[100b-e-NR-5G\_V2X\_NRSL-PHYstructure-02]

Email discussion/approval on resource pool configuration - subchannel size and resource pool size

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- A. Whether/how to introduce additional subchannel size and whether the number of PRBs configured for a resource pool should be integer multiple of sub-channel size

 till 4/24, with potential TP till 4/29 – Jeongho (SS)

This document has the following questions.

- A. Whether the number of PRBs configured for a resource pool should be integer multiple of sub-channel size?

- B. Whether/which new numbers is defined for a subchannel size?

# **A. Whether the number of PRBs configured for a resource pool should be integer multiple of sub-channel size?**

Based on the submitted contributions, there are the following alternatives and supporting companies.

* Alt A-1. All numbers of PRBs can be configured and a UE is not expected to use the last subchannel in Rel-16.
  + [vivo], [OPPO], [Sony], [MediaTek], [TCL], [Apple], [Panasonic], [Qualcomm]
* Alt A-2. All number of PRBs can be configured and a different size is used for the last subchannel.
  + [LGE], [Intel], [NTT DCM](assume the same PRBs for TBS determination)
* Alt A-3. Use only integer multiple of subchannel for the resource pool size.

Based on the contributions, the following proposal can be made.

*Proposal 1. For the size of resource pool, numbers of PRBs can be configured and a UE is not expected to use the last subchannel in Rel-16.*

Please share your views if Proposal 1 is agreeable or, if not, please share your views on the reason why it is not workable.

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| **Company** | **Views** |
| NTT DOCOMO | We are supportive of Alt A-2 and Alt A-3, but Alt A-1 is unclear for us.  Let us ask question for Alt A-1: When all numbers of PRBs are (pre-)configured and the PRBs are not a multiple of sub-channel size, does UE need to do something on the remaining PRBs? Does not do anything? If UE does not anything, what is the motivation of Alt A-1? |
| Huawei, HiSilicon | The important point is to avoid PRB wastage in NR V2X, where the cost of doing so is not only in % spectral efficiency, but also in comparisons to other technologies. As we stated in the last meeting, we open to any reasonable solution. We are aware that various configuration options can be used so that not all cases have lost PRBs. But, the assumption we make is that any company wishing to include a configuration which would discard PRBs should have a way to explain how they will reclaim them for some other purpose, before proposal 1 can be considered.  PS. The proposal as written does not seem to operate. |
| Futurewei | We expect this problem to be largely solved by implementation with A-3 being the logical implementation/deployment being used. In that sense, not putting additional constraint is fine with us. If the group feels that some specification is needed to handle this error case, either A-1 or A-3 is fine. A-2 would make the implementation more complex and is not preferred |
| Intel | Our goal is to enable mechanism to efficiently use SL spectrum for different numerologies and avoid waist of spectrum resources. We disagree with current proposal and do not understand its value and motivation behind. In order to solve problem, we are open to consider Alt A-2. At the same time, we believe that more reasonable technical solution is to distribute reminder of PRBs across allocated subchannels.  We suggest the following proposal:  *Proposal 1. Arbitrary number of PRBs can be configured for the size of resource pool. UEs use all configured PRBs for communication, irrespective of sub-channel size configuration.* |
| Sharp | We think Alt A-3 is sufficient here. If there is any problem, it can be resolved by a solution for issue B below. |
| CATT | Our preference is Alt 3, the resource pool can be configured with suitable sub-channel size to lead no or small resource wastage. We can also accept alt 2 with the consideration of resource efficiency, in alt 2, PSCCH can’t be transmitted on the last sub-channel. |
| LG | We are supportive of that all numbers of PRBs can be configured and have a strong concern not to use remaining PRBs.  Currently, the NR sidelink is not a unique solution for V2X, and it competes with other techniques. In the future, it would be possible that the NR sidelink could be competed with brand new technique.  In this situation, it cannot be understood why companies allow some PRBs in a resource pool would not be used for the actual transmission despite of the inherent disadvantage in the spectral efficiency. |
| vivo | We prefer Alt A-1.  Our understanding is that Alt A-1 and Alt A-2 are basically the same, except that the last sub-channel is not used *in this release*. Our concern on Alt A-2 is simply on the efforts to resolve the remaining issues in this release within two e-meetings, given there are still lots of issues to be fixed. The TBS issue notified by DoCoMo is one of them, but probably not the only one. These issues can be resolved in later release.  We object to the Alt A-3, it may lead to wasting a large portion of PRBs in many cases. |
| Ericsson | Agreeable to us. By introducing new subchannel sizes as in question B below and by good pre(configuration) we believe the issues with unused PRBs is minimized. |
| OPPO | We support Alt A-1.  Any number of PRBs can be configured for a resource pool, depending on proper (pre-) configuration, the number of remaining PRBs can be minimized. Furthermore, we suggest to support more sub-channel sizes to mitigate the issue further.  We are negative to support uneven subchannel sizes in a resource pool, which could complicate the system design. |
| Bosch | We are fine with either Alt-1 or Alt-3. Both alternatives need more subchannel-sizes to reduce PRB wastage. Hence, we may consider the next question to introduce more subchannel sizes (e.g., B-2, B1, or both). Regarding Alt-2, we believe it may impact the complexity at this maintenance stage, i.e., PSCCH placement, DMRS design, sensing procedure, etc. |
| Xiaomi | FL proposal is agreeable. |
| Spreadtrum | We support Alt A-1. In future release, we can consider to deal with the last subchannel containing remaining PRBs. |
| Qualcomm | We’re supportive of the FL proposal, but would like to update the wording to clarify that the last sub-channel here refers to the remaining PRBs only when the number of sub-channel is not a multiple of the sub-channel size. In which case, it would be clearer to phrase the proposal using the remining PRBs instead of last sub-channel to avoid confusion with the case when the number of PRBs in the pool is a multiple of the sub-channel size.  This provides the ability for future releases to use those PRBs while using the same pool and being able to communicate with Rel-16 UEs (on the other sub-channels).  Having different sub-channel sizes will introduce many problems at this stage: e.g. TBS determination, mapping, sensing, variable performance between sub-channels, potentially other cases. It will also increase UE complexity because operations will be different between sub-channels. |
| InterDigital | Support the proposal |
| Apple | We are supportive with Alt A-1.  The different sub-channel sizes in a resource pool complicates the UE sensing (SL measurement) and resource selection operation.  To our understanding, the current proposal tries to capture Alt A-1. If so, we think the following modification is needed.  *Proposal 1. For the size of resource pool, numbers of PRBs can be configured and a UE is not expected to use the last subchannel in Rel-16* ***if the last subchannel has a different size.*** |
| Samsung | We are supportive of the FL proposal (Alt A-1). We did not have enough time to study impacts for supporting different subchannel size. We can further discuss/study utilizing this for spectrum efficiency in the future release. |
| ZTE, Sanechips | Our preference is Alt A-3.  We feel more than 1 resource pool with potentially different ***startRB-Subchannel*** ***subchannelsize*** could be configured within a band to avoid PRB waste. In this way, no specification efforts are needed. |
| Panasonic | We support proposal 1(Alt A-1) to finalize the standardization. We can agree Alt A-2 if additional number of PRBs per a subchannel in question B is alt B-1. |
| TCL | Agree.  PRB wastage can be minimized by specifying appropriate sub-channel sizes if necessary. |
| MediaTek | Supportive of the proposal with some changes on the wording, i.e.,  *Proposal 1. For the size of resource pool, numbers of PRBs can be configured and a UE is not expected to use the last subchannel with the RB number less than the sub-channel size in Rel-16.* |
| Nokia, NSB | For A-1, if no additional UE behaviour is specified regarding the “remaining” RBs, then I don’t see any practical difference between A-1 and A-3:  Today, the resource pool is defined in the frequency domain by the parameters (sl-StartRB-Subchannel, sl-NumSubchannel, sl-SubchannelSize). A-1 could be implemented by introducing a new parameter sl-EndRB which gives the last RB of the pool. Without any further specification of UE behaviour, a Rel-16 UE would simply ignore sl-EndRB. How then is that different from introducing sl-EndRB in a future release for use by UEs for that release?  Alt A-2 would require additional work, it seems a bit late for that.  Hence, unless someone explains in more detail how Alt A-1 is superior to A-3, we prefer A-3. |

**FL summary from the first round of discussion**

* The proposal based on Alt A-1 is supported by vivo, Ericsson, OPPO, Bosch, Xiaomi, Spreadtrum, Qualcomm, InterDigital, Apple, Samsung, Panasonic, TCL. Nokia, NSB, [LGE]
* Alt A-2 is supported by NTT DCM, Intel.
* Alt A-3 is supported by Futurewei, Sharp, CATT, Bosch, ZTE, Sanechips.
* Huawei, HiSilicon mentioned that the second topic should be concluded first.

The majority view is to use all PRB numbers for subchannel size and not to use the last subchannel if the size is smaller than others’ size. However, since this is not consensus yet, further discussion is expected, where the discussion will focus on whether there is a critical issue on the proposal.

Also, this issue will be discussed together with Issue B.

Based on some comments, the proposal is rephrased.

*Proposal 1 (NOT consensus yet)*

* Any number of PRBs can be configured for the size of a resource pool and a UE is not expected to use the remaining PRBs only when the number of sub-channel is not a multiple of the sub-channel size in Rel-16.

# **B. Whether/which new numbers is defined for a subchannel size?**

Based on the submitted contributions, there are the following alternatives and supporting companies.

* Alt B-1. Introduce 11, 12, 13, 17, 19, 27, 53 PRBs as new subchannel sizes
  + [Huawei, HiSilicon]
* Alt B-2. Introduce 4,5,6 as new subchannel size
  + ~~[LGE],~~ [Ericsson], [Spreadtrum], [NEC]
* Alt B-3. No need to define a new size for a subchannel.

Please share your views on this issue and the reason of your views.

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| **Company** | **Views** |
| NTT DOCOMO | Support Alt B-3.  We would like to support Alt B-2, while we are not sure whether decoding performance of PSCCH/2nd-stage SCI is sufficient. In addition, when sufficient PSCCH/2nd-stage SCI could lead to quite small number of REs for SL-SCH. If multiple sub-channels are used in typical case, the motivation of Alt B-2 will be lost. |
| Huawei, HiSilicon | We are open to any reasonable solution: B-1, B-2, or something else. The purpose of our proposal was to show one simple (we hope) way that PRB loss can be avoided without impact on sensing procedures, UE complexity, etc. |
| Futurewei | In our view, with good implementation/deployment scenarios, there should not be needs for new subchannel, thus B-3 is preferred. That said, if a new subchannel size is shown to provide deployment benefits, we are willing to consider. |
| Intel | Alt B-3 is our first preference. We do not see motivation to introduce many options for subchannels sizes, since it does not solve issue of reminder of PRBs completely. We should not forget that it also increases UE complexity, since we may need new configurations for control channels (1st and 2nd stage SCI) and DMRS, as well as more challenges in PSSCH demodulations. |
| Sharp | Fine with Alt B-1. |
| CATT | We are open for this issue.  Regarding to Alt 2, since the sub-channel size is reduced, in order to maintain the PSCCH reliability, it may be need to enlarge the PSCCH symbols. |
| LG | Since the current version of B-1 does not serves all the problematic cases, we still prefer A-2.  In case of B-2, at this maintenance stage, it is not preferable to introduce new number of PSCCH PRB numbers.  Note that B-2 is not our preference, so we remove our company name on B-2. |
| vivo | We are fine with Alt B-3. We understand Huawei’s concern on the PRB loss issue. But if Alt A-1 or Alt A-1 is agreed, we don’t need to introduce additional number of sub-channel size. |
| Ericsson | We believe that Alt B-2 should be supported to be future looking. For example, PS data which is of much smaller size and introducing smaller subchannel size increase the channel utilization. Also, it will partially resolve the issue in question A. |
| OPPO | Both Alt B-1 and Alt B-2 are acceptable for us. |
| Bosch | Considering our answer to the previous question (i.e., either Alt-1 or Alt-3), it will be useful to increase the granularity of the subchannel sizes. Hence, we support at least B-2. |
| Spreadtrum | We support Alt B-3. In future release, we can consider to introduce smaller subchannel size. |
| Qualcomm | We disagree with Alt B-2 (sub-channel size < 10 PRBs) at this point in the release. RAN1 would need to reconsider the PSCCH, SCI-2, slot structure, and potentially DMRS design to accommodate it.  Introducing so many new sub-channel sizes as in Alt B-1 causes problems on the UE implementation side due to all the additional sub-channel sizes (and accompanying PSCCH sizes) that must be supported and tested. Similar to Futurewei’s view, if one of the subchannel sizes is expected to have significant benefits in deployment, we can focus on discussing that size. |
| InterDigital | Support Alt B-2 for forward compatibility. |
| Apple | We are fine with Alt B-3. The introduction of sub-channel sizes smaller than 10 PRBs may reduce the PRB waste in Question A. But we need to ensure the PUCCH and 2nd stage SCI decoding performance is not degraded, considering that PUCCH has up to 3 symbols. |
| Samsung | Our preference is Alt B-3 since we do not find strong motivation to introduce new numbers for subchannel size. |
| ZTE, Sanechips | Alt B-3. |
| Panasonic | Our first preference is Alt B-3. We have concerns on B-2 on the number of blind decoding of PSCCH and the larger number of symbols of PSCCH needs to be required to be considered for less than 10 PRBs subchannel size |
| TCL | We support Alt B-3 but are also open to new sub-channel sizes if necessary for this release. |
| MediaTek | Alt B-3. If the new sub-channel size is introduced as Alt B-2, the PSCCH transmission carrying 1st SCI should not be allowed in such sub-channel due to at most 3 symbols. |
| Nokia, NSB | Agree with Futurewei. |

**FL summary from the first round of discussion**

* The proposal based on Alt B-3 is supported by NTT DCM, Futurewei, Intel, vivo, Spreadtrum, Qualcomm, Apple, Samsung, ZTE, Sanechips, Panasonic, MediaTek, Nokia, NSB
* Alt B-1 is supported by Huawei, HiSilicon, Sharp, OPPO
* Alt B-2 is supported by Huawei, HiSilicon, OPPO, InterDigital, Ericsson, Bosch.
* CATT and TCL are open for alternatives.

The majority view is not to define new subchannel size. But, there are quite concerns on the waste of resources in a resource pool, when combined with resource pool size discussed in Issue A. There are also concern on the smaller number of PRBs of sub-channel size.

Therefore, this issue will be discussed together with Issue A.

Based on some comments, the proposal is rephrased.

*Proposal 2 (NOT consensus yet)*

* A new sub-channel size is not defined.