**3GPP TSG RAN WG1 Meeting #106-e R1-** **210xxxx**

**e-Meeting, August 16th – 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. **Proposals for Monday’s GTW (August 16th)**

After reviewing contributions submitted in this meeting, I observed that companies’ views on supporting inter-UE coordination information for each scheme (see below) are not so much changed compared to the situation at the last meeting.

* Type(s) of inter-UE coordination information
  + In scheme 1,
    - Preferred and non-preferred resource set
      * [Huawei,1] [Mitsubishi,3] [Spreadtrum,5] [CATT,9] [Fraunhofer,10] [Fujitsu,11] [NEC,13] [Panasonic,18] [Qualcomm,19] [CMCC,20] [ETRI,21] [MediaTeK,22] [LG,23] [Intel,24] [Apple,26] [ZTE,27] [Sharp,28] [DCM,29] [CEWiT,35] [Xiaomi,30] [Lenovo/Motorola Mobility] (**21** companies)
    - Preferred resource set only
      * [vivo,4] [Samsung,8] (**2** companies)
    - Non-preferred resource set only
      * [OPPO,17] [Ericsson,36] (**2** companies)
  + In scheme 2,
    - Presence of potential resource conflict and detected resource conflict
      * [Fraunhofer,10] [Fujitsu,11] [Futurewei,12] [NEC,13] [Qualcomm,19] [ETRI,21] [Apple,26] [DCM,29] [Xiaomi,30] [CEWiT,35] [Ericsson,36] [Lenovo/Motorola Mobility, 14] (**12** companies)
    - Presence of potential resource conflict only
      * [Mitsubishi,3] [vivo,4] [LG,23] [Samsung,8] [CATT,9] [Panasonic,18] [ZTE,27] [Sharp,28] [InterDigital,33] (**9** companies)

To be specific, in scheme 1, majority companies support both preferred resource set and non-preferred resource set. So, I put the last proposal suggested at the last meeting as Option 1, which has the 1st priority from FL’s perspective. However, considering the case in which it is difficult to agree on Option 1, I prepare another proposal as Option 2, which has the 2nd priority from FL’s perspective. To be specific, in Option 2, one signalling is used to send inter-UE coordination information informing UE-B of a resource to be excluded from its resource selection, but UE-A could use “preferred resource set” or “non-preferred resource set” to generate the information.

In scheme 2, there is no clear majority to support detected resource conflict indication. So, I list up two alternative options for scheme 2. One is to support both expected/potential resource conflict indication and detected resource conflict indication, which has the 1st priority from FL’s perspective. The other is to support only expected/potential resource conflict indication, which has the 2nd priority from FL’s perspective.

**Regarding this topic**, **RAN1 already had the lengthy discussion at the last meeting, but failed to make the conclusion. I don’t think that having additional email discussion can make any meaningful progress. Also without the relevant conclusion, it is not possible to agree the details to support the feature of inter-UE coordination in Mode 2. So, I ask Chairman to make a decision on Draft Proposal 1/2 in Monday’s GTW session**.

***Draft proposal 1:***

***Option 1 with 1st preference from FL’s point of view****:*

* *For scheme 1, the following inter-UE coordination information signalling from UE-A is supported. FFS details including condition(s)/scenario(s) under which each information is enabled to be sent by UE-A and used by UE-B.*
  + *Set of resources preferred for UE-B’s transmission*
  + *Set of resources non-preferred for UE-B’s transmission*
  + *FFS: Whether in one signalling instance of coordination information, UE-A sends one type of resources (either preferred or non-preferred)*
  + *FFS: Whether information for another resource set can be implicitly derived from signalling of information for a specific resource set*
  + *Note that this implies that RAN1 decides no further down-selection between the preferred resource set and the non-preferred resource set in the following FFS point (marked with grey) of agreement made in RAN1#104bis-e meeting.*

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| *Agreement made in RAN1#104bis-e meeting:*   * *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* |

***Option 2 with 2nd preference from FL’s point of view****:*

* *For scheme 1, the following inter-UE coordination information signalling from UE-A is supported. FFS details including condition(s)/scenario(s) under which each information is enabled to be sent by UE-A and used by UE-B.*
  + *A set of resources is indicated in the inter-UE coordination information. UE-B excludes in its resource selection the resources in the set.* 
    - *The set indicated in the inter-UE coordination information is the set of non-preferred resources determined by UE-A or the complementary set of preferred resources determined by UE-A.*

***Draft Proposal 2:***

***Option 1 with 1st preference from FL’s point of view:***

* *For scheme 2, the following inter-UE coordination information signalling from UE-A is supported. FFS details including condition(s)/scenario(s) under which each information is enabled to be sent by UE-A and used by UE-B*
  + *Presence of expected/potential resource conflict on the resources indicated by UE-B’s SCI*
  + *Presence of detected resource conflict on the resources indicated by UE-B’s SCI*
  + *Note that this implies that RAN1 decides no further down-selection between the expected/potential conflict and the detected resource conflict in the following FFS point (marked with grey) of agreement made in RAN1#104bis-e meeting.*

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| *Agreement made in RAN1#104bis-e meeting:*   * *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* |

***Option 2 with 2nd preference from FL’s point of view:***

* *For scheme 2, the following inter-UE coordination information signalling from UE-A is supported. FFS details including condition(s)/scenario(s) under which each information is enabled to be sent by UE-A and used by UE-B*
  + *Presence of expected/potential resource conflict on the resources indicated by UE-B’s SCI*

1. **Email discussion after Monday’s GTW (August 16th)**

**2.1 Conditions for UE(s) to be UE-A(s) and/or UE-B(s)**

During a few meetings, the conditions for UE(s) to be UE-A(s) and/or UE-B(s) have been discussed, but have not been concluded since companies have divergent views. I think that one way to overcome this difficulty is to discuss the condition(s) that UE(s) become UE-A(s) and/or UE-B(s), assuming a situation in which a technique supported by majority companies is applied. According to the submitted contributions in this meeting, as majority companies support request-based inter-UE coordination information transmission for scheme 1, I prepare Draft Proposal 3 for the condition(s) that UE(s) become UE-A(s) and/or UE-B(s) under the assumption that this technique is applied. For scheme 2, as majority companies proposed that UE-A transmits inter-UE coordination information after observing resource conflict on resource(s) indicated by UE-B, I prepare Draft Proposal 4 for the condition(s) that UE(s) become UE-A(s).

**I ask companies to provide inputs on the following two questions below. The deadline for companies to provide inputs is August 17th 11:59am UTC. To prepare/make more stable draft proposals before the start of Wednesday’s GTW session (August 18th), it would be highly appreciated if companies make comments as soon as possible. Also to make progress more efficiently, I would like to encourage companies to directly provide “revised wording” or “new wording needed to be added”.**

**Question 1**: Do you agree Draft Proposal 3 for scheme 1?

***Draft Proposal 3****:*

* *In scheme 1, the following is supported for UE(s) to be UE-A(s)/UE-B(s) in the inter-UE coordination in Mode 2:*
  + *A UE sends a request for inter-UE coordination information and can be UE-B*
    - *FFS: Details including whether the condition of sending a request is specified or up to UE implementation*
  + *A UE that received a request from UE-B can be UE-A and send inter-UE coordination information to the UE-B* 
    - *FFS: Details including* 
      * *Whether UE-A that received a request from UE-B always sends inter-UE coordination information to the UE-B*
      * *Whether there is a case where UE-A sends inter-UE coordination information without receiving UE-B’s request*
      * *Whether the condition of sending inter-UE coordination information with or without receiving a request from UE-B is specified or up to UE implementation*
  + *It is supported that UE-A is a destination UE of a TB transmitted by UE-B*
    - *FFS: In which cast type UE-A is a destination UE of a TB transmitted by UE-B*
  + *FFS: It is supported that a UE which is not a destination UE of a TB transmitted by UE-B can be UE-A when higher layer(s) configures*

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| **Company** | **Yes or no** | **Comment** |
| NTT DOCOMO | Yes | In our understanding, the following is still FFS in this proposal.   * non-request-based approach * UE-A is not a destination UE of UE-B’s transmission.   If correct, we are supportive of this proposal. |
| Qualcomm | No | The proposal is specific to request-based schemes and excludes event-based schemes. It is also more suited for the scheme with preferred resources than non-preferred resources. Our results show that event-based schemes have lower latency and provide better gain in many scenarios.  We propose the following   * *In scheme 1, the following is supported for UE(s) to be UE-A(s)/UE-B(s) in the inter-UE coordination in Mode 2:*   + *At least when preferred resources are indicated:*     - *A UE sends a request for inter-UE coordination information and can be UE-B*       * *FFS: Details including whether the condition of sending a request is specified or up to UE implementation*       * *FFS: Whether the request is dynamic and/or semi-static*     - *A UE that received a request from UE-B can be UE-A and send inter-UE coordination information to the UE-B*        * *FFS: Details including*          + *Whether UE-A that received a request from UE-B always sends inter-UE coordination information to the UE-B*         + *Whether there is a case where UE-A sends inter-UE coordination information without receiving UE-B’s request*         + *Whether the condition of sending inter-UE coordination information with or without receiving a request from UE-B is specified or up to UE implementation*     - *It is supported that UE-A is a destination UE of a TB transmitted by UE-B*       * *FFS: In which cast type UE-A is a destination UE of a TB transmitted by UE-B*     - *FFS: It is supported that a UE which is not a destination UE of a TB transmitted by UE-B can be UE-A when higher layer(s) configures*   + At least when non-preferred resources are indicated:     - A UE sends inter-UE coordination messages when conditions are met and becomes a UE-A:       * FFS: Details, including conditions to transmit inter-UE coordination information.     - A UE that receives the coordination information becomes a UE-B     - It is supported that any UE-A can be a UE-A |
| Lenovo/Motorola Mobility | Yes | We are supportive of the FL proposal. Below are few comments on the FL proposal for consideration   * Conditions of sending a request can be left to UE implementation. * Periodic reporting of inter-coordination message should be supported   UE-A after encountering consecutive TB failure may transmit the inter-UE coordination message which can be an example for the non-request based inter-UE coordination information |
| Futurewei | See comments | UE-B triggering the inter-UE coordination can be one option. Inter-UE coordination can also be configured by higher layer semi-statistically, without explicitly triggering. On the other hand, UE-A can also send request for inter-UE coordination. In public safety, e.g., a fire scene, and truck platooning cases, the chief commander and the leading truck, as UE-A’s, can send the inter-UE request to the transmit UEs when they are either receivers of UE-B or not the receivers of UE-B. We also propose to the last FFS shall be one of the options.  So we propose to revise the proposal as   * *In scheme 1, the following is supported for UE(s) to be UE-A(s)/UE-B(s) in the inter-UE coordination in Mode 2:*   + *A UE sends a request for inter-UE coordination information and can be UE-B or UE-A*     - *FFS: Details including whether the condition of sending a request is specified or up to UE implementation*   + *A UE that received a request from UE-B can be UE-A and send inter-UE coordination information to the UE-B*     - *FFS: Details including*        * *Whether UE-A that received a request from UE-B always sends inter-UE coordination information to the UE-B*       * *Whether there is a case where UE-A sends inter-UE coordination information without receiving UE-B’s request*       * *Whether the condition of sending inter-UE coordination information with or without receiving a request from UE-B is specified or up to UE implementation*   + *A UE that received a request from the UE-A can be UE-B and receive the inter-UE coordination information from UE-A*     - *FFS: Details*   + *Inter-UE coordination can be configured by high layer semi-statically*   + *It is supported that UE-A is a destination UE of a TB transmitted by UE-B*     - *FFS: In which cast type UE-A is a destination UE of a TB transmitted by UE-B*   + *~~FFS:~~ It is supported that a UE which is not a destination UE of a TB transmitted by UE-B can be UE-A when higher layer(s) configures* |
| InterDigital | Yes with comments | We support the FL proposal in principle. Few comments from our side:   * It would be clearer if 1st bullet that the request based Scheme 1 is supported in all cast types, because the FFS of “in which cast type UE-A is a destination UE of a TB transmitted by UE-B” seems to presume all cast types are supported already   When all cast types can be supported, a broadcast transmission involve many destination UEs and conditions of sending such a request can be quite different from a unicast or groupcast. Therefore, we’d prefer to change it to e.g., “FFS: Details including whether the condition of sending a request for each supported cast type is specified or up to UE implementation” to take cast type into consideration accordingly. |
| Samsung | See comments | At first, we think that this proposal can be applied not only for Scheme 1 but also for Scheme 2. In our understanding, the intension for Proposal 3 and 4 is to decide whether UE-A can be any UE or intended receiver from UE-B. Our preference is that UE-A can only be an intended receiver of UE-B. We think that it not good idea to connect this issue for two schemes of inter-UE coordination since details for managing two schemes were not decided yet. For example, according to current proposal 3 and 4, may UE-A need to send the coordination information at the same time for Scheme1 and Scheme2? Considering the remaining time for this WI, we think that a common design should be considered rather than introducing separate design for each scheme. |
| ZTE | Yes | We are supportive of this proposal. And updates as below are also preferred:  In general, for the 1st bullet, in our view, at least the UE implementation based solution should be supported and whether to define additional condition can be FFS.   * + *At least, a UE sends a request for inter-UE coordination information up to its own implementation and can be UE-B*      - *FFS: Details including whether the condition of sending a request is specified ~~or up to UE implementation~~* |
| Vivo | Yes, with minor wording change | Event-triggered based coordination transmission and periodic coordination transmission is FFS based on the proposal. Then the following bullet should be sub-bullet of the main bullet.   * + - * *Whether there is a case where UE-A sends inter-UE coordination information without receiving UE-B’s request*   We also think such mechanism is at least applied to scheme 1 preferred resource; for non-preferred resource, we are free for further discussion. |
| Intel | Yes with comments | It is important to support scenario when UE-A shares inter-UE coordination information without dedicated request based on pre-defined conditions.  ***Draft Proposal 3****:*   * *In scheme 1, the following is supported for UE(s) to be UE-A(s)/UE-B(s) in the inter-UE coordination in Mode 2:*   + *A UE sends inter-UE coordination information based on pre-configured conditions can be UE-A*     - *FFS conditions to initiate transmission of inter-UE coordination information*   + *A UE that received inter-UE coordination information from UE-A and takes it into account for resource allocation can be UE-B without prior transmission of a request for inter-UE coordination information*   + *A UE sends a request for inter-UE coordination information and can be UE-B*     - *FFS: Details including whether the condition of sending a request is specified or up to UE implementation*   + *A UE that received a request from UE-B can be UE-A and send inter-UE coordination information to the UE-B*      - *FFS: Details including*        * *Whether UE-A that received a request from UE-B always sends inter-UE coordination information to the UE-B*       * *~~Whether there is a case where UE-A sends inter-UE coordination information without receiving UE-B’s request~~*       * *Whether the condition of sending inter-UE coordination information with ~~or without~~ receiving a request from UE-B is specified or up to UE implementation*   + *It is supported that UE-A is a destination UE of a TB transmitted by UE-B*     - *FFS: In which cast type UE-A is a destination UE of a TB transmitted by UE-B*   + *~~FFS:~~ It is supported that a UE which is not a destination UE of a TB transmitted by UE-B can be UE-A ~~when higher layer(s) configures~~* |

**Question 2**: Do you agree Draft Proposal 4 for scheme 2?

***Draft Proposal 4****:*

* *In scheme 2, the following is supported for UE(s) to be UE-A(s)/UE-B(s) in the inter-UE coordination in Mode 2:*
  + *Any capable UE that detects resource conflict on resource(s) indicated by UE-B’s SCI can be UE-A and send inter-UE coordination information to UE-B*
    - *FFS: Details including*
      * *Definition of resource conflict, e.g.,*
        + *RSRP value measured on other UE’s reserved resource(s) overlapping with resource(s) indicated by UE-B’s SCI in time-and-frequency is larger than (pre)configured RSRP threshold*
        + *UE-B is a destination UE of other UE whose reserved resource(s) overlap with resource(s) indicated by UE-B’s SCI in time*
      * *Whether to define additional condition(s) for UEs to be UE-A(s), e.g.,* 
        + *a UE receives a request from UE-B*

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| **Company** | **Yes or no** | **Comment** |
| NTT DOCOMO | Yes with modifications | Based on the last sub-bullet, condition to be UE-A is still FFS. In that sense, ‘any capable UE’ is not good. In addition, ‘resource conflict’ should be clarified sufficiently. Therefore, the following update is preferable.   * + *~~Any~~ A capable UE that detects expected/potential resource conflict on resource(s) indicated by UE-B’s SCI can be UE-A and send inter-UE coordination information to UE-B* |
| Qualcomm | Yes with comment | We’d like to remove the examples from the proposal. This can all be addressed as part of FFS details.   * *In scheme 2, the following is supported for UE(s) to be UE-A(s)/UE-B(s) in the inter-UE coordination in Mode 2:*   + *Any capable UE that detects resource conflict on resource(s) indicated by UE-B’s SCI can be UE-A and send inter-UE coordination information to UE-B*     - *FFS: Details including*       * *Definition of resource conflict, ~~e.g.,~~*         + *~~RSRP value measured on other UE’s reserved resource(s) overlapping with resource(s) indicated by UE-B’s SCI in time-and-frequency is larger than (pre)configured RSRP threshold~~*         + *~~UE-B is a destination UE of other UE whose reserved resource(s) overlap with resource(s) indicated by UE-B’s SCI in time~~*       * *Whether to define additional condition(s) for UEs to be UE-A(s), ~~e.g.,~~*          + *~~a UE receives a request from UE-B~~* |
| Lenovo/Motorola Mobility | no | On the definition of resource conflict one additional condition should be considered: the time gap between two SCIs whose reserved resources are overlapping should be smaller than the processing delay. If not, the resource conflict can be addressed by pre-emption checking.  ***Modified Draft Proposal 4****:*   * *In scheme 2, the following is supported for UE(s) to be UE-A(s)/UE-B(s) in the inter-UE coordination in Mode 2:*   + *Any capable UE that detects resource conflict on resource(s) indicated by UE-B’s SCI can be UE-A and send inter-UE coordination information to UE-B*     - *FFS: Details including*       * *Definition of resource conflict, e.g.,*         + *RSRP value measured on other UE’s reserved resource(s) overlapping with resource(s) indicated by UE-B’s SCI in time-and-frequency is larger than (pre)configured RSRP threshold*         + T*he time gap between SCIs whose reserved resources are overlapping is smaller than the processing delay*         + *UE-B is a destination UE of other UE whose reserved resource(s) overlap with resource(s) indicated by UE-B’s SCI in time*       * *Whether to define additional condition(s) for UEs to be UE-A(s), e.g.,*          + *a UE receives a request from UE-B* |
| Futurewei | Yes with comments | We are general fine with the proposal. For FFS, we may include the half-duplex as resource conflict.   * + - *FFS: Details including*       * *Definition of resource conflict, e.g.,*         + *RSRP value measured on other UE’s reserved resource(s) overlapping with resource(s) indicated by UE-B’s SCI in time-and-frequency is larger than (pre)configured RSRP threshold*         + *UE-B is a destination UE of other UE whose reserved resource(s) overlap with resource(s) indicated by UE-B’s SCI in time*         + *UE-A as a receiver of UE-B has a resource conflict due to the uplink or other sidelink transmissions*       * *Whether to define additional condition(s) for UEs to be UE-A(s), e.g.,*          + *a UE receives a request from UE-B* |
| InterDigital | No | We support the proposal in principle. However, while it spells out in the proposal that any capable UE can become a UE-A upon a detected conflict based on at least the exemplary conflict definition, the definition in this scenario regarding which UE becoming UE-B is missing. In our view, it is critical to clarify for Scheme 2 which UE becomes UE-B, but the proposal seems to indicate UE-B is already determined prior to the conflict detection.  We consider it difficult to support the scenario in which a UE who is not intended RX UE of any UE-Bs to become a UE-A, e.g., when a UE detect a conflict in sensing between two UEs and this UE is not the intended RX UE of either detected UEs. If any such UE is allowed to become a UE-A and send an indication message to either detected UE, it could cause large overhead and in addition, this conflict detection may likely be already performed by another UE who is the intended RX UE of either detected UE. Without such a priori UE-B definition, a UE-A will perform brute force conflict detection over all resources, which we consider not as the purpose of Scheme 2.  Therefore, for Scheme 2, we suggest to start with a scenario in which a UE becomes UE-A when it is an intended RX UE from a UE-B and upon conflict detection based on this UE-B’s SCI, the UE-A can find another UE with conflicting reservation and the detected UE becomes another UE-B in the sense that the UE-A can send indication to either UE-B. In addition, a UE-B should have certain capability to act on indication received from UE-A in Scheme 2.  In addition, about the definition of resource conflict, we prefer to include further definitions when UE-A is the intended RX UE into consideration. For example, the conditions include UE-A’s resource(s) for SL and/or UL transmissions overlap with resource(s) indicated by UE-B’s SCI in time and UE-A’s resource(s) for SL reception from another UE overlap with resource(s) indicated by UE-B’s SCI. |
| Samsung | No | See our comment in Proposal 3. Our preference is that UE-A can only be an intended receiver of UE-B. If any capable UE may report the coordination message when collision is detected, it will introduce huge overhead and decrease overall system performance. |
| ZTE | Yes with modification | Actually this proposal seems not be strong since all details are FFS.  W.r.t the description of this first sub-bullet, we are negative to enable “any capable UE” to be UE-A since it will lead to complicated mechanism for reporting design including conflict resolving among different reports.  The updated version from DCM can be compromise and following description for scheme-1 should also be applied for scheme-2 as baseline since if the 2rd party UE may not share same understanding due the location difference.   * + *It is supported that UE-A is a destination UE of a TB transmitted by UE-B*     - *FFS: In which cast type UE-A is a destination UE of a TB transmitted by UE-B*   One additional part is that we can remove the “~~e.g., …~~” to avoid the potential “implication”. |
| vivo | Yes in principle | The example for resource conflict should be deleted. |
| Intel | Yes, with comments | If there is no intention to define definition of sidelink conflicts then we prefer to remove examples, otherwise let’s discuss one by one.  Scheme-2 should operate based on request otherwise inter-UE coordination information can be provided but not considered by UE-B.  ***Draft Proposal 4****:*   * *In scheme 2, the following is supported for UE(s) to be UE-A(s)/UE-B(s) in the inter-UE coordination in Mode 2:*   + *Any UE that performs TB transmission and requests inter-UE coordination information can be UE-B*   + *Any capable UE that detects resource conflict(s) on resource(s) indicated by UE-B’s SCI can be UE-A and send inter-UE coordination information to UE-B*     - *FFS: ~~Details including~~*       * *Additional condition(s) for transmission of inter-UE coordination information*       * *Definition of resource conflict(s)*       * *, ~~e.g.,~~*         + *~~RSRP value measured on other UE’s reserved resource(s) overlapping with resource(s) indicated by UE-B’s SCI in time-and-frequency is larger than (pre)configured RSRP threshold~~*         + *~~UE-B is a destination UE of other UE whose reserved resource(s) overlap with resource(s) indicated by UE-B’s SCI in time~~*       * *~~Whether to define additional condition(s) for UEs to be UE-A(s), e.g.,~~*          + *~~a UE receives a request from UE-B~~* |

**2.2 How to determine inter-UE coordination information for each scheme**

During Monday’s GTW session (August 16th), RAN1 agreed to support the following inter-UE coordination information signalling for each scheme.

* Scheme 1
  + Set of resources preferred for UE-B’s transmission
  + Set of resources non-preferred for UE-B’s transmission
* Scheme 2
  + Presence of expected/potential resource conflict on the resources indicated by UE-B’s SCI

From FL’s point of view, further discussion is needed on how inter-UE coordination information is determined in each scheme. One thing I would like to emphasize is that for scheme 1, there should be a difference between “condition(s) for determining preferred resource set” and “condition(s) for determining non-preferred resource set”. Otherwise, from a signalling point of view, there is no need to separate the preferred resource set and the non-preferred resource set.

**I ask companies to provide inputs on the following two questions below. The deadline for companies to provide inputs is August 17th 11:59am UTC. To prepare/make more stable draft proposals before the start of Wednesday’s GTW session (August 18th), it would be highly appreciated if companies make comments as soon as possible. Also to make progress more efficiently, I would like to encourage companies to directly provide “revised wording” or “new wording needed to be added”.**

**Question 1**: Do you agree Draft Proposal 5 for scheme 1?

***Draft Proposal 5****:*

* *In scheme 1, the following is supported to determine inter-UE coordination information:*
  + *UE-A considers resource(s) satisfying at least following condition(s) as set of resource(s) preferred for UE-B’s transmission*
    - *Condition 1-A-1:*
      * *Resource(s) at least except for* 
        + *Reserved resource(s) of other UE identified by UE-A whose RSRP measurement is larger than (pre)configured RSRP threshold*

*FFS: Details*

* + *UE-A considers resource(s) satisfying at least following condition(s) as set of resource(s) non-preferred for UE-B’s transmission*
    - *Condition 1-B-1:*
      * *Slot(s) where UE-A cannot perform SL reception*
        + *FFS: Details*
  + *FFS: Details on how UE-A identifies other UE’s reserved resource(s)*

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| **Company** | **Yes or no** | **Comment** |
| NTT DOCOMO | Comment | It seems that the above direction intends that preferred has the complementary relationship with non-preferred. Whether this view is shared among companies is unclear for us.  If this direction is OK, for example a condition corresponding to condition 1-B-1 should be added to preferred. 1-A-1 to non-preferred is the same.  If this direction is not OK, what is each goal of preferred/non-preferred should be clarified first. |
| Qualcomm | No | In non-preferred resource indication, UE-A’s task is to minimize resource collisions. This is independent of whether UE-A itself can receive or not in that slot.  Separately, we observed in out evaluations that performance significantly improved when utilizing the expected interference level at UE-A as part of selecting preferred resources.  We propose the following update:   * *In scheme 1, the following is supported to determine inter-UE coordination information:*   + *UE-A considers resource(s) satisfying at least following condition(s) as set of resource(s) preferred for UE-B’s transmission*     - *Condition 1-A-1:*       * *Resource(s) ~~at least except for~~ excluding*         + *Reserved resource(s) of other UE identified by UE-A whose RSRP measurement is larger than (pre)configured RSRP threshold*   *FFS: Details*   * + - * + *Reserved resource(s) of other UEs identified by UE-A for which the ratio of the expected RSRP for a transmission from UE-B to the RSRP measured for this reserved resource is below a threshold.*   *FFS: Details*   * + *UE-A considers resource(s) satisfying at least one of the following condition(s) as set of resource(s) non-preferred for UE-B’s transmission*     - *Condition 1-B-1:*       * *~~Slot(s) where UE-A cannot perform SL reception~~*         + *~~FFS: Details~~*       * *Resources that UE-A has selected for its own initial transmission*         + *FFS Details*     - *Condition 1-B-2:*       * *Resource that other UEs will use for their transmissions.*         + *FFS Details*   + *FFS: Details on how UE-A identifies other UE’s reserved resource(s)* |
| Lenovo/Motorola Mobility | Yes with comments | We are supportive of the FL proposal and below are few comments for further consideration   * Preferred resource may also comprise of resource set information extracted from candidate resource selection which includes SA whose RSRP level above RSRP threshold. * Non-preferred resource may also comprise of resource set information extracted from candidate resource exclusion that are not part of SA whose RSRP level is below RSRP level   On the RSRP threshold used to determine the preferred/non-preferred resource(s) it should be further studied including a) the RSRP threshold is (pre-)configured or b) the RSRP threshold is indicted by UE-B |
| Futurewei | See comments | For non-preferred resource set, it shall include the case that measured RSRP value on the same reserved resources from other UE is larger a configured threshold. So for the sub-bullet, we propose to add   * + *UE-A considers resource(s) satisfying at least following condition(s) as set of resource(s) non-preferred for UE-B’s transmission*     - *Condition 1-B-1:*       * *Slot(s) where UE-A cannot perform SL reception*         + *FFS: Details*     - *Condition 1-B-2:*       * *Other UE’s reserved resource(s) identified by UE-A are overlapping with resource(s) indicated by UE-B’s SCI in time-and-frequency*         + *RSRP value measured on other UE’s reserved resource(s) is larger than (pre)configured RSRP threshold*   *FFS: Details* |
| InterDigital | Yes | We support the proposal |
| Samsung | See comments | For Scheme 1, we think that Rel-16 mode 2 sensing and resource selection procedure can be reused as much as possible to decide the set of preferred or non-preferred resource. Specifically, Rel-16 sensing and resource selection procedure can generate a set of candidate resource (this can be candidates for preferred) and a set of excluded resource (this can be candidates for non-preferred). So, we suggest to modify the proposal such that:   * *In scheme 1, Rel-16 mode 2 sensing and resource selection procedure is a starting point*   + *A set of identified resource from Rel-16 mode sensing and resource selection procedure becomes the candidate for preferred resource.*     - * *FFS: how to determine a set of preferred resource for signaling*   + *A set of excluded resource from Rel-16 mode sensing and resource selection procedure becomes the candidate for non-preferred resource.*     - * *FFS: how to determine a set of non-preferred resource for signaling*   FFS: additional conditions to decide a set of preferred or non-preferred resources (ex, excluding scheduled UL resources and reserved SL resources for UE-A’s own transmission) |
| ZTE | Comments | In our views, the intention to introduce the preferred resource is to enable the optimized resource feedback from UE-A based on the UE-B’s guidance, including details requirement for future traffic. Then, for condition 1-A-1, following updated version si preferred:   * + - *Condition 1-A-1:*       * *Resource(s) satisfying the requirement indicated by UE-B*         + *FFS: details of requirement*         + *FFS: indication signalling*       * *~~Resource at least except for~~*          + *~~Reserved resource(s) of other UE identified by UE-A whose RSRP measurement is larger than (pre)configured RSRP threshold~~*   *~~FFS: Details~~* |
| vivo | Yes | For preferred resource, the condition is modified as following, since RSRP threshold may be derived by UE-A based on defined rule. We are also fine to discuss the SINR based condition as proposed by QC.   * + - Condition 1-A-1:       * Resource(s) at least except for         + Reserved resource(s) of other UE identified by UE-A whose RSRP measurement is larger than ~~(pre)configured~~ RSRP threshold |
| Intel | Yes, with comments | Additional conditions to define preferred and non-preferred resource sets are added  ***Draft Proposal 5****:*   * *In scheme 1, the following is supported to determine inter-UE coordination information:*   + *UE-A considers resource(s) satisfying at least following condition(s) as set of resource(s) preferred for UE-B’s transmission*     - *Condition 1-A-1:*       * *Non-reserved resources*       * *~~Resource(s) at least except for~~*       * *Reserved resource(s) of other UE identified by UE-A whose RSRP measurement is below ~~larger~~ than (pre)configured RSRP threshold*   *FFS: Details*   * + *UE-A considers resource(s) satisfying at least following condition(s) as set of resource(s) non-preferred for UE-B’s transmission*     - *Condition 1-B-1:*       * *Slot(s) where UE-A cannot perform SL reception*         + *FFS: Details*     - *Condition 1-B-2:*       * *Reserved resource(s) of other UE identified by UE-A whose RSRP measurement is larger than (pre)configured RSRP threshold*         + *FFS: Details*   + *FFS: Details on how UE-A identifies other UE’s reserved resource(s)* |

**Question 2**: Do you agree Draft Proposal 6 for scheme 2?

***Draft Proposal 6****:*

* *In scheme 2, the following is supported to determine inter-UE coordination information:*
  + *Among resource(s) indicated by UE-B’s SCI, UE-A considers that expected/potential resource conflict occurs on the resource(s) satisfying at least following condition(s):* 
    - *Condition 2-A-1:*
      * *Other UE’s reserved resource(s) identified by UE-A are overlapping with resource(s) indicated by UE-B’s SCI in time-and-frequency*
        + *RSRP value measured on other UE’s reserved resource(s) is larger than (pre)configured RSRP threshold*

*FFS: Details*

* + - *Condition 2-A-2:*
      * *Other UE’s reserved resource(s) identified by UE-A are overlapping with resource(s) indicated by UE-B’s SCI in time*
        + *Groupcast destination ID of resource(s) reserved by other UE is the same as groupcast destination ID of resource(s) indicated by UE-B’s SCI*

*FFS: Details*

* + - * + *Unicast destination ID of resource(s) reserved by other UE is the same as unicast source ID of resource(s) indicated by UE-B’s SCI*

*FFS: Details*

* + *FFS: Details on how UE-A identifies other UE’s reserved resource(s)*

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or no** | **Comment** |
| NTT DOCOMO | Comment | Condition 2-A-1 should include both full overlapping and partial overlapping. Current text is unclear for this point, so update is needed.   * + - * *Other UE’s reserved resource(s) identified by UE-A are fully/partially overlapping with resource(s) indicated by UE-B’s SCI in time-and-frequency*   On condition 2-A-2, there is no motivation for UE-A to transmit UE-B. In this case, it might be feasible that no UE has capability to do so. Condition beneficial for both UE-A and whole system should be discussed in my understanding.  In addition, the following collision should be included.   * Collision between UE-A and UE-B * Collision related to PSFCH * Collision between SL and UL |
| Qualcomm | Yes with comment | We understand the conditions as alternative not that both have to be satisfied simultaneously. With that understanding, we propose the following clarification:   * *In scheme 2, the following is supported to determine inter-UE coordination information:*   + *Among resource(s) indicated by UE-B’s SCI, UE-A considers that expected/potential resource conflict occurs on the resource(s) satisfying at least one of the following condition(s):* |
| Lenovo/Motorola Mobility | No | We have few comments  *Condition 2-A-1:*   * *Other UE’s reserved resource(s) identified by UE-A are overlapping with resource(s) indicated by UE-B’s SCI in time, time-and-frequency.* * *In condition 2-1* besides the RSRP value the time gap between two SCIs whose reserved resources are overlapping should be smaller than the processing delay. If not, the resource conflict can be addressed by pre-emption checking.   ***Modified Draft Proposal 6****:*   * *In scheme 2, the following is supported to determine inter-UE coordination information:*   + *Among resource(s) indicated by UE-B’s SCI, UE-A considers that expected/potential resource conflict occurs on the resource(s) satisfying at least following condition(s):*      - *Condition 2-A-1:*       * *Other UE’s reserved resource(s) identified by UE-A are overlapping with resource(s) indicated by UE-B’s SCI in time, time-and-frequency*         + *RSRP value measured on other UE’s reserved resource(s) is larger than (pre)configured RSRP threshold*   *FFS: Details*   * + - * + T*he time gap between SCIs whose reserved resources are overlapping is smaller than the processing delay*     - *Condition 2-A-2:*       * *Other UE’s reserved resource(s) identified by UE-A are overlapping with resource(s) indicated by UE-B’s SCI in time*         + *Groupcast destination ID of resource(s) reserved by other UE is the same as groupcast destination ID of resource(s) indicated by UE-B’s SCI*   *FFS: Details*   * + - * + *Unicast destination ID of resource(s) reserved by other UE is the same as unicast source ID of resource(s) indicated by UE-B’s SCI*   *FFS: Details*   * + *FFS: Details on how UE-A identifies other UE’s reserved resource(s)* |
| Futurewei | See comments | We are ok with condition 2-A-1. For condition 2-A-2, we are not clear on condition 2-A-2. If it is for the case that other UE reserved the same resources for UE-A, it shall still be the resource indicated by UE-B’s SCI in time-and-frequency meaning at least with a partial overlap in time-and-frequency. The reserved resources on the same time slot does not necessary mean that they have a conflict. So we suggest move it to 2-A-1  Also the proposal does not include the conflict due to half-duplex.  We propose the following change on the proposal   * *In scheme 2, the following is supported to determine inter-UE coordination information:*   + *Among resource(s) indicated by UE-B’s SCI, UE-A considers that expected/potential resource conflict occurs on the resource(s) satisfying at least following condition(s):*      - *Condition 2-A-1:*       * *Other UE’s reserved resource(s) identified by UE-A are overlapping with resource(s) indicated by UE-B’s SCI in time-and-frequency*         + *RSRP value measured on other UE’s reserved resource(s) is larger than (pre)configured RSRP threshold*   *FFS: Details*   * + - * + *Groupcast destination ID of resource(s) reserved by other UE is the same as groupcast destination ID of resource(s) indicated by UE-B’s SCI*   *FFS: Details*   * + - * + *Unicast destination ID of resource(s) reserved by other UE is the same as unicast source ID of resource(s) indicated by UE-B’s SCI*   *FFS: Details*   * + - *Condition 2-A-2:*       * *~~Other UE’s reserved resource(s) identified by UE-A are overlapping with resource(s) indicated by UE-B’s SCI in time~~*         + *~~Groupcast destination ID of resource(s) reserved by other UE is the same as groupcast destination ID of resource(s) indicated by UE-B’s SCI~~*   *~~FFS: Details~~*   * + - * + *~~Unicast destination ID of resource(s) reserved by other UE is the same as unicast source ID of resource(s) indicated by UE-B’s SCI~~*   *~~FFS: Details~~*   * + - * *Resource(s) reserved for UE-A’s transmissions are overlapping with resource(s) indicated by UE B’s SCI in time*         + *FFS: Details*   + *FFS: Details on how UE-A identifies other UE’s reserved resource(s)* |
| InterDigital | No | As discussed for draft proposal 4, it is not clear to us which SCI is “UE-B’s SCI” indicated in the beginning of the proposal. In our view, It is also necessary to define which UE-B’s SCI in the context of cast type to understand the Condition 2-A-2 correctly. |
| Samsung | See comments | We think the most important condition should be UE-A’s reserved resource(s) is overlapping with resource(s) indicated by UE-B’s SCI in time-and-frequency. Also, we can consider other condition additionally, We do not see necessity of condition 2-A-2 on the top of condition 2-A-1. |
| ZTE | Comments | For scheme-2, we should firstly identify the collision between UE-A and UE-B. Then, whether to introduce the additional consideration related to “other UEs” can be considered later once the definition is clear. |
| vivo | See comment | Agree with DCM, at least UL transmission needs to be considered, we proposed to add another condition 2-A-3.   * + - condition 2-A-3       * UE-A’s UL transmission resource and UE-A’s LTE SL transmission/reception resource are overlapping with resource(s) indicated by UE-B’s SCI in time   Regarding condition 2-A-2, the motivation is not clear. Do you mean that UE-B may not able to receive multiple TBs simultaneously? |
| Intel | Yes, with comments | ***Draft Proposal 6****:*   * *In scheme 2, the following is supported to determine inter-UE coordination information:*   + *Among resource(s) indicated by UE-B’s SCI, UE-A considers that expected/potential resource conflict occurs on the resource(s) satisfying at least one of the following condition(s):*      - *Condition 2-A-1:*       * *Other UE’s reserved resource(s) identified by UE-A are overlapping with resource(s) indicated by UE-B’s SCI in time-and-frequency*         + *RSRP value measured on other UE’s reserved resource(s) is larger than (pre)configured RSRP threshold*   *FFS: Details*   * + - * + *FFS: Distance based criteria b/w UE-A and UE-B*     - *Condition 2-A-2:*       * *Other UE’s reserved resource(s) identified by UE-A are overlapping with resource(s) indicated by UE-B’s SCI in time*         + *Groupcast destination ID of resource(s) reserved by other UE is the same as groupcast destination ID of resource(s) indicated by UE-B’s SCI*   *FFS: Details*   * + - * + *Unicast destination ID of resource(s) reserved by other UE is the same as unicast source ID of resource(s) indicated by UE-B’s SCI*   *FFS: Details*   * + - * + *FFS additional criteria*   + *FFS: Details on how UE-A identifies other UE’s reserved resource(s)* |

1. **Summary of contributions**

* Type(s) of inter-UE coordination information
  + In scheme 1,
    - Preferred and non-preferred resource set
      * [Huawei,1] [Mitsubishi,3] [Spreadtrum,5] [CATT,9] [Fraunhofer,10] [Fujitsu,11] [NEC,13] [Panasonic,18] [Qualcomm,19] [CMCC,20] [ETRI,21] [MediaTeK,22] [LG,23] [Intel,24] [Apple,26] [ZTE,27] [Sharp,28] [DCM,29] [CEWiT,35] [Xiaomi,30] [Lenovo/MoTM, 14] (21 companies)
    - Preferred resource set only
      * [vivo,4] [Samsung,8] (2 companies)
    - Non-preferred resource set only
      * [OPPO,17] [Ericsson,36] (2 companies)
  + In scheme 2,
    - Presence of potential resource conflict and detected resource conflict
      * [Fraunhofer,10] [Fujitsu,11] [Futurewei,12] [NEC,13] [Qualcomm,19] [ETRI,21] [Apple,26] [DCM,29] [Xiaomi,30] [CEWiT,35] [Ericsson,36] [Lenovo/MoTM, 14] (12 companies)
    - Presence of potential resource conflict only
      * [Mitsubishi,3] [vivo,4] [LG,23] [Samsung,8] [CATT,9] [Panasonic,18] [ZTE,27] [Sharp,28] [InterDigital,33] (9 companies)
* Details of inter-UE coordination signaling
  + In scheme 1,
    - Sensing-related information
      * [Fujitsu,11] [Apple,26] [InterDigital,33] [ASUSTeK,34]
    - Indicator to indicate either preferred resource or non-preferred resource
      * [Fraunhofer,10]
    - Purpose of the set of resources (e.g. avoiding half-duplex problem or high interference resources)
      * [LG,23]
    - Target UE-B’s transmission to use inter-UE coordination information
      * [Fraunhofer,10] [LG,23]
    - Reference feedback timestamp
      * [Intel,24]
    - Location information
      * [InterDigital,33]
  + In scheme 2,
    - Indication of whether resource conflict is due to either half-duplex or resource collision
      * [LG,23] [Intel,24] [InterDigital,33]
    - Time location of the resource conflict
      * [Zhejiang Lab,6] [Intel,24]
    - Indication of whether half-duplex in reception of UE-A
      * [Intel,24]
* Condition(s) for UEs to be UE-A(s)/UE-B(s) for inter-UE coordination
  + For scheme 1,
    - UE(s) among the intended receiver(s) of UE-B can be a UE-A
      * The intended receiver(s) is the destination UE(s) of a TB transmitted by UE-B
        + [Mitsubishi,3] [vivo,4] [Spreadtrum,5] [Samsung,8] [CATT,9] [Fujitsu,11] [Futurewei,12] [NEC,13] [OPPO,17] [Qualcomm,19](for preferred resource) [CMCC,20] [LG,23] [Intel,24] [ZTE,27] [Sharp,28] [DCM,29] [Xiaomi,30] [InterDigital,33] [Ericsson,36] [Lenovo/MoTM, 14] (20 companies)
    - Any UE can be a UE-A
      * [Huawei,1] [vivo,4] [Spreadtrum,5] [Fraunhofer,10] [Futurewei,12] [Panasonic,18] [Qualcomm,19](for non-preferred resource) [CMCC,20] [MediaTeK,22] [LG,23] [Intel,24] [InterDigital,33] [Lenovo/MoTM, 14] (13 companies)
      * Additional condition
        + UE-A is RX UE of the PSSCH of which resource(s) is conflicted with UE-B’s resource [Fujitsu,11]
        + Radio or geometric distance between UEs are close [Ericsson,36]
        + Negotiation between UEs to be UE-A and/or UE-B [vivo,4] [Samsung,8] [LG,23]
        + Semi-persistent transmissions are enabled for a resource pool [Intel,24]
        + Provided by its own higher layer to be UE-A and/or UE-B

[Huawei,1] [Fraunhofer,10] [CMCC,20] [LG,23]

* + - * + Pre-configuration and UE-capability

[Panasonic,18]

* + For scheme 2,
    - UE(s) among the intended receiver(s) of UE-B can be a UE-A
      * The intended receiver(s) is the destination UE(s) of a TB transmitted by UE-B
      * [Mitsubishi,3] [vivo,4] [Spreadtrum,5] [Samsung,8] [CATT,9] [Fujitsu,11] [Futurewei,12] [NEC,13] [OPPO,17] [LG,23] [Intel,24] [Apple,26] [Sharp,28] [DCM,29] [InterDigital,33] [Lenovo/MoTM, 14] (16 companies)
    - Any UE can be a UE-A
      * [Huawei,1] [Spreadtrum,5] [Fraunhofer,10] [Fujitsu,11] [Futurewei,12] [Panasonic,18] [Qualcomm,19] [MediaTeK,22] [LG,23] [Intel,24] [DCM,29] [Xiaomi,30] [InterDigital,33] [Ericsson,36] (14 companies)
      * Additional conditions
        + UE-A is RX UE of the PSSCH of which resource(s) is conflicted with UE-B’s resource [Fujitsu,11] [DCM,29] [Lenovo/MoTM, 14]
        + Radio or geometric distance between UEs are close [Intel,24] [Ericsson,36]
        + Negotiation between UEs to be UE-A and/or UE-B [LG,23]
        + Provided by higher layer to be UE-A and/or UE-B

[Huawei,1] [Fraunhofer,10] [LG,23]

* + - * + Pre-configuration and UE-capability

[Panasonic,18]

* Information to generate inter-UE coordination information
  + In scheme 1,
    - Other UEs’ reserved resources or candidate resource set based on UE-A’s sensing result
      * [Huawei,1] [vivo,4] [Samsung,8] [CATT,9] [Fraunhofer,10] [Fujitsu,11] [Futurewei,12] [NEC,13] [Lenovo,14] [OPPO,17] [CMCC,20] [ETRI,21] [LG,23] [Intel,24] [Kyocera,25] [Apple,26] [ZTE,27] [DCM,29] [Xiaomi,30] [InterDigital,33] (20 companies)
      * Details
        + Sensing operation is performed based on UE-B’s traffic requirements if available [Huawei,1] [vivo,4] [Samsung,8] [NEC,13] [Lenovo,14] [OPPO,17] [LG,23] [ZTE,27]
        + Estimated SINR is used instead of RSRP measurement [Fujitsu,11]
        + UE-A’s sensing results in non-monitored slot(s) of UE-B [Fujitsu,11] [LG,23]
        + RSRP measurement is within a certain range [LG,23]
        + Periodic transmissions [Kyocera,25]
    - Coordination information received from other UEs
      * [Samsung,8] [Futurewei,12] [Qualcomm,19] [LG,23] [Apple,26] (5 companies)
      * Details
        + Resources to be used for other UE’s initial transmission [Qualcomm,19]
        + Non-preferred resources identified by scheme 2 [Samsung,8]
        + Preferred or non-preferred resources for UE-B’s transmission [LG,23]
    - Resource set for other UE-B’s transmissions is selected by UE-A
      * [Huawei,1] [vivo,4] [CATT,9] [DCM,29] (4 companies)
    - For the case where UE-A is intended receiver of UE-B’s transmission
      * UE-A’s NR SL resources selected for its transmission(s) of TB(s)
        + [Huawei,1] [CATT,9] [Futurewei,12] [NEC,13] [Lenovo,14] [Qualcomm,19] [CMCC,20] [LG,23] [Intel,24] [Kyocera,25] [Apple,26] [DCM,29] (12 companies)
        + Details

Only resources to be used for initial transmisison [Qualcomm,19]

* + - * UE-A’s scheduled and/or configured resources for UL
        + [Nokia,2] [Futurewei,12] [NEC,13] [LG,23] [Intel,24] [Kyocera,25] [Apple,26] [DCM,29] (8 companies)
      * LTE SL transmission and/or reception of UE-A
        + [CATT,9] [Futurewei,12] [LG,23] [Kyocera,25] [DCM,29] (5 companies)
      * PSFCH transmission and/or reception of UE-A
        + [Apple,26] [DCM,29] (2 companies)
      * Non-active time
        + [Kyocera,25]
  + In scheme 2,
    - Other UEs’ reserved resources based on UE-A’s sensing result
      * [Huawei,1] [Nokia,2] [vivo,4] [Fraunhofer,10] [Futurewei,12] [NEC,13] [OPPO,17] [ETRI,21] [MediaTeK,22] [LG,23] [Intel,24] [Apple,26] [DCM,29] (13 companies)
      * Details
        + UE-A’s sensing results in non-monitored slot(s) of UE-B [Huawei,1] [LG,23]
        + RSRP measurement is within a certain range [LG,23]
        + Source ID/destination ID of other UE’s resource [Intel,24]
    - Other UEs’ existing transmission (i.e. used resources) based on UE-A’s sensing result
      * [Nokia,2] [Fraunhofer,10] [NEC,13] [Intel,24] [Apple,26] [DCM,29] (6 companies)
      * Details
        + Source ID/destination ID of other UE’s resource [Intel,24]
    - Coordination information received from other UEs
      * [Samsung,8] [Fraunhofer,10] [Futurewei,12] [LG,23] [Apple,26] (5 companies)
      * Details
        + Preferred or non-preferred resources for UE-B’s transmission [Samsung,8] [LG,23]
    - SL resources indicated by UE-B’s SCI
      * [vivo,4] [Samsung,8] [OPPO,17] [LG,23] [Intel,24] [Apple,26] (6 companies)
    - For the case where UE-A is intended receiver of UE-B’s transmission
      * UE-A’s NR SL resources selected for its transmission(s) of TB(s)
        + [Nokia,2] [Futurewei,12] [NEC,13] [LG,23] [Apple,26] [DCM,29] (6 companies)
      * UE-A’s scheduled/configured resources for UL
        + [Nokia,2] [vivo,4] [Futurewei,12] [NEC,13] [LG,23] [Apple,26] [DCM,29] (7 companies)
      * LTE SL transmission and/or reception of UE-A
        + [vivo,4] [Futurewei,12] [LG,23] [DCM,29] (4 companies)
      * PSFCH transmission and/or reception of UE-A
        + [vivo,4] [Apple,26] [DCM,29] (3 companies)
  + Further consideration on the processing time budget for generating and transmitting inter-UE coordination information from UE-A
    - [vivo,4] [Fraunhofer,10] [Futurewei,12] [Lenovo,14] [LG,23] [Apple,26] (6 companies)
* 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
      * [Huawei,1] [Nokia,2] [vivo,4] [Spreadtrum,5] [Sony,7] [Samsung,8] [CATT,9] [Fraunhofer,10] [Fujitsu,11] [Futurewei,12] [NEC,13] [Lenovo,14] [OPPO,17] [Panasonic,18] [CMCC,20] [ETRI,21] [LG,23] [Intel,24] [Kyocera,25] [Apple,26] [ZTE,27] [Sharp,28] [Xiaomi,30] [ITL,31] [InterDigital,33] [CEWiT,35] (26 companies)
      * Details of the request signaling
        + Information

A set of preferred or non-preferred resources determined at UE-B [Nokia,2]

UE-B’s resource (re)selection procedure-related parameters [Huawei,1] [vivo,4] [CATT,9] [Fujitsu,11] [OPPO,17] [LG,23] [Xiaomi,30] [InterDigital,33] (8 companies)

Resource reserved for UE-A’s transmission with coordination information [Nokia,2]

Type of coordination information to be requested [Fraunhofer,10] [ZTE,27]

* + - * + Container

PSFCH-like format [ETRI,21] [Kyocera,25]

SCI [Huawei,1] [Nokia,2] [vivo,4] [Futurewei,12] [Lenovo,14] [Kyocera,25]

MAC CE [vivo,4] [Lenovo,14] [LG,23] [ZTE,27]

PC5-RRC signaling [ZTE,27]

* + - * + Further consideration on how UE-B to transmit the request [Nokia,2] [vivo,4] [Xiaomi,30]
    - UE-A’s higher layer decision [Futurewei,12] [NEC,13] [LG,23]
    - Based on (pre)configured periodicity [Huawei,1] [vivo,4] [LG,23] [CEWiT,35]
    - Based on presence of resource conflict [Spreadtrum,5] [Sony,7] [Fraunhofer,10] [OPPO,17] [LG,23] [ITL,31] [InterDigital,33]
    - Based on RSRP measurement and/or distance at UE-A side [Mitsubishi,3] [CMCC,20] [Xiaomi,30] [ITL,31]
    - Based on the SL HARQ-ACK states [NEC,13] [Lenovo,14] [ITL,31]
  + In scheme 2,
    - UE-A receives the request from UE-B
      * [Samsung,8] [CATT,9] [Panasonic,18] [Intel,24] [Sharp,28]
      * Details of the request signaling
        + Container

SCI [CATT,9] [Intel,24]

* + - Based on presence of resource conflict [vivo,4] [Spreadtrum,5] [Sony,7] [CATT,9] [Fraunhofer,10] [Lenovo,14] [Panasonic,18] [LG,23] [Intel,24] [Apple,26] [Xiaomi,30] [InterDigital,33]
      * Further consideration on checking condition to decide resource conflict [Fujitsu,11] [Lenovo,14] [LG,23] [Intel,24] [Apple,26] [Xiaomi,30]
        + Portion of overlapping [Fujitsu,11] [Lenovo,14] [LG,23]
        + RSRP measurement [Lenovo,14] [LG,23] [Intel,24]
        + Location of UE-B and other UEs [LG,23] [Intel,24] [Xiaomi,30]
        + Whether this transmission is UE-B’s last retransmission or not [Apple,26]
        + Whether or not L2-IDs are achieved [Lenovo,14] [LG,23]
    - Based on the SL HARQ-ACK states [Fujitsu,11] [Futurewei,12] [Lenovo,14]
* Container used for carrying coordination information
  + In scheme 1,
    - 1st SCI format
      * [Fujitsu,11] [Futurewei,12] [CAICT,15] [Hyundai,16] [CMCC,20] [MediaTeK,22] [Sharp,28]
    - 2nd SCI format
      * [Huawei,1] [vivo,4] [Spreadtrum,5] [Sony,7] [Samsung,8] [Fraunhofer,10] [Fujitsu,11] [Futurewei,12] [Hyundai,16] [OPPO,17] [CMCC,20] [Apple,26] [Xiaomi,30] [CEWiT,35]
    - MAC CE
      * [vivo,4] [Spreadtrum,5] [Fujitsu,11] [NEC,13] [Panasonic,18] [LG,23] [Intel,24] [ZTE,27] [DCM,29] [InterDigital,33] [CEWiT,35]
    - PC5-RRC signaling
      * [NEC,13] [OPPO,17] [ZTE,27] [InterDigital,33] [CEWiT,35] [Ericsson,36]
    - PSFCH-like signaling
      * [NEC,13] [OPPO,17]
    - Details
      * Whether or how to Multiplex with data
        + SCI transmission without SL-SCH [Huawei,1] [Fraunhofer,10] [Qualcomm,19]
        + Multiplexing without data other than coordination information [Fraunhofer,10] [Qualcomm,19] [LG,23]
        + Multiplexing with data other than coordination information[Fraunhofer,10] [Intel,24]
      * Cast type of inter-UE coordination signaling
        + Unicast [Huawei,1] [Spreadtrum,5]
        + Groupcast [Nokia,2] [OPPO,17]
        + Broadcast
  + In scheme 2,
    - PSFCH-like format
      * [Huawei,1] [Nokia,2] [vivo,4] [Zhejiang Lab,6] [Sony,7] [Fraunhofer,10] [Fujitsu,11] [Futurewei,12] [NEC,13] [CAICT,15] [Hyundai,16] [Panasonic,18] [Qualcomm,19] [MediaTeK,22] [LG,23] [Intel,24] [Apple,26] [DCM,29] [Xiaomi,30] [InterDigital,33] [Ericsson,36]
      * Details
        + Unused PSFCH resources for SL HARQ-ACK feedback are used [Huawei,1] [Lenovo,14]
        + Unused PSFCH resources for SL HARQ-ACK feedback Option 2 can be used [Nokia,2]
        + Timing of the PSFCH-like channel

With respect to the time location of the potential conflicted PSSCH resource

[vivo,4] [Fraunhofer,10] [LG,23] [DCM,29]

With respect to the time location of a SCI indicating PSSCH resource with potential resource conflict

[Apple,26]

* + - * + NACK transmission of UE-A on behalf of the intended receiver for detected resource conflict [Lenovo,14] [Qualcomm,19] [Intel,24]
        + More than 1 bits can be conveyed on a PSFCH-like channel [Intel,24]
      * Further consideration prioritization rule for PSFCHs for SL HARQ-ACK feedback and inter-UE coordination [Fujitsu,11] [Lenovo,14] [Intel,24]
    - 1st SCI format
      * [Sharp,28]
    - 2nd SCI format
      * [Samsung,8]
    - MAC CE
      * [Futurewei,12]
  + Further consideration on whether shared or dedicated resource is used for inter-UE coordination signaling [Nokia,2] [Qualcomm,19] [Kyocera,25]
* 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
      * [Huawei,1] [Mitsubishi,3] [vivo,4] [Samsung,8] [CATT,9] [Fraunhofer,10] [Fujitsu,11] [Futurewei,12] [NEC,13] [Lenovo,14] [Hyundai,16] [OPPO,17] [Qualcomm,19] [CMCC,20] [ETRI,21] [MediaTeK,22] [LG,23] [Intel,24] [Kyocera,25] [Apple,26] [ZTE,27] [Sharp,28] [DCM,29] [Xiaomi,30] [Convida,32] [InterDigital,33] [CEWiT,35] [Ericsson,36]
      * Details
        + For preferred resource set, use intersection of preferred resource set and UE-B’s candidate resource set [Huawei,1] [vivo,4] [Samsung,8] [Fraunhofer,10] [Lenovo,14] [LG,23]
        + For preferred resource set, use union of preferred resource set and UE-B’s candidate resource set [vivo,4]
        + For non-preferred resource set, exclude the non-preferred resource set from UE-B’s candidate resource set [Huawei,1] [CATT,9] [Lenovo,14] [LG,23]
        + For non-preferred resource set, reselect UE-B’s transmission resource overlapping with the non-preferred resources [Lenovo,14] [OPPO,17] [CMCC,20] [MediaTeK,22] [LG,23] [Apple,26] [InterDigital,33]
        + Inter-UE coordination information is used in resource (re)selection procedure at MAC layer [ZTE,27]
      * Further clarification when UE-B has no available sensing results [LG,23]
    - 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
      * [Huawei,1] [vivo,4] [Fraunhofer,10] [Futurewei,12] [NEC,13] [Hyundai,16] [Qualcomm,19] [CMCC,20] [ETRI,21] [MediaTeK,22] [Apple,26] [Convida,32] [InterDigital,33]
      * Condition
        + When UE-A is a leading UE of a UE group of UE-B [Huawei,1] [vivo,4]
        + When UE-B has no sensing results [ETRI,21] [InterDigial,32]
        + When UE-A is the intended receiver of the UE-B’s transmission [MediaTeK,22]
      * Further clarification when UE-B has no available sensing results [LG,23]
  + In scheme 2,
    - Option 2-1: UE-B can determine resource(s) to be re-selected based on the received coordination information
      * [vivo,4] [Samsung,8] [CATT,9] [Fujitsu,11] [NEC,13] [OPPO,17] [Qualcomm,19] [ETRI,21] [MediaTeK,22] [LG,23] [Intel,24] [Apple,26] [Sharp,28] [DCM,29] [Xiaomi,30] [Convida,32] [InterDigital,33] [Ericsson,36]
      * Details
        + Exclude resource and perform resource reselection [LG,23] [Intel,24]

When the type of resource conflict is resource collision, UE-B assumes that its reserved time-and-frequency PSSCH resources associated with resource conflict is non-preferred resources for UE-B’s transmission [LG,23]

When the type of resource conflict is half-duplex problem, UE-B assumes that all the frequency resources in a slot associated with the resource conflict is non-preferred resources for UE-B’s transmission [LG,23]

* + - * + Continue transmission on reserved resource [Intel,24]
        + Skip transmission on reserved resource [Intel,24]
    - Option 2-2: UE-B can determine a necessity of retransmission based on the received coordination information
      * [Fraunhofer,10] [Fujitsu,11] [NEC,13] [Qualcomm,19] [ETRI,21] [Intel,24] [Apple,26] [DCM,29] [Xiaomi,30] [Convida,32] [Ericsson,36]
      * Condition
        + Groupcast with SL HARQ-ACK feedback option 1 is enabled [Fujitsu,11] [Apple,26] [DCM,29] [Xiaomi,30]
      * Details
        + Increase amount of intended (re)transmission or increment max number of retransmissions [Intel,24]
  + Further consideration whether using the coordination information is mandated or not [Futurewei,12] [DCM,29] [Convida,32]
* Validity check for the inter-UE coordination information received by UE-B
  + In scheme 1,
    - Based on PDB [Samsung,8]
    - Based on whether the indicated resource set is inside UE-B’s selection window [Fraunhofer,10] [LG,23]
    - Based on RSRP values conveyed by coordination information [Fraunhofer,10]
    - Based on distance between UE-A and UE-B [Samsung,8] [Fraunhofer,10] [Fujitsu,11]
    - Based on RSRP measured by coordination information signaling [Samsung,8] [Fraunhofer,10] [Fujitsu,11] [LG,23]
    - Based on the target of the coordination information and/or the parameters of PSCCH/PSSCH to be transmitted by UE-B [Samsung,8] [Fraunhofer,10] [LG,23]
    - Based on the candidate resource ratio [LG,23]
    - Based on the aging time with respect to the reference feedback timestamp [Intel,24]
  + In scheme 2,
    - Based on PDB [Samsung,8]
    - Based on distance between UE-A and UE-B [Samsung,8] [Fraunhofer,10]
    - Based on the target of the coordination information and/or the parameters of PSCCH/PSSCH to be transmitted by UE-B [Samsung,8] [Fraunhofer,10] [LG,23]
* 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,2]
  + Further consideration on relaying the received SCI [Nokia,2]
  + Further consideration on having preferred resources with different preference levels [Samsung,8]
  + Send SL to RAN2 to ask the feasibility of hierarchical mechanism [Panasonic,18]
  + Further consideration on the impact on Rel-16 UE sharing the same resource pool with UEs using inter-UE coordination operation [Panasonic,18]
  + 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,23]
  + Further consideration on SL DRX to determine “A set of resources” at UE-A side [ASUSTeK,34]
  + Further consideration of that non-sensing UE uses scheme 2 [Ericsson,36]

1. **Reference**
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35. R1-2108097 Discussion on V2X mode 2 enhancements ASUSTeK
36. R1-2108115 Feasibility and benefits for NR Sidelink mode 2 enhancements CEWiT
37. R1-2108137 Feasibility and benefits of mode 2 enhancements for inter-UE coordination Ericsson
38. **Appendix**

**5.1 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*

**5.2 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*

**5.3 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*

**5.4 Agreements made in RAN1#106-e meeting**

* *Agreement:*
  + *For scheme 1, the following inter-UE coordination information signalling from UE-A is supported. FFS details including condition(s)/scenario(s) under which each information is enabled to be sent by UE-A and used by UE-B.*
    - *Set of resources preferred for UE-B’s transmission*
    - *Set of resources non-preferred for UE-B’s transmission*
* *Agreement:*
  + *For scheme 2, the following inter-UE coordination information signalling from UE-A is supported. FFS details including condition(s)/scenario(s) under which each information is enabled to be sent by UE-A and used by UE-B*
    - *Presence of expected/potential resource conflict on the resources indicated by UE-B’s SCI*
      * *FFS: UE behaviour when the presence of expected/potential resource conflict is detected by the transmitter*
    - *FFS: Whether to additionally support the presence of detected resource conflict on the resources indicated by UE-B’s SCI*