**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] (**20** 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] (**11** 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** |
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**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** |
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**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** |
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**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)*

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| **Company** | **Yes or no** | **Comment** |
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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] (20 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] (11 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] (19 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] (12 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] (15 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]
        + 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**
2. R1-2106478 Inter-UE coordination in sidelink resource allocation Huawei, HiSilicon
3. R1-2106532 Inter-UE coordination for Mode 2 enhancements Nokia, Nokia Shanghai Bell
4. R1-2106570 Inter-UE coordination for enhanced resource allocation Mitsubishi Electric RCE
5. R1-2108210 Discussion on mode-2 enhancements vivo
6. R1-2106715 Discussion on inter-UE coordination in sidelink resource allocation Spreadtrum Communications
7. R1-2106725 Discussion on inter-UE coordination for mode 2 enhancements Zhejiang Lab
8. R1-2106819 Discussion on inter-UE coordination for Mode 2 enhancements Sony
9. R1-2106910 On Inter-UE Coordination for Mode2 Enhancements Samsung
10. R1-2106943 Discussion on inter-UE coordination in sidelink mode 2 CATT, GOHIGH
11. R1-2107023 Resource Allocation Enhancements for Mode 2 Fraunhofer HHI, Fraunhofer IIS
12. R1-2107038 Considerations on inter-UE coordination for mode 2 enhancements Fujitsu
13. R1-2107092 Discussion on techniques for inter-UE coordination FUTUREWEI
14. R1-2107152 Discussion on mode 2 enhancements NEC
15. R1-2107164 Discussion on inter-UE coordination for Mode 2 enhancements Lenovo, Motorola Mobility
16. R1-2107172 Considerations on mode 2 enhancements CAICT
17. R1-2107196 Discussion on inter-UE coordination for Mode 2 enhancements Hyundai Motors
18. R1-2107224 Inter-UE coordination in mode 2 of NR sidelink OPPO
19. R1-2107303 Inter-UE coordination for Mode 2 enhancements Panasonic Corporation
20. R1-2107368 Reliability and Latency Enhancements for Mode 2 Qualcomm Incorporated
21. R1-2107423 Discussion on inter-UE coordination for mode 2 enhancement CMCC
22. R1-2107482 Discussion on inter-UE coordination for Mode 2 enhancements ETRI
23. R1-2107522 Discussion on Mode 2 enhancements MediaTek Inc.
24. R1-2107529 Discussion on inter-UE coordination for Mode 2 enhancements LG Electronics
25. R1-2107610 Design of Inter-UE Coordination Solutions for Sidelink Communication Intel Corporation
26. R1-2107621 Inter-UE Coordination for Mode 2 Enhancements Kyocera
27. R1-2107761 Discussion on Inter-UE Coordination Apple
28. R1-2107782 Discussion on inter-UE coordination ZTE
29. R1-2107805 Discussion on inter-UE coordination for mode 2 enhancements Sharp
30. R1-2107880 Resource allocation for reliability and latency enhancements NTT DOCOMO, INC.
31. R1-2107900 Discussion on inter-UE coordination Xiaomi
32. R1-2107994 Inter-UE coordination for mode 2 enhancements ITL
33. R1-2108024 Inter-UE Coordination for NR SL Mode 2 Enhancements Convida Wireless
34. R1-2108036 On inter-UE coordination for Mode 2 enhancement InterDigital, Inc.
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*