**3GPP TSG RAN WG1 Meeting #105-e R1-** **210xxxx**

**e-Meeting, May 19th – 27th, 2021**

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**Source:** Moderator (LG Electronics)

**Title:** Feature lead summary for AI 8.11.1.2 Inter-UE coordination for Mode 2 enhancements

**Document for:** Discussion and information

1. **Contents to be discussed in Wednesday’s GTW (May 19th)**

After reviewing contributions submitted in this meeting, I observed that it is difficult to down-select one of information types (listed in the last meeting) for each inter-UE coordination scheme. So, it is proposed to support all the information types for each scheme. In order to clarify the reason why both types of information are needed in each scheme, the UE-B’s resource selection behaviour based on each information type was added in the proposals. When going in this direction, one concern from FL’s point of view is whether it is possible to complete all required details within the remaining meetings. Considering this aspect, it would be desirable for RAN1 to strive for common design for both information types in each scheme, and the relevant sentence was added in the proposals.

***FL’s proposal****:*

* *For scheme 1, the following inter-UE coordination information signaling from UE-A and resource selection behavior in UE-B is supported:*
  + *Set of resources preferred for UE-B’s transmission*
    - *UE-B prioritizes all or a subset of the preferred resources in the resource selection for its transmission, not precluding the possibility of selecting a resource not indicated as the preferred resources*
  + *Set of resources non-preferred for UE-B’s transmission*
    - *UE-B excludes a resource indicated as the non-preferred resource in the resource selection for its transmission*
  + *RAN1 to strive for common design for both information types in the scheme 1*
* *For scheme 2, the following inter-UE coordination information signaling from UE-A and resource selection behavior in UE-B is supported:*
  + *Presence of expected/potential resource conflict on the resources indicated by UE-B’s SCI*
    - *UE-B does not use the resources indicated as the expected/potential resource conflict and triggers resource reselection*
  + *Presence of detected resource conflict on the resources indicated by UE-B’s SCI*
    - *UE-B performs retransmission of the TB that has been transmitted on the resources indicated as the detected resource conflict*
      * *FFS whether/when UE-B does not perform the retransmission of TB*
  + *RAN1 to strive for common design for both information types in the scheme 2*
* *FFS under which condition each of the inter-UE coordination information signaling and resource selection behavior is operated*

According to my review of contributions submitted in this meeting, the majority of companies supported the scenario where UE(s) among the intended receiver(s) of UE-B can be a UE-A. In this case, the intended receiver(s) includes at least the destination UE(s) of a TB transmitted by UE-B.

***FL’s proposal****:*

* *At least the following condition is supported for UEs to be UE-A(s)/UE-B(s) in the inter-UE coordination in Mode 2:*
  + *For both scheme 1 and 2,*
    - *UE(s) among the intended receiver(s) of UE-B can be a UE-A*
      * *At least the intended receiver(s) is the destination UE(s) of a TB transmitted by UE-B*
        + *FFS additional condition(s) of being the intended receiver(s) of UE-B*

The majority view is that at least the information listed in the proposal below could be used to generate the inter-UE coordination information.

***FL’s proposal****:*

* *At least the following information is used for UE-A to generate the inter-UE coordination information:*
  + *For scheme 1,* 
    - *Other UEs’ reserved resources based on UE-A’s sensing result*
    - *UE-A’s NR SL resources selected for its transmission(s) of TB(s)*
    - *UE-A’s scheduled/configured resources for UL*
  + *For scheme 2,* 
    - *Other UEs’ reserved resources and/or existing transmission (i.e. used resources) based on UE-A’s sensing result*
    - *UE-A’s NR SL resources selected for its transmission(s) of TB(s)*
    - *UE-A’s scheduled/configured resources for UL*

1. **Email discussion before Friday’s GTW (May 21th)**

**2.1 Inter-UE coordination information signalling from UE-A and resource selection behaviour in UE-B**

First of all, according to my review of contributions, it is summarized as follows:

* *Type(s) of coordination information sent from UE-A to UE-B for each scheme:*
  + *In scheme 1,*
    - *Preferred resource set only: [Huawei,3] [vivo,4] [InterDigital,32]*
    - *Non-preferred resource set only: [Kyocera,6] [Qualcomm,10] [OPPO,13] [Xiaomi,26] [Ericsson,36]*
    - *Preferred and non-preferred resource set: [Spreadtrum,5] [CATT,7] [Fraunhofer,8] [CMCC,9] [Zhejiang Lab,11] [Lenovo,14] [Fujitsu,16] [Apple,17] [ZTE,19] [LG,20] [ETRI,21] [NEC,22] [Mitsubishi,23] [MediaTeK,25] [Sharp,29] [Panasonic,30]*
  + *In scheme 2,* 
    - *Presence of expected/potential resource conflict only: [vivo,4] [OPPO,13] [ZTE,19] [LG,20] [Panasonic,30]*
    - *Presence of expected/potential resource conflict and detected resource conflict: [Spreadtrum,5] [Fraunhofer,8] [Qualcomm,10] [Lenovo,14] [Intel,15] [Fujitsu,16] [ETRI,21] [NEC,22] [Xiaomi,26] [Ericsson,36]*
* *UE-B’s behavior upon receiving inter-UE coordination information from UE-A*
  + *In scheme 1,* 
    - *Option 1-1: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based on both UE-B’s sensing result (if available) and the received coordination information*
      * *[Futurewei,2] [Huawei,3] [vivo,4] [Kyocera,6] [CATT,7] [Fraunhofer,8] [CMCC,9] [Qualcomm,10] [OPPO,13] [Lenovo,14] [Intel,15] [Fujitsu,16] [Apple,17] [ZTE,19] [LG,20] [ETRI,21] [NEC,22] [Mitsubishi,23] [Samsung,24] [MediaTeK,25] [Xiaomi,26] [Convida,27] [Hyundai,28] [InterDigital,32] [DCM,33] [Ericsson,36]*
    - *Option 1-2: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based only on the received coordination information*
      * *[Futurewei,2] [Huawei,3] [vivo,4] [CATT,7] [Fraunhofer,8] [CMCC,9] [Apple,17] [ETRI,21] [NEC,22] [MediaTeK,25] [Convida,27] [Hyundai,28] [InterDigital,32]*
      * *Condition*
        + *When UE-A is a leading UE of a UE group of UE-B [Huawei,3] [vivo,4]*
        + *When UE-B has no PSCCH/PSSCH RX capability [CATT,7]*
        + *When UE-B has no sensing results [CMCC,9] [ETRI,21] [InterDigial,32]*
        + *When UE-A is the intended receiver of the UE-B’s transmission [MediaTeK,25]*
    - *Option 1-3: UE-B’s resource(s) to be re-selected based on the received coordination information*
      * *[OPPO,13] [Lenovo,14] [InterDigital,32]*
    - *Option 1-4: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based on the received coordination information*
  + *In scheme 2,* 
    - *Option 2-1: UE-B can determine resource(s) to be re-selected based on the received coordination information*
      * *[vivo,4] [Qualcomm,10] [OPPO,13] [Lenovo,14] [Intel,15] [Fujitsu,16] [Apple,17] [ZTE,19] [LG,20] [ETRI,21] [NEC,22] [Samsung,24] [MediaTeK,25] [Xiaomi,26] [Convida,27] [InterDigital,32] [DCM,33] [Ericsson,36]*
    - *Option 2-2: UE-B can determine a necessity of retransmission based on the received coordination information*
      * *[Qualcomm,10] [Lenovo,14] [Intel,15] [Fujitsu,16] [Apple,17] [ETRI,21] [NEC,22] [Xiaomi,26] [Convida,27] [Ericsson,36]*
      * *Condition*
        + *Groupcast with SL HARQ-ACK feedback option 1 is enabled [Fujitsu,16] [Apple,17] [Xiaomi,26]*

During the GTW session, there was a comment that it is necessary to check further whether it is possible to down-select one of the information types (listed in the last meeting) for each inter-UE coordination scheme and whether it is possible to down-select/merge one or more of the options (listed in the last meeting) for UE-B’s behaviour upon receiving the inter-UE coordination information from UE-A. **So, I ask companies to provide what combination of options they prefer for each scheme (e.g., Option 1-x/Option 1-x-y for scheme 1, Option 2-x/Option 2-x-y for scheme 2)**. Note that in terms of making progress, the yellow-marked options (supported by the minority of companies) in the above summary are excluded from the list below. **When entering your preference in the table below, please provide more details on UE-B’s behaviour of using the received inter-UE coordination information in the resource selection for its transmission**. By doing so, we will be able to agree on more details compared to the contents of the options listed at the last meeting, and this is the reason why I added statements to the draft proposals (in Section 1) such as “UE-B prioritizes all or a subset of the preferred resources in the resource selection for its transmission, not precluding the possibility of selecting a resource not indicated as the preferred resources“ and “UE-B excludes a resource indicated as the non-preferred resource in the resource selection for its transmission”. I would like to emphasize that if the remaining resources except for the non-preferred resource set become the preferred resource set, there would be no motivation to support both the preferred and non-preferred resource sets. **The deadline for companies to provide inputs is May 21st 4:59am UTC. To prepare/make more agreeable draft proposals before the start of GTW session and the check point/timing of Chairman, it would be highly appreciated if companies make comments as soon as possible.**

* *For scheme 1,* 
  + *Option 1-A: Set of resources preferred for UE-B’s transmission*
    - *Option 1-A-1: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based on both UE-B’s sensing result (if available) and the received coordination information*
    - *Option 1-A-2: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based only on the received coordination information*
  + *Option 1-B: Set of resources non-preferred for UE-B’s transmission*
    - *Option 1-B-1: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based on both UE-B’s sensing result (if available) and the received coordination information*
    - *Option 1-B-2: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based only on the received coordination information*
* *For scheme 2,* 
  + *Option 2-A: Presence of expected/potential resource conflict on the resources indicated by UE-B’s SCI*
    - *Option 2-A-1: UE-B can determine resource(s) to be re-selected based on the received coordination information*
    - *Option 2-A-2: UE-B can determine a necessity of retransmission based on the received coordination information*
  + *Option 2-B: Presence of detected resource conflict on the resources indicated by UE-B’s SCI*
    - *Option 2-B-1: UE-B can determine resource(s) to be re-selected based on the received coordination information*
    - *Option 2-B-2: UE-B can determine a necessity of retransmission based on the received coordination information*

**Question 1**: Do you support “Set of resources preferred for UE-B’s transmission (i.e., Option 1-A)” in scheme 1? If so, what is UE-B’s behavior you support (e.g., Option 1-A-1 and/or Option 1-A-2)?

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Preferred UE-B’s behaviour with more details |
| NTT DOCOMO | No | It seems that many companies supporting ‘preferred’ type assume hierarchical mechanism like mode 2d. I think that at first RAN1 should discuss whether such direction is supported or not. Otherwise, companies are not on the same page and no consensus is assumed… |
| Intel | Yes w/ comments | 1. Option 1-A-1. In our view, inter-UE coordination feedback should be considered only if there is an intersection of TX candidate resource set and preferred set from feedback. If there is no intersection, then fallback should be to TX candidate resource set. 2. If both preferred and non-preferred sets of resources are agreed, then we need to add FFS whether indication of both sets can be enabled in the same resource pool / same time / inter-UE coordination feedback 3. We prefer to have a bit more time for study before making decision on whether both preferred and non-preferred set types are supported. The reason is that we are not very clear on how both sets are constructed by assisting UE and used by TX UEs. These details are important in our view. Maybe we can continue work on definition of details how the sets are constructed by assisting UEs / used by TX UEs and then come-back to the question which sets are supported to have more data-based decision and selection process. 4. We consider only distributed scheme if preferred resource set is agreed. |
|  |  |  |
| Panasonic | Yes | Option 1-A-1.  We agree with Docomo. Whether hierarchical inter-UE coordination is supported or not should be concluded earlier. In our view, hierarchical inter-UE coordination is not supported in rel.17 since the usage scenario is not well discussed. For non-hierarchical inter-UE coordination, how to use this inter-UE coordination information is up to UE-B operation. UE-B can use own UE-B’s sensing results (if available). |
| Ericsson | No | Preferred resources are easily outdated due to new reservations from other UEs. This is critical given that it will take a few slots between the time the coordination information is gathered by UE-A and the time it is used by UE-B. |
| OPPO | NO | If the intention of supporting “preferred” resources is to support mode-2d like scheme, it would introduce huge impact to RAN2, although we agree that mode-2d like scheme would improve the reliability of sidelink, we do not think it is possible to complete this within R-17 time frame.  If the intention is of supporting it is to assist sensing based resource selection of UE-B, we believe there is no difference between “preferred” and “non-preferred” resources in this aspect. As the set of resources are supposed to be selected within resource selection window of UE-B, if “non-preferred” resources are known, the remaining resources in the resource selection window could be regarded as “preferred” resource. |
| vivo | Yes | No need to distinguish whether hierarchical or non-hierarchical structure, we think a unified solution can be applied to both structures. Hierarchical approach is only a sub-scheme of 1-A. we think we could have a general solution, which may allow UE-A to coordinate multiple UE-Bs or allow UE-A as RX UE to assist UE-B as TX UE.  Both 1-A-1 and 1-A-2 can be supported. If UE-B does not perform sensing 1-A-2 is used. |
| Spreadtrum | Yes | Option 1-A-1 and option 1-A-2.  For option 1-A-1, we think preferred resources can be used to alleviate the half-duplex problem. UE-A can provide preferred resources on the slots in the resources selection window that does not be sensed by UE-B due to half-duplex. Then, UE-B can consider the preferred resources when doing resource selection to reduce the waste of resources caused by half-duplex problems.  For option 1-A-2, we think it can be supported when UE-B does not have the sensing ability. |
| Huawei, HiSilicon | Yes | Support both Option 1-A-1 and Option 1-A-2.  Option 1-A (preferred resources) can well solve the issues of hidden nodes, exposed nodes, half duplex constraint, power saving, and consecutive packet loss, and the performance gain are already shown by many simulation results. So Option 1-A is a necessary part of the support for inter-UE coordination.  Option 1-A-1 is feasible only when UE-B has the sensing results. So RAN1 also needs to discuss UE-B’s behaviour when UE-B does not have the sensing results, e.g. when UE-B does not have the sensing capability, or UE-B choose to not have the ability to perform sensing for power saving. In this case, the transmission resource for UE-B can only be determined by the coordination from UE-A, so Option 1-A-2 should apply.  In addition, thanks to Option 1-A-2, the performance gains by the centralized scheduling can also be achieved when UE-A provides transmission resources for multiple UE-Bs. |
| CMCC | Yes (for Option 1-A-1 and Option 1-A-2) | For Option 1-A-1, it refers to the case where both UE-A and UE-B perform sensing. In such a case, exposed node issue can be solved using the preferred set of resources provided by UE-A. From UE-B’s perspective, it determines its transmission resources based on both its own sensing results and the preferred set of resources indicated by UE-A. To be specific, for resources that preferred by UE-A but excluded from UE-B’s resource selection procedure, which would be over exclusion resources caused by the exposed node issue, and UE-B can use them for transmission.  For Option 1-A-2, it refers to the case where only UE-A senses. In such a case, UE-A acts as the scheduler of UE-B(s), and the UE-B can directly use the preferred set of resources indicated by the UE-A. |
| Kyocera | No | Set of preferred resources has outdated issue as mentioned above. Second, set of preferred resources could be large resulting in a large signalling overhead. On the other hand, if a small set of preferred resources list is sent then it limits the UE B’s (re-)selection choices. |
| Mitsubishi | No with comments | We are opposed to specifying mode 2d-like scheme in Rel.17. Our first choice would be to support transferring non-preferred resources only, or a mix of preferred and non-preferred resources (that is, we can accept combining option 1-A-1 with 1-B-1) |
| Nokia, NSB | Yes | Reason: The preferred set may be smaller (i.e., lower overhead) than the non-preferred set (e.g., under high system load).  Option 1-A-1.  UE-B’s sensing result is essential to ensure as little impact as possible of UE-B’s transmission on its surrounding environment. |
| Fraunhofer | Yes for both | We support both Option 1-A-1 and 1-A-2.  In both the listed options, it is possible for UE-B to request UE-A for assistance information as well as for UE-A to send this assistance information after detecting a certain event. Hence, we do not think that supporting a set of preferred resources equates to a mode 2d-like scheme, and definitely does not need to be linked to any hierarchical structure.  As mentioned by Huawei, both options can solve all the identified issues that inter-UE coordination is targeting, and hence should be supported. The triggering process is common for both, while the only differentiation is based on how UE-B uses the resources depending on its available sensing results.  In the case of Option 1-A-1, if UE-B has valid sensing results available, it can use this in combination with the set of resources from the coordination information to obtain resources for its transmission.  In the case of Option 1-A-2, if UE-B does not have sensing results, to save power, or does not have valid sensing results, due to DRX inactivity durations, it can use the received set of resources alone to determine the resources for its transmission. |
| Qualcomm | Yes with comments | We support a distributed preferred-resource inter-UE coordination scheme and show the performance gains for such a scheme for unicast communications in commercial use-case scenarios.  Using only coordination information would help the performance of power saving UEs that aren’t doing sensing. We’re ok with either Option 1-A-1 or 1-A-2 if power saving UEs can use only coordination information. This could be addressed as a sub-bullet under 1-A-1 describing when sensing information is not available. |
| Apple | Yes | Both Option 1-A-1 and Option 1-A-2  If UE-B does not have sensing results, then Option 1-A-2 is used. Here, UE-B may further down select from the set of preferred resources from UE-A, like random selection, or may directly use the set of preferred resources.  If UE-B has sensing results, then Option 1-A-1 is used. Here, UE-B may identify a set of candidate resources () based on its own sensing. If the set of preferred resource is (), then UE-B determines the resources by taking the intersection of and . |
| IDCC | Yes | We support both Option 1-A-1 and Option 1-A-2. The “Preferred resource set” will provide a set of resources applicable to the transmission window of UE-B and thus   * The “Preferred resource set” includes a number of resources for UE-B to perform resource selection, not for UE-B to skip both sensing and resource selection and therefore this is not a Mode 2d operation. * The “Preferred resource set” enables UE-B to skip only sensing, e.g., for power saving purposes, but to perform resource selection within the provided resource set only. This benefit is not available with “Non-preferred resource set”. * “Non-preferred resource set” and “Preferred resource set” can be suitable for different scenarios regarding whether UE-B performs sensing and how UE-B takes the information into account. And these scenarios are still for further discussions and therefore in our view we should keep both options in the design consideration. * If UE-A always performs sensing based on UE-B transmission window in the inter-coordination schemes, the preferred resource information will be always available. And it will be beneficial for UE-A to provide the preferred and/or non-preferred in different scenarios/conditions. Therefore, in our view, we should continue discussing the design with both options included. |
| Futurewei | Yes (for both options) w/comments | We support both option 1-A-1 and 1-A-2.  But option 1-A-1 shall not preclude the possibility of selecting a resource not indicated as the preferred resources as specified in the proposal before the Wednesday GTW meeting, particularly if there is a conflict e.g., preferred resources are all among the excluded resources from UE-B’s own sensing results. Therefore, we propose a change on option 1-A-1.   * + - *Option 1-A-1: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based on both UE-B’s sensing result (if available) and the received coordination information, not precluding the possibility of selecting a resource not in the preferred resource set in the coordination information.*   The use cases for 1-A-1 are quite clear. UE-B based on its own sensing results selects the resources from intersection of its available resource set and preferred resource set.  However, in some scenarios, e.g., there is a conflict when the preferred resource set is not in the coordination information, UE-B has to choose using its own sensing results by ignoring the coordination information or selecting a resource based on the coordination information only (which is 1-A-2). Both options shall be considered. In the platooning and public safety case (a fire scene), the leading vehicle and the fire commander as UE-B can ignore the coordination information and select resources based on its own sensing results.  For 1-A-2, the use case can be UE-B just relies UE-A for resource selection for power saving. Also for the case of RSU in an intersection, RSU can preform sensing and scheduling for the vehicles coming from or toward to different directions. Also as described above, in the truck platooning and public safety cases, if UE-A is the platoon leader or the fire commander, UE-B can follow the coordination information strictly even its own sensing results are available. |
| ZTE | Yes | Option 1-A-1 is preferred. Even for the preferred resource, the final decision on transmission resource should be up to UE’s decision with consideration on other factors. The feedback information from UE-A is only assistance information. |
| Bosch | Yes, with comments | Option 1-A-1 (only):  In this case, we assume a leading UE (group-lead or group manager UE) sending a preferred list of resources to UE-B’s. Hence, if UE-B is not supporting sensing (or not configured to do sensing, i.e., if it is an inter UE coordination condition), sensing results will not be available. Therefore, there is no need for Option 1-A-2.  Additionally, we should stive for a common design for the preferred and non-preferred resources. In this case, Option 1-A-1 will have a similar design as option 1-B-1.  Note: *periodic resources* will not be quickly outdated as mentioned by some companies. |
| Fujitsu | Yes | Option 1-A-1. UE B selects resources for its transmission in the intersection of Set B and Set A. Set B is the set of candidate resources determined based on UE B’s sensing. Set A is indicated by the coordination information. |
| NEC | Yes | Support option 1-A-1 if sensing result in UE-B is available and option 1-A-2 if sensing result in UE-B is not available |
| Samsung | Yes | Option 1-A-1  If UE-B receives preferred resources from more than one UE-A and performs sensing, UE-B can select resources from the intersection of the preferred resources from the UE-A’s and the candidate set of resources based on its own sensing (if available).  We are also open to further discuss the conditions under which UE-B’s sensing results are available. If and when UE-B can disable its sensing. |
| ETRI | Yes | Support both option 1-A-1 and 1-A-2  It depends on the situations. In case of unicast, if UE-B has its own sensing results, there is no reason not to use it. However, if there is a leading UE (e.g., managed groupcast communication), it will better to follow only the coordination information. |
| ITL | Yes | Option 1-A-1 is basically supported. We tend to agree with ZTE’s view. That is, the final determination of transmission resource should be UE’s decision.  In addition, Option 1-A-2 can be also supported depending on scenarios for inter-UE coordination since it would be beneficial to be applicable for the some specific scenarios where for example, a RSU controls and allocates the SL resources to UE-B based on tighter resource coordination. |
| Convida Wireless | Yes | Option 1-A-1 and Option 1-A-2.  Option 1-A-2 can be used in case UE A schedules the resources for UE B’s transmission. |
| Sony | Yes | We support option 1-A-1. If UE-B’s sensing result is not available, we think it would be the same as option 1-A-2. |
| Lenovo&MotM | Yes w/ comments | We support both Option 1-A-1 and Option 1-A-2  On Option 1-A-1 we think UE-B performs resource selection from the intersection of UE-B’s sensing result and the set of resources. If there is no intersection UE-B may fallback to perform resource selection based on its own sensing result. And Option 1-A-1 is applied when UE-B performs sensing  Option 1-A-2 can be used for the cases that UE-B has no sensing capability or just performs random resource selection or RSU sharing the sensing results to VRU. |
| CATT, GOHIGH | Yes | We support both option 1-A-1 and option 1-A-2.  Regarding option 1-A-2, we think it could be used for UE-B without sensing results or insufficient sensing results. UE-B can randomly select its transmission resource from the preferred resource set. we don’t support that UE-B is scheduled by UE-A, which may introduce high interference for UE-B’s neighbouring transmission. |
| xiaomi | Yes | Option1-A-1. Because of hidden terminal issue, the resource of UE-B’s sensing result is not [total](https://www.youdao.com/w/total/#keyfrom=E2Ctranslation)ly accurate.If UE-B’s sensing result is available, UE-B should consider UE-B’s sensing result and the received coordination information , which can improve the reliability;If UE-B’s sensing result is not available, the coordination information contains preferred resource,so UE-B can only use received coordination information to select resource to transmit. |
| LG | Yes | Option 1-A-1.  UE-B’s sensing results should be used for its resource (re)selection procedure to avoid another hidden-node problem (i.e. UE-B’s transmission on high interference resources).  The preferred resource set would be beneficial to reduce signalling overhead especially when it is used together with the non-preferred resource set. To be specific, the UE-B can selects transmission resources within the preferred resource set avoiding the non-preferred resources within the preferred resource set.  Regarding Option 1-A-2, it is unclear when the UE-B has no sensing results. If the UE-B has no RX capability, then there is no way to receive the coordination information either. If the UE-B has RX capability, the power saving gain due to skipping sensing operation will be not so large because most power consumption is dominant on the RF circuit to receive SL channels. If the UE-B has no sensing due to SL DRX, it is not yet decided whether the UE will be allowed to perform sensing outside active time or not. Moreover, it needs to consider the case when UE-B has another SL transmission or UL transmission on the preferred resource set. In this case, it is natural to ignore the preferred resource set for UE-B’s transmission. |
| MediaTek | Yes w/ comments | Support Option 1-A-1 and Option 1-A-2 (w/ updates)  Regarding to Option 1-A-2, UE-B transmission without its own sensing may cause the interference to the other UE. There may be two purposes for sensing: protect the other UEs’ reception and find the resources for the own UE’s reception (Tx sensing is close to Rx sensing for short range communication). If the preferred resource by UE-A can be delivered to UE-B, it can serve the purpose to find the Rx UE preferred resources for transmission. However, it can’t avoid the interference to others. In that sense, UE-B’s sensing may be needed for resource (re-)selection in addition to the coordination message. Secondly, if the UE-B can anyway receive the SL messages, there is such capability for sensing as well. Then the key issue is whether to be (pre-)configured for sensing or not considering power saving, which doesn’t matter with sensing capability.  Meanwhile, we also see the benefits of Option 1-A-2 if the following updates can be considered to address the interference issue and serve the scheduling purpose:  ***Option 1-A-2:*** *UE-B’s resource(s) to be used for its transmission resource (re)-selection is ~~based~~ only ~~on~~ from the received coordination information by additionally considering the UE-B’s sensing result.* |

**Question 2**: Do you support “Set of resources non-preferred for UE-B’s transmission (i.e., Option 1-B)” in scheme 1? If so, what is UE-B’s behavior you support (e.g., Option 1-B-1 and/or Option 1-B-2)?

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Preferred UE-B’s behaviour with more details |
| NTT DOCOMO | Yes | Option 1-B-1.  If UE-B does not use own sensing results, the transmission causes large interference i.e. resource collision to UEs other than UE-A. |
| Intel | Yes w/ comments | Option 1-B-1.   1. If both preferred and non-preferred sets of resources are agreed, we need to add FFS whether indication of both sets can be enabled in the same resource pool / same time / inter-UE coordination feedback 2. We prefer to have a bit more time for study before making decision on whether both preferred and non-preferred set types are supported. The reason is that we are not very clear on how both sets are constructed by assisting UE and used by TX UEs. These details are important in our view. Maybe we can continue work on definition of details how the sets are constructed by assisting UEs / used by TX UEs and then come-back to the question which sets are supported to have more data-based decision and selection process. |
| Panasonic | Yes | Option 1-B-1. How to use this inter-UE coordination information is up to UE-B operation. UE-B can use own UE-B’s sensing results (if available) |
| Ericsson | Yes | Option 1-B-1.  In our view, Option 1-B-2 does not make much sense for non-preferred resources. The coordination message only provides information about unsuitable resources from the point of view of UE-A. The UE should include its own information to select among the suitable resources, including the perspective of UE-B. |
| OPPO | YES | Option 1-B-1  For progress and also to constrain the scope of this topic, we are also fine to preclude the following option:   * + - *Option 1-3: UE-B’s resource(s) to be re-selected based on the received coordination information* |
| vivo | No | We think one shortcoming to use ‘non-preferred resource’ is higher overhead, because a bitmap of hundred or thousand bits will be used. Regarding the benefit, we think more evaluation should be performed after working out more details.  Only Option 1-B-1 is workable for 1-B.  Since the 1-A/1-B can use common procedure (in most cases, opposite behaviour of 1-A is 1-A), we can work out the details for both options. The down-selection can be performed later. |
| Spreadtrum | Yes | Option 1-B-1  For option 1-B-1, UE-B can exclude the resources indicated by UE-A from its candidate resources set, then UE-B do resource selection from the final candidate resources set.  For option 1-B-2, UE-B may only select resources randomly from resources other than those non-preferred resources provided by UE-A in the resource selection window. In this case, the selected resources may be not accurate, because the non-preferred resources are only from the perspective of UE-A.  We think option 1-B-1 is more suitable for non-preferred resources. |
| Huawei, HiSilicon | see comments | Unlike the preferred resource set, some potential issues existing in Rel-16 may not be solved by the non-preferred resource set. For example, the power consumption cannot be decreased since UE-B still needs to perform the sensing procedure to find available transmission resources. Moreover, the resource waste caused by the exposed node cannot be solved in this case. For the consecutive packet loss issue or the half duplex issue, the non-preferred resources can only provide the collided resources or UE-A’s transmitting or receiving resource, but which resources should be used to replace the collided resources are still unclear. UE-B would still possibly select the other reserved resource due to the incomplete coordination information.  In general, we think Option 1-A (preferred resources) is the best option for inter-UE coordination, and Option 1-B (non-preferred resources) is the second priority. However, if it is hard for the group to achieve the consensus on this point in RAN1 #105-e, then we suggest no further down-selection in scheme 1, i.e. both preferred and non-preferred resources are supported.  Option 1-B-2 may need more clarifications, e.g., how UE-B’s transmission resources are selected in this case? |
| CMCC | Yes (for Option 1-B-1) | When the set of resources are non-preferred for UE-B’s transmission, only Option 1-B-1 can work. In such a case, the UE-A can determine the “set of resources” based on its sensing procedure, and then forward the sensing results to UE-B (to solve the hidden node issue). In addition, the UE-A can also indicate its own reservation to UE-B (to solve the half-duplex and consecutive packet loss issue). The UE-B can take the coordination information into account when determining the resources for its transmission. To be specific, the UE-B can exclude the high interference resources at the Rx UE side, or the UE-A’s selected resources to avoid potential conflict. |
| Kyocera | Yes | Support Option 1-B-1. This option does not limit the choices for the UE B’s (re-)selection process. |
| Mitsubishi | Yes | We support Option 1-B-1  It is unclear how 1-B-2 can be applied and have doubts about the usefulness of such a method |
| Nokia, NSB | Yes | Reason: The non-preferred set may be smaller (i.e., lower overhead) than the preferred set (e.g., under low system load).  Option 1-B-1.  UE-B’s sensing result is essential to ensure as little impact as possible of UE-B’s transmission on its surrounding environment. |
| Fraunhofer | Yes for Option 1-B-1 | We support Option 1-B-1.  In the case of Option 1-B-2, in the absence of UE-B’s sensing results, it cannot use the set of non-preferred resources alone to determine resources for its transmission.  When considering the entirety of scheme 1, between Option 1-A and 1-B, UE-A can be triggered to send coordination information based on either an explicit request or implicit event. Depending on this trigger, either one of the options can be used depending on what is required by UE-B, and UE-B can then use the set of resources accordingly. Hence, we think a unified procedure is possible between these options for scheme 1. |
| Qualcomm | Yes | In our contribution we show performance gains for unicast, groupcast option 1, and groupcast option 2 when Scheme 1 is used with non-preferred resources.  We support option 1-B-1. The set of non-preferred resources is generally not the complement of the preferred resource set and sensing information is needed to select resources. |
| Apple | Yes | Support Option 1-B-1. This set of non-preferred resources may be used by multiple UE-Bs, since it is common to all UEs.  Here, UE-B may identify a set of candidate resources () based on its own sensing. If the set of non-preferred resource is (), then UE-B refines the set of candidate resources by excluding the resources in from . |
| IDCC | Yes | As discussed in Question 1, we support continued discussions with both Option 1-A and Option 1-B, because each option will benefit different scenarios and they can have a unified design to enable both options. |
| Futurewei | Yes (for both options) w/comments | We support both option 1-B-1 and 1-B-2.  Again, 1-B-1 shall not preclude the case that UE-B can ignore the coordination information when both sensing results are available. We propose a change on option 1-B-1.   * + - *Option 1-B-1: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based on both UE-B’s sensing result (if available) and the received coordination information, not precluding the possibility of selecting a resource in the non-preferred resource set in the coordination information.*   First supporting both preferred resource and non-preferred resource sets are necessary. One important use case is the multi-UE coordination, preferred resource set for UE-B1’s resource selection may be sent to UE-B2 as non-preferred resource set.  Second, regarding the FL’s comment on “if the remaining resources except for the non-preferred resource set become the preferred resource set, there would be no motivation to support both the preferred and non-preferred resource sets”, we do not agree. For groupcast or broadcast scenario, each Rx UE as UE-A sends non-preferred resource set to the UE-B based on its own sensing results, UE-B can select a resource by excluding all non preferred resource sets from UE-As without performing sensing as its own sensing results may not be reliable for all Rx UE’s anyway. Then 1-B-2 can be more beneficial than sending preferred resource set from each UE-A, particularly when number of UEs is large, the probability to find a common resource from all preferred resource sets is small.  For 1-B-1 one clear case is that UE-B selects a resource by excluding any resource in the non-preferred resource set from available resource set based on UE-B’s sensing results. However, when there is an conflict that available resource sets are all in the non-preferred resource sets, UE may strict follow coordination information even its own sensing results are available (which is then 1-B-2 behaviour), or just select a resource based on its own sensing results, which might be in the non-preferred resource set from the coordination information. |
| ZTE | Yes | Option 1-B-1. Option 1-B-2 is not workable by itself In case of assistance information wasn’t received |
| Bosch | Yes | Option 1-B-1 only:  First, option 1-B-1 will have a similar design as option 1-A-1.  Second, option 1-B-2 will have only non-preferred list, i.e., which cannot be used for transmission without own sensing. However, if UE-B‘s exclude non-preferred resources from all possible resources without sensing, they will cause interference. |
| Fujitsu | Yes | Option 1-B-1. UE B selects resources for its transmission in the set which is obtained by excluding Set B and Set A. Set B includes the resources excluded based on UE B’s sensing. Set A is indicated by the coordination information.  In our view, “Non-preferred resources” cannot be replaced or derived by “preferred resources”, or vice versa. Firstly, they can target different use cases. For preferred resources, they can be transmitted only by the intended receiver of UE B. For non-preferred resources, they can be transmitted by any UE, e.g., when a TX UE notifies its own TX resources, other UEs receiving these can avoid using these TX resources. Secondly, the non-preferred- resource set is not necessarily the complementary set of the preferred- resource set. E.g., non-preferred resources can include only several most non-preferred resources to avoid the worst cases, and preferred resources can include only several most preferred resources to achieve the best cases. In this case, one set of resources cannot be derived from the other set. |
| NEC | Yes. | Option 1-B-1 is supported. |
| Samsung | No | Preferred and non-preferred resources can be considered complimentary. If a resource is not-preferred, it can be considered as preferred, and vice versa. We are also open to study having different levels of preferred resources and indicate these in the inter-UE co-ordination message (see section 2.3).  Providing preferred resources is sufficient. |
| ETRI | Yes | Support only option 1-B-1 since the benefit of option 1-B-2 is unclear. |
| ITL | Yes | Option 1-B-1. Both UE-B’s sensing result and the received coordination information should be taken into account in the context of option 1-B. |
| Convida Wireless | Yes | We prefer Option 1-B-1. |
| Sony | Yes | We support option 1-B-1. |
| Lenovo&MotM | Yes | Option 1-B-1 |
| CATT, GOHIGH | Yes | Option1-B-1 only.  From our understanding, if option 1-B-1 is used, UE-B should have sensing results, otherwise option 1-A should be used.  *Option 1-B-1: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based on both UE-B’s sensing result ~~(if available)~~ and the received coordination information*  After UE-B received the non-preferred resource set from UE-A, the UE-B should first exclude the non-preferred resource set from its initial candidate resource set, and then perform the resource exclusion mechanism in Rel-16 to construct available candidate resource set (SA). |
| xiaomi | Yes | *Option 1-B-1.*  Set of resources non-preferred for UE-B’s transmission *just provide not recommended resource, UE-B need choose suitable resource to transmit data, the resource sensed by UE-B is candidate resource, which is suitable resource to transmit for UE-B, so UE-B need still consider both UE-B’s sensing result (if available) and the received coordination information*, then UE-B selects suitable resource to transmit data. |
| LG | Yes | Option 1-B-1.  The non-preferred resource set would be beneficial to reduce signalling overhead especially when it is used together with the preferred resource set. To be specific, the UE-A can provide non-preferred resources within the preferred resource set. |
| MediaTek | Yes | Option 1-B-1. Two use cases are considered:  Case 1: The other UEs (any UE) can indicate the resources for its own usage from their own Tx UE as the non-preferred resources to UE-B to avoid UE-B’s interference. In this case, it can be carried in the first SCI as the normal sensing message.  Case 2: Rx UE (intended receiver UE) can indicate the non-preferred resources based on its sensing results to UE-B for derivation of the preferred RX resources. |

**Question 3**: Do you support “Presence of expected/potential resource conflict on the resources indicated by UE-B’s SCI (i.e., Option 2-A)” in scheme 2? If so, what is UE-B’s behavior you support (e.g., Option 2-A-1 and/or Option 2-A-2)?

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Preferred UE-B’s behaviour with more details |
| NTT DOCOMO | Yes | Option 2-A-1. |
| Intel | Yes | We are fine if such feedback is provided but we assume that UE-B also performs autonomous detection of expected/potential resource conflict during sensing procedure. This aspect needs to be added/clarified.  Whether to use Option 2-A-1 or 2-A-2 can be further discussed and depends on further design details. For instance, for the same conflict UE-B1 can apply Option 2-A-1, i.e. reselect resource while another UE-B2 continue transmission and further decide on Option 2-A-2.  The following clarifications are needed,   * in case of Option 2-A-1, UE excludes resource with detected presence of expected/potential resource conflict and then select new one * in case of Option 2-A-2, UE continues transmission in the resource with detected presence of expected/potential resource conflict |
| Panasonic | Yes | Option 2-A-1. |
| Ericsson | Yes | Option 2-A-1.  Given that Option 2-A refers to “presence of expected/potential resource conflict”, we do not understand how “UE-B can determine a necessity of retransmission based on the received coordination information”. The conflict being expected or potential implies that UE-B has not made the corresponding transmission yet. How can the need of retransmission be determined? |
| OPPO | YEs | Option 2-A-1 |
| vivo | yes | Option 2-A-1 |
| Spreadtrum | Yes | Option 2-A-1.  In option 2-A, the collision has not yet occurred. The most direct behavior of UE-B should be to do resource re-selection. |
| Huawei, HiSilicon | Need more clarifications | The wording “expected, potential” are unclear, they may refer to different detailed cases as below. So more discussions/clarifications are needed before making decisions.  Does “expected resource conflict” and “potential resource conflict” refer to the same thing? If the two words share the same meaning, suggest to choose one of them to avoid confusion. Otherwise, clarifications are needed and they should be separately discussed.  As we mentioned in GTW, it is necessary to decide what are the cases or conditions under which a part of scheme 2 would be applicable and usable, and then we can decide which are of wide enough use to include. Our analysis on this basis is as follows:  In our view, the “expected resource conflict” can be divided into two sub cases:   * Case 1 (UE-B/UE-C collision): Expected resource conflict between the reserved resources indicated by UE-B’s SCI and the other UE’s reservation based on UE-A’s sensing results, i.e., UE-A helps UE-B to perform pre-emption check. * Case 2 (UE-B/UE-A collision): Expected resource conflict between the reserved resources indicated by UE-B’s SCI and UE-A’s own transmission resources.   For Case 1, according to R16 NRV design, UE-B itself will always do pre-emption check before using the reserved resource and can possibly find such collision, so the benefits of expected resource conflict might very limited.  For the cases where UE-A may have information that UE-B does not, Case 1 may have other problems. For example, for hidden node which might not be detected by UE-B, the reselected resources after receiving the expected resource conflict indication are the un-reserved resources for the other sensing UEs, so these UEs cannot exclude the reselected resources when performing sensing procedure. In this case, the collisions may happen again on the reselected resources. In addition, the resources reversed by the previous SCI are not released, which also leads to inaccurate exclusion for the other sensing UEs. Therefore, the expected resource conflict indication will cause re-selection and unreserved transmission, which has the drawback of higher collision chance, increased delay, etc. While such drawbacks do not exist in Scheme 1.  Moreover, UE-A detects such collision does not necessarily mean the Rx UE of UE-B cannot decode the data successfully (e.g. exposed node case as explained in our Tdoc R1-2104237 Figure 6). So the expected resource conflict indication is inaccurate in exposed node case.    **Figure 6: Expected resource conflict is inaccurate for an exposed node.**  For Case 2, UE-A can proactively trigger the resource re-selection to avoid the resource collision or half-duplex issue instead of sending the resource conflict indication. The benefits of sending this expected resource conflict indication is unclear. |
| CMCC | Yes (for Option 2-A-1) |  |
| Nokia, NSB | Yes | Option 2-A-1.  There’s no point in retransmitting based on an expected conflict. |
| Fraunhofer | Yes for Option 2-A-1 | We are fine with Option 2-A-1, as long as it permits UE-B to exclude the potentially colliding resources and reselect resources accordingly.  Regarding Option 2-A-2, we agree with Ericsson that it is unclear as to how UE-B can trigger a retransmission for a potential resource collision associated to a transmission that has not taken place yet. |
| Qualcomm | Yes | In our contribution, we show that such a scheme improves performance in conjunction with signaling non-preferred resources.  We support Option 2-A-1. |
| Apple | Yes | Support Option 2-A-1.  UE-B could reselect the resources to replace the potential conflicted resources as indicated by UE-A. |
| IDCC | Yes | Option 2-A-1. |
| Futurewei | Yes | We support 2-A-1.  One of use cases for this option is that UE-A helps with re-evaluation and pre-emption for the UE’B. Based on the wording that UE-B can determine the resource to be reselected, the option indicates that it may not perform resource reselection. If there is no such indication, we suggest revising the option   * + - *Option 2-A-1: UE-B can determine resource(s) to be re-selected based on the received coordination information, not precluding the possibility that UE-B may not perform resource reselection*   For 2-A-2, we are not clear on the scenario for this option. Since the transmission is not started yet, in which scenario UE-B needs to determine the necessity of retransmission. |
| *ZTE* | Yes | Option 2-A-1  The general design principle or needs for scheme-2 to mitigate the potential “burst” conflict and the benefits can be maximized by re-selection. |
| Bosch | Yes | We support 2-A-1.  The difference between 2-A-1 and 2-A-2 is confined. It is clear that the determination of resource(s) to be re-selected can indicate the necessity of retransmission. Therefore, we propose the following modification:  *Option 2-A-1: UE-B can determine resource(s) to be possible re-selected based on the received coordination information* |
| Fujitsu | Yes | Option 2-A-1. UE B performs resource re-selection. In our view, this has some similarities with pre-emption. The difference is that the pre-emption is notified by UE A since UE B may not identify this due to the hidden-node issue. Furthermore, UE B should be aware of both ACK/NACK and presence of expected/potential resource conflict. This is to avoid performing re-selection for a ACKed TB. |
| NEC | Yes | Option 2-A-1 |
| Samsung | Yes | Option 2-A-1  UE-A indicates potential conflicts for resources reserved by UE-B. UE-B re-selects resources with a potential conflict as indicated by UE-A. |
| ETRI | Yes | Option 2-A-1  It depends on the situations (timing). With an indication of potential/expected conflict, UE-B can re-select resources to avoid a potential conflict. Therefore, it is not necessary to consider retransmission of a TB. However, with an indication of detected conflict, UE-B can determine the retransmission of a TB. |
| ITL | Yes | Option 2-A-1  It is not clear how to consider option 2-A-2 in scheme 2. It needs to be clarified such as what is meaning of “determing a necessity of retransmission”. |
| Convida Wireless | Yes | Option 2-A-1.  We are open for Option 2-A-2. |
| Sony | Yes | We support Option 2-A-1.  Option 2-A-2 would cause more resource consumption compared with Option 2-A-1. |
| Lenovo&MotM | Yes | Option 2-A-1 |
| CATT, GOHIHG | Yes | Option 2-A-1 |
| xiaomi | Yes | Option 2-A-1. After receive coordination information, UE-B can make a resource re-selection to avoid conflict in the future, which can improve [reliability](https://www.youdao.com/w/reliability/#keyfrom=E2Ctranslation). |
| LG | Yes | Option 2-A-1.  Regarding the periodic reservation at UE-B, it is necessary to consider the case when UE-B changes TX parameters such as source ID, destination ID, and so on. To be specific, expected half-duplex problem may not occur in the future when UE-B changes destination ID for the PSSCH transmission on the reserved resources. |
| MediaTek | Yes | Option 2-A-1.  UE-A can check whether the resource reservation in SCI from UE-B are collided with others based on the sensing results. Then UE-A can indicate such potential collision (detected but not happened) to UE-B for interference avoidance. |

**Question 4**: Do you support “Presence of detected resource conflict on the resources indicated by UE-B’s SCI (i.e., Option 2-B)” in scheme 2? If so, what is UE-B’s behavior you support (e.g., Option 2-B-1 and/or Option 2-B-2)?

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Preferred UE-B’s behaviour with more details |
| NTT DOCOMO | Comment | If this mechanism is applied only to groupcast option 1 (and broadcast?), we can accept this. For unicast/groupcast option 2, DTX of ACK/NACK feedback achieves same thing. That is, no gain is assumed. |
| Intel | Yes | It should be supported for the NACK only groupcast and blind transmissions to address half-duplex problem |
| Panasonic |  | If specification effort is not so large, "detected resource conflict" is supported. For option 2-B, the difference between option 2-B-1 and 2-B-2 is unclear. |
| Ericsson | Yes | Like Intel and DOCOMO, we believe that there has to be a discussion on the cast modes for which 2-B is applicable. |
| OPPO | NO | 1. The scheme seems targeting to a particular case:    * Groupcast with HARQ feedback Option 1;    * There is half duplex between UE-B and at least one of its intended receivers;    * None of UE-B’s intended receiver feedback NACK;   It is questionable how possible all these would happen simultaneously in reality, and if so, would reliability of groupcast with HARQ feedback Option 1 not be satisfied.   1. The scheme relies on UE-A (not an intended receiver of UE-B) to identify the intended receiver of UE-B, UE-A could do that based on either zone ID or source/destination ID of UEs, however due to the limited bit width for these IDs, the UE-A may misinterpret a UE as intended receiver of UE-B, which would cause unnecessary retransmission at UE-B consequently. 2. The scheme requires UE-A to perform more processing on the received SCI to identify the resource conflict, and requires it to transmit more PSFCH (assume PSFCH is used) to indicated the conflict to UE-B, however, the UE-A could not benefit directly from these operations, it is also questionable whether the UE-A should be required to do so by specification.   We did not see any commonality between this scheme and other candidate schemes, including UE-A/UE-B behaviour, how to determine UE-A/UE-B etc., it needs a dedicated discussion thread in RAN1 if it is supported. |
| vivo | No, for now | 2-B-2 can be applied to 2-B. However, we need more study on the scenarios associated with 2-B-2. We can firstly identify the conflict cases associated with 2-B, if the associated scenario is reasonable, we can consider it after more evaluation. |
| Spreadtrum |  | We think the exactly scenarios about option 2-B are not clear. And we should further study the rationality of option 2-B. |
| Huawei, HiSilicon | Need more clarifications | Similar as the reply for Question 3, the wording “detected” is unclear, and may refer to different detailed cases as below. So more discussions/clarifications are needed before making decisions.  As we mentioned in GTW, it is necessary to decide what are the cases or conditions under which a part of scheme 2 would be applicable and usable, and then we can decide which are of wide enough use to include. Our analysis on this basis is as follows:  In our view, and “detected resource conflict” can be divided into half-duplex indication and post-collision indication.  Case 1: half-duplex indication  Half-duplex indication might be applicable in groupcast where all the UEs (i.e., UE-A, UE-B, UE-C) are in the same group and UE-A needs to decode and compare the destination IDs (both 16 bits in SCI and 8 bits in MAC PDU). However, half-duplex indication might be useful only in rare case since it requires all the following conditions:   * Condition#1: within a group, two UEs (UE-B and UE-C) choose to transmit on the same slot. * Condition#2: all the other group members have successfully decoded the packet.   We also had simulation results (see R1-2104237 section 4.3) to prove that there is no obvious performance gain by solving this kind of half-duplex issue.  Case 2: post-collision indication  The feasibility of PSCCH-collision indication is doubtful since UE-A probably cannot detect such collided PSCCH, because current specification does not require the UE to decode more than one PSCCH at each PSCCH resource candidate. Moreover, if the colliding PSCCH use the same OCC for DMRS, the UE has no way to detect such collision. |
| CMCC | No | In our view, the detected resource conflict can be solved by R16 HARQ mechanism, and it seems meaningless to further introduce a conflict indication. |
| Nokia, NSB | Yes | Both options (Option 2-B-1 and Option 2-B-2).  In case of periodic resource reservation, a detected conflict may trigger both retransmission (to ensure the failed transmission is received) and reselection (to ensure future transmissions don’t fail). |
| Fraunhofer | No | Option 2-B is a post collision indication that does not provide any information to UE-B apart from the fact that a transmission has failed, in the case that the indication is a NACK. The UE will not be able to differentiate between a failed transmission and a resource collision.  In Option 2-B-1, it does not make much sense for UE-B to trigger a resource reselection in case the transmission decoding had failed, but there was no resource collision.  In Option 2-B-2, UE‑B can only trigger a retransmission, but this depends on the signaling used for the collision indication. If a NACK is used, as mentioned by other companies, this is limited to only groupcast option 1, and it is unclear as to how this can be used for other cast types.  Unless further study is carried out, we cannot support this now. |
| Qualcomm | Yes | We support this scheme and show that it not only benefits Rel-17 UEs but also Rel-16 UEs in the same pool when the indication is NACK. This gain is observed over the baseline even when the baseline is properly configured to maximize the its performance with suitable feedback distance for the scenario (highway and urban).  This scheme addresses cases that cannot be addressed by Rel-16 feedback procedure alone and does not require any new signaling, only a change in feedback procedure.  We evaluated and support Option 2-B-2. We also support Option 2-B-1 for periodic transmission, where it would also be beneficial since a detected past conflict could be a recurring collision as mentioned by others. |
| Apple | Yes | Option 2-B-2.  Like some other companies, we think this scheme is only applicable to groupcast feedback option 1 (NACK only). When UE-B makes sidelink unicast transmission to UE-A, UE-A sends ACK or NACK to UE-B depending on whether the data is received. UE-B’s retransmission decision is based on ACK or NACK feedback from UE-A, rather than based on the detected resource collision. In this case, the inter-UE coordination does not change UE-B’s behavior. Hence, it is unnecessary for this type of inter-UE coordination scheme in unicast with feedback enabled or groupcast HARQ option 2. |
| IDCC | No | The scenario in which UE-A detects “present” conflict needs further clarification, e.g., should this be considered in groupcast option 1? Once this is clear, evaluation result may be helpful to determine whether this should be supported, especially if UE-B’s behavior will be different upon received indication of “expected/potential” or “detected” conflict. |
| Futurewei | Yes | We support 2-B-1. A use case for this option is to avoid the consecutive packet loss when there is a conflict on the existing transmission.  We are generally ok with option 2-B-2, but need a certain clarification. UE B can perform resource reselection immediately without retransmissions on the originally selected resources to avoid systematic retransmissions due to collisions. But for the new selected resource, UE-B can either still perform retransmissions for HARQ or start it as new transmission with MAC ARQ procedure. We support both behaviours. |
| ZTE | No | The performance gain of Option 2-B-2 over legacy HARQ is marginal. Also, with supportive on the Option 2-A-1, the needs for re-selection is not trivial and it’s not reasonable to introduce such mechanism with larger spec effort and UE’s complexity |
| Bosch | Yes, with comments | We support option 2-B-1 (for the same reason as Question 3).  However, we need to propose for Scheme 2 only one option, which considers expected and/or detected resource conflict(s) (i.e., mixed B and C). |
| Fujitsu | Yes | Option 2-B-2. UE B performs retransmission. One use case is for groupcast with HARQ option 1. Even if UE B and UE C have half-duplex issues, UE B and UE C may still consider it as ACK since no NACK is transmitted by UE B or UE C. If UE A identifies that the half-duplex problem happens between UE B and UE C, it can notify UE B and UE C to perform retransmission. The retransmissions of UE B and UE C may not have half-duplex issues and thus being performing successfully. |
| Samsung | No | We have yet to agree on the supported cast types for inter-UE co-ordination. Our view is that it should be limited to unicast and groupcast, and not used for broadcast.  For Unicast and groupcast type 2, detected resources conflicts are already indicated based on HARQ-ACK feedback (NACK).  If indication of detected resource conflicts is important, groupcast type 1 is not configured, instead groupcast type 2 is configured.  We see no benefit in defining a new scheme. |
| ETRI | Yes | Option 2-B-2  See the comments for question 3 |
| ITL | No | We don’t see meaningful performance gain from Option 2-B compared to HARQ mechanism. |
| Convida Wireless | Yes | Which option, Option 2-B-1 and/or Option 2-B-2 can be further discussed. |
| Sony | No | Option 2-B is not beneficial for the indication of a detected resource conflict as compared to a legacy HARQ reporting. |
| Lenovo&MotM | Yes | Option 2-B-2  Should be supported for groupcast option-1 and Tx UE after receiving the coordination information may perform retransmission |
| CATT, GOHIGH | No | From our understanding, if Broadcast and groupcast with HARQ feedback option 1 is the potential use cases of option 2-B. and the potential resource conflict could be either half-duplex and resource overlapping.  The resource overlapping cases could be resolved by R16 SL HARQ feedback.  The half-duplex cases should be further clarified. If the UE-A is the intended receiving UE of UE-B, it can not know the detected half-duplex collision. It UE-A is the third-part UE, it is unclear for UE-A to determine which half-duplex collision pair is the target pair to be coordinated. Therefore, at current stage, we don’t support option 2-B |
| Xiaomi | Yes | We support 2-B-2.For specific cast mode, such as broadcast and groupcast option 1, when UE-A decodes failure for the UE-B’s transmission, UE-A does not send feedback to UE-B, UE-B does not perform retransmission, however, option 2-B-2 can trigger UE-B to make a retransmission based on the received coordination information to improve reliability for broadcast and groupcast option 1. |
| LG | No | In case of resource collision in the past, since the RX UE would store the contaminated coded bits due to the collision in the RX buffer, even though the RX UE receives a number of retransmissions and performs chase combining, the stored coded bits would not be recovered. It will results decoding failure despite of a number of retransmission with a help of the post-collision indication.  In case of half-duplex problem, since the UE-B could know whether half-duplex problem will occur or not based on the received SCI in advance, the resources associated with the resource conflict would be initial transmission only. In other words, one more than initial transmissions causing half-duplex problem will be transmitted in the same time. Depending on the above situation is corner case or not, we can decide whether this information type is deprioritized or not. |
| MediaTek | Yes w/ comments | Option 2-B-2 with comments:  In case of detected collision, it may mean the UE-A may not even receive the SCI from UE-B. In this case, the DTX status of PSFCH A/N can be considered as the “implicit” coordination message. UE-B can (re-)select the resource based on the DTX status. It is especially for the periodic transmission with initial transmission collisions with others, which will cause the consecutive collisions. Our simulation shows 7% gain if the DTX status of PSFCH A/N for initial transmission of periodic traffic can be used as the coordination message implicitly. |

**2.2 Condition(s) for UEs to be UE-A(s)/UE-B(s)**

During the GTW session, there was a comment that the case in which any UE can be a UE-A should be supported. **So, I ask companies to provide feedback on whether the following FL’s proposal is agreeable. If not, please provide your preferred option/condition with details**. **The deadline for companies to provide inputs is May 21st 4:59am UTC. To prepare/make more agreeable draft proposals before the start of GTW session and the check point/timing of Chairman, it would be highly appreciated if companies make comments as soon as possible.**

***FL’s proposal****:*

* *One or more of following cases are supported for determining UE-A (sending to UE-B(s) the inter-UE coordination information) and UE-B (receiving and using the inter-UE coordination information from UE-A(s)). FFS details including possibly down-selecting one or more of the options below, applicable scenario(s)/inter-UE coordination scheme(s) for each option. Note that other options are not precluded.*
  + *Option 1: Only UE(s) among the intended receiver(s) of UE-B can be a UE-A*
    - *At least the intended receiver(s) is the destination UE(s) of a TB transmitted by UE-B*
      * *FFS additional condition(s) of being the intended receiver(s) of UE-B*
  + *Option 2: Any UE can be a UE-A*
    - *FFS additional condition to be met to become a UE-A*

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| Company | Yes or no | Comment |
| NTT DOCOMO | Yes | One reason that discussions are controversial would be same as Q1 of 2.1. Several companies assume hierarchical mechanism like mode 2d. I think that at first RAN1 should discuss whether such direction is supported or not.  In addition, this discussion should be separate between scheme 1 and scheme 2. Mechanism/concept is different, so outcome of this discussion could be different. |
| Intel | Yes | We think both options should be supported by the system and is up to configuration/scenario. We agree w/ NTT DOCOMO that it is useful to have a discussion for each scheme separately |
| Panasonic | Yes | For additional condition, three options should be considered. Option 1 is the capability of inter UE coordination is exchanged by application layer or PC5 RRC. Option 2 is the resource pool or group is pre-configured and all UEs in the resource pool or group have the capability of UE-inter coordination. Option 3 is UE without capability of inter-UE coordination can also join the pre-defined resource pool or group and the capability is exchanged by physical layer/MAC layer. |
| Ericsson | Yes | We think both options should be supported. We also think it is necessary to discuss which of the options can be used with each of the (sub)schemes. |
| OPPO | NO | We can agree on Option 1 this meeting and FFS others, as it is not possible to use Option 2 in scheme 1 and scheme 2 with Option 2-A. |
| vivo | No | For scheme 2, option 1 is baseline, option 2 can be FFS. We think option 2 is applied only in some conflict scenario, while option 1 is applied to more general conflict cases. From our perspective, we think UE-B should be receive too many coordination messages from multiple UE-As, otherwise, the UE-B’s behaviour is not clear.  For scheme 1, which UE can request coordination information or send the coordination information should be confirmed before starting the inter-UE coordination; otherwise, scheme 1 could not work at all. So the relationship should be determined somehow, either application layer or RRC should be used for exchanging the desire or capability for inter-UE coordination. We can try the following proposal  ‘For scheme 1, the inter-UE coordination relationship of UE-A and UE-B is known to each other before applying inter-UE coordination. FFS details’ |
| Spreadtrum | Yes | Both options should be supported. And we think it should be discussed for different schemes and cast types separately. |
| Huawei, HiSilicon | Yes with comments | For Option 2, suggest to add “, and UE-A is determined by higher layers”, and then the FFS can be removed. Because similar with the link establishment for unicast and groupcast, the role of UE-A or UE-B can also be determined by higher layers during the link establishment procedure. V2X application layer can designate the role of UE-A and UE-B when the link is established. There is no need for additional conditions.  We support FL’s view that RAN1 needs further discussion on applicable scenario(s)/inter-UE coordination scheme(s) for each option. |
| CMCC |  | We think that the determination of UE-A and UE-B should be discussed separately for each scheme.  For Scheme 1, both options can be supported regarding different scenarios and target issues. On the other hand, for Scheme 2, only Option 1 is reasonable. |
| Kyocera | Yes | Both should be supported. However, need to discuss which one applies to Scheme I vs Scheme II. |
| Mitsubishi | With comments | We support option 1. We prefer to leave Option 2 as FFS |
| Nokia, NSB | Yes | Option 2, for both Schemes 1 and 2.  In Scheme 1, if a UE is not an intended receiver, it is true that UE-A’s sensing is not necessarily relevant. However, there are some use cases where coordination information from a UE-A that is not an intended receiver may be useful:   * At an intersection, an RSU (UE-A) may coordinate transmissions among vehicles, pedestrians, etc., even if the RSU itself is not an intended recipient. * Similarly, in a platoon, the platoon leader (UE-A) may coordinate platoon members’ transmission resources (e.g., slots), even if the leader is not an intended recipient. * An arbitrary UE may act as a UE-A by retransmitting reserved resources for its reception of TBs (indicated as non-preferred), thus helping to address the hidden node issue.   In Scheme 2, a conflict may sometimes be detected only by a UE other than an intended receiver. In that case, with Option 1, the conflict would go undetected. |
| Fraunhofer | Yes, with comments | We agree with Huawei that Option 2 should include that any UE can be UE-A as determined by higher layers. Additional conditions can be applied on top of Option 2, since it is possible for UE-A to provide coordination information to UE-B without being the intended receiver. Option 1 can be considered one of the additional conditions, where UE-A can be the intended receiver(s) of UE-B, depending on the scenario in question. |
| Qualcomm | Yes with comments | We support both option and think both should be utilized depending on scenario. We provided results using different options to suit the utilized inter-UE coordination scheme and scenario. |
| Apple |  | It depends on inter-UE coordination schemes. Option 1 is applicable to both inter-UE coordination schemes 1 and 2. Option 2 is generally only applicable to inter-UE coordination scheme 1.  In our view, for inter-UE coordination scheme 2, we could restrict UE-A to be an intended receiver of UE-B. Since the inter-UE coordination in scheme 2 is most likely delivered in feedback channel, it is natural that UE-A is an intended receiver of UE-B to qualify UE-A’s usage of the feedback channel corresponding to UE-B’s PSCCH/PSSCH transmissions. |
| IDCC | Yes | However, in our view further discussions are needed to determine which scenario, e.g. cast type, applies to the Option 2 as well as which UE type, e.g., RSU. Option 2 operation should be more restricted to avoid excessive UE-A transmissions. |
| Futurewei | Yes | Since option 2 covers option 1, we can only have option 2. But we are ok to keep both options without down-selection if other companies prefer this.  The use cases are clear for the option 1 that an intended receiver of UE-B can be UE-A. For option 2, there are some scenarios where a UE not among the intended receivers. One important scenario is the RSU that is deployed at an area where pedestrians are likely to be present (e.g., intersection, traffic, light, pedestrian crossway, etc.) and use inter-UE coordination as follows: after sensing, the RSU reserves some resources for pedestrian usage UEs in its vicinity and also the V2P UEs which can select the resource from the resources reserved for the V2Ps by the RSU. Another scenario is the public safety case where the incident commander as reserves resources for other UEs. Both are important applications and use cased for sidelink. Therefore, UE A may not be any of intended receivers. |
| ZTE | Yes with modification | W.r.t the main bullet, this note should be removed to narrow down scope for discussion: *~~Note that other options are not precluded.~~*  W.r.t the Option-2, more details are needed to be added with association on corresponding scheme. Otherwise, both options are not in the same level. |
| Fujitsu | Yes | Agree to FFS both Option 1 and Option 2. Between these two options, we prefer Option 2. Besides the intended receivers of UE B, other UE can be UE A and transmits the coordination information. E.g., consider a case of Scheme 2 where UE A is the intended receiver of UE C, but not the intended receiver of UE B. When UE A identifies the presence of expected resource conflict between UE B and UE C, UE A may not have the opportunity to notify UE C to re-select resources, but UE A can still notify UE B to re-select resources. In this case, UE A is not the intended receiver of UE B. |
| NEC | Yes | We think both options could be applied for different scenarios. |
| Samsung | Comment | Option 1 and option 2 target different scenarios and can both be specified.  When UE-A is the intended receiver of UE-B (Option 1), UE-B triggers UE-A to send a set of resources.  When UE-A is any UE (option 2), UE-A can be an infra-structure UE (e.g. RSU) or a UE configured to provide inter-UE co-ordination information. The following two scenarios can be supported:   * Inter-UE co-ordination information is provided after receiving a trigger or activation message from UE-B. * Inter-UE co-ordination information is provided periodically, regardless of a trigger from UE-B.   Given the limited time for this work item, we would like to focus on option 1, where UE-A is the intended receiver of UE-B. |
| ETRI | Yes | Both option 1 and option 2 should be supported.  It depends on the situations. In case of unicast between a pair of UE, option 1 can be considered. If it is assumed that there is a group including a leading UE, option 2 can be considered. |
| ITL | Yes | Both options are ok for us even through Option 2 can cover Option 1 as a special case. We also think note in main bullet needs to be removed. |
| Convida Wireless | Yes | Both options could be considered. |
| Sony | Yes | In our view, Option 2 could be superset of Option 1. But we are OK with supporting both options. |
| Lenovo&MotM | Yes | We think both Option 1 & 2 should be supported. |
| CATT, GOHIGH | No | We support option 1, and leave option 2 FFS.  In scheme 1, in order to construct prefer resource set/non preferred resource set, we think option 1 is sufficient, it is unnecessary to introduce option 2.  In scheme 2 with potential/expected resource conflict, the intended receiving UE can found the resource conflict of both half-duplex collision and resource overlapping. But for the UE not the intended receiving UE, it can not find the half-duplex collision. From this point of view, we also think it is unnecessary to introduce option 2. |
| xiaomi | Yes | We support option 1 at least for schme 1 and scheme 2-A. option2 is still not clear , it is necessary to provide more details and discuss which scheme should be considered for option 2. |
| LG | Yes | Considering that the UE-A may not know whether UE-B will transmit PSCCH/PSSCH targeting the UE-A or not after the UE-B receives coordination information from the UE-A, both options could be considered. |
| MediaTek | Yes | Both options should be supported due to the difference use cases and scenarios for interference avoidance (i.e., favour its own reception or avoid interference to others). |

**2.3 Information used for generating inter-UE coordination information**

**I ask companies to provide feedback on whether the following FL’s proposal is agreeable. If not, please provide information needs to be added with details**. **The deadline for companies to provide inputs is May 21st 4:59am UTC. To prepare/make more agreeable draft proposals before the start of GTW session and the check point/timing of Chairman, it would be highly appreciated if companies make comments as soon as possible.** Note that the information listed in the proposal below was selected based on the majority view, and I encourage companies to be more constructive to make progress.

***FL’s proposal****:*

* *At least the following information is used for UE-A to generate the inter-UE coordination information:*
  + *For scheme 1,* 
    - *Other UEs’ reserved resources based on UE-A’s sensing result*
    - *UE-A’s NR SL resources selected for its transmission(s) of TB(s)*
    - *UE-A’s scheduled/configured resources for UL*
  + *For scheme 2,* 
    - *Other UEs’ reserved resources and/or existing transmission (i.e. used resources) based on UE-A’s sensing result*
    - *UE-A’s NR SL resources selected for its transmission(s) of TB(s)*
    - *UE-A’s scheduled/configured resources for UL*

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| Company | Yes or no | Comment |
| NTT DOCOMO | No | ‘at least’ will not be OK among companies based on discussions at the last meeting and contributions. Our suggestion is to decide firstly concepts/conditions/message-contents of UE-A performing inter-UE coordination. After that, required information would be decided naturally. Otherwise, companies are not on the same page in concept level, so no consensus is assumed. |
| Intel | Yes w/ comments | We are fine with the direction if the intention is to further discuss additional conditions such as use of sidelink transmission priority, SL-RSRP measurements, use of source/destination IDs, UL vs SL priority for all sub-bullets of scheme 1 and scheme 2. Perhaps, it should be clarified. |
| Panasonic | No | When UE-A is not receiver of UE-B in section 2.2, the information on UE-A’s scheduled/configured resources for UL is not related to UE-B’s transmission resources. |
| Ericsson | Yes for Scheme 1  Need clarification for Scheme 2 | We think that there must be a discussion on when each of the types of information is used (for both schemes). It is not clear to us that they are all applicable in all cases.  For Scheme 2, we would like to understand when the following two types of information are useful:   * *UE-A’s NR SL resources selected for its transmission(s) of TB(s)* * *UE-A’s scheduled/configured resources for UL*   At least for Option 2-B, they do not seem to make much sense. What is the difference wrt to using regular HARQ FB? |
| OPPO | Yes in general | Seems “*UE-A’s scheduled/configured resources for UL*” is not on the same level as others, as it is used only when RF capability of UE-A is limited. |
| vivo | No | For scheme 1, we prefer to list UE-A’s behaviours. For scheme 2, we prefer to define the conflict cases. We think some of the listed factors is specification transparent. It is more straightforward to down-selection UE behaviours in the following meetings. |
| Spreadtrum | No | Similar view with Panasonic. When UE-A is not receiver of UE-B, UE-A’s NR SL resources selected for its transmission(s) of TB(s) and UE-A’s scheduled/configured resources for UL should not be considered. So we think some clarification should be needed. |
| Huawei, HiSilicon | See comments | Currently, we think only the 1st sub-bullet for Scheme 1 is necessary. Other sub-bullets need more discussions or can be discussed after issues in Section 2.1/2.2 are clear enough.  For scheme 1:  1st sub-bullet is necessary since sensing is the basis of Mode 2 procedure.  2nd and 3rd sub-bullets only apply when UE-A is UE-B’s receiver. We suggest to first discuss UE-A determination, and then come back to these issues. In addition, R16 NRV seems also face such issues, but R16 NRV does not have special solutions to handle such issues. So it seems such issues are corner cases, and network configuration and packet dropping are enough to alleviate/handle such issues. So RAN1 may need to first discuss why current solutions are not enough for such issues.  For scheme 2  1st sub-bullet: it depends on which sub-scheme of scheme 2 is supported, e.g. expected collision (UE-B/UE-C collision, or UE-B/UE-A collision), potential collision, detected collision (half-duplex, or PSCCH collision), etc. We suggest to first discuss Section 2.1, and identify the necessary information for each sub-scheme later on if necessary.  2nd and 3rd sub-bullets: same comment as for Scheme 1. |
| CMCC |  | Similar concern that the information used by UE to determine the coordination information should be dependent on the target issue and the determination of UE-A/UE-B. |
| Kyocera | Yes | In general, we’re fine except in our view this decision could be deferred until the other issues such as preferred/non-preferred resources, Scheme I vs II conditions/scenarios are agreed. Based on the above design decisions then we can decide what info is needed to fulfil the design goals. |
| Mitsubishi |  | Rediscuss depending on the outcome of the proposal in 2.1 |
| Nokia, NSB | Yes | For Scheme 1, it is preferred to include also the following:   * *Information on UE-B’s traffic requirements (e.g., conveyed via triggering information from UE-B, if any)* * *UE-A’s candidate resource set based on UE-A’s sensing*   Without the above two items, it is difficult to see how UE-A can determine a meaningful recommendation for UE-B. |
| Fraunhofer | Yes for scheme 1, with comments | We feel that options listed out in this proposal are dependent on different scenarios. Hence, although we are supportive of the direction of the proposal, it might be more constructive to associate the information needed by UE-A to generate the coordination information to the applicable scenario and the information that it is intending to generate. |
| Qualcomm | Not in current form | Our evaluation results show that using inter-UE coordination from other UE-As is needed to achieve performance gains, relying only on sensing results negates the majority of observed gains. This is the case for both Scheme 1 with preferred resources and Scheme 1 with non-preferred resources and regardless of whether UE-A is an intended recipient of UE-B.  Indicating the initial transmission as a non-preferred resource in Scheme 1 provides significant gains as shown in our contribution. This is also the case in Scheme 1 with preferred resources where other UEs interpret the initial transmission as non-preferred. Those gains applied in scenarios where UE-A was an intended recipient of UE-B as well as scenarios where UE-A was not an intended recipient of UE-B. We’re ok with considering using retransmission information for determining the resources but this would be in addition to using only the initial transmission.  We don’t see the need to use UL information, in particular for Scheme 2 but also for Scheme 1. |
| Apple | No | For scheme 1 or scheme 2 with potential resource conflict, UE-A generates the inter-UE coordination based on   * UE-A’s sensing results * UE-A’s received or transmitted inter-UE coordination * UE-A’s scheduled/configured sidelink and uplink transmission, if UE-A is an intended receiver * UE-A’s scheduled/configured PSFCH reception, if UE-A is an intended receiver   For scheme 2 with detected resource conflict, UE-A generates the inter-UE coordination based on   * UE-A’s sensing results   UE-A’s received or transmitted inter-UE coordination. |
| IDCC | Yes | We support this in principle.  Also, we would like to point out that at least “*Other UEs’ reserved resources based on UE-A’s sensing result”* is supported can imply UE-A always performs sensing in both schemes and as a result, UE-A will have “preferred resource” information available as discussed in Question 1 and 2. |
| Futurewei | Yes | We are ok with the proposal. |
| ZTE | No | For the scheme-1, at least the following part is needed to enable the proper selection on both preferred and non-preferred resource with consideration on the needs for upcoming transmission.   * guidance information from UE-B |
| Bosch | Yes | We fine with the proposal. |
| Fujitsu | No | For Scheme 1, it seems that the listed information is only for generating non-preferred resources. However, whether to support non-preferred and/or preferred resources has not been determined yet.  For Scheme 2, it is not quite clear how the 2nd and 3rd sub-bullets work. If UE A found some conflicts between UE A and UE B, UE A may not need to notify UE B. Alternatively, UE A can avoid such conflicts by using resource (re)selection or prioritization rules. |
| NEC | Yes in general |  |
| Samsung | Comment | We support having common criteria for the generation of inter-UE co-ordination information for scheme 1 and scheme 2. We notice that the options listed under scheme 1 and scheme 2 are quite similar, so even if the generated inter-UE co-ordination information is different, the criteria to generate this information should be the same.  The following criteria can be used to determine the inter-UE co-ordination information.  First, UE-A’s sensing. Sensing can identify:   * Candidate resources in a resource selection window. These resources can be considered as preferred resources. * Resources excluded due to reservation by other UE’s detected during sensing, these are non-preferred resources, where a collision occurs.   We are open to further study conditions, if any, under which sensing can be disabled when UE-A provides inter-UE co-ordination information.  Further study if preferred resources can have different preference levels to help mitigate shortage of preferred resources at UE-B.  Second, UE-A’s own transmission. Due to the half-duplex problem, single slot resources in all slots where there is a SL transmission are considered as non-preferred, and are removed from the preferred resources signalled to UE-B.  For UL dynamically scheduled uplink resources, the time between a UE receiving the UL grant in a DCI and the uplink transmission, might not be long enough to indicate that resource to the other UE. We prefer to further study the feasibility and necessity of considering uplink dynamically scheduled UL transmissions when determining inter-UE co-ordination information.  For UL configured grant, resources might not be always used for uplink transmissions. These resources can be signalled as part of preferred resources but with lower preference levels as there is a potential risk of collision. |
| ETRI | Yes | We are generally fine with the proposal. |
| ITL | Yes | We are ok with this way from FL. |
| Convida Wireless | Yes | We are generally fine with the proposal. |
| Sony |  | We think the required information to generate the inter-UE coordination information depends on the determination of UE-A discussed in section 2.2. |
| Lenovo&MotM | Yes | We are fine with current proposal, and other conditions/information to generate the inter-UE coordination information can be further discussed for each scheme. |
| CATT, GOHIGH | No | We think it would be better to determine the details of resource set/resource conflict types related to each scheme. And then determine how to obtain the resource set/resource conflict. |
| xiaomi | Yes | For scheme 1 and scheme 2，we support only 1st sub-bullet , because sensing is the basis of Mode 2 procedure.In addition,S-rsrp measurement also be included, no matter for preferred or non-preferred resources,potential or detected resource conflict, UE-A need both decode SCI and do S-RSRP measurement by sensing . |
| LG | Yes | At this moment, we think that these information can be used to generate the coordination information. It seems that most companies does not object the listed information at least for scheme 1.  Regarding the scheme 2, when the UE-A is the intended RX UE of a TB transmission from the UE-B, the UE-A can check whether the resources indicated by UE-B’s SCI is overlapping with expected UL or SL transmission of UE-A. If there is overlapping, the UE-A can provide resource conflict indication to the UE-B. |
| MediaTek | No | For scheme 2, PSFCH feedback status (e.g., DTX, NACK) should be listed as the coordination message to indicate the detected collisions. Such message has the advantage of low overhead, low latency and high efficiency. |

1. **Contents to be discussed in Friday’s GTW (May 21st)**

We have had the email discussion to check which coordination information needs to be supported (including the possibility of down-selection) for each scheme and what is UE-B’s behaviour of using the received inter-UE coordination information in its resource selection for each scheme.

* *For scheme 1,* 
  + *Option 1-A: Set of resources preferred for UE-B’s transmission*
    - *Option 1-A-1: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based on both UE-B’s sensing result (if available) and the received coordination information*
    - *Option 1-A-2: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based only on the received coordination information*
  + *Option 1-B: Set of resources non-preferred for UE-B’s transmission*
    - *Option 1-B-1: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based on both UE-B’s sensing result (if available) and the received coordination information*
    - *Option 1-B-2: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based only on the received coordination information*
* *For scheme 2,* 
  + *Option 2-A: Presence of expected/potential resource conflict on the resources indicated by UE-B’s SCI*
    - *Option 2-A-1: UE-B can determine resource(s) to be re-selected based on the received coordination information*
    - *Option 2-A-2: UE-B can determine a necessity of retransmission based on the received coordination information*
  + *Option 2-B: Presence of detected resource conflict on the resources indicated by UE-B’s SCI*
    - *Option 2-B-1: UE-B can determine resource(s) to be re-selected based on the received coordination information*
    - *Option 2-B-2: UE-B can determine a necessity of retransmission based on the received coordination information*

The following is the summary of companies’ views:

* For scheme 1,
  + Option 1-A: Set of resources preferred for UE-B’s transmission
    - **Support**: Intel, Panasonic, vivo, Spreadtrum, Huawei, CMCC, Nokia, Fraunhofer, Qualcomm, Apple, IDCC, Futurewei, ZTE, Bosch, Fujitsu, NEC, Samsung, ETRI, ITL, Convida Wireless, Sony, Lenovo&MotM, CATT, xiaomi, LG, MediaTek (**26**)
      * Option 1-A-1: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based on both UE-B’s sensing result (if available) and the received coordination information
        + **Support**: Intel, Panasonic, vivo, Spreadtrum, Huawei, CMCC, Nokia, Fraunhofer, Qualcomm, Apple, IDCC, Futurewei, ZTE, Bosch, Fujitsu, NEC, Samsung, ETRI, ITL, Convida Wireless, Sony, Lenovo&MotM, CATT, xiaomi, LG, MediaTek (**26**)
      * Option 1-A-2: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based only on the received coordination information
        + **Support**: vivo, Spreadtrum, Huawei, CMCC, Fraunhofer, Qualcomm, Apple, IDCC, Futurewei, NEC, ETRI, ITL, Convida Wireless, Sony, Lenovo&MotM, CATT (**16**)
    - **Not support**: NTT DOCOMO, Ericsson, OPPO, Kyocera, Mitsubishi (**5**)
  + Option 1-B: Set of resources non-preferred for UE-B’s transmission
    - **Support**: NTT DOCOMO, Intel, Panasonic, Ericsson, OPPO, Spreadtrum, CMCC, Kyocera, Mitsubishi, Nokia, Fraunhofer, Qualcomm, Apple, IDCC, Futurewei, ZTE, Bosch, Fujitsu, NEC, ETRI, ITL, Convida Wireless, Sony, Lenovo&MotM, CATT, xiaomi, LG, MediaTek (**28**)
      * Option 1-B-1: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based on both UE-B’s sensing result (if available) and the received coordination information
        + **Support**: NTT DOCOMO, Intel, Panasonic, Ericsson, OPPO, Spreadtrum, CMCC, Kyocera, Mitsubishi, Nokia, Fraunhofer, Qualcomm, Apple, IDCC, Futurewei, ZTE, Bosch, Fujitsu, NEC, ETRI, ITL, Convida Wireless, Sony, Lenovo&MotM, CATT, xiaomi, LG, MediaTek (**28**)
      * Option 1-B-2: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based only on the received coordination information
        + **Support**: Futurewei (**1**)
    - **Not support**: vivo, [Huawei,] Samsung (**3**)
* For scheme 2,
  + Option 2-A: Presence of expected/potential resource conflict on the resources indicated by UE-B’s SCI
    - **Support**: NTT DOCOMO, Intel, Panasonic, Ericsson, OPPO, vivo, Spreadtrum, CMCC, Nokia, Fraunhofer, Qualcomm, Apple, IDCC, Futurewei, ZTE, Bosch, Fujitsu, NEC, Samsung, ETRI, ITL, Convida Wireless, Sony, Lenovo&MotM, CATT, xiaomi, LG, MediaTek (**28**)
      * Option 2-A-1: UE-B can determine resource(s) to be re-selected based on the received coordination information
        + **Support**: NTT DOCOMO, Intel, Panasonic, Ericsson, OPPO, vivo, Spreadtrum, CMCC, Nokia, Fraunhofer, Qualcomm, Apple, IDCC, Futurewei, ZTE, Bosch, Fujitsu, NEC, Samsung, ETRI, ITL, Convida Wireless, Sony, Lenovo&MotM, CATT, xiaomi, LG, MediaTek (**28**)
      * Option 2-A-2: UE-B can determine a necessity of retransmission based on the received coordination information
        + **Support**: Intel (**1**)
    - **Not support**: [Huawei,] (**1**)
  + Option 2-B: Presence of detected resource conflict on the resources indicated by UE-B’s SCI
    - **Support**: [NTT DOCOMO,] Intel, [Panasonic,] Ericsson, Convida Wireless, Nokia, Qualcomm, Futurewei, Bosch, Apple, ETRI, Lenovo&MotM, Xiaomi, MediaTek (**15**)
      * Option 2-B-1: UE-B can determine resource(s) to be re-selected based on the received coordination information
        + **Support**: Nokia, Qualcomm, Futurewei, Bosch, (**4**)
      * Option 2-B-2: UE-B can determine a necessity of retransmission based on the received coordination information
        + **Support**: Nokia, Qualcomm, Apple, Futurewei, ETRI, Lenovo&MotM, Xiaomi, MediaTek (**8**)
    - **Not support**: OPPO, vivo, [Spreadtrum,] [Huawei,] CMCC, Fraunhofer, IDCC, ZTE, Samsung, ITL, Sony, CATT, LG (**13**)

Considering the summary mentioned above, the following guideline is suggested from FL’s perspective.

* In this meeting, RAN1 focuses on discussing/identifying more details relevant to the following coordination information (including UE-B’s behavior) and tries to agree to support it.
  + For scheme 1,
    - Set of resources preferred for UE-B’s transmission
    - Set of resources non-preferred for UE-B’s transmission
  + For scheme 2,
    - Presence of expected/potential resource conflict on the resources indicated by UE-B’s SCI

1. **Email discussion before Tuesday’s GTW (May 25th)**

**4.1 Inter-UE coordination information signalling from UE-A and resource selection behaviour in UE-B**

**4.1.1 Scheme 1**

According to the summary of companies’ views (see Section 3) shared in Friday’s GTW session (May 21st), the majority of companies are supportive of both “set of resources preferred for UE-B’s transmission” and “set of resources non-preferred for UE-B’s transmission” for scheme 1. From FL’s perspective, in order to make the agreement on whether to specify both types of information for scheme 1, further details of UE-B’s behaviour that companies think should be discussed/clarified. **So, I ask companies to provide inputs on the following tables. The deadline for companies to provide inputs is May 25st 4:59am UTC. To prepare/make more agreeable draft proposals before the start of GTW session and the check point/timing of Chairman, it would be highly appreciated if companies make comments as soon as possible.**

**Question 1**: Should UE-B only select resource(s) belonging to the preferred resource set received from UE-A? If not, please provide the relevant details/conditions.

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comment |
| Intel | No with comments | UE-B should always have TX candidate resource set and if there is intersection b/w TX candidate resource set and the set provided by UE-A, then UE-B can prioritize selection of resources from intersection. Otherwise, UE-B should fallback to TX candidate resource set.  Conditions to consider candidate resource set from assisting UE should be further discussed (e.g. distance, RSRP range, etc.) |
| Vivo | Yes | UE-B may not perform sensing for power saving purpose, in this case, UE-B can select any resource from the ‘recommended preferred resource’. |
| OPPO | NO | Firstly, we do not understand why we discuss this question at this stage, the answer is related to several aspects which are still open for now, including whether the resource set provided by UE-A is subject to some restrictions in terms of minimum number/interval of resources, whether there is restriction on the time when UE-A sends the resource set, whether UE-B can select resource based only on the resource set, how UE-B select resource based on both sensing result and the resource set, etc.  From our perspective, UE-B may select resource(s) not belonging to the preferred resource set received from U-A at least if:   * Number of resources in the set are not sufficient; * UE-B received the resource set too later; * UE-B cannot find resources satisfying the minimum/maximum interval requirement; * All or part of resources in the set are not belonging to the set determined based on sensing. |
| NTT DOCOMO |  | As commented before, we think whether hierarchical mechanism is supported or not should be clarified as Question 0. It seems that many companies supporting ‘preferred’ type assume hierarchical mechanism like mode 2d.  If Q0’s answer is YES, UE-A is like scheduling UE, then Q1’s answer might be YES.  If Q0’s answer is NO, UE-B should consider other UEs’ reservations and as a result, Q1’s answer should be NO. |
| Spreadtrum | No | We think that at least at this stage, UE-B should not be restricted to only select resource(s) belonging to the preferred resource set.  If all resources in the preferred resource set cannot meet some specific requirements, UE-B can select the resources based on its own sensing results. |
| Huawei, HiSilicon |  | The proposal should be reformulated to address the relevant question:  **Proposal**: When UE-B does not have sensing results, or when UE-A can provide transmission resources for multiple UE-Bs, the transmission resources for UE-B are determined only by the preferred resource set received from UE-A.  When UE-B does not have sensing results, e.g. when UE-B does not have the sensing capability, or UE-B choose to not have the ability to perform sensing for power saving. In this case, the transmission resource for UE-B can only be determined by the coordination from UE-A.  In addition, even if UE-B has sensing results, the performance gains by the centralized scheduling can also be achieved when UE-A provides transmission resources for multiple UE-Bs and UE-B uses such resources directly. |
| Ericsson | No | UE-B should not discard local information to select resources. Our contribution shows that this is clearly sub-optimal. It also prevents re-evaluation/re-selection and pre-emption. Performance is worse than for Rel-16.  In addition, we share the points made above by Intel. |
| Fraunhofer | Yes with comments | In the case where UE-B does not carry out sensing, we agree that UE-B should select resources for its transmission from the set of preferred resources sent by UE-A.  In the case where UE-B does carry out sensing, it can use both the set of preferred resources from UE-A as well as its own sensing results to determine the final resources for its transmission. |
| Kyocera | No | As we mentioned in our previous response UE-B should not limit itself by not including its own resource information. |
| Mitsubishi | No | UE-B can prioritize selection of UE-A(s)’s preferred resources whenever possible on a best effort basis, but selection of those resources should not be mandatory.  For example, contradictory sets may be received from different UE-A(s), or sets contradicting UE-B’s sensing results may be received. UE-B must have means of performing reasonable resource selection in these cases.  We agree that it is useful to further discuss some conditions for using the assistance information: for example, for solving the hidden node problem, it is useful to rely on UE-A(s) far from UE-B, while for power saving it is useful to rely on UE-A(s) close from UE-B, etc. This stands for both preferred/non-preferred resource sets. |

**Question 2**: Should UE-B only select other resource(s) that do not belong to the non-preferred resource set received from UE-A? If not, please provide the relevant details/conditions.

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comment |
| Intel | No with comments | Our understanding information on non-preferred resource set should be used either as an input to UE-B’s resource exclusion procedure of or UE-B should try to avoid selecting resources that overlap with non-preferred set. In both cases there may be probability that resource from non-preferred set is selected, if it is happened to be a part of TX candidate resource set.  Conditions to consider non-preferred resource set from assisting UE should be further discussed (e.g. distance, RSRP range, etc.).  Our understanding is that UE-A can still attempt to receive on non-preferred resource set from UE-B. |
| Vivo | Partially yes | UE-B can deprioritize the ‘non-preferred resource’. E.g., when candidate resource set (derived based on Rel-16 procedure) includes the non-preferred resource, UE is allowed (but not mandate) to deprioritize to select the resources. |
| OPPO | NO | Similar comments as that for Q1 |
| NTT DOCOMO | Yes |  |
| Spreadtrum | No | Similar in Q1. We think when some specific conditions are not satisfied as mentioned by intel, UE-B may not consider the non-preferred resources received from UE-A.  So, we think that at this stage, it is not necessary to restrict how UE-B uses the resource set received from UE-A. This issue depends on the discussion of other issues. For example, how does UE-A determine the preferred or non-preferred resource set. |
| Huawei, HiSilicon | Need clarification | We don’t understand why this question is being posed. It’s not clear which option(s) from those agreed this is intended to address, and we don’t understand why last meeting’s agreements are not being discussed, again. |
| Ericsson | No | We think that the design principle is that UE-B must incorporate the non-preferred resources to its resource (re-)selection procedures, which build upon Rel-16 procedures. UE-B must make use its own sensing information.  Besides that, it may not even be possible to follow non-preferred resources at all in some cases:   * There may be a conflict between local information and non-preferred resources. In this case, the UE will have to make a decision that may conflict with the coordination message. * There may be a conflict with other coordination messages.   In all cases, UE-B has to make a decision using also its own information. |
| Fraunhofer | Yes with comments | In our understanding, when UE-B receives a set of non-preferred resources from UE-A, it would compare these resources with its own candidate resource set and exclude these resources, in order to avoid potential resource collisions. However, this can also be dependent on conditions such as the distance and priority/RSRP threshold. |
| Kyocera | No | When UE-B may find its own resource in conflict with the received coordination information. However, this is not a problem. For example, UE-B could list the non-preferred resources in the coordination information at the bottom of the list of selected resources. |
| Mitsubishi | No with comments | UE-B can prioritize exclusion of UE-A(s)’s non-preferred resources whenever possible on a best effort basis, but selection of those resources should still be possible to avoid blocking situations.  For example, contradictory sets may be received from different UE-A(s), or sets contradicting UE-B’s sensing results may be received. UE-B must have means of re-including some of those resources. When several UE-A(s) provide non-preferred resources, it should be also possible for UE-B to take into account the number of UEs indicating a certain resource as non-preferred, or some associated information (e.g. RSRP or some other indication, if available).  We agree that it is useful to further discuss some conditions for using the assistance information: for example, for solving the hidden node problem, it is useful to rely on UE-A(s) far from UE-B, while for power saving it is useful to rely on UE-A(s) close from UE-B, etc. This stands for both preferred/non-preferred resource sets. |

**Question 3**: Do you agree with the following UE-B’s behavior for scheme 1? Note that the wording of “random resource selection” is more comprehensive/general than the wording of “availability of sensing result”.

* When UE-B performs the random resource selection, only the received coordination information is used for its transmission resource (re)-selection. Otherwise, it use both UE-B’s sensing result and the received coordination information for its transmission resource (re)-selection.

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comment |
| Intel | No | Random resource selection is primarily designed for UEs w/o sidelink reception capability. If it is not the case, UE-B should generate candidate resource set based on its own sensing and may consider inter-UE coordination feedback. |
| vivo | No | The scenario only to use coordination information is valid for now. But the detailed condition to use such feature can be discussed later, because we even have no idea when to perform random selection. |
| OPPO | Yes with comments | We suggest to generalize the condition to “When UE-B has no available sensing results when it performs resource selection”. |
| NTT DOCOMO | No | My feeling is quite similar to Intel. It is questionable that random selection UE has capability of inter-UE coordination. At least scheme 1 uses PSCC/PSSCH as the container. The UE would not receive PSCCH/PSSCH. |
| Spreadtrum | No | Similar view with intel and DOCOMO. Random selection UE may not have reception capability. Then UE cannot receive the coordination information when the container is PSCCH or PSSCH. |
| Huawei, HiSilicon | ? | The question seems to be a contradiction of itself. Is the scenario one where UE-B has chosen resources by random selection, or has not chosen? As we replied to Q1, there are cases where UE-B performs no sensing, e.g. to save power or cost, etc.  The relevant point is:  **Proposal**: When UE-B does not have sensing results, or when UE-A can provide transmission resources for multiple UE-Bs, the transmission resources for UE-B are determined only by the preferred resource set received from UE-A. |
| Ericsson | No | We do not see the point of having reception of inter-UE coordination but not use sensing. Inter-UE coordination is an enhancement of Rel-16 procedures, not a replacement thereof.  For UEs doing random selection due to limited reception capabilities (i.e., Type-B UEs), we are open to discuss ways to make use of the coordination information in the resource allocation procedure (e.g., trigger reselection). But this discussion is not limited to Scheme 1. |
| Fraunhofer | Yes with comments | We agree with OPPO’s wording, with the addition that UE-B would consider ONLY the received coordination information as long as it contains a set of preferred resources. As indicated in the previous round of discussions, it does not make sense for UE-B to use only a set of non-preferred resources.  Using the term random resource selection might lead to confusion since certain type A UEs have no reception capability.  To this regard, the behaviour could be rephrased to:  “When UE-B has no available sensing results, only the received coordination information containing a set of preferred resources is used for its transmission resource (re-)selection. Otherwise, it uses both UE-B’s sensing result and the received coordination information (preferred or non-preferred resources) for its transmission resource (re)-selection.” |
| Kyocera | No. | See our response for Question 2. |
| Mitsubishi | No | The purpose of this question is quite unclear. As multiple companies stated above, it is unlikely for UEs performing random resource selection to have reception capabilities compatible with inter-UE coordination. We could agree with the initial wording “when UE-B does not have available sensing results” |

**Question 4**: During the email discussion, there were comments that it should be firstly clarified whether “Hierarchical mechanism (e.g., Mode 2(d) in Rel-16)” can be supported in scheme 1 or not. Please check the following FL’s understanding, and provide inputs if companies have different opinions on it.

* Assuming that UE-A creates SL grant used by UE-B and sends it to UE-B in the hierarchical mechanism, this mechanism is not the scope of WID. This is because according to WID, it is clear that UE-B takes the received coordination information into account in the resource selection for its own transmission. This means that UE-B should create its SL grant by itself. Just to be clear, for example, limiting UE-B’s resource selection to the preferred resource set does not simply mean the hierarchical mechanism.

|  |  |  |
| --- | --- | --- |
| Company | Support or not | Comment |
| Huawei, HiSilicon |  | WID scope questions belong to RAN, not to the FL’s own interpretation. This is particularly true when RAN has had multiple discussions on the scope of the WID without changing it, and whilst being aware of what RAN1 is discussing.  The only words in the WID are: “… *UE-B takes this into account in the resource selection for its own transmission* …”, the detailed meaning of “takes this into account” is left open to solutions at a technical level, and the presumption in the sub-bullet of the question is not provided by any RAN decision.  We can also point out that the WID task to avoid consecutive collisions is able to be addressed by such solutions, particularly within a coordinated group. |
| Ericsson | Yes, with comments | We think that the wording “UE-B takes into account the resource selection for its own transmission” is quite clear. It leaves the decision to UE-B. It does not say “follows the coordination message for its own transmission”.  Depending on the progress of the work, RAN1 may agree to support limitations of UE’Bs resource selection. But from the above reasoning it is clear that the design goal cannot be to limit the decision possibilities of UE-B by providing a small enough set of resources so that UE-B cannot make a decision at all. That would be a grant. |
| Fraunhofer | Yes with comments | We do not agree entirely with the FL’s interpretation of the WID. In a hierarchical mechanism, it is possible for UE-A to provide UE-B with a set of preferred resources, for example a candidate resource set, from which UE-B will then select the resources for its own transmission. This would technically mean that UE-B “creates its SL grant by itself”.  However, in the interest of reducing overhead and signalling effort, if UE-B is expected to select resources from the candidate resource set provided by UE-A in a random manner, we do not see why it is not possible for UE-A to simply select the resources from the candidate resource set and send these selected resources to UE-B. |

**4.1.2 Scheme 2**

Considering the summary of companies’ views (see Section 3) shared in Friday’s GTW session (May 21st), it is not possible to support only “presence of detected resource conflict on the resources indicated by UE-B’s SCI” except for “presence of expected/potential resource conflict on the resources indicated by UE-B’s SCI”. Also it doesn’t seem easy to support both options for scheme 2. Note that there were comments that it could not be feasible to support too much options due to the limited number of remaining meetings for this WI. From FL’s perspective, in order to make the agreement on whether to down-select one of options for scheme 2, further details of UE-B’s behaviour/applicable scenario that companies think should be discussed/clarified. **So, I ask companies to provide inputs on the following tables. The deadline for companies to provide inputs is May 25st 4:59am UTC. To prepare/make more agreeable draft proposals before the start of GTW session and the check point/timing of Chairman, it would be highly appreciated if companies make comments as soon as possible.**

**Question 1-1**: Do you agree that the information of “presence of expected/potential resource conflict on the resources indicated by UE-B’s SCI” is used for UE-B to determine not to use the resources indicated as the expected/potential resource conflict and trigger the resource re-selection? If there are other expected behaviors of UE-B, please provide the relevant details.

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comment |
| Intel | Comments | Sidelink conflict always involves at least two sidelink TX UEs. One of the TX UEs may continue transmission and another UE may need to reselect. Therefore, in our view two UE-B’s behaviours are possible if conflict is detected: 1) continue transmission and 2) exclude resource and select new resource. Specific behaviour depends on scenario and further discussion. |
| vivo | Yes |  |
| OPPO | Yes |  |
| NTT DOCOMO | YES |  |
| Spreadtrum | Yes |  |
| Huawei, HiSilicon | Need clarification | The question wording does not seem to map to options 2-1 and 2-2 of what is already agreed for scheme 2. This was an agreement like any other, and needs to be adhered to:   * *For scheme 2:*   + *Option 2-1: UE-B can determine resource(s) to be re-selected based on the received coordination information*   + *Option 2-2: UE-B can determine a necessity of retransmission based on the received coordination information*   As replied in the 1st round, more clarifications on the wording “expected, potential” are needed to make sure companies are on the same page about the issues being discussed. Such clarifications are necessary to decide what are the cases or conditions under which a part of scheme 2 would be applicable and usable, and then we can decide which are of wide enough use to include. This may also impact later questions, e.g. cast type, container, UE-A determination, etc.  For example, in our view, the “expected resource conflict” can be divided into two sub cases:   * Case 1 (UE-B/UE-C collision): Expected resource conflict between the reserved resources indicated by UE-B’s SCI and the other UE’s reservation based on UE-A’s sensing results, i.e., UE-A helps UE-B to perform pre-emption check. * Case 2 (UE-B/UE-A collision): Expected resource conflict between the reserved resources indicated by UE-B’s SCI and UE-A’s own transmission resources.   In Case 1, it seems UE-A does not need to be UE-B’s receiver. However, in case 2, UE-A needs to be UE-B’s receiver. So the UE-A determination and cast type in Case 1, 2 could be different.  In addition, if both case 1 and 2 are to be supported, does the conflict indication need to include two states to differentiate them?  In summary, Case 1, 2 may have different applicable scenarios, designing details, etc. So we suggest RAN1 to further clarify the meaning of “expected/potential resource conflict”, otherwise companies may not on the same page when answering the following questions (cast type, contained, UE-A determination, etc.).  Note: The difference between “expected resource conflict” and “potential resource conflict” need to be clarified. If the two words share the same meaning, suggest to choose one of them to avoid confusion. Otherwise, clarifications are needed and they should be separately discussed. |
| Ericsson | Yes | Details of who reselects, who does not, etc. can be discussed later. |
| Fraunhofer | Yes with comments | In the case that UE-B receives a collision indication pertaining to particular resource(s), UE-B should ensure that the resource(s) are excluded from the triggered resource (re-)selection process. |

**Question 1-2**: Under what cast types/feedback options can the information of “presence of expected/potential resource conflict on the resources indicated by UE-B’s SCI” be used?

|  |  |  |
| --- | --- | --- |
| Company | Applicable cast type/feedback option | Comment |
| Intel | All cast types | We prefer RAN1 to come up with a solution applicable to all cast types. |
| vivo | Unicast or groupcast | For broadcast, since intended receiver of UE-B is a lot, the frequency to receive the conflict indication is high, which may trigger too much resource reselections. It is noted that system performance is negatively impacted by frequent reselection. |
| OPPO | Unicast and groupcast | As shared resource could be used by all UE-A to indicate the conflict, this scheme can be used even there are multiple intended receivers. However, we do not think it could be used for broadcast as it is difficult to prevent UEs out of the PSSCH coverage from indicating the conflict. |
| NTT DOCOMO | All cast types |  |
| Spreadtrum | Unicast and groupcast | Since there is no specific receiver In broadcast, when two or more UEs suffering from potential resource conflicts have received the conflict indication, it may cause all UEs to perform resource reselection. We think this situation should be avoided. |
| Huawei, HiSilicon | Need clarification | As replied for Question 1-1, we suggest RAN1 to further clarify the meaning of “expected/potential resource conflict”, otherwise companies may not on the same page when answering the following questions (cast type, contained, UE-A determination, etc). |
| Ericsson | All | We prefer RAN1 to come up with a solution applicable to all cast types. |
| Fraunhofer | At least unicast and groupcast |  |

**Question 1-3**: What container/signaling format is used for UE-A to send “presence of expected/potential resource conflict on the resources indicated by UE-B’s SCI”?

|  |  |  |
| --- | --- | --- |
| Company | Container/signalling format | Comment |
| Intel | PSFCH like signalling | Details can be discussed later when RAN1 reaches more high level agreements on design directions. |
| vivo | PSFCH like |  |
| OPPO | PSFCH | PFSCH suffices to convey up to 2 bits |
| NTT DOCOMO | PSFCH like signalling |  |
| Spreadtrum | PSFCH like signalling or SCI | When the bits of the resource conflict indication is large, SCI can be used. For example, in addition to the conflict indication, the resources information and the priority of another conflicting UE should be included.  So we can first determine what information the resource conflict indication should contain. |
| Huawei, HiSilicon | Need clarification | As replied for Question 1-1, we suggest RAN1 to further clarify the meaning of “expected/potential resource conflict”, otherwise companies may not on the same page when answering the following questions (cast type, contained, UE-A determination, etc).  For example, if the indication intends to differentiate different types of conflict (e.g., UE-B/UE-C collision, UE-B/UE-A collision), the indication needs to have more states. This may impact the container or signaling format. |
| Ericsson | PSFCH like signalling | Details can be discussed later. |
| Fraunhofer | PSFCH like signalling |  |

**Question 2-1**: Do you agree that the information of “presence of detected resource conflict on the resources indicated by UE-B’s SCI” is used for UE-B to determine the necessity of retransmission of the TB that has been transmitted on the resource(s) indicated as the detected resource conflict? If there are other expected behaviors of UE-B, please provide the relevant details.

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comment |
| Intel | Yes | It is needed to at least address half-duplex problem |
| vivo | See comment | it is preferred to list the candidate options for this sub-scheme. In our understanding, use of existing HARQ-ACK feedback to trigger reselection due to persistent packet loss can be further studied for this sub-scheme.  Could you please list few options for this sub-schemes for further study, including the several optimization for groupcast option 1 and the mentioned consecutive packet loss resolution solution. |
| OPPO | NO | This scheme should not be supported. |
| NTT DOCOMO | Yes |  |
| Spreadtrum | No |  |
| Huawei, HiSilicon | Need clarification | As with Q1-1, the question wording does not seem to map to options 2-1 and 2-2 of what is already agreed for scheme 2. This was an agreement like any other, and needs to be adhered to:   * *For scheme 2:*   + *Option 2-1: UE-B can determine resource(s) to be re-selected based on the received coordination information*   + *Option 2-2: UE-B can determine a necessity of retransmission based on the received coordination information*   As replied in the 1st round, more clarifications on the wording “detected” are needed to make sure companies are on the same page about the issues being discussed. For example, in our view, “detected resource conflict” can be divided into half-duplex indication and post-collision indication.  Case 1: half-duplex indication  Half-duplex indication might be applicable in groupcast where all the UEs (i.e., UE-A, UE-B, UE-C) are in the same group and UE-A needs to decode and compare the destination IDs (both 16 bits in SCI and 8 bits in MAC PDU). However, half-duplex indication might be useful only in rare case since it requires all the following conditions:   * Condition#1: within a group, two UEs (UE-B and UE-C) choose to transmit on the same slot. * Condition#2: all the other group members have successfully decoded the packet.   We also had simulation results (see R1-2104237 section 4.3) to prove that there is no obvious performance gain by solving this kind of half-duplex issue.  Case 2: post-collision indication (i.e. PSCCH collision)  The feasibility of PSCCH-collision indication is doubtful since UE-A probably cannot detect such collided PSCCH, because current specification does not require the UE to decode more than one PSCCH at each PSCCH resource candidate. Moreover, if the colliding PSCCH use the same OCC for DMRS, the UE has no way to detect such collision.  Case 1, 2 may have different designs in terms of cast type, UE-A determination, etc. So RAN1 needs to clarify the meaning of “detected resource conflict” first. |
| Ericsson | Yes |  |
| Fraunhofer | No with comments | We feel that there are 2 aspects to this type of collision indication.  In aspect 1, if the objective is to trigger a retransmission, the collision indication is useful only for groupcast option 1. For the other cast types (unicast and groupcast option 2), the existing Rel-16 HARQ feedback procedure is sufficient to trigger a retransmission. This is true in the case of a half-duplex problem as well.  In aspect 2, if the objective is to avoid consecutive packet collisions, then a retransmission itself would not suffice, and a resource reselection needs to be triggered. |

**Question 2-2**: Under what cast types/feedback options can the information of “presence of detected resource conflict on the resources indicated by UE-B’s SCI” be used?

|  |  |  |
| --- | --- | --- |
| Company | Applicable cast type/feedback option (e.g., groupcast w/ HARQ FB option 1) | Comment |
| Intel | All | We prefer RAN1 to come up with a solution applicable to all cast types. |
| vivo | All |  |
| OPPO | Only groupcast w/ HARQ FB option 1 | There is no point to support it in unicast and groupcast w/ HARQ FB option 2, as resource conflict in the past can be identified by legacy HARQ feedback. |
| NTT DOCOMO | Groupcast-1 | Rel-16 SL supports ACK/NACK feedback in Unicast/Groupcast-2. No benefit is assumed in these cast types.  For broadcast, further discussion is possible while no support is OK for us. |
| Huawei, HiSilicon | Need clarification | As replied for Question 2-1, we suggest RAN1 to further clarify the meaning of “detected resource conflict”, otherwise companies may not on the same page when answering the following questions (cast type, contained, UE-A determination, etc). |
| Ericsson | All | We prefer RAN1 to come up with a solution applicable to all cast types. |
| Fraunhofer | Groupcast option 1 | As mentioned in Q2-1, as well as by OPPO and Docomo, the existing Rel-16 procedure would handle past resource conflicts for other cast types, except for groupcast option 1.  It might also possibly be beneficial for broadcast. |

**Question 2-3**: For the information of “presence of detected resource conflict on the resources indicated by UE-B’s SCI”, what is the commonality with “presence of expected/potential resource conflict on the resources indicated by UE-B’s SCI” we can pursue? Note that checking in what aspects commonality exists could be useful in deciding whether to support both options for scheme 2.

|  |  |  |
| --- | --- | --- |
| Company | Commonality aspect(s), if any | Comment |
| Intel | Comments | It is a next level of details. In general, physical structure of feedback signalling can have commonality |
| vivo | No | Detected resource conflict indication based on legacy PSFCH, potential resource conflict indication based on PSFCH-like siganling. |
| OPPO | Maybe only the container (PSFCH) | Hard to see any commonality except the container (assuming PSFCH is used as container in the scheme “presence of expected/potential resource conflict on the resources indicated by UE-B’s SCI”) |
| NTT DOCOMO |  | I do not have clear understanding of this question. Why do we need to discuss commonality here? What is the assumed outcome? |
| Spreadtrum |  | At this stage, we cannot be sure of the commonality between the “detected resource conflict” and “expected/potential resource conflict”. We think they can be discussed separately. |
| Huawei, HiSilicon | Need clarification | Purpose of the question is not clear to us.  In addition, if both “expected/potential resource conflict” and “detected resource conflict” are supported, does the conflict indication need to include multiple states to differentiate them? |
| Ericsson | Channel design | Both alternatives for scheme 2 can use the same channel. How to differentiate them can be FFS (e.g., CS, etc.) |

**4.2 Condition(s) for UEs to be UE-A(s)/UE-B(s)**

There was the email discussion on whether the following proposal is agreeable or not.

***FL’s proposal****:*

* *One or more of following cases are supported for determining UE-A (sending to UE-B(s) the inter-UE coordination information) and UE-B (receiving and using the inter-UE coordination information from UE-A(s)). FFS details including possibly down-selecting one or more of the options below, applicable scenario(s)/inter-UE coordination scheme(s) for each option. Note that other options are not precluded.*
  + *Option 1: Only UE(s) among the intended receiver(s) of UE-B can be a UE-A*
    - *At least the intended receiver(s) is the destination UE(s) of a TB transmitted by UE-B*
      * *FFS additional condition(s) of being the intended receiver(s) of UE-B*
  + *Option 2: Any UE can be a UE-A*
    - *FFS additional condition to be met to become a UE-A*

The summary of companies’ views is as follows:

* **Yes**:
  + NTT DOCOMO, Intel, Panasonic, Ericsson, Spreadtrum, Huawei, [CMCC (for scheme 1),] Kyocera, Nokia, Fraunhofer, Qualcomm, [Apple (for scheme 1),] IDCC, Futurewei, ZTE, Fujitsu, NEC, ETRI, ITL, Convida Wireless, Sony, Lenovo&MotM, xiaomi, LG, MediaTeK (**25**)
* **No:** 
  + OPPO, vivo, Mitsubishi, Samsung, CATT, (**5**)
    - Option 1 only: OPPO, vivo (for scheme 2), [CMCC (for scheme 2),] Mitsubishi, [Apple (for scheme 2),] Samsung, CATT, **(7**)

Even though the majority of companies are supportive of this proposal itself, but considering several companies’ comments that at least further clarification on the applicable inter-UE coordination scheme/cast type is necessary or separate proposals are needed for each inter-UE coordination scheme, I think that it would be useful to have more email discussion round for this aspect. **So, I ask companies to provide inputs on the following tables. The deadline for companies to provide inputs is May 25st 4:59am UTC. To prepare/make more agreeable draft proposals before the start of GTW session and the check point/timing of Chairman, it would be highly appreciated if companies make comments as soon as possible.**

**Question 1**: Which option (e.g., option 1/2) can be applied to which inter-UE coordination scheme (e.g., scheme 1/2)?

|  |  |  |
| --- | --- | --- |
| Company | Option(s) applicable to each inter-UE coordination scheme (e.g., option x for scheme a) | Comment |
| Intel | All | All options are applicable to both schemes. Configuration can be considered to support some restrictions is if it is deemed necessary. |
| OPPO | Option 1 for both Scheme 1 and Scheme 2 | In Scheme 1, hierarchical inter-UE coordination scheme should not be supported. In other sub-schemes of Scheme 1, if any UE is allowed to be UE-A, transmission of the resource set would cause system congestion.  In scheme 2, in general if any UE can be UE-A, the conflict indication would cause unnecessary retransmission due to the ambiguity on zone ID/destination ID/source ID. We also think it is not reasonable to require a third UE (not an intended receiver) to identify/indicate the conflict by specification as the UE cannot benefit directly from the operations. |
| NTT DOCOMO | Option 1 for scheme 1  Option 1 + 2 with restriction for scheme 2 | Basically, a transmitter UE should consider channel quality at the receiver UE. Option 1 is reasonable choice.  For scheme 1, whether hierarchical mechanism is supported or not should be clarified as commented above.  In scheme 2, there is another reasonable case. If UE-A will receive a packet with higher priority at resource X from UE-Z, and UE-Y reserves the resource X to transmit a packet with lower priority to other UE, UE-Y should become UE-B rather than UE-Z. This means that option 2 with restriction is good for scheme 2. |
| Spreadtrum | All | For scheme 1, we think any UE including intended receiver of UE-B can be a UE-A. The UE-A can be (pre)configured or determined by distance or other conditions.  For scheme 2, we think any UE that detects the expected/potential resource conflict between two TX UEs can be a UE-A. |
| Huawei, HiSilicon | Option 2 for Scheme 1 preferred.  Option 1 for Scheme 1 non-preferred and Scheme 2. | For scheme 1 preferred case, UE-A can be any UE, the transmission resource for UE-B can only be determined by the coordination from UE-A.  Scheme 1 non-preferred and scheme 2 are similar that UE-B’s receiver indicate resources that are non-preferred, in an explicit or implicit way. |
| Ericsson | Sch.1 – Opt.1  Sch.2 – Opt.2 | For Scheme 1, this clear out the FFS “FFS additional condition(s) of being the intended receiver(s) of UE-B” |
| Fraunhofer | All | For scheme 1 and 2, we support Option 2, where any UE can be UE-A as determined by higher layers. Additional conditions can be applied on top of Option 2, since it is possible for UE-A to provide coordination information to UE-B without being the intended receiver. Option 1 can be considered one of the additional conditions, where UE-A can be the intended receiver(s) of UE-B, depending on the scenario in question. |
| Kyocera | Sch 1 uses Option 1 | In our view Sch. 1 is supported only for the unicast. In such case only the intended UE should provide the coordination information. |
| Mitsubishi | Option 1 for both schemes | Further selection criteria may apply in order to restrain the number of UE-A(s) |

**Question 2**: What cast type (e.g., unicast/groupcast/broadcast) between UE-A and UE-B can be applicable to each option (e.g., option 1/2)? Note that this question doesn’t preclude a possibility that no cast type is required between UE-A and UE-B for a certain option.

|  |  |  |
| --- | --- | --- |
| Company | Cast type(s) between UE-A and UE-B applicable to each option (e.g., unicast for option x) | Comment |
| Intel | All |  |
| OPPO | comments | Depends on the scheme/sub-scheme that the option is applied to |
| NTT DOCOMO |  | It seems difficult to answer before certain concept for each scheme is agreed. |
| Huawei, HiSilicon | Comments | For scheme 1 preferred, we propose Option 2 can be used in Question 1 above. And we further suggest to use unicast and groupcast option 2 to transmit coordinating/triggering information between UE-A and UE-B.  This is mainly because the number of receivers in broadcast and groupcast option 1 would be uncontrollable, when trigger information is transmitted from UE-B to multiple UE-A using these cast types, the corresponding signaling overhead for coordination information from multiple UE-A to UE-B would also become uncontrollable. In addition, the coordination information might be useless to UE-B in broadcast and groupcast option 1 cases, e.g., when the coordination information is transmitted by a distant UE-A.  On the contrary, unicast and groupcast option 2 do not have the problems above, and is proposed to be supported to transmit the coordination information and trigger information in inter-UE coordination.  For other cases (e.g. scheme 2, option 1), we suggest to discuss previous questions first, especially clarifying the meaning of “expected, potential, detected resource conflict”, so that RAN1 can better understand the applicable cast type. |
| Ericsson | Opt. 1 – UC  Opt. 2 – All | For Scheme 1 it is undesirable to have channel flooding. Restriction to UC is desirable from this point of view and from use case point of view. It also simplifies signalling details.  Scheme 2 using PSFCH-like signalling is compatible with all cast modes. |
| Fraunhofer | Comments | This would depend on the scenario and its particular applicability. |
| Kyocera | Opt 1 - unicast |  |
| Mitsubishi | All cast types for scheme 1 | Scheme 1 should apply to all cast types and should NOT be limited to unicast. Mechanisms of selection of UEs acting as UE-A easily avoid the concerns of channel flooding expressed here-above.  Further discussion is needed for scheme 2 once the details of the scheme are more clear, because depending on the selected choices for some cast types the existing HARQ mechanism may be enough. |

**4.3 Information used for generating inter-UE coordination information**

There was the email discussion on whether the following proposal is agreeable or not.

***FL’s proposal****:*

* *At least the following information is used for UE-A to generate the inter-UE coordination information:*
  + *For scheme 1,* 
    - *Other UEs’ reserved resources based on UE-A’s sensing result*
    - *UE-A’s NR SL resources selected for its transmission(s) of TB(s)*
    - *UE-A’s scheduled/configured resources for UL*
  + *For scheme 2,* 
    - *Other UEs’ reserved resources and/or existing transmission (i.e. used resources) based on UE-A’s sensing result*
    - *UE-A’s NR SL resources selected for its transmission(s) of TB(s)*
    - *UE-A’s scheduled/configured resources for UL*

The summary of companies’ views is as follows:

* **Yes**:
  + Intel, Ericsson (for Scheme 1), OPPO, Kyocera, Nokia, Fraunhofer (for Scheme 1), IDCC, Futurewei, Bosch, NEC, ETRI, ITL, Convida Wireless, Lenovo&MotM, xiaomi, LG (**16**)
* **No:** 
  + NTT DOCOMO, Panasonic, vivo, Spreadtrum, Huawei, CMCC, Mitsubishi, Qualcomm, [Apple (add more information),] [ZTE (add more information),] Fujitsu, Samsung, Sony, CATT, MediaTek (add more information) ((**15**)

During the email discussion, there were comments that it would be better to discuss this topic after making the decision at least on which coordination information needs to be supported for each scheme. So, I think that we can focus on discussing other topics first.

1. **Summary of contributions**

* Type(s) of inter-UE coordination information
  + In scheme 1,
    - Preferred resource set only: [Huawei,3] [vivo,4] [InterDigital,32]
    - Non-preferred resource set only: [Kyocera,6] [Qualcomm,10] [OPPO,13] [Xiaomi,26] [Ericsson,36]
    - Preferred and non-preferred resource set: [Spreadtrum,5] [CATT,7] [Fraunhofer,8] [CMCC,9] [Zhejiang Lab,11] [Lenovo,14] [Fujitsu,16] [Apple,17] [ZTE,19] [LG,20] [ETRI,21] [NEC,22] [Mitsubishi,23] [MediaTeK,25] [Sharp,29] [Panasonic,30]
  + In scheme 2,
    - Presence of expected/potential resource conflict only: [vivo,4] [OPPO,13] [ZTE,19] [LG,20] [Panasonic,30]
    - Presence of expected/potential resource conflict and detected resource conflict: [Spreadtrum,5] [Fraunhofer,8] [Qualcomm,10] [Lenovo,14] [Intel,15] [Fujitsu,16] [ETRI,21] [NEC,22] [Xiaomi,26] [Ericsson,36]
* Details of inter-UE coordination signaling
  + In scheme 1,
    - Signaling form of a set of resources
      * Lowest sub-channel index and slot index [Nokia,1]
      * Sub-channel(s) and slot location [Nokia,1]
    - Maximum number of resources
      * 3
      * More than 3
    - Other information
      * Sensing-related information [Fujitsu,16] [Apple,17] [InterDigital,32] [ASUSTeK,34]
      * Cause of non-preferred resources [Apple,17]
    - Further consideration on the resource domain of the set of resources indicated by the coordination information [Zhejiang Lab,11] [LG,20]
  + In scheme 2,
    - Indication of whether resource conflict is due to either half-duplex or resource collision [Intel,15] [LG,20] [InterDigital,32]
    - Indication of whether the resource conflict occurs at UE-A or not[LG,20]
    - Time location of the resource conflict [Zhejiang Lab,11] [Intel,15]
* Condition(s) for UEs to be UE-A(s)/UE-B(s) for inter-UE coordination
  + In scheme 1,
    - UE-A’s coordination information is used for UE-B’s resource (re)selection procedure for its PSCCH/PSSCH transmission to the intended receiver(s) including the UE-A
      * [Futurewei,2] [Spreadtrum,5] [CATT,7] [CMCC,9] [Qualcomm,10] [OPPO,13] [Lenovo,14] [Intel,15] [Fujitsu,16] [Sony,18] [ZTE,19] [LG,20] [ETRI,21] [Mitsubishi,23] [Samsung,24] [MediaTeK,25] [InterDigital,32] [DCM,33] [Ericsson,36]
    - UE-A’s coordination information is used for UE-B’s resource (re)selection procedure for its PSCCH/PSSCH transmission to the intended receiver(s) other than the UE-A
      * [Futurewei,2] [Spreadtrum,5] [CMCC,9] [Intel,15] [MediaTeK,25]
    - UE’s V2X layer decision
      * [Huawei,3] [vivo,4] [Fraunhofer,8] [CMCC,9] [Sony,18] [LG,20] [Samsung,24]
    - UE’s power saving mode
      * [Samsung,24]
    - Pre-configuration and UE-capability
      * [Panasonic,30]
    - Cast type of UE-B’s PSCCH/PSSCH transmission based on coordination information
      * Unicast [Huawei,3] [Spreadtrum,5] [Kyocera,6] [CATT,7] [Qualcomm,10] [OPPO,13] [Fujitsu,16] [Mitsubishi,23] [Samsung,24] [InterDigital,32] [Ericsson,36]
      * Groupcast [Spreadtrum,5] [Kyocera,6] [Qualcomm,10] [OPPO,13] [Fujitsu,16] [Mitsubishi,23] [Samsung,24]
        + With SL HARQ-ACK feedback Option 2 enabled only [Huawei,3] [CATT,7]
      * Broadcast [Spreadtrum,5] [Qualcomm,10] [Fujitsu,16] [Mitsubishi,23]
  + In scheme 2,
    - UE-A’s coordination information is used for UE-B’s resource (re)selection procedure for its PSCCH/PSSCH transmission to the intended receiver(s) including the UE-A
      * [Futurewei,2] [vivo,4] [CATT,7] [OPPO,13] [Intel,15] [Fujitsu,16] [Apple,17] [Sony,18] [LG,20] [ETRI,21] [Mitsubishi,23] [Samsung,24] [MediaTeK,25] [InterDigital,32] [DCM,33] [Ericsson,36]
    - UE-A’s coordination information is used for UE-B’s resource (re)selection procedure for its PSCCH/PSSCH transmission to the intended receiver(s) other than the UE-A
      * [Futurewei,2] [Intel,15] [Fujitsu,16] [MediaTeK,25] [DCM,33] [Ericsson,36]
      * Conditions
        + UE-A is RX UE of the PSSCH of which resource(s) is conflicted with UE-B’s resource [Fujitsu,16]
        + Radio or geometric distance between UEs are close [Ericsson,36]
    - UE’s V2X layer decision
      * [Huawei,3] [Fraunhofer,8] [Apple,17] [Sony,18] [LG,20] [Samsung,24]
    - UE’s power saving mode
      * [Samsung,24]
    - Cast type of UE-B’s PSCCH/PSSCH transmission based on coordination information
      * Unicast [vivo,4] [Spreadtrum,5] [CATT,7] [Qualcomm,10] [OPPO,13] [Fujitsu,16] [InterDigital,32] [Ericsson,36]
      * Groupcast [vivo,4] [Spreadtrum,5] [CATT,7] [Qualcomm,10] [OPPO,13] [Fujitsu,16] [InterDigital,32] [Ericsson,36]
        + With SL HARQ-ACK feedback Option 1 enabled only [Fujitsu,16] [Apple,17] [Xiaomi,26]
      * Broadcast [Spreadtrum,5] [CATT,7] [Qualcomm,10] [Fujitsu,16] [Ericsson,36]
* Information to generate inter-UE coordination information
  + In scheme 1,
    - Other UEs’ reserved resources based on UE-A’s sensing result
      * [Nokia,1] [Futurewei,2] [Huawei,3] [vivo,4] [Kyocera,6] [CATT,7] [Fraunhofer,8] [CMCC,9] [Qualcomm,10] [Intel,15] [Apple,17] [LG,20] [DCM,33]
    - Coordination information received from other UEs
      * [Nokia,1] [Futurewei,2] [Intel,15] [Apple,17] [LG,20]
    - Information on UE-B’s traffic requirements (e.g., conveyed via triggering information from UE-B, if any)
      * [Nokia,1] [Futurewei,2] [Huawei,3] [DCM,33]
    - Location information on UE-B and other UEs
    - UE-A’s NR SL resources selected for its transmission(s) of TB(s)
      * [Nokia,1] [Futurewei,2] [Huawei,3] [vivo,4] [Kyocera,6] [CATT,7] [CMCC,9] [Qualcomm,10] [Intel,15] [Apple,17] [LG,20] [DCM,33]
    - UE-A’s scheduled resources for UL
      * [Nokia,1] [Futurewei,2] [vivo,4] [Kyocera,6] [CATT,7] [Qualcomm,10] [Intel,15] [Apple,17] [DCM,33]
    - UE-A’s configured resources for UL
      * [Nokia,1] [Futurewei,2] [vivo,4] [Kyocera,6] [CATT,7] [Qualcomm,10] [Intel,15] [Apple,17] [LG,20] [DCM,33]
    - LTE SL transmission and/or reception of UE-A
      * [Futurewei,2] [vivo,4] [Kyocera,6] [CATT,7] [Qualcomm,10] [LG,20] [DCM,33]
    - Resource set selected by UE-A for other UE-Bs’ transmissions
      * [Huawei,3] [DCM,33]
    - PSFCH transmission and/or reception of UE-A
      * [vivo,4] [Apple,17] [DCM,33]
    - UE-A’s candidate resource set based on UE-A’s sensing
      * [Nokia,1] [Huawei,3] [CATT,7] [Fraunhofer,8] [Intel,15]
    - UE-B’s ability to use coordination information
      * [DCM,33]
  + In scheme 2,
    - Other UEs’ reserved resources based on UE-A’s sensing result
      * [Nokia,1] [Futurewei,2] [Huawei,3] [vivo,4] [Fraunhofer,8] [Intel,15] [Apple,17] [LG,20] [DCM,33]
    - Other UEs’ existing transmission (i.e. used resources) based on UE-A’s sensing result
      * [Nokia,1] [Fraunhofer,8] [Intel,15] [Apple,17] [DCM,33]
    - Coordination information received from other UEs
      * [Futurewei,2] [Fraunhofer,8] [Apple,17] [LG,20]
    - Information on UE-B’s traffic requirements
      * [Intel,15] [DCM,33]
    - Location information on UE-B and other UEs
      * [Intel,15]
    - UE-A’s NR SL resources selected for its transmission(s) of TB(s)
      * [Nokia,1] [Futurewei,2] [vivo,4] [Intel,15] [Apple,17] [LG,20] [DCM,33]
    - UE-A’s scheduled/configured resources for UL
      * [Nokia,1] [Futurewei,2] [vivo,4] [Intel,15] [Apple,17] [LG,20] [DCM,33]
    - LTE SL transmission and/or reception of UE-A
      * [Futurewei,2] [vivo,4] [LG,20] [DCM,33]
    - PSFCH transmission and/or reception of UE-A
      * [vivo,4] [Intel,15] [Apple,17] [DCM,33]
    - UE-B’s ability to use coordination information
      * [DCM,33]
  + Further consideration on the processing time budget for generating and transmitting inter-UE coordination information from UE-A [Futurewei,2] [vivo,4] [Fraunhofer,8] [Lenovo,14] [Apple,17] [LG,20] [DCM,33]
* Condition(s) for UE-A to send inter-UE coordination information to UE-B
  + In scheme 1,
    - UE-A receives the request from UE-B [Nokia,1] [Futurewei,2] [Huawei,3] [vivo,4] [Spreadtrum,5] [Kyocera,6] [CATT,7] [Fraunhofer,8] [CMCC,9] [OPPO,13] [Lenovo,14] [Fujitsu,16] [Apple,17] [Sony,18] [ZTE,19] [LG,20] [ETRI,21] [NEC,22] [Samsung,24] [Xiaomi,26] [Sharp,29] [Panasonic,30] [ITL,31] [InterDigital,32]
      * Details of the request signaling
        + Information

A set of preferred or non-preferred resources determined at UE-B [Nokia,1] [CATT,7] [OPPO,13]

UE-B’s resource (re)selection procedure-related parameters [Huawei,3] [vivo,4] [Spreadtrum,5] [CATT,7] [OPPO,13] [Lenovo,14] [Fujitsu,16] [ZTE,19] [NEC,22] [Samsung,24] [Xiaomi,26] [InterDigital,32]

Type of coordination information to be requested [Fraunhofer,8] [ZTE,19]

* + - * + Container

PSFCH-like format [Kyocera,6] [ETRI,21]

SCI [Futurewei,2] [vivo,4] [Kyocera,6] [Fujitsu,16]

MAC CE [vivo,4] [OPPO,13] [Fujitsu,16] [LG,20]

* + - * + Further consideration on the condition for UE-B to transmit the request [Xiaomi,26]
    - UE-A’s higher layer decision [Futurewei,2] [LG,20]
    - Based on (pre)configured periodicity [Huawei,3] [vivo,4] [LG,20]
    - Based on presence of resource conflict [Spreadtrum,5] [Fraunhofer,8] [OPPO,13] [Sony,18] [LG,20] [ETRI,21] [ITL,31] [InterDigital,32]
    - Based on RSRP measurement and/or distance at UE-A side [CMCC,9] [Mitsubishi,23] [Xiaomi,26] [ITL,31]
    - Based on the SL HARQ-ACK states [Lenovo,14] [ITL,31]
  + In scheme 2,
    - UE-A receives the request from UE-B [CATT,7] [Intel,15] [Panasonic,30]
      * Details of the request signaling
        + Container

SCI [CATT,7] [Intel,15]

* + - Based on presence of resource conflict [vivo,4] [Spreadtrum,5] [Qualcomm,10] [OPPO,13] [Intel,15] [Apple,17] [Sony,18] [LG,20] [Xiaomi,26] [Sharp,29] [Panasonic,30] [InterDigital,32] [Bosch,35]
      * Further consideration on checking condition to decide resource conflict [OPPO,13] [Lenovo,14] [Intel,15] [Apple,17] [LG,20] [Xiaomi,26] [Bosch,35]
        + Portion of overlapping [Lenovo,14] [LG,20] [Bosch,35]
        + RSRP measurement [Lenovo,14] [LG,20] [Bosch,35]
        + Location of UE-B and other UEs [Intel,15] [LG,20] [Xiaomi,26] [Bosch,35]
        + Whether this transmission is UE-B’s last retransmission or not [Apple,17]
        + Whether or not L2-IDs are achieved [LG,20]
        + Priority of UE-B’s transmission [Bosch,35]
        + CBR [Bosch,35]
    - Based on the SL HARQ-ACK states [Lenovo,14]
* Container used for carrying coordination information
  + In scheme 1,
    - 1st SCI format
      * [Futurewei,2] [Spreadtrum,5] [CMCC,9] [Lenovo,14] [Fujitsu,16] [Hyundai,28] [Sharp,29] [Bosch,35]
    - 2nd SCI format
      * [Futurewei,2] [Huawei,3] [vivo,4] [Spreadtrum,5] [Fraunhofer,8] [CMCC,9] [CAICT,12] [OPPO,13] [Lenovo,14] [Fujitsu,16] [Sony,18] [Samsung,24] [Xiaomi,26] [Hyundai,28] [Bosch,35]
    - MAC CE
      * [vivo,4] [Spreadtrum,5] [Lenovo,14] [Intel,15] [Fujitsu,16] [ZTE,19] [LG,20] [NEC,22] [Panasonic,30] [DCM,33] [Bosch,35]
    - PC5-RRC signaling
      * [OPPO,13] [ZTE,19] [NEC,22] [Ericsson,36]
    - Further consideration on how to set PSCCH/PSSCH parameters (e.g. source ID, destination ID, cast type, SL HARQ-ACK feedback enabled/disabled, priority value) [LG,20]
  + In scheme 2,
    - PSFCH-like format
      * [Nokia,1] [vivo,4] [Fraunhofer,8] [Qualcomm,10] [Zhejiang Lab,11] [CAICT,12] [OPPO,13] [Lenovo,14] [Intel,15] [Fujitsu,16] [Apple,17] [Sony,18] [LG,20] [NEC,22] [Xiaomi,26] [Hyundai,28] [Panasonic,30] [InterDigital,32] [DCM,33] [Bosch,35] [Ericsson,36]
      * Timing of the PSFCH-like channel
        + With respect to the time location of the potential conflicted PSSCH resource

[vivo,4] [Fraunhofer,8] [LG,20] [DCM,33]

* + - * + With respect to the time location of a SCI indicating PSSCH resource with potential resource conflict
      * Further consideration prioritization rule for PSFCHs for SL HARQ-ACK feedback and inter-UE coordination [Intel,15] [Fujitsu,16]
    - 1st SCI format
      * [Sharp,29]
    - 2nd SCI format
      * [Samsung,24]
  + Further consideration on whether shared or dedicated resource is used for inter-UE coordination signaling [Nokia,1] [Kyocera,6] [Qualcomm,10]
* UE-B’s behavior upon receiving inter-UE coordination information from UE-A
  + In scheme 1,
    - Option 1-1: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based on both UE-B’s sensing result (if available) and the received coordination information
      * [Futurewei,2] [Huawei,3] [vivo,4] [Kyocera,6] [CATT,7] [Fraunhofer,8] [CMCC,9] [Qualcomm,10] [OPPO,13] [Lenovo,14] [Intel,15] [Fujitsu,16] [Apple,17] [ZTE,19] [LG,20] [ETRI,21] [NEC,22] [Mitsubishi,23] [Samsung,24] [MediaTeK,25] [Xiaomi,26] [Convida,27] [Hyundai,28] [InterDigital,32] [DCM,33] [Ericsson,36]
    - Option 1-2: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based only on the received coordination information
      * [Futurewei,2] [Huawei,3] [vivo,4] [CATT,7] [Fraunhofer,8] [CMCC,9] [Apple,17] [ETRI,21] [NEC,22] [MediaTeK,25] [Convida,27] [Hyundai,28] [InterDigital,32]
      * Condition
        + When UE-A is a leading UE of a UE group of UE-B [Huawei,3] [vivo,4]
        + When UE-B has no PSCCH/PSSCH RX capability [CATT,7]
        + When UE-B has no sensing results [CMCC,9] [ETRI,21] [InterDigial,32]
        + When UE-A is the intended receiver of the UE-B’s transmission [MediaTeK,25]
    - Option 1-3: UE-B’s resource(s) to be re-selected based on the received coordination information
      * [OPPO,13] [Lenovo,14] [InterDigital,32]
    - Option 1-4: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based on the received coordination information
  + In scheme 2,
    - Option 2-1: UE-B can determine resource(s) to be re-selected based on the received coordination information
      * [vivo,4] [Qualcomm,10] [OPPO,13] [Lenovo,14] [Intel,15] [Fujitsu,16] [Apple,17] [ZTE,19] [LG,20] [ETRI,21] [NEC,22] [Samsung,24] [MediaTeK,25] [Xiaomi,26] [Convida,27] [InterDigital,32] [DCM,33] [Ericsson,36]
    - Option 2-2: UE-B can determine a necessity of retransmission based on the received coordination information
      * [Qualcomm,10] [Lenovo,14] [Intel,15] [Fujitsu,16] [Apple,17] [ETRI,21] [NEC,22] [Xiaomi,26] [Convida,27] [Ericsson,36]
      * Condition
        + Groupcast with SL HARQ-ACK feedback option 1 is enabled [Fujitsu,16] [Apple,17] [Xiaomi,26]
* Validity check for the inter-UE coordination information received by UE-B
  + In scheme 1,
    - Based on whether the indicated resource set is inside UE-B’s selection window [Fraunhofer,8] [LG,20]
    - Based on RSRP values conveyed by coordination information [Fraunhofer,8]
    - Based on distance between UE-A and UE-B [Fraunhofer,8] [Samsung,24]
    - Based on RSRP measured by coordination information signaling [Fraunhofer,8] [Fujitsu,16] [LG,20] [Samsung,24]
    - Based on the target of the coordination information and/or the parameters of PSCCH/PSSCH to be transmitted by UE-B [Fraunhofer,8] [Lenovo,14] [LG,20] [Samsung,24]
    - Based on the candidate resource ratio [LG,20]
    - Based on PDB [Samsung,24]
  + In scheme 2,
    - Based on distance between UE-A and UE-B [Fraunhofer,8] [Samsung,24]
    - Based on the target of the coordination information and/or the parameters of PSCCH/PSSCH to be transmitted by UE-B [Fraunhofer,8] [LG,20] [Samsung,24]
    - Based on PDB [Samsung,24]
* Others
  + Further consideration of indication to UE-A of ID(s) used by UE-B and the intended receiver(s) of UE-B’s transmission [Nokia,1]
  + Further consideration on relaying the received SCI [Nokia,1]
  + Further consideration on the unmonitored slot at UE-B side [Fujitsu,16] [ITL,31]
  + Further consideration on the possibility that UE-B changes PSCCH/PSSCH parameters (e.g. source ID, destination ID, whether SL HARQ-ACK feedback enabled or disabled) period-to-period [LG,20]
  + Further consideration on the impact on Rel-16 UE sharing the same resource pool with UEs using inter-UE coordination operation [Panasonic,30] [Bosch,35]
  + Further consideration on SL DRX to determine “A set of resources” at UE-A side [ASUSTeK,34]

1. **Reference**
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33. R1-2105675 On inter-UE coordination for Mode 2 enhancement InterDigital, Inc.
34. R1-2105719 Resource allocation for reliability and latency enhancements NTT DOCOMO, INC.
35. R1-2105848 Discussion on V2X mode 2 enhancements ASUSTeK
36. R1-2105881 Discussion on inter-UE coordination for sidelink mode-2 ROBERT BOSCH GmbH
37. R1-2105894 Feasibility and benefits of mode 2 enhancements for inter-UE coordination Ericsson
38. **Appendix**

**7.1 Conclusions made in RAN1#103-e meeting**

* ***Conclusion****:*
  + *The schemes of inter-UE coordination in Mode 2 are categorized as being based on the following types of “A set of resources” sent by UE-A to UE-B:*
    - *UE-A sends to UE-B the set of resources preferred for UE-B’s transmission*
      * + *e.g., based on its sensing result*
    - *UE-A sends to UE-B the set of resources not preferred for UE-B’s transmission*
      * + *e.g., based on its sensing result and/or expected/potential resource conflict*
    - *UE-A sends to UE-B the set of resource where the resource conflict is detected*
    - *FFS: details of resource conflict, e.g., including type of resource conflict*
    - *FFS: details of sensing operation at UE-A side*
    - *FFS: which type(s) of resource set information is(are) beneficial/feasible to which cast type(s)*
    - *Note: these different types may be used in combination with each other*
  + *From RAN1 perspective, further study on the feasibility/benefit of inter-UE coordination is required*
  + *Send an LS to RAN plenary*
    - *Final LS in* [*R1-2009841*](file:///C:/Users/wanshic/OneDrive%20-%20Qualcomm/Documents/Standards/3GPP%20Standards/Meeting%20Documents/TSGR1_103/Docs/R1-2009841.zip)
* ***Conclusion****:*
  + *For the schemes of inter-UE coordination identified as feasible/beneficial, at least the following aspects are further discussed.*
    - *How/when UE-A determines the contents of ”A set of resources”, including consideration of UL scheduling*
    - *When UE-A sends ”A set of resources” to UE-B, including which UE(s) sends it*
    - *How UE-A and UE-B are determined*
    - *How UE-A sends ”A set of resources” to UE-B, including container used for carrying it, implicitly or explicitly or both*
    - *How/when/whether UE-B receives “A set of resources” and takes it into account in the resource selection for its own transmission*
    - *How/whether to define the relationship between support/signaling of inter-UE coordination and cast type*

**7.2 Conclusions made in RAN1#104-e meeting**

* ***Conclusion****:*
  + *RAN1 concludes that the inter-UE coordination in Mode 2 is feasible, and is beneficial (e.g., reliability, etc.) compared to Rel-16 Mode 2 RA, and thus recommends specification of the feature.*
    - *The detailed observations can be found in the attachment of the LS*
* *Draft LS in* [*R1-2102165*](file:///C:/Users/wanshic/OneDrive%20-%20Qualcomm/Documents/Standards/3GPP%20Standards/Meeting%20Documents/TSGR1_104/Docs/R1-2102165.zip)*, along with the attachment* [*R1-2102166*](file:///C:/Users/wanshic/OneDrive%20-%20Qualcomm/Documents/Standards/3GPP%20Standards/Meeting%20Documents/TSGR1_104/Docs/R1-2102166.zip)*, is approved (with a typo fix)* 
  + *Final LS in R1-2102168*

**7.3 Agreements made in RAN1#104bis-e meeting**

* *Agreement:*
  + *Support the following schemes of inter-UE coordination in Mode 2:*
    - *Inter-UE Coordination Scheme 1:* 
      * *The coordination information sent from UE-A to UE-B is the set of resources preferred and/or non-preferred for UE-B’s transmission*
        + *FFS details including a possibility of down-selection between the preferred resource set and the non-preferred resource set, whether or not to include any additional information other than indicating time/frequency of the resources within the set in the coordination information*
      * *FFS condition(s) in which Scheme 1 is used*
    - *Inter-UE Coordination Scheme 2:* 
      * *The coordination information sent from UE-A to UE-B is the presence of expected/potential and/or detected resource conflict on the resources indicated by UE-B’s SCI*
        + *FFS details including a possibility of down-selection between the expected/potential conflict and the detected resource conflict*
      * *FFS condition(s) in which Scheme 2 is used*
* *Agreement:*
  + *Study further to determine the conditions for UEs to be UE-A(s)/UE-B(s) for inter-UE coordination:*
    - *Details include applicable scenario(s)/inter-UE coordination scheme(s)*
    - *E.g., only UE(s) among the intended receiver(s) of UE-B can be a UE-A, any UE can be a UE-A, high-layer configured, etc.*
      * *Including the possibility of being subject to certain conditions and/or capability*
* *Agreement:*
  + *When UE-B receives the inter-UE coordination information from UE-A, consider at least one of the following options (with details FFS including possibly down-selecting/merging one or more of the options below, applicable scenario(s)/condition(s) for each option, UE behavior) for UE-B’s to take it into account in the resource (re)-selection for its own transmission*
    - *For scheme 1:*
      * *Option 1-1: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based on both UE-B’s sensing result (if available) and the received coordination information*
      * *Option 1-2: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based only on the received coordination information*
      * *Option 1-3: UE-B’s resource(s) to be re-selected based on the received coordination information*
      * *Option 1-4: UE-B’s resource(s) to be used for its transmission resource (re)-selection is based on the received coordination information*
    - *For scheme 2:*
      * *Option 2-1: UE-B can determine resource(s) to be re-selected based on the received coordination information*
      * *Option 2-2: UE-B can determine a necessity of retransmission based on the received coordination information*