**#3GPP TSG RAN WG1 #104-e R1-210xxxx**

**e-Meeting, January 25th – February 5th, 2021**

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**Source:** Moderator (LG Electronics)

**Title:** Feature lead summary for AI 8.11.1.2 Feasibility and benefits for mode 2 enhancements

**Document for:** Discussion and information

1. **Summary of evaluation results**

In RAN1#103-e meeting, RAN1 listed up three types of “A set of resources” for inter-UE coordination in Mode 2:

* Type A: UE-A sends to UE-B the set of resources preferred for UE-B’s transmission
  + e.g., based on its sensing result
* Type B: 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
* Type C: UE-A sends to UE-B the set of resource where the resource conflict is detected

The summary of evaluation results is as follows:

* For Type A without sensing at UE-B,
  + When a UE-A transmits multiple Type A information to multiple UE-B(s),
    - It is assumed that R16 Mode 2 RA is used to determine resources for inter-UE coordination signalling.
      * 5.4% PRR gain is observed in highway scenario for periodic unicast traffic at 320m [Huawei, R1-2100206].
        + Coverage of 200m is extended in highway scenario at PRR=0.95.
  + When a UE-A is the intended RX UE of UE-B,
    - Assumptions on latency and signalling overhead of transmitting and processing coordination information
      * R16 Mode 2 RA is used to determine resources for inter-UE coordination signalling,
        + PRR loss is observed in highway and urban scenario for aperiodic unicast traffic at 320m [Intel, R1-2100673].
      * No latency and signalling of transmitting and processing coordination information
        + 3.4% PRR gain is observed in highway scenario for aperiodic unicast traffic at 300m [Samsung, R1-2101232].

Coverage of 5m is extended in highway scenario at PRR=0.95.

* For Type A and/or Type B with sensing at UE-B,
  + When a UE-A is the intended RX UE of UE-B,
    - Assumptions on latency and signalling overhead of transmitting and processing coordination information
      * R16 Mode 2 RA is used to determine resources for inter-UE coordination signalling,
        + [1-4.3]% PRR gain is observed in highway scenario for periodic unicast traffic at 320m [Huawei, R1-2100206].

Coverage of [10-100]m is extended in highway scenario at PRR=0.95.

* + - * + No PRR gain is observed in highway scenario for periodic and aperiodic unicast traffic [Intel, R1-2100673].
      * No signalling overhead and latency of 3ms+2 slots,
        + 7.6% PRR gain is observed in urban scenario for periodic unicast traffic at 150m [OPPO, R1-2100142].

Coverage of 20m is extended in highway scenario at PRR=0.95.

* + - * No signalling overhead and latency of 2ms,
        + 20% PRR gain is observed in highway scenario for periodic unicast traffic at 320m [CATT, R1-2100352].

Coverage of 20m is extended in highway scenario at PRR=0.95.

* + - * + No PRR gain is observed in highway scenario for aperiodic unicast traffic [CATT, R1-2100352].
      * No latency and 1 sub-channel in a slot for signalling overhead of transmitting and processing coordination information
        + 3% PRR gain is observed in urban scenario for aperiodic unicast traffic at 150m [vivo, R1-2101791].

No coverage is extended in highway scenario at PRR=0.95.

* + - * + 4.3% PRR gain is observed in urban scenario for periodic unicast traffic at 150m [vivo, R1-2101791].

Coverage of 15m is extended in highway scenario at PRR=0.95.

* + - * + If 20% of slots are used for UL TX of UE-A,

9% PRR gain is observed in urban scenario for periodic unicast traffic at 150m [vivo, R1-2101791].

Coverage of 40m is extended in highway scenario at PRR=0.95.

* + - * + If 50% of slots are UL TX of UE-A,

46% PRR gain is observed in urban scenario for periodic unicast traffic at 150m [vivo, R1-2101791].

* + - * 10% of resources are used for signalling related to coordination and latency of 10 slots,
        + PRR loss is observed in highway scenario for periodic groupcast traffic at 320m [Fujitsu, R1-2100746].
      * No latency and signalling of transmitting and processing coordination information
        + 6% PRR gain is observed in highway scenario for periodic unicast traffic at 320m [Mitsubishi, R1-2100828].

Coverage of 50m is extended in highway scenario at PRR=0.95.

* + - * + 3.2% PRR gain is observed in highway scenario for periodic groupcast traffic at 320m [Mitsubishi, R1-2100828].

Coverage of 50m is extended in highway scenario at PRR=0.95.

* + - * + 0.2% PRR gain is observed in urban scenario for aperiodic groupcast traffic at 50m [Qualcomm, R1-2101486].

Coverage of 1.2m is extended in highway scenario at PRR=0.95.

Coverage of 5m is extended in highway scenario at PRR=0.99.

* + When UE-A is determined by UE-B via PC5-RRC,
    - It is assumed that no latency and signalling of transmitting and processing coordination information
    - 2.6% PRR gain is observed in highway scenario for periodic broadcast traffic at 320m [ZTE, R1-2100925].
      * Coverage of 40m is extended in highway scenario at PRR=0.95.
    - 5.8% PRR gain is observed in urban scenario for periodic broadcast traffic at 150m [ZTE, R1-2100925].
      * Coverage of 10m is extended in highway scenario at PRR=0.95.
* For Type C,
  + Evaluation assumptions
    - UE-A is one of the RX UE of UE-B within the communication range requirement from the UE-B, if any.
    - PSFCH format is used for convey resource conflict indication.
  + When the communication range requirement is smaller than or equal to 200m,
    - For the post-conflict indication,
      * [0.4-1.3]% PRR gain is observed in highway scenario for aperiodic and periodic groupcast traffic at 50m [Intel, R1-2100673] [Fujitsu, R1-2100746].
        + Coverage of [5-25]m is extended in highway scenario at PRR=0.95.
        + Coverage of [50-60]m is extended in highway scenario at PRR=0.99.
      * 1.2% PRR gain is observed in highway scenario for aperiodic groupcast traffic at 300m [Intel, R1-2100673].
      * 2% PRR gain is observed in urban scenario for periodic groupcast traffic at 100m [Fujitsu, R1-2100746].
        + Coverage of 10m is extended in highway scenario at PRR=0.95.
      * 0.5% PRR gain is observed in urban scenario for aperiodic groupcast traffic at 150m [Fujitsu, R1-2100746].
        + Coverage of 5m is extended in highway scenario at PRR=0.95.
        + Coverage of 25m is extended in highway scenario at PRR=0.99.
      * 0.5% PRR gain is observed in urban scenario for aperiodic groupcast traffic at 50m [Qualcomm, R1-2101486].
        + Coverage of 2.5m is extended in highway scenario at PRR=0.95.
        + Coverage of 10m is extended in highway scenario at PRR=0.99.
      * PRR loss is observed in highway scenario for aperiodic groupcast traffic compared to R16 Mode 2 RA with minimum number of (re)transmissions of 2 [Intel, R1-2100673].
  + When the communication range requirement is larger than or equal to 240m,
    - For the post-conflict indication,
      * [0.1-0.5]% PRR gain is observed in highway scenario for aperiodic groupcast traffic at 320m [Intel, R1-2100673] [Ericsson, R1-2101804].
        + Coverage of 25m is extended in highway scenario at PRR=0.95.
        + Coverage of [10-50]m is extended in highway scenario at PRR=0.99.
      * PRR loss is observed in highway scenario for aperiodic groupcast traffic compared to R16 Mode 2 RA with minimum number of (re)transmissions of 2 [Intel, R1-2100673].
    - For the pre-conflict indication,
      * 0.3% PRR gain is observed in highway scenario for aperiodic groupcast traffic at 320m [Ericsson, R1-2101804].
        + Coverage of 40m is extended in highway scenario at PRR=0.99.
    - For the mix of pre-conflict and post-conflict indication,
      * 0.6% PRR gain is observed in highway scenario for aperiodic groupcast traffic at 320m [Ericsson, R1-2101804].
        + Coverage of 70m is extended in highway scenario at PRR=0.99.
  + When no communication range requirement is configured,
    - For the post-conflict indication,
      * 3% PRR gain is observed in highway scenario for periodic unicast traffic at 50m [MediaTek, R1-2100606].
        + Coverage of 10m is extended in highway scenario at PRR=0.95.

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| **Source (tdoc number)** | **Evaluation Scenario** | **What is the relationship between UE-A and UE-B, including additional latency and signaling overhead model** | **How UE-A determines the set of resources, including the form of the information** | **When UE-A sends the set of resources to UE-B** | **How UE-A sends the set of resources to UE-B, including container and signaling overhead model** | **How/when UE-B takes the received set of resources into account in the resource selection for its own transmission, including additional latency model** | **Gain over Rel.16 Mode-2 RA** |
| OPPO [R1-2100142] | Unicast,  Urban,  Periodic  (UUP) | UE-A is receiver of UE-B. | Type B. | 2 slots after UE-A receiving the triggering signalling from UE-B | Not modelled | The latency of transmitting and processing coordination information is set to 3ms.  UE-B precludes resources overlapping with the indicated set, and selects resource from the remaining. | PRR gain is 1% at the range of 50m.  PRR gain is 7.6% in the range at 150m.  PIR gain is 5ms in average in the range of [100m,240m].  Coverage of 20m is extended at PRR=0.95.  Coverage of []m is extended at PRR=0.99. |
| Huawei [R1-2100206] | Unicast,  Highway,  Periodic  (UHP) | **Scheme 1:**  UE-A is the UE closest the center of UE group in geographical sense.  UE-B(s) are other UEs in the UE group.  **Scheme 2&3:**  UE-A is receiver of UE-B. | Type A.  **Scheme 1:**  The set of resources is the resources for UE-B’s transmission.  **Scheme 2&3:**  The set of resources is the identified candidate resource set obtained by UE-A’s sensing and resource exclusion procedure. | When UE-A receives the trigger information from UE-B.  The request signalling occupies one sub-channel in a slot.  **Scheme 1:**  Resources for the request are (pre)configured by UE-A.  **Scheme 2&3:**  Resources for the request are obtained by UE-B’s sensing and exclusion procedure. | The signalling of the set of resources occupies one sub-channel in a slot.  Resources for the signalling are obtained by UE-A’s sensing and exclusion procedure. | **Scheme 1:**  UE-B uses the transmission resources provided by UE-A.  **Scheme 2:**  UE-B takes the union of UE-B’s S\_A and UE-A’s S\_A to obtain the final candidate resource set  **Scheme 3:**  UE-B takes the intersection of UE-B’s S\_A and UE-A’s S\_A to obtain the final candidate resource set. | **Scheme 1:**  PRR gain is 5.4% at the range of 320m.  Coverage of 200m is extended at PRR=0.95.  Coverage of []m is extended at PRR=0.99.  **Scheme 2:**  PRR gain is 4.3% at the range of 320m.  Coverage of 100m is extended at PRR=0.95.  Coverage of []m is extended at PRR=0.99.  **Scheme 3:**  PRR gain is 1% at the range of 320m.  Coverage of 10m is extended at PRR=0.95.  Coverage of []m is extended at PRR=0.99. |
| CATT [R1-2100352] | Unicast,  Highway,  Periodic  (UHP) | UE-A is receiver of UE-B. | A mix of Type A and Type B.  UE-A determines the possible transmission occasions of UE-A as Type B resource set. | When UE-A receives the trigger information from UE-B. | Not modelled | The latency of transmitting and processing coordination information is set to 2ms.  UE-B takes the intersection of UE-B’s S\_A and Type A resource set to obtain the final candidate resource set.  UE-B will preclude all the resources of Type B resource set. | **Type A only:**  PRR gain is 11% at the range of 300m  Coverage of 50m is extended at PRR=0.95.  Coverage of []m is extended at PRR=0.99.  **Type B only:**  PRR gain is 9% at the range of 300m  Coverage of 50m is extended at PRR=0.95.  Coverage of []m is extended at PRR=0.99.  **Mix of Type A and B:**  PRR gain is 20% at the range of 300m.  Coverage of 100m is extended at PRR=0.95.  Coverage of []m is extended at PRR=0.99. |
| CATT [R1-2100352] | Unicast,  Highway,  Aperiodic  (UHA) | UE-A is receiver of UE-B. | A mix of Type A and Type B.  UE-A determines the possible transmission occasions of UE-A as Type B resource set. | When UE-A receives the trigger information from UE-B.  Resources for the request are obtained by UE-B’s sensing and exclusion procedure. | Not modelled | The latency of transmitting and processing coordination information is set to 2ms.  UE-B takes the intersection of UE-B’s S\_A and Type A resource set to obtain the final candidate resource set.  UE-B will preclude all the resources of Type B resource set. | No PRR gain. |
| vivo [R1-2101791] | Unicast,  Urban,  Aperiodic  (UUA) | UE-A is receiver of UE-B. | Type A. | Once resource (re)-selection is triggered at UE-B, the assistance info is provided by UE-A | 1 sub-channel and 1 slot signalling overhead is assumed; 0ms latency is assumed | Based on mixed candidate resource set derived by TX UE and RX UE | 3% PRR gain at the range of 150m.  Coverage of 10m is extended at PRR=0.95.  No coverage is extended at PRR=0.99. |
| vivo [R1-2101791] | Unicast,  Urban,  Periodic  (UUP)  UL/SL coexistence | UE-A is receiver of UE-B. | Type A.  UE-A determines Type A resource set to further consider half-duplex problem. | When UE-A change transmission occasion | 1 sub-channel and 1 slot signalling overhead is assumed; 0ms latency is assumed | Based on mixed candidate resource set derived by TX UE and RX UE Further precluding on UE-A’s transmission occasion | **No UL slot:**  4.3% PRR gain at the range of 150m.  Coverage of 15m is extended at PRR=0.95.  Coverage of []m is extended at PRR=0.99.  **20% UL slot:**  5.4% PRR gain at the range of 50m.  9% PRR gain at the range of 150m.  Coverage of 40m is extended at PRR=0.95.  Coverage of []m is extended at PRR=0.99.  **50% UL slot:**  46% PRR gain in 150m. |
| MediaTek [R1-2100606] | Unicast,  Highway,  Periodic  (UHP) | UE-A is receiver of UE-B.  UE-B can include TX UEs other than the intended TX UE of UE-A. | Type C and Type B.  When UE-A determines the resources reserved by UE-B as non-preferred resources, then the UE-A transmits non-preferred resource indication to UE-B.  Otherwise, the UE-A will transmit the resource reserved by UE-B as non-preferred resource for other TX UE’s transmission. | Upon receiving a new reservation. | PSFCH format is used for non-preferred resource indication. | Upon receiving an inter-UE coordination message, a UE drops the concerned reservation and reselects resources | 3% PRR gain in 50m.  []% PRR gain in 320m.  Coverage of 10m is extended at PRR=0.95.  Coverage of []m is extended at PRR=0.99. |
| Intel [R1-2100673] | Groupcast (Option 1 with target range of 200m),  Highway,  Aperiodic  (GHA) | UE-A is another receiver of UE-B within the target range. | Type C. | When UE-A observes half-duplex restriction for the same UE group.  (Post-conflict indication) | PSFCH resource for groupcast HARQ-ACK feedback is reused. | Upon receiving NACK from UE-A, UE-B performs retransmission. | **Reference is R16 Mode 2:**  0.4% PRR gain in 50m.  1.2% PRR gain in 300m.  Coverage of 25m is extended at PRR=0.95.  Coverage of 60m is extended at PRR=0.99.  **Reference is Mode 2 RA with minimum (re)transmissions of 2:**  0.1% PRR loss in 50m.  2% PRR loss in 300m.  Coverage of 20m is reduced at PRR=0.95.  No coverage is extended at PRR=0.99. |
| Intel [R1-2100673] | Groupcast (Option 1 with target range of 400m),  Highway,  Aperiodic  (GHA) | UE-A is another receiver of UE-B within the target range. | Type C. | When UE-A observes half-duplex restriction for the same UE group.  (Post-conflict indication) | PSFCH resource for groupcast HARQ-ACK feedback is reused. | Upon receiving NACK from UE-A, UE-B performs retransmission. | **Reference is R16 Mode 2:**  0.5% PRR gain in 320m.  0% PRR gain in 400.  Coverage of 25m is extended at PRR=0.95.  Coverage of 50m is extended at PRR=0.99.  **Reference is Mode 2 RA with minimum (re)transmissions of 2:**  0.5% PRR loss in 320m.  1% PRR loss in 400m.  No coverage is extended at PRR=0.95.  No coverage is extended at PRR=0.99. |
| Intel [R1-2100673] | Unicast (AN disabled),  Highway,  Periodic  (UHP) | UE-A is receiver of UE-B. | Type A. | When UE-A receives the trigger information from UE-B.  Signalling for the request is not modelled. | Resources for the signalling are obtained by UE-A’s sensing and exclusion procedure. | UE-B takes the intersection of UE-B’s S\_A and UE-A’s S\_A to obtain the final candidate resource set. | 0% PRR gain. |
|  | Unicast (AN disabled),  Highway,  Aperiodic  (UHA) | UE-A is receiver of UE-B. | Type A. | When UE-A receives the trigger information from UE-B.  Signalling for the request is not modelled. | Resources for the signalling are obtained by UE-A’s sensing and exclusion procedure. | **Scheme 1:**  UE-B takes the intersection of UE-B’s S\_A and UE-A’s S\_A to obtain the final candidate resource set.  **Scheme 2:**  UE-B uses the transmission resources provided by UE-A. | **Scheme 1:**  0% PRR gain.  **Scheme 2:**  15% PRR loss in 300m. |
|  | Unicast (AN disabled),  Urban,  Periodic  (UUP) | UE-A is receiver of UE-B. | Type A. | When UE-A receives the trigger information from UE-B.  Signalling for the request is not modelled. | Resources for the signalling are obtained by UE-A’s sensing and exclusion procedure. | UE-B takes the intersection of UE-B’s S\_A and UE-A’s S\_A to obtain the final candidate resource set. | 0% PRR gain. |
|  | Unicast (AN disabled),  Urban,  Aperiodic  (UUA) | UE-A is receiver of UE-B. | Type A. | When UE-A receives the trigger information from UE-B.  Signalling for the request is not modelled. | Resources for the signalling are obtained by UE-A’s sensing and exclusion procedure. | **Scheme 1:**  UE-B takes the intersection of UE-B’s S\_A and UE-A’s S\_A to obtain the final candidate resource set.  **Scheme 2:**  UE-B uses the transmission resources provided by UE-A. | **Scheme 1:**  0% PRR gain.  **Scheme 2:**  11% PRR loss in 150m. |
| Ericsson [R1-2101804] | Groupcast (Option 1 with target range of 500m)  Highway,  Aperiodic | Any UE. | Type C.  **Scheme 1:**  A UE detects that a collision has taken place on a sub-channel or it detects that two UEs from the same group are in a half-duplex situation  **Scheme 2:**  A UE checks if the reservation overlaps some other reservation received earlier. If there is an overlap and the RSRP associated new reservation exceeds a certain threshold, the UE sends one bit.  **Scheme 3:**  Combination of Scheme 1 and 2. | **Scheme 1:**  When UE-A observes a collision on a sub-channel or a half-duplex restriction for the same UE group.  **Scheme 2:**  Upon receiving a new (overlapping) reservation.  **Scheme 3:**  Combination of Scheme 1 and 2. | PSFCH format is used, and it can be shared with multiple UE-A(s) for the same problematic resources. | **Scheme 1:**  Upon receiving NACK from UE-A, UE-B performs retransmission.  **Scheme 2:**  Upon receiving an inter-UE coordination message, a UE drops the concerned reservation and reselects resources  **Scheme 3:**  Combination of Scheme 1 and 2. | **R16 Mode 2 RA:**  **Scheme 1:**  0.1% PRR gain in 320m.  Coverage of 20m is extended at PRR=0.975.  Coverage of 10m is extended at PRR=0.99.  **Scheme 2:**  0.3% PRR gain in 320m.  Coverage of 50m is extended at PRR=0.975.  Coverage of 40m is extended at PRR=0.99.  **Scheme 3:**  0.6% PRR gain in 320m.  Coverage of 100m is extended at PRR=0.975.  Coverage of 70m is extended at PRR=0.99.  **Gain over Random RA (Scheme 2):**  1% PRR gain in 320m.  Coverage of 100m is extended at PRR=0.975.  Coverage of 70m is extended at PRR=0.99. |
| Fujitsu [R1-2100746] | Groupcast (Option with target range of 100m)  Highway,  Periodic  (GHP) | UE-A is another receiver of UE-B. | Type C. | When UE-A observes half-duplex restriction for the same UE group.  (Post-conflict indication) | PSFCH resource for groupcast HARQ-ACK feedback is reused. | Upon receiving NACK from UE-A, UE-B performs retransmission. | 1% PRR gain in 50m.  []% PRR gain in 320m.  Coverage of 5m is extended at PRR=0.95.  Coverage of []m is extended at PRR=0.99. |
| Fujitsu [R1-210746] | Groupcast (Option with target range of 100m)  Urban,  Periodic  (GUP) | UE-A is another receiver of UE-B. | Type C. | When UE-A observes half-duplex restriction for the same UE group.  (Post-conflict indication) | PSFCH resource for groupcast HARQ-ACK feedback is reused. | Upon receiving NACK from UE-A, UE-B performs retransmission. | 1% PRR gain in 50m.  2% PRR loss in 100m.  Coverage of 10m is extended at PRR=0.95.  Coverage of []m is extended at PRR=0.99. |
| Fujitsu [R1-210746] | Groupcast (Option with target range of 100m)  Highway,  Aperiodic  (GHA) | UE-A is another receiver of UE-B. | Type C. | When UE-A observes half-duplex restriction for the same UE group.  (Post-conflict indication) | PSFCH resource for groupcast HARQ-ACK feedback is reused. | Upon receiving NACK from UE-A, UE-B performs retransmission. | 1.3% PRR gain in 50m.  []% PRR gain in 320m.  Coverage of 10m is extended at PRR=0.95.  Coverage of 50m is extended at PRR=0.99. |
| Fujitsu [R1-210746] | Groupcast (Option with target range of 100m)  Urban,  Aperiodic  (GUA) | UE-A is another receiver of UE-B. | Type C. | When UE-A observes half-duplex restriction for the same UE group.  (Post-conflict indication) | PSFCH resource for groupcast HARQ-ACK feedback is reused. | Upon receiving NACK from UE-A, UE-B performs retransmission. | 0.7% PRR gain in 50m.  0.5% PRR loss in 150m.  Coverage of 5m is reduced at PRR=0.95.  Coverage of 25m is extended at PRR=0.99. |
| Fujitsu [R1-210746] | Groupcat (Option 1 with target range of 320m)  Highway,  Periodic  (GHP) | UE-A is receiver of UE-B. | Type A and B. | When UE-A receives the trigger information from UE-B. | 10% of PRBs in a RP is always reserved for the signalling of the inter-UE coordination and the request. | The latency of transmitting and processing coordination information is set to 10 slots in average.  UE-B takes the intersection of UE-B’s S\_A and UE-A’s S\_A to obtain the final candidate resource set. | 0.1% PRR loss in 320m.  Coverage of 50m is reduced at PRR=0.95.  Coverage of []m is extended at PRR=0.99. |
| Mitsubishi [R1-2100828] | Unicast (AN disabled),  Highway,  Periodic  (UHP) | UE-A is receiver of UE-B. | Type B. | Once resource (re)-selection is triggered at UE-B, the assistance info is provided by UE-A | Not modelled. | UE-B will preclude all the resources of Type B resource set. | 6% PRR gain in 320m.  Coverage of 50m is extended at PRR=0.95.  Coverage of []m is extended at PRR=0.99. |
| Mitsubishi [R1-2100828] | Groupcast,  Highway,  Periodic  (GHP) | UE-A is receiver of UE-B. | Type B. | When UE-A is within a certain range from UE-B. | Not modelled. | UE-B will preclude all the resources of Type B resource set. | 3.2% PRR gain in 320m.  Coverage of 50m is extended at PRR=0.95.  Coverage of []m is extended at PRR=0.99. |
| ZTE [R1-2100925] | Broadcast,  Highway,  Periodic  (BHP) | UE-A is selected by UE-B via PC5-RRC. | Type A. |  | Not modelled. | UE-B takes the intersection of UE-B’s S\_A and UE-A’s S\_A to obtain the final candidate resource set. | 2.6% PRR gain in 320m.  Coverage of 40m is extended at PRR=0.95.  Coverage of []m is extended at PRR=0.99. |
| ZTE [R1-2100925] | Broadcast,  Urban,  Periodic  (BUP) | UE-A is selected by UE-B via PC5-RRC. | Type A. |  | Not modelled. | UE-B takes the intersection of UE-B’s S\_A and UE-A’s S\_A to obtain the final candidate resource set. | 5.8% PRR gain in 150m.  Coverage of 10m is extended at PRR=0.95.  Coverage of []m is extended at PRR=0.99. |
| Samsung [R1-2101232] | Unicast,  [Highway],  Periodic  (UHP) | UE-A is receiver of UE-B. | Type A. | When UE-A receives the trigger information from UE-B. | Not modelled. | UE-B uses the transmission resources provided by UE-A. | 60% PRR gain in 300m.  No coverage is extended at PRR=0.95.  No coverage is extended at PRR=0.99. |
| Samsung [R1-2101232] | Unicast,  Highway,  Aperiodic  (UHA) | UE-A is receiver of UE-B. | Type A. | When UE-A receives the trigger information from UE-B. | Not modelled. | UE-B uses the transmission resources provided by UE-A. | 3.4% PRR gain in 300m.  Coverage of 5m is extended at PRR=0.95.  Coverage of []m is extended at PRR=0.99. |
| Qualcomm [R1-2101486] | Groupcat (Option 1 with target range of 60m)  Urban  Aperiodic  (GHA) | UE-A is another receiver of UE-B. | Type C. | When UE-A observes resource conflict for the same UE group.  (Post-conflict indication) | PSFCH resource for groupcast HARQ-ACK feedback is reused. | Upon receiving NACK from UE-A, UE-B performs retransmission. | 0.5% PRR gain in 50m.  []% PRR gain in 150m.  Coverage of 2.5m is extended at PRR=0.95.  Coverage of 10m is extended at PRR=0.99. |
| Qualcomm [R1-2101486] | Groupcat (Option 1 with target range of 60m)  Urban  Aperiodic  (GHA) | UE-A is receiver of UE-B. | Type B. | Whenever forwarding UEs have data to transmit | Not modelled. | UE-B will preclude all the resources of Type B resource set. | 0.2% PRR gain in 50m.  []% PRR gain in 150m.  Coverage of 1.2m is extended at PRR=0.95.  Coverage of 5m is extended at PRR=0.99. |

Please check whether the above evaluation methodology and gain are correctly captured or not, and provide input, if any, **by January 26th, 4:59pm UTC**. You can also make correction directly in the above summary of evaluation results.

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| Company | Comment |
| Ericsson | See corrections above. Given that our scenario has PRR>0.95 for almost every simulated case, we have included results at PRR=0.975 instead |
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1. **FL’s observation on evaluation results**

In this RAN1 meeting, it needs to make conclusion on the feasibility/benefit of inter-UE coordination and send an LS to RAN plenary meeting. In this sense, FL made the following observation after reviewing the submitted evaluation results.

***FL’s observation on evaluation results****:*

* *Type A and/or B*
  + *For the case when one UE-A indicates the preferred resource set to each of multiple UE-Bs,*
    - *one company claimed that the inter-UE coordination is beneficial compared to Rel-16 Mode 2 RA.*
  + *For the case when UE-A is the intended receiver of UE-B,* 
    - *eight companies claimed that the inter-UE coordination is beneficial compared to Rel-16 Mode 2 RA*
      * *One company claimed that the gain of this solution becomes larger under the scenario where UL transmission can overlap with SL transmission/reception.*
    - *three companies claimed that the inter-UE coordination has no gain under certain scenarios (e.g., highway and/or urban scenario for aperiodic unicast traffic, highway scenario for periodic groupcast traffic)*
* *Type C*
  + *For the case when UE-A indicates the resource conflict in previous transmission (i.e., post conflict),*
    - *five companies claimed that the inter-UE coordination is beneficial compared to Rel-16 Mode 2 RA*
      * *one company claimed that the inter-UE coordination has a lower gain with Rel-16 Mode 2 RA with ensuring the minimum number of (re)transmissions.*
  + *For the case when UE-A indicates the resource conflict in future (i.e., pre-conflict),*
    - *one company claimed that the inter-UE coordination is beneficial compared to Rel-16 Mode 2 RA and the gain is higher than the case when UE-A indicates the resource conflict in previous transmission*

Please provide comment, if any, on the above FL’s observation **by January 26th, 4:59pm UTC**. Note that after finishing checking this observation, FL has a plan to provide/discuss potential conclusions on the feasibility/benefit of inter-UE coordination.

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| --- | --- |
| Company | Comment |
| NTT DOCOMO | Firstly, thank you so much for your efforts on evaluations.  Then, three comments from our side.  - In our understanding, pre-collision indication is a part of type B, and post-collision indication is intended as type C. However, the above FL’s observation seems to include pre-collision indication in both type-B (UL vs SL) and type C (second bullet). Correct categorizing is preferred.  - In the above FL’s observation, type A and type B are treated in the same bullet. However, as abovementioned, type B includes pre-collision indication. This implies that achievable gain is different among type A and type B. Separate analysis is preferable.  - Regarding type A, many companies show some gain under periodic traffic, not aperiodic. As presented in QC’s contribution, sharing latency is a key aspect for discussion on ‘beneficial or not’. From this perspective, type A is good scheme only for periodic transmission. As you know, NR-SL supports aperiodic transmission, which is one of the important features. For aperiodic transmissions, pre/post collision indication achieves performance gain as some companies kindly evaluated. This point should be included in the above observation and corresponding conclusion should consider it. |
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1. **Summary of contributions**

* How UE-A and UE-B are determined
  + Option 1: UE-B is a PSCCH/PSSCH TX UE for data transmission, and UE-A is the intended receiver of UE-B [1] [2] [4] [5] [6] [10] [16] [19] [27]
  + Option 2: UE-A and UE-B is determined via higher layer (e.g. application layer) [3] [5] [7]
  + Option 3: UE-A is pre-defined, and UE-B is UEs that can receive inter-UE coordination information from other UE [7]
  + Further consideration on the case when a leading-UE to suggest transmission resources to other UE(s) in a UE group [3] [5] [7] [18] [22] [33]
* How/when UE-A determines the contents of “A set of resources”, including consideration of UL scheduling?
  + Type of “A set of resources”
    - Type A: UE-A sends to UE-B the set of resources preferred for UE-B’s transmission
      * e.g., based on its sensing result
    - Type B: 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
    - Type C: UE-A sends to UE-B the set of resource where the resource conflict is detected
    - Companies views
      * Option 1: Support Type A only [3] [5] [27]
      * Option 2: Support both Type A and Type B [2] [4] [6] [7] [10] [13] [14] [15] [17] [18] [19] [24] [25] [28] [29] [36]
      * Option 3: Support Type C [10] [14] [22] [28] [32]
      * Option 4: Support Type B only [35]
      * Option 5: Type B + Type C [12]
  + Other information in the inter-UE coordination information
    - Type indicator for a set of resources [6] [7] [13] [28]
    - Indication about the intended recipient UE [13]
    - Resource pool index [13] [23]
    - Source ID of UE-B [14] [21]
    - Destination ID associated with UE-B [14] [21]
    - Associated RSRP [21] [28] [34]
    - Associated RX priority [28] [34]
    - Common DRX configuration [29]
    - Recommended TX parameters [29]
  + Further consideration on the assumption of the behavior of UE-A to determine the inter-UE coordination information [8]
* When UE-A sends ”A set of resources” to UE-B, including which UE(s) sends it
  + Explicit Trigger-based based coordination procedures [2] [3] [4] [5] [6] [13] [14] [15] [16] [17] [20] [22] [24] [25] [26] [27] [28] [30] [33]
    - Condition that UE-B transmit the triggering
      * When UE-B triggers resource selection procedure [2] [5] [7]
      * When UE-B fails TB reception [20]
      * Upon receiving scheduling request [20]
    - Information carried by the explicit triggering
      * the parameters related to the sensing procedure of UE-B [3] [4] [14] [22] [28]
      * the parameters related to TX packet of UE-B [7]
    - Container of the explicit triggering
      * 2nd SCI format [3] [14]
      * MAC CE [14]
      * PSFCH format [7] [28]
  + Event-trigger based coordination procedures [3] [5] [6] [7] [12] [13] [14] [16] [17] [20] [24] [25] [26] [29] [30] [32] [33] [35]
    - Based on (pre)configured periodicity [3] [7] [29] [30]
    - Based on detection of resource conflict [5] [12] [13] [16] [20] [26] [29] [32] [35]
    - When the coordination information is updated for UE-B [7]
    - Based on decision in higher layer [7] [20]
    - Based on congestion status [13]
    - Based on distance between UE-A and UE-B [17] [24] [26] [29]
    - Based on RSRP measurement [24]
* How UE-A sends ”A set of resources” to UE-B, including container used for carrying it, implicitly or explicitly or both
  + Container
    - SCI format 1-A [1] [24] [26] [29]
    - 2nd SCI format [1] [2] [3] [13] [14] [18] [24] [26] [27] [29] [33] [36]
    - MAC CE [7] [14] [20] [29] [33] [36]
    - PC5-RRC [2] [19] [20] [33] [36]
    - PSFCH format [2] [12] [14] [18] [20] [28] [32]
  + Retransmission of the inter-UE coordination information
  + Further consideration on whether shared or dedicated resource is used for inter-UE coordination signaling [8] [32]
* How/when/whether UE-B receives “A set of resources” and takes it into account in the resource selection for its own transmission
  + Whether UE-B can skip sensing operation
    - UE-B does not perform its own sensing operation
    - UE-B performs its own sensing operation [7] [24]
  + How UE-B performs resource (re)selection procedure upon receiving the inter-UE coordination information
    - Combine UE-B’s sensing results and resource set provided from UE-A [2] [3] [7] [13] [14] [20] [21] [22] [24] [25] [26] [28] [31]
    - Use resource set provided from UE-A without a consideration of UE-B’s sensing results [2] [3] [13] [21] [22] [25] [28] [31]
    - UE-B performs retransmission on the already selected resource(s) [32]
    - UE-B reselect all or a subset of its own selected resource(s) [2] [7] [10] [12] [20] [28] [31] [32] [35]
    - It is up to UE-B how to use it [6] [27]
  + Cast type of UE-B that can use inter-UE coordination information
    - Unicast [2] [3] [5] [6] [7] [12] [13] [14] [16] [17] [25] [26] [27] [31] [33] [36]
    - Groupcast with HARQ-ACK feedback Option 1 [5] [6] [7] [12] [13] [14] [16] [17] [22] [27] [31] [32] [33] [36]
    - Groupcast with HARQ-ACK feedback Option 2 [2] [3] [5] [6] [7] [12] [13] [14] [16] [17] [22] [25] [27] [31] [33] [36]
    - Broadcast [6] [7] [12] [14] [16] [17] [22] [31] [33]
    - Cast type used in UE-B which is PC5-RRC connected to UE-A [19]
  + Validity check of the received inter-UE coordination information at UE-B side
    - Based on distance between UE-A and UE-B [7] [13] [14]
    - Based on RSRP from UE-A to UE-B [7] [13] [14]
    - Based on information about target UE of the inter-UE coordination information [7]
    - Based on whether the indicated resource set is inside UE-B’s selection window [7] [13]
* Others
  + Further consideration of using a single signaling to transmit one or multiple “set of resources” to multiple of UEs [2] [14] [22]
  + Further consideration on the case when UE-B receives multiple inter-UE coordination information from one or multiple UE-A(s) [6] [7] [13] [33]
  + Further consideration of congestion control for inter-UE coordination signaling [7] [29]
  + Further consideration on the unmonitored slot at UE-B side [7] [14]
  + Additional inter-UE coordination schemes do not show noticeable gain when practical evaluation assumptions are considered [11]
  + Further consideration of using inter-UE coordination for UE with limited RX capability [12]
  + Further consideration on the impact on Rel-16 UE sharing the same resource pool with UEs using inter-UE coordination operation [23] [29]
  + Further consideration of retransmission of inter-UE coordination signaling [29]
  + Further consideration on SL DRX to determine “A set of resources” at UE-A side [34]

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