**3GPP TSG-RAN WG2 Meeting #116bis electronic R2-220xxxx**

**Online, 17 – 25 January 2022**

**Source: LG**

**Title:** **Summary of [POST116bis-e][707][V2X/SL] Open issues on IUC, Phase 2**

**Agenda Item:** **8.15.3**

**Document for:** **Discussion and Decision**

# Introduction

This contribution summarizes the Phase-1 discussion on open issue list review of the following email discussion:

* [POST116bis-e][707][V2X/SL] Open issues on IUC (LG)

**Scope:** 1st phase: Make an open issue lists with the proposed candidate options or rapporteur suggestion. Open issue lists can include pre-identified issues (e.g. FFS, not decided or skipped from previous offline/email discussion) and new issues raised in company contributions at RAN2#116bis. For new issues that have not discussed before, rapporteur can collect companies’ inputs (e.g. whether it is essential issue that need to be considered and closed in Rel-17) and based on that, determine whether to be included in the open issue list or not.

2nd phase: email discussion on the identified open issues with collecting companies’ inputs on the candidate options or rapporteur’s suggestion.

**Intended outcome:** Open issue list with the proposed candidate options or rapporteur’s suggestion from 1st phase (in R2-2201807). Discussion summary for the identified open issues from 2nd phase.

**Deadline:** 1st phase (1/21 – 1/28 UTC), 2nd phase (2/9 – 2/14 UTC)

The discussion is focusing on the open issue list (i.e., IUC issues RAN2 starts discussion) identified in [2] and missing RAN2 specific IUC issues not discussed in the #116b-e meeting.

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|  |  |  |
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# Phase-2 discussion on open issue list for IUC

The identified “RAN2 specific IUC issues” in [2] are needed to be discussed for WI completion. Companies are invited to provide views on the suggested way of treatment/handling for each of them (i.e. Company input into Pre117-e-offline, Company tdocs invited, CR rapporteur handled issue, Other [1]).

* **#116b-e agreements:**

Agreement on resource allocation enhancements RAN2 scopes:

1: Inter-UE coordination (IUC) issues RAN2 mainly relies on RAN1:

- HARQ retransmission number for inter-UE coordination information

- Information and length of information of IUC MAC CE. The information indicated in RAN1 LS should be taken into account as baseline.

- UE-B procedure (e.g. final selection of resources) to the (non-)preferred resource set in IUC

- Scheme 2 inter-UE coordination design

- Condition for the UE-A to transmit IUC

- Signaling design and trigger conditions for the request from UE-B to UE-A

- Cast types (UC/GC/BC) of inter-UE coordination

- Transmission of inter-UE coordination MAC CE on dedicated resource

- L1 parameters/configurations for IUC in Uu RRC (including L1 configurations per resource pool)

- Whether UE-A can be in mode1 or mode2 (interested companies are invited to raise/discuss the issue directly in RAN1)

2. IUC issues RAN2 starts discussion:

- LCP for inter-UE coordination MAC CE, support for standalone inter-UE coordination MAC CE/multiplex MAC CE and MAC SDU in a MAC PDU

- Timer to handle latency bound for inter-UE coordination

- Priority value/priority order of inter-UE coordination MAC CE. RAN1 progress can be taken into account in phase-2 discussion.

- HARQ feedback option of inter-UE coordination MAC CE

3. IUC in SL DRX is deprioritized in Rel-17 from RAN2 point of view

## Issue 1. LCP for inter-UE coordination MAC CE, i.e., support for standalone inter-UE coordination MAC CE/multiplex MAC CE and MAC SDU in a MAC PDU

RAN1 has agreed to support both standalone and multiplex with other MAC SDU for IUC MAC CE (both UE-A’s IUC information and UE-B’s explicit request). The meaning of “can be” in the RAN1 agreement below means that it is assumed that standalone is supported in RAN1 by default. Also, since RAN1 agreed on the ICU MAC being multiplexed with other MAC SDU, issue 1 has already been resolved and there seems to be no further issues. Therefore, RAN2 can start with the discussion of HARQ feedback option (issue 2)/priority order (issue 3) for standalone and MUX with other MAC SDU.

* *RAN1 agreement:*
  + *For inter-UE coordination information transmission in Scheme 1,* 
    - *Inter-UE coordination information can be multiplexed with other data only if the source/destination ID pair is the same*
      * *Retransmission of the TB carrying inter-UE coordination information is supported*
  + *For explicit request transmission in Scheme 1,* 
    - *Explicit request can be multiplexed with other data only if the source/destination ID pair is the same*
      * *Retransmission of the TB carrying request is supported*

## Issue 2. HARQ feedback option of inter-UE coordination MAC CE

RAN2 should determine the HARQ feedback option (i.e., enabled or disabled) for IUC MAC CE (i.e., both MAC CEs for UE-A’s IUC information and UE-B’s explicit request). Also, HARQ feedback option for standalone IUC MAC CE and HARQ feedback option for IUC MAC CE multiplexed with MAC SDU should be discussed.

**Q2-1: Which option would your company prefer for HARQ feedback option of a standalone MAC CE for UE-A’s IUC information?**

1. **HARQ Feedback Enabled**
2. **HARQ Feedback Disabled**
3. **Any other**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| OPPO | b) |  |
| Xiaomi | b |  |
| Intel | b) |  |
| Huawei, HiSilicon | b | Same handling as CSI and DRX MAC CE |
| NEC | b) | Prefer to align with CSI MAC CE in Rel-16. |
| LG | b |  |
| Ericsson | b) |  |
| InterDigital | b) |  |
| CATT | b) |  |
| vivo | b) |  |
| Samsung | b) |  |
| ZTE | b |  |
| Qualcomm | b | Reduce unnecessary feedback traffic. |
| Apple | b |  |
| Lenovo | b) |  |

**Q2-2: Which option would your company prefer for HARQ feedback option of a MAC CE multiplexed with MAC SDU for UE-A’s IUC information?**

1. **Follow the multiplexed MAC SDU’s HARQ feedback option (i.e., feedback enabled or feedback disabled)**
2. **Any other**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| OPPO | a) |  |
| Xiaomi | a |  |
| Intel | a) |  |
| Huawei, HiSilicon | See comments | Is this question asking about the HARQ feedback option of the MAC PDU containing MAC SDU(s) and IUC MAC CE?  If so we think the HARQ attribute depends on whether the sl-HARQ-FeedbackEnabled being set to enabled or disabled for the highest priority logical channel included in the MAC PDU (please note there may be more than one MAC SDU). |
| NEC | a) | Follow RAN#107bis-e agreement.  **Agreement**   * For inter-UE coordination information transmission in Scheme 1,   + Inter-UE coordination information can be multiplexed with other data only if the source/destination ID pair is the same     - Retransmission of the TB carrying inter-UE coordination information is supported * For explicit request transmission in Scheme 1,   + Explicit request can be multiplexed with other data only if the source/destination ID pair is the same   + Retransmission of the TB carrying request is supported |
| LG | a) |  |
| Ericsson | a |  |
| InterDigital | a) |  |
| CATT | a) |  |
| vivo | a) |  |
| Samsung | a) |  |
| ZTE | a |  |
| Qualcomm | a |  |
| Apple | a |  |
| Lenovo | a) |  |

**Q2-3: Which option would your company prefer for HARQ feedback option of a standalone MAC CE for UE-B’s explicit request?**

1. **HARQ Feedback Enabled**
2. **HARQ Feedback Disabled**
3. **Any other**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| OPPO | b) |  |
| Xiaomi | b |  |
| Intel | b) |  |
| Huawei, HiSilicon | b | Same handling as CSI and DRX MAC CE |
| NEC | b) |  |
| LG | b) |  |
| Ericsson | b) |  |
| InterDigital | b) |  |
| CATT | b) |  |
| vivo | b) |  |
| Samsung | b) |  |
| ZTE | b |  |
| Qualcomm | b | Reduce unnecessary feedback traffic. |
| Apple | b |  |
| Lenovo | b) |  |

**Q2-4: Which option would your company prefer for HARQ feedback option of a MAC CE multiplexed with MAC SDU for UE-B’s explicit request?**

1. **Follow the multiplexed MAC SDU’s HARQ feedback option (i.e., feedback enabled or feedback disabled)**
2. **Any other**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| OPPO | a) |  |
| Xiaomi | a |  |
| Intel | a) |  |
| Huawei, HiSilicon | See comments | Is this question asking about the HARQ feedback option of the MAC PDU containing MAC SDU(s) and IUC request MAC CE?  If so we think the HARQ attribute depends on whether the sl-HARQ-FeedbackEnabled being set to enabled or disabled for the highest priority logical channel included in the MAC PDU (please note there may be more than one MAC SDU). |
| NEC | a) | Same as Q2-2. |
| LG | a) |  |
| Ericsson | a) |  |
| InterDigital | a) |  |
| CATT | a) |  |
| vivo | a) |  |
| Samsung | a) |  |
| ZTE | a |  |
| Qualcomm | a |  |
| Apple | a |  |
| Lenovo | a) |  |

## Issue 3. Priority value/priority order of MAC CE for inter-UE coordination information

Regarding the priority order of IUC MAC CEs (i.e., both inter-UE coordination information and explicit request), the following agreements have been made by RAN1.

* *RAN1 agreement:*
  + *For inter-UE coordination information triggered by an explicit request in Scheme 1, the priority value of the inter-UE coordination information is (pre)configured priority value if it is provided by (pre)configuration. Otherwise, the priority value is the same as indicated by UE-B’s explicit request.*
    - *For the case when inter-UE coordination information is transmitted together with other data, the priority value of the multiplexed sidelink transmission is determined by the smallest priority value between the inter-UE coordination information and data*
* *RAN1 agreement:*
  + *For inter-UE coordination information triggered by an explicit request in Scheme 1, the priority value of explicit request is (pre)configured priority value if it is provided by (pre)configuration. Otherwise, the priority value is the same as that of a TB to be transmitted by UE-B.*
    - *For the case when the explicit request is transmitted together with other data, the priority value of the multiplexed sidelink transmission is determined by the smallest priority value between the explicit request and data*
* *RAN1 agreement:*
  + *For inter-UE coordination information triggered by a condition other than explicit request reception in Scheme 1, the priority value of the inter-UE coordination information is (pre)configured priority value if it is provided by (pre)configuration.* 
    - *FFS: Otherwise, the priority value is determined by UE-A’s implementation.*
    - *For the case when inter-UE coordination information is transmitted together with other data, the priority value of the multiplexed sidelink transmission is determined by the smallest priority value between the inter-UE coordination information and data*

Therefore, there is no need to further discuss the priority value of IUC MAC CE in RAN2. In RAN2, it is only needed to discuss the priority order of IUC MAC CEs (i.e., both inter-UE coordination information and explicit request) at this period of time.

Priority order of Sidelink MAC CE is specified in 38.321 running CR as follows:

Logical channels shall be prioritized in accordance with the following order (highest priority listed first):

- data from SCCH;

- Sidelink CSI Reporting MAC CE;

- Sidelink DRX Command MAC CE;

- data from any STCH.

**Q3-1: Which option would your company prefer for priority order of a MAC CE for UE-A’s IUC information?**

1. **Between data from SCCH and SL CSI reporting MAC CE**
2. **Between SL CSI reporting MAC CE and SL DRX command MAC CE**
3. **Between SL DRX command MAC CE and data from any STCH**
4. **Any other**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| OPPO | c) | No strong view, can follow majority. |
| Xiaomi | c | No strong view |
| Intel | b) |  |
| Huawei, HiSilicon | See comments | We think the priority order also depends on the priority value of this MAC CE.  **Case 1: the priority value is configured or indicated with a priority value “1”**  For case 1, since we already agreed the CSI MAC CE and DRX MAC CE have a fixed priority value “1”, we need to discuss the priority order among these three MAC CEs and we slightly prefer option b.  **Case 2: the priority value is configured or indicated with a priority value larger than “1”**  For case 2, since the priority value is larger than “1” , this MAC CE must have lower order than CSI MAC CE, DRX MAC CE and data from STCH that having lower priority value than this MAC CE. For the priority order between this MAC CE and data from STCH with the same priority value or higher priority value, we think this MAC CE should have higher order. |
| NEC | No strong view | Tend to agree with c) but can accept other options. |
| LG | a |  |
| Ericsson | d | IUC MAC CE can share the same priority as CSI report MAC CE, since they are similar in terms of MAC layer procedure, i.e., timer based handling. |
| InterDigital | b) | We think DRX MAC CE should be the lowest priority since it is related to power savings and not proper functioning. Then CSI should have higher priority because link adaptation should have priority over resource selection. |
| CATT | b) | SL DRX command MAC CE is used to stop SL DRX. The priority order of IUC MAC CE can he higher than SL DRX command MAC CE. |
| vivo | d) | According to RAN1 agreement:  *the priority value of the inter-UE coordination information is (pre)configured priority value if it is provided by (pre)configuration. Otherwise, the priority value is the same as indicated by UE-B’s explicit request.*  The IUC MAC CE should be same as request MAC CE and the request MAC CE should be depending on multiplexed data.  I’m wondering if the priority of MAC CE is always higher than data, is it aligned with RAN1 agreement? |
| Samsung | a) or b) | We’re ok with either a) or b) which supported by majority companies. |
| ZTE | See comments | As we know IUC MAC CE include N resource combination, however, how many combinations can be included in the IUC MAC CE has not been decided. In other words, it is possible that IUC MAC CE may cause signaling overhead.  If the priority order of IUC MAC CE is higher than service data, the IUC MAC CE may exhaust all SL grant, which cause there is no enough resource to transmit the service data.  Therefore, before deciding the priority order, we think RAN2 should first discuss how to solve the signaling overhead of IUC MAC CE. |
| Qualcomm | b | Generally speaking, IUC MAC CE may be treated the same as CSI MAC CE. However, between IUC MAC CE and CSI MAC CE, CSI MAC CE is higher than IUC MAC CE. |
| Apple | b or a | We think option b is most reasonable. But we can also accept a. |
| Lenovo | No strong view | Follow RAN1’s agreements on the relative priority of a IUC MAC CE. |

**Q3-2: Which option would your company prefer for priority order of a MAC CE for UE-B’s explicit request?**

1. **Between data from SCCH and SL CSI reporting MAC CE**
2. **Between SL CSI reporting MAC CE and SL DRX command MAC CE**
3. **Between SL DRX command MAC CE and data from any STCH**
4. **Any other**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| OPPO | c) | No strong view, can follow majority. |
| Xiaomi | c | No strong view |
| Intel | b) |  |
| Huawei, HiSilicon | See comments | See our reply on Q3-1. |
| NEC | No strong view | Tend to agree with c) but can accept other options. |
| LG | a) |  |
| Ericsson | d | IUC MAC CE can share the same priority as CSI report MAC CE, since they are similar in terms of MAC layer procedure, i.e., timer based handling. |
| InterDigital | b) | Same reasoning as Q3-1. |
| CATT | b) | The same reason as IUC MAC CE. |
| vivo | d) | Same comment as Q3-1. |
| Samsung | b) |  |
| ZTE | No strong view |  |
| Qualcomm | b | Generally speaking, IUC request MAC CE may be treated the same as CSI MAC CE with certain latency bound. However, between IUC request MAC CE and CSI MAC CE, CSI MAC CE is higher than IUC request MAC CE. |
| Apple | b |  |
| Lenovo | No strong view | Follow RAN1’s agreements on the relative priority of a IUC MAC CE |

**Q3-3: Which option would your company prefer for a priority order between MAC CE for UE-B’s explicit request and MAC CE for UE-A's IUC information?**

1. **MAC CE for UE-B’s explicit request has a higher priority than MAC CE for UE-A’s IUC information**
2. **MAC CE for UE-A’s IUC information has a higher priority than MAC CE for UE-B’s explicit request**
3. **MAC CE for UE-B’s explicit request and MAC CE for UE-A’s IUC information have the same priority**
4. **Any other**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| OPPO | a) or b) | Considering that it might be possible that the two (request and IUC-report) may target at the same peer UE, c) is not feasible anyway. |
| Xiaomi | A or b | Either is fine. We prefer clear priority order, which is simpler for UE implementation. |
| Intel | A or b | Either one works for us |
| Huawei, HiSilicon | See comments | Firstly, we want to clarify that the priority comparison should be within the same UE, i.e., it only makes sense to compare the IUC MAC CE and explicit request from the same UE.  Secondly, it seems not clear if this kind of scenario is supported or not, i.e., a certain UE transmitting both IUC request MAC CE and IUC MAC CE simultaneously to the peer UE. Some clarification on the existence of this scenario is needed.  Thirdly, if there is such a scenario, we think this also depends on the indicated/configured priority value of these two MAC CEs, i.e., MAC CE having lower priority value has higher priority order. If these two MAC CEs having the same priority value, we have no strong view which MAC CE having higher priority order and can follow the majority view. |
| NEC | a) or b) |  |
| LG | a) |  |
| Ericsson | c | We don’t see strong motivation to treat them with different priority levels. We even think they can share the same priority as CSI report MAC CE |
| InterDigital | c | Same view as Ericsson. |
| CATT | a) or b) | Either is fine. |
| vivo | A or b | Agree with OPPO that c may not work. |
| Samsung | a) or b) |  |
| ZTE | See comments | See comments in Q3-1 |
| Qualcomm | c | No strong view on a or b, depending on the priority. To simplify the process, C is OK. |
| Apple | c |  |
| Lenovo | a) or b) |  |

## Issue 4. Timer to handle latency bound for inter-UE coordination

An issue that could be discussed in RAN2 is how to ensure that the inter-UE coordination information can be transmitted to MAC layer in time since the inter-UE coordination information is time-sensitive. There are two options RAN2 will discuss first. That is, it is possible to first decide whether to introduce a mechanism such as CSI report functionality (i.e. also timer-based) for IUC MAC CE transmission in RAN2 or leave it to the UE implementation.

For the issue 4, the modulator's opinion is as follows:

For request-based IUC, RAN1 agreed to provide information on Selection Window for resource set determination in the Request message sent from UE-B to UE-A. For condition-based IUC, RAN1 agreed that the selection window should be determined by the UE implementation. And also, RAN1 agreed on resource selection for transmitting IUC information as follows.

* *RAN1 agreement:*
  + *For Scheme 1, when the inter-UE coordination information transmission is triggered by UE-B’s explicit request,* 
    - *Starting/Ending time locations of resource selection window is provided by UE-B’s explicit request*
      * *Starting/Ending time locations of resource selection window is a form of combination of DFN index and slot index*
* *RAN1 agreement:* 
  + *For determining preferred resource set in Scheme 1, when inter-UE coordination information transmission is triggered by a condition other than explicit request reception,*
    - *Values of following parameters are (pre)configured for a resource pool. If there is no (pre)configuration, UE-A determines by its implementation the values of the following parameters*
      * *prio\_TX*
      * *L\_subCH*
      * *P\_rsvp\_TX*
    - *UE-A determines by its implementation values of following parameters* 
      * *n+T\_1, n+T\_2*
    - *FFS: Whether/how to support (pre)configuration of n+T\_1 and n+T\_2*
    - *Note that it is up to RAN2 decision whether/how the values of these parameters are provided by PC5-RRC signaling from UE-B to UE-A and UE-A uses the received information to determine the preferred resource set*
* *RAN1 agreement:*
  + *For sidelink transmission carrying inter-UE coordination information in Scheme 1,* 
    - *UE-A performs its resource (re)selection according to the same procedure in TS 38.214 Section 8.1.4 to transmit the inter-UE coordination information to UE-B.*
  + *For sidelink transmission carrying request in Scheme 1,* 
    - *UE-B performs its resource (re)selection according to the same procedure in TS 38.214 Section 8.1.4 to transmit the request for the inter-UE coordination information to UE-A if UE-B performs sensing/resource exclusion. Otherwise, at least UE-B can perform random selection*
  + *Note: RAN1 does not pursue specific enhancement of Rel-17 resource (re)selection for the transmission of inter-UE coordination information and its request.*

In summary, it can be seen that RAN1 does not explicitly introduce restriction of latency bound for UE-A to transmit IUC information to UE-B. On the other hand, according to the RAN1 agreements, when UE-A decides to send IUC information to UE-B, the latest timing at which IUC information can be transmitted can be implicitly interpreted as the ending point of Selection Window for determining the resource set.

That is, for the issue 4, moderator’s suggestion is that RAN2 does not need to spend time considering additional latency bounds under IUC scenarios, it is sufficient to leave it as UE-A's implementation.

**Q4-1: Which option would your company prefer for “Timer to handle latency bound for transmission of UE-A’s IUC information”?**

1. **Introduce a mechanism for timer-based latency bound restriction for transmission of UE-A’s IUC information**
2. **Leave it to the UE implementation**
3. **Any other**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| OPPO | Option a) | Firstly, we think the time restriction for UE-A to send the IUC MAC CE is needed no matter it is in a form of timer or something else since,   1. IUC message is a time-sensitive message, it only meaningful in a certain time duration; 2. There needs to be a way for UE-B to determine the validity of the IUC message/to map the IUC message with request, time restriction can be the way.   Then for RAN1 agreement on the starting/ending points, we hold different understanding as rapp on “when UE-A decides to send IUC information to UE-B, the latest timing at which IUC information can be transmitted can be implicitly interpreted as the ending point of Selection Window for determining the resource set”  I.e., if we do it in this way, it would leave no time for UE-B to prepare the transmission (especially considering the HARQ re-transmission delay (since it is a MAC-CE) is unpredictable, so add further uncertainty to the delay). In short, the latency requirement would help to leave some space (in time) to process the received IUC-report.  Therefore, we think the introduction of time restriction for transmission of UE-A’s IUC information is needed. |
| Xiaomi | c | We understand the PHY mechanism can ensure the IUC is generated in time. But whether IUC MAC CE is transmitted in time is determined by MAC, due to LCP. Therefore, we need to specify the latency bound in MAC.  However, as rapp analyzed, RAN1 didn’t agree on the value of latency bound of IUC. Furthermore, the remaining latency bound depends when PHY generates the IUC information. It’s better to specify the latency bound restriction by description text in MAC and leave the IUC MAC CE cancel to UE implementation. |
| **Intel** | a) with comment | We have sympathy with OPPO’s comment since the usefulness of IUC is indeed time sensitive. We think something similar to the SL CSI reporting (as in *sl-LatencyBoundCSI-Report*) can be adopted.  That being said, if the majority prefers to not capture anything, we can follow the majority view. |
| Huawei, HiSilicon | a | Same handling as CSI MAC CE |
| NEC | b) | Agree with moderator’s suggestion. |
| LG | b) |  |
| Ericsson | a | It is beneficial to have similar handling as CSI report MAC CE, for explicit request procedure, the timer is maintained as the following steps  The timer is started with the value equal to the latency bound after reception of a request message from UE-B  The IUC MAC CE is cancelled upon expiry of the timer  The IUC MAC CE is cancelled after the MAC CE is generated.  For non explicit request procedure, the timer is maintained as the following  The timer is started with the value equal to the latency bound after a trigger condition is met  The IUC MAC CE is cancelled upon expiry of the timer  The IUC MAC CE is cancelled after the MAC CE is generated. |
| InterDigital | b | We agree with moderator’s analysis. |
| CATT | a) with comment | At least latency bound for IUC MAC CE is need. Since value of latency bound is related to the TRIVs in IUC MAC CE, how to set the value of latency bound for IUC MAC CE can up to UE implementation. For IUC request MAC CE, we agree with OPPO, enough time should be left for UE-A to provide IUC information. |
| vivo | Option a) | We understand a) is needed and this is aligned with the design for CSI reporting MAC CE. |
| Samsung | a) | Same handling as CSI reporting MAC CE |
| ZTE | A | Same with CSI reporting MAC CE. |
| Qualcomm | a | The latency bound for transmitting IUC is earlier than the selection window starting point at n\_T1. Therefore, it’s better for both UE-A and UE-B to know the time window for IUC. |
| Apple | C. | We agree that there is need of latency bound, but we do not agree with the rapporteur of the following:  “*when UE-A decides to send IUC information to UE-B, the latest timing at which IUC information can be transmitted can be implicitly interpreted as the ending point of Selection Window for determining the resource set*”.  If UE-A sends the IUC MAC CE by the end of resource selection window, then UE-B cannot use any of those information (e.g., preferred resource), the procedure becomes not useful.  We are also not sure if UE-B or UE-A needs to run a timer for this procedure to ensure meeting the latency requirements. That is a stage 3 discussion.. |
| Lenovo | a) | In order to ensure that the requested IUC information is not outdated when received by UE-B, UE-A should ensure that IUC report, MAC CE is transmitted within the given latency bound. |

**Q4-2: If your company answered option “A” to Q4.1, which option would your company prefer for the applied scenario for the latency bound for the transmission of UE-A’s IUC information, i.e., explicit request based case, condition based case?**

1. **Explicit request-based case only**
2. **Condition-based case only**
3. **Both explicit request case and condition-based case**
4. **Any other**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| OPPO | at least a) | It is clearly needed for request-based case. For condition-based case, since the [T1, T2] window can only be up to UE-A implementation, there seems no much gain as compared to request-based case. |
| Intel | a) | It makes more sense to have this latency bound applicable for the explicit request case |
| Huawei, HiSilicon | c | Prefer unified solution. |
| Ericsson | c |  |
| CATT | a) or c) | Since the resources in IUC MAC CE are valid in a range of time, it should be avoided to transmission when it is invalid. |
| Vivo | c) |  |
| Samsung | a) |  |
| ZTE | a | Do not see the necessary for conditional based IUC. |
| Qualcomm | a or c |  |
| Apple | A | We do not see the necessary of timers in cases other than the explicit request case. |
| Lenovo | c) |  |

**Q4-3: If your company answered option “A” to Q4.1, which option would your company prefer for the applied cast type(s) for the latency bound for the transmission of UE-A’s IUC information in the condition-based IUC?**

1. **introduce latency bound restriction to unicast in the condition-based IUC**
2. **introduce latency bound restriction to GC (for non-preferred resource set) in the condition-based IUC**
3. **introduce latency bound restriction to BC (for non-preferred resource set) in the condition-based IUC**
4. **Any other**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| OPPO | a) (we do not think GC/BC can be supported) | Our understanding is it is still pending whether the GC/BC is supported in scheme 1 non-REQ case(.For REQ-based approach, R1 has concluded on the support of UC case only)    For non-REQ-based approach, we understand it is hard to figure a GC/BC-based L2 ID for the IUC MAC-CE, so GC/BC should not be supported, and thus the related mechanism (timer here) should not be applicable as a result. |
| Intel | a) |  |
| Huawei, HiSilicon | a | Same view as OPPO. According to RAN1, there is a FFS on the condition to support BC/GC. So until now it is still not determined whether BC and GC are supported for IUC. We can only agree with this mechanism for unicast. |
| Ericsson | A at least | What cast types should be supported for IUC in scheme 1 triggered by condition shall be decided by RAN1, it is not in RAN2 domain. See the following RAN1 Was  **Agreement**  For Scheme 1, unicast is supported for an explicit request transmission for inter-UE coordination information   * Unicast is used for the inter-UE coordination information transmission triggered by the explicit request   **Working Assumption**  For Scheme 1, following cast type(s) are supported for inter-UE coordination information transmission triggered by a condition other than explicit request reception   * Groupcast/Broadcast for non-preferred resource set, FFS for preferred resource set   + FFS: Under which conditions groupcast/broadcast can be supported * Unicast * FFS: Under which conditions unicast can be supported |
| CATT | At least a), b) and c) if BC/GC is supported. |  |
| vivo | At least a) |  |
| Samsung | d) | We indicated a) Explicit request-based case only to Q4-2, so it is not applied to condition-based IUC regardless of cast type. |
| ZTE | a |  |
| Qualcomm | a (at least) | Support latency bound at least for unicast. Supporting GC/BC or not, need to wait for RAN1’s decision on the FFS. |
| Apple | None |  |
| Lenovo | a) | Whether BC/GC is supported or not is still FFS, wait for RAN1’s conclusions. |

**Q4-4: If your company answered option “A” to Q4.1, which option would your company prefer for the applied resource set type(s) for the latency bound for the transmission of UE-A’s IUC information?**

1. **Apply only to preferred resource set**
2. **Apply only to non-preferred resource set**
3. **Apply to both preferred resource set and non-preferred resource set**
4. **Any other**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Option** | | **Comment** |
| Option for explicit request based case | Option for condition-based case |
| OPPO | c) | c) |  |
| Intel | c) | c) |  |
| Huawei, HiSilicon | c | c | We don’t need to distinguish the resource set for the latency bound handling. |
| Ericsson | c | c |  |
| CATT | c) | c) |  |
| vivo | c) | c) |  |
| Samsung | c) | c) |  |
| ZTE | C | c |  |
| Qualcomm | c | c | Uniformed design. |
| Lenovo | c) | c) |  |

**Q4-5: If your company answered option “A” to Q4.1, which option would your company prefer for how to configure this timer for the transmission of UE-A’s IUC information?**

1. **UE-B sets timer value to UE-A through PC5 RRC signaling**
2. **Timer value is configured based on (pre)configuration of the network**
3. **Leave it to the UE implementation**
4. **Any other**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Option** | | **Comment** |
| Option for explicit request based case | Option for condition-based case |
| OPPO | a) or b) | b) | For condition-based case, a) is not feasible, so b) is preferred;  For explicit request-based case, a) and b) are both feasible and b) is simple since it can be aligned with the condition-based case. |
| Intel | B | B |  |
| Huawei, HiSilicon | a | a | Follow the same handling as CSI MAC CE, i.e., the requesting UE configures the value. Prefer unified solution for explicit request case and condition based case. |
| Ericsson | a | a | There is no reason to adopt different signaling alternative as the existing CSI report MAC CE |
| CATT | c) | c) |  |
| vivo | a) or b) | b) |  |
| Samsung | a) | a) |  |
| ZTE | See comments | See comments | We generally agree A. however, we think the latency bound value is depends on RAN1, not RAN2. |
| Qualcomm | a or b | a | This needs to be communicated with RAN1 |
| Lenovo | a) or b) | b) |  |

**Q4-6: If your company answered option “A” to Q4.1, which option would your company prefer for when to start this timer for the transmission of UE-A’s IUC information?**

1. **When receiving an explicit request from UE-B**
2. **When UE-A decides to send IUC information to UE-B in the condition-based IUC**
3. **Any other**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Option** | | **Comment** |
| Option for explicit request based case | Option for condition-based case |
| OPPO | a) | b) |  |
| Intel | a) | b) |  |
| Huawei, HiSilicon | a | b |  |
| Ericsson | a | b |  |
| CATT | b) | b) |  |
| vivo | a) | b) |  |
| Samsung | a) | NA (see comment) | We indicated a) Explicit request-based case only to Q4-2. |
| ZTE | A | NA | Seem with samsung |
| Qualcomm | a | b |  |
| Lenovo | a) | b) |  |

**Q4-7: If your company answered option “A” to Q4.1, which option would your company prefer for when to stop this timer for the transmission of UE-A’s IUC information?**

1. **When transmitting an IUC information to UE-B**
2. **Any other**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Option** | | **Comment** |
| Option for explicit request based case | Option for condition-based case |
| OPPO | a) | a) |  |
| Intel | a) | a) |  |
| Huawei, HiSilicon | See comments | See comments | Similar as CSI reporting, the timer should be stopped when the IUC MAC CE is generated by the Multiplexing and Assembly procedure (not tranmitted yet). So the wording should be revised a bit.  When an IUC information to UE-B is generated by the Multiplexing and Assembly procedure |
| Ericsson | comments | comments | Agree with Huawei, the IUC MAC CE should be cancelled after the MAC CE is generated same as for CSI report MAC CE |
| CATT | a) | a) |  |
| vivo | a) | a) |  |
| Samsung | a) | NA | We indicated a) Explicit request-based case only to Q4-2. |
| ZTE | A | NA | The behaviour can mimic CSI reporting MAC CE.  And for conditional based IUC, do not see the necessary for supporting latency bound. |
| Qualcomm | a | a |  |
| Lenovo | a) | a) |  |

**Q4-8: If your company answered option “A” to Q4.1, which option would your company prefer for when to cancel the transmission of UE-A’s IUC information?**

1. **if the timer for the triggered UE-A’s IUC information reporting expires**
2. **Any other**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Option** | | **Comment** |
| Option for explicit request based case | Option for condition-based case |
| OPPO | a) | a) |  |
| Intel | a) | a) |  |
| Huawei, HiSilicon | See comments | See comments | Besides the timer for the triggered UE-A’s IUC information reporting expires, when an IUC information to UE-B is generated by the Multiplexing and Assembly procedure, the IUC reporting should be cancelled as well. |
| Ericsson | comments | comments | Fully agree with Huawei, we just need to adopt the same handling rules as for CSI report MAC CE, there is no reason to take different handling for IUC MAC CE as CSI report MAC CE |
| CATT | a) | a) |  |
| vivo | a) | a) |  |
| Samsung | a) | NA (see comment) | We indicated a) Explicit request-based case only to Q4-2. |
| ZTE | A | NA | We prefer to mimic CSI reporting MAC CE. |
| Qualcomm | a | a | Based on expiration is fine. But there are also other factors may trigger the cancellation. |
| Lenovo | a) | a) |  |

## Issue 5. MAC CE for explicit request message

RAN1 has agreed to support MAC CE for UE-B’s explicit request. Thus, RAN2 should discuss priority order and HARQ feedback option for this MAC CE as well. This issue 5 is covered in Issue 2 and Issue 3.

## Issue 6. Cast types (UC/GC/BC) of inter-UE coordination

In the last #116b-e meeting, RAN2 did not classify the cast type discussion of IUC as a RAN2 specific issue. However, Considering FFS points in the RAN1 agreements below, it could be useful to decide whether RAN2 can start to discuss the relevant issue or RAN2 should wait more for RAN1’s ​​progress. If the majority of companies support the former direction, the discussion can proceed through a separate discussion (e.g., offline discussion in #117-e) rather than this post email discussion (Guidance of Session Chair)”

* *Working Assumption:*
  + *For Scheme 1, following cast type(s) are supported for inter-UE coordination information transmission triggered by a condition other than explicit request reception*
    - *Groupcast/Broadcast for non-preferred resource set, FFS for preferred resource set*
      * *FFS: Under which conditions groupcast/broadcast can be supported*
    - *Unicast*
      * *FFS: Under which conditions unicast can be supported*

**Q6-1: Would your company agree that RAN2 can start discussing FFS point of RAN1 agreement (i.e., FFS: Under which conditions groupcast/broadcast can be supported, FFS: Under which conditions unicast can be supported) of condition-based IUC information without waiting more for RAN1’s progress?**

1. **Yes**
2. **No (i.e., waiting for more RAN1 progress)**
3. **Any other**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| OPPO | a) i.e., R2 can disc whether GC/BC can be supported for non-REQ case of scheme-1 | Since the key obstacle for supporting GC/BC is at R2 or higher layer, i.e., hard for R1 to identify, it is beneficial for R2 to express the view on this point.  From company perspective, technically we think GC/BC is not feasible in scheme1 non-REQ based case since there is no GC/BC L2 ID for such MAC-CE only ignaling. |
| Xiaomi | B | We think RAN1 would discuss this issue. Better avoid duplicated discussions. |
| Intel | a) | It is clear that RAN1 has a lot of issues to go through and this falls in RAN2 scope as well, so we think it would be good to address this in RAN2.  As far support of GC/BC goes, we agree with OPPO’s point that it is hard to see how MAC CE based solution would work for GC/BC. At least it would be good to eliminate the conditions/scenarios where GC/BC cannot work as a starting point. |
| Huawei, HiSilicon | a | Actually based on the feedback from our RAN1, for the supported conditions for B/G, they cannot make a decision and is out of their scope. So they rely on RAN2 to handle the conditions.  For example, for roupcast, if there is no group established before the transmission of IUC MAC CE and if groupcast is supported for this case, then the coordinating UE needs to firstly establish a group before transmitting the IUC MAC CE in groupcast manner. In this case, some discussion on defining a new application type for IUC message to trigger the establishment of a group is needed. This kind of discussion should be carried by RAN2 not RAN1.  In addition, we also support OPPO’s view that B/G should not be supported. |
| NEC | b) |  |
| LG |  | Follow majority view. |
| Ericsson | b | No need to duplicate discussions in RAN2, we can just rely on RAN1 decision. |
| InterDigital | a | We think certain aspects of this discussion (e.g. how to handle groupcast) are more related to RAN2, and RAN2 can discuss this via an at meeting email and/or contributions to the meeting. |
| CATT | b) | RAN1 will discuss this issue, it can be open for RAN2. We agree with OPPO, it doesn’t work for MAC CE without GC/BC L2 ID. |
| Vivo | b) | Our understanding is also that RAN1 may continue to discuss this issue. |
| Samsung | b) | We think we need more stable RAN1 progress before RAN2 starts the discussion. |
| ZTE | b |  |
| Qualcomm | b | It’s better to wait for RAN1’s decision. |
| Apple | b |  |
| Lenovo | a) | The supported cast type is determined by RAN1. RAN2 can initiate the discussion on the conditions to support UC/GC/BC based on current agreements of RAN1, e.g., for unicast. |

## Issue 7. Support of signalling parameters used for determining preferred resource set from UE-B to UE-A

According to the RAN1 agreement (RAN1 instructed RAN2 to decide), in phase-2, it can be discussed whether/how the values of the parameters (i.e., prio\_TX, L\_subCH, P\_rsvp\_TX, n+T\_1, n+T\_2) are provided by PC5-RRC signalling from UE-B to UE-A and UE-A uses the received information to determine the preferred resource set.

* *RAN1 agreement:*

For determining preferred resource set in Scheme 1, when inter-UE coordination information transmission is triggered by a condition other than explicit request reception,

* Values of following parameters are (pre)configured for a resource pool. If there is no (pre)configuration, UE-A determines by its implementation the values of the following parameters
  + prio\_TX
  + L\_subCH
  + P\_rsvp\_TX
* UE-A determines by its implementation values of following parameters
  + n+T\_1, n+T\_2
* FFS: Whether/how to support (pre)configuration of n+T\_1 and n+T\_2
* Note that it is up to RAN2 decision whether/how the values of these parameters are provided by PC5-RRC signaling from UE-B to UE-A and UE-A uses the received information to determine the preferred resource set

**Q7-1: Would your company agree that PC5-RRC signaling from UE-B to UE-A can be used for transmitting the parameters (i.e., prio\_TX, L\_subCH, P\_rsvp\_TX, n+T\_1, n+T\_2)?**

1. **Yes**
2. **No**
3. **Yes, but only supports PC5-RRC signaling if there is no (pre)configuration of parameters (i.e., prio\_TX, L\_subCH, P\_rsvp\_TX, n+T\_1, n+T\_2)**
4. **Any other**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| OPPO | b) | Firstly, we understand this Q is only for non-REQ case (i.e., as in R1 agreement “by a condition other than explicit request reception”).  Then we do not see much need for introducing additional PC5-RRC message. RAN1 has already agreed on rely on (pre)configuration or UE-A implementation which is sufficient (we understand pre-configuration should always be there). |
| Xiaomi | B | As agreed by RAN1, these parameters are configured per resource pool. |
| Intel | B | We think the simplest solution is to have these parameters (pre-) configured per resource pool, without the need for defining new PC5-RRC signaling. This also means that GC/BC may also be made to work without having the need for PC5-RRC signaling. |
| Huawei, HiSilicon | b | Rely on pre-configuration and UE implementation can already work. Considering the timeline, we think the PC5-RRC signaling mechanism is some kind of optimization and should be avoided. |
| NEC | b) | If there is no (pre)configuration, not sure whether PC5-RRC signaling is beneficial or not. UE-A determination by its implementation is sufficient in Rel-17. |
| LG | b) | Rely on (pre)configuration or UE-A implementation which is sufficient |
| Ericsson | b | For non explicit request procedure, it is sufficient for UE-A to derive the parameters base on (pre)configuration for the resource pool. If there is no configuration/pre-configuration available, we can leave to UE-A implementation to determine the value of parameters. It is unnecessary to introduce PC5-RRC signaling for UE-B to signal these parameters. If UE-B needs to provide value of parameters to UE-A, UE-B can apply explicit request procedure instead of non-explicit request procedure. |
| InterDigital | a | We see some merit in supporting this information from UE B, since UE B is the one that will eventually perform the resource selection. |
| CATT | b) | Agree with OPPO, Xiaomi and Intel. |
| vivo | b) |  |
| Samsung | b) |  |
| ZTE | b |  |
| Qualcomm | b |  |
| Apple | A | Same view as InterDigital. For unicast case, UE-B knows better than gNB about how to use Scheme 1. |
| Lenovo | b) | RAN1 agreements are for conditions-based case, no need to introduce PC5-RRC signaling cost from UE-B to UE-A in this case. Current RAN1 agreements are sufficient to solve the issue. |

Moreover, RAN2 can discuss and decide how to implement these parameters (i.e., prio\_TX, L\_subCH, P\_rsvp\_TX, n+T\_1, n+T\_2). We think this can be handled as “CR rapporteur handled issue” during running CR discussion.

## Issue 8. Support of signalling capability of UE-B’s sensing/resource exclusion used for UE-A to determine resource set type to be provided by IUC information to UE-B

According to the RAN1 agreement (RAN1 instructed RAN2 to decide), in phase-2, it can be discussed whether/how UE-B provides its support of sensing/resource exclusion to UE-A via PC5-RRC signalling and UE-A uses the received information to determine the type of resource set to be transmitted to UE-B.

* *RAN1 agreement*

For inter-UE coordination information is triggered by UE-B’s request,

* A resource pool level (pre-)configuration can enable one of the following alternatives:
  + Alt 1:
    - Resource set type to be provided by inter-UE coordination information transmission is determined by UE-A’s implementation and its information is indicated by UE-A’s inter-UE coordination information
      * UE-A’s inter-UE coordination information indicates either preferred resource set or non-preferred resource set
  + Alt 2:
    - Resource set type to be provided by inter-UE coordination information transmission is indicated by UE-B’s request
      * UE-B’s request indicates either preferred resource set or non-preferred resource set
* Note that it is up to RAN2 decision whether/how UE-B provides its support of sensing/resource exclusion to UE-A via PC5-RRC signaling and UE-A uses the received information to determine the type of resource set to be transmitted to UE-B

**Q8-1: Would your company agree that PC5-RRC signaling from UE-B to UE-A can be used for providing the UE-B’s support of sensing/resource exclusion in the Alt 1 scenario (i.e., Resource set type to be provided by inter-UE coordination information transmission is determined by UE-A’s implementation and its information is indicated by UE-A’s inter-UE coordination information) of the RAN1 agreement?**

1. **Yes**
2. **No (e.g., optimization issue)**
3. **Any other**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| OPPO | rely on R1 discussion on UE feature list | We understand this issue is only for the case of non-preferred resource set.  Then we understand it can just rely on the capability info sent by UE-B, which is being discussed in R1, via UE feature list (now still in pending state) |
| Xiaomi | B | We understand UE-B should support both resource set types. There is no need to indicate which resource set type is supported/not supported. |
| Intel | Wait for RAN1 progress |  |
| Huawei, HiSilicon | b | We share the same view as rapporteur that this indication is some kind of optimization and should be avoided. For Alt1, if non-preferred resource is received while UE-B does not perform sensing, UE-B can directly ignore this information. |
| NEC | b) |  |
| LG | b) | Agree with Xiaomi and Huawei. This indication is an optimization issue. |
| Ericsson | b | For IUC MAC CE transmission triggered by UE-B’s request, it is sufficient for UE-A to rely on the two alternatives agreed by RAN1 to determine the resource set type, i.e., preferred resource set or non-preferred resource set. it is unnecessary to introduce additional PC5-RRC signaling for UE-B to provide additional information. The RRC signaling is redundant, may cause signaling overhead to UE-B. |
| InterDigital | b | We think UE B can make use of either preferred or non-preferred resources equally. |
| CATT | Wait for RAN1 progress |  |
| vivo | A with comments | We understand that for purpose of flexibility of UE implementation, UE-B should be allowed to only support one resource set type (preferred or non-preferred). How to apply this can be FFS. |
| Samsung | Wait for RAN1 progress |  |
| ZTE | b |  |
| Qualcomm | B w. comment | Waiting for RAN1’s decision is also OK. |
| Apple | a | We understand UE will not be able to support all those schemes. |
| Lenovo | b) |  |

# Phase-1 summary

**Issue 1. LCP for inter-UE coordination MAC CE, i.e., support for standalone inter-UE coordination MAC CE/multiplex MAC CE and MAC SDU in a MAC PDU**

* **Issue 1 has already been resolved (i.e., support standalone inter-UE coordination MAC CE/MAC CE multiplexed with other MAC SDU) and there seems to be no further issues.**

**Issue 2. HARQ feedback option of inter-UE coordination MAC CE**

* **For standalone MAC CE and multiplexed MAC CE with other MAC SDU, HARQ feedback option (i.e. enabled or disabled) is discussed in the phase-2 discussion. Furthermore, HARQ feedback option for both MAC CEs for UE-A’s IUC information and UE-B’s explicit request is discussed in the phase-2.**

**Issue 3. Priority value/priority order of MAC CE for inter-UE coordination information**

* **It is only needed to discuss the priority order of IUC MAC CE (i.e., both MAC CE for UE-A’s IUC information and MAC CE for UE-B’s explicit request) at this point. Like the discussion of SL CSI and SL DRX command MAC CE, the priority order for IUC MAC CE is discussed in phase-2.**

**Issue 4. Timer to handle latency bound for inter-UE coordination**

* **There are two options RAN2 will discuss first. RAN2 can first decide whether to introduce a mechanism such as CSI report functionality (i.e. also timer-based) for IUC MAC CE transmission in RAN2 or leave it to the UE implementation.**
* **If it is decided to introduce a mechanism such as CSI report functionality (i.e. also timer-based) in RAN2, the following issues can be further discussed:**
  + **The applied scenario for the latency bound, i.e., explicit request procedure only or non-explicit request procedure only or both explicit and non-explicit request procedures.**
  + **How to configure this timer**
  + **When to start/stop this timer**
  + **When to cancel the IUC MAC CE**
  + **UE behaviour if transmission of a pending IUC MAC CE with the sidelink grant(s) cannot fulfil the latency requirement associated to the IUC reporting**

**Issue 5. MAC CE for explicit request message**

* **Issue 2/3 includes a discussion of priority order/HARQ feedback options for MAC CE for explicit request messages.**

**Issue 6. Cast types (UC/GC/BC) of inter-UE coordination**

* **In Phase-2, cast types for inter-UE coordination information transmission can be discussed. However, it is questionable if new conditions are needed other than to work like UC/GC/BC in legacy. For example, if there is a UC connection, it is transmitted to UC. If there is no UC connection, it is transmitted to GC or BC.**

**Issue 7. Support of signalling parameters used for determining preferred resource set from UE-A to UE-B**

* **According to the RAN1 agreement (RAN1 instructed RAN2 to decide), in phase-2, it can be discussed whether/how the values of these parameters are provided by PC5-RRC signalling from UE-B to UE-A and UE-A uses the received information to determine the preferred resource set.**

**Issue 8. Support of signalling capability of UE-B’s sensing/resource exclusion used for UE-A’s resource set type to be provided by IUC information to UE-B**

* **According to the RAN1 agreement (RAN1 instructed RAN2 to decide), in phase-2, it can be discussed whether/how UE-B provides its support of sensing/resource exclusion to UE-A via PC5-RRC signalling and UE-A uses the received information to determine the type of resource set to be transmitted to UE-B.**

# Phase-2 summary

# References

1. R2-2201807 Summary of [POST116bis-e][707][V2XSL] Open issues on IUC Phase-1 LG