- | --- |
| Company | Comment |
| LGE | A SCI and reserved resources indicated by the SCI can be located in different SFN cycle. Meanwhile, the notation or is logical slots confined with a SFN cycle (). Regardless of which options are selected in Q1-Q2, when we express the slot position of the reserved resources with respect to the SCI reception timing by using the above notation, it would be necessary to clarify how to handle the case the indicated slot position of the reserved resource is outside the SFN cycle where the SCI is transmitted. For instance, if the SCI is transmitted in slot n, and if the resource reservation period indicated by the SCI is P, the location of the reserved resource would be slot (n+P mod T’\_max).  |
| Ericsson | We are fine with considering cross SFN cycle aspect mentioned by LGE. |
| Sharp | We do not think it is needed to consider the SFN cycle aspect. Considering the equation “”as specified in step 5 in clause 14.1.1.6 of TS36.213 for LTE V2X, the same SFN cycle issue happens as well since could be . In our understanding, slot n+k only means the slot with interval k after slot n, if crossing the SFN boundary, then UE would start from the beginning slot without ambiguity. |
| Samsung | 1. We support the interpretation of handling logical slots outside the SFN cycle with the mod operator as raised by LGE. We think that this is only for clarification, there is no need to update the spec.
2. If we go with option 1 for question 2 above for the “Resource Reservation Period”, it would seem natural to consider the conversion of the “Resource Reservation Period” from physical time to logical slots (i.e. in section 8.1.7 of TS 38.214), to take into account only the slots that are in a SL resource pool within a 20 ms period (issue M2-4). While it was discussed and agreed in the preparation phase to postpone this topic to RAN1#104-e, however, given its close relation to Q2, it would be good to discuss and conclude in this meeting.
 |
| vivo | Regarding the cross-SFN reservation issue raised by LG, we share the same view as sharp that we don’t need to introduce a mod operator because LTE did not consider this aspect either. Please note that for Uu scheduling, n+k is often used to indicate a slot that is k slots after slot n. e.g., as the location of PDSCH/PUSCH. It is also possible that slot n and slot n+k are different SFN cycle, but the mod operator is not used in these cases. |
| Panasonic | We are fine with to consider the SFN cycle aspect. |
| Huawei/HiSilicon | Regarding crossing SFN cycle, we think there is no need to change the specification since there is no ambiguity. |
| CATT  | There is no need to capture the operation to SFN cycle handling in spec. The reserved resources would be always in logical slots and UE can map the reserved resource after next P logical slots. |

**Proposal set #1**

Proposal 1:

If a UE transmits a SCI format 1-A in slot n in a resource pool, and if “Time resource assignment” in the SCI format 1-A indicates ti, the UE understanding is as follows:

* ti is counted in (i.e. The number of slots in the resource pool between slot n and slot n+ti is always the same as ti (including slot n+ti itself).

Proposal 2:

If a UE transmits a SCI format 1-A in slot n in a resource pool, and if “Resource reservation period” in the SCI format 1-A indicates P’ (following 8.1.5 of 38.214),

* Option 1: P’ is counted in (i.e. The number of slots in the resource pool between slot n and slot n+P is always the same as P (including slot n+P itself)).
* Option 2: P’ is counted in (i.e. The number of slots in the resource pool between slot n and slot n+P can be less than P).
	+ [UE expects belong to the set of slots assigned to the sidelink resource pool]

Proposal 3:

Q3: When a UE performs PSSCH resource selection procedure in sidelink resource allocation mode 2, the UE monitors SCIs for sensing operation over in the sensing window.