3GPP TSG-RAN WG2 Meeting #115-e R2-210xxxx

Electronic Meeting, August 9 – 27, 2021

Agenda: 8.15.2

Source: InterDigital

Title: Summary of [POST114-e][706][V2X/SL] Discussion on remaining FFSs/open issues in SL DRX timer maintenance (InterDigital)

Document for: Discussion, Decision

# 1 Introduction

The following email discussion was triggered at RAN2#114-e[1]:

* [POST114-e][706][V2X/SL] Discussion on remaining FFSs/open issues in SL DRX timer maintenance (InterDigital)

 **Scope:** Discuss remaining FFSs and open issues in DRX timer maintenance (for unicast, groupcast, and broadcast) and decide the most agreeable option. Focus the issues that we have already discussed but remained as FFSs and open issues. Note confirmation of WA is not the scope. Good to have two sub-deadlines. First one is to collect companies’ options, and the second one is for the discussion and decision.

 **Intended outcome:** Discussion summary

**Deadline:** Long email discussion

# 2 Open Issues in SL DRX Timer Maintenance

## 2.1 Remaining Issues on SL Inactivity Timer

In RAN2#113bis-e [1], the following agreements were made on SL Inactivity timer for unicast:

6: For unicast, the RX UE maintains a separate SL inactivity timer for each pair of src/dest L2 ID.

7: For unicast, the SL inactivity timer value may take into consideration the QoS. Whether any specification impacts are needed is FFS.

8: For unicast, RX UE starts/restarts the inactivity timer with the value configured for that pair of src/dest L2 ID.

Specifically, a value of the SL inactivity timer is configured for a pair of src/dest L2 ID in unicast. This value is determined at the TX UE and sent to the RX UE as part of the DRX configuration. The specification impacts to take QoS into consideration (if any) remain to be discussed.

In Rel16 V2X, QoS on SL is handled by the SL Radio bearer concept. A SL radio bearer is configured for a QoS flow based on the QoS profile of the flow to be carried by the bearer. The SLRB parameters, as well as the flow to bearer mapping, is determined by network configuration or pre-configuration, depending on the coverage situation of the UE (NW configuration for in-coverage and pre-configuration for OOC). A similar approach can be used for configuring the SL inactivity timer for unicast to take QoS into consideration.

**Q1.1) Does the TX UE obtain the SL inactivity timer for unicast from (pre)configuration?**

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| Company | Response (Y/N) | Comments |
| Ericsson | N | Actually, we are uncertain on the purpose of this question. For now, RAN2 has not concluded any direct and clear mapping relation between QoS parameters and inactivity timer values, in order to have solid outcome, RAN2 needs to have further discussions to sort out at least two issues1. What QoS parameters shall affect the timer value?
2. In addition to QoS parameters, is there any other detailed factor which may also affect the timer value?

which would add a lot of extra design efforts for RAN2.In order to simplify RAN2 efforts, we think a setting of inactivity timer can be determined by TX UE or TX UE’s gNB based on implementation may taking into account the QoS parameters which are configured or preconfigured. This would be sufficient.Meanwhile, in Uu DRX, there is no any clear mapping relation between QoS parameters and the inactivity timer values either. Therefore, we don’t foresee any spec impact of QoS on setting of the inactivity timer.  |
| OPPO | See comments | For RRC\_CONNECTED UE, obviously the value of inactivity timer can be configured by the NW.For OOC and IDLE/INACTIVE case, before discussing this issue specifically for inactivity timer, one should discuss the following proposal which RAN2 skipped during #114 in generalProposal 4 [11/21] In SL unicast, for DRX configuration of each direction where one UE as Tx-UE and the other UE as Rx-UE, when Tx-UE is OOC, RAN2 discuss whether Tx-UE decides the DRX configuration in signalling-2 (Tx->Rx) with or without relying on pre-configuration.Proposal 6 [16/21] In SL unicast, for DRX configuration of the direction where one UE as Tx-UE and the other as Rx-UE, when Tx-UE is in-coverage and in RRC\_IDLE/RRC\_INACTIVE state, Tx-UE obtain DRX configuration from SIB to generate signalling-2 (Tx->Rx).In our view, since R2 has agreed on assistance information as the input for Tx-UE decision on DRX configuration, it would be contradictory if introduce another input (either SIB or pre-configuration) for Tx-UE decision – how should the Tx-UE do with the two input if colliding with each other?, In short, SIB/pre-configuration is not needed since there will be some negotiation between Tx and Rx UE to determine the DRX configuration.  |
| Apple | No with comment | Based on the agreement in RAN2#114, TX-UE need consider RX UE assistance information when deciding the SL DRX configuration for SL unicast. Since the content of RX UE assistance information may involve recommendation of Inactivity timer setting, the TX UE need to take that into account. The length of inactivity timer is critical to power saving, so I think RX UE’s input is important.On the other hand, the TX UE can always override the (pre)configured value. So, even if configured, it is questionable that how significant it really is factored in TX UE decision process.  |

For RRC\_CONNECTED UE, the network can provide the inactivity timer for the pair if src/dest L2 ID via dedicated signalling. For IDLE/INACTIVE and OOC cases, how the inactivity timer is configured should be discussed. Specifically, the UE may be (pre)configured with one or multiple values, and whether these values are configured per QoS profile or per SLRB should be discussed.

**Q1.2) If the answer to Q1.1 is yes, for unicast, how is SL inactivity timer (pre)configured for IDLE/INACTIVE and OOC cases?**

1. **A single value of the inactivity timer is (pre)configured per QoS profile**
2. **Multiple (allowable) values of inactivity timer can be (pre)configured per QoS profile**
3. **A single value of the inactivity timer is (pre)configured per SLRB**
4. **Multiple (allowable) values of inactivity timer can be (pre)configured per SLRB**
5. **Based on assistance information only**
6. **Min and Max value of inactivity timer can be optionally configure**
7.

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| Company | Response  | Comments |
| Ericsson | none | We are not certain on the purpose of this question either.In this case, we think it is sufficient up to TX UE’s implementation, i.e., may consider QoS profile, and/or other information (e.g., resource pool configuration) configured or preconfigured.  |
| OPPO | E | As replied in Q1.1, it should be up to TX-UE implementation by taking assistance information from Rx-UE into account. |
| Apple | F | I assume this is still for SL unicast case. The DRX rule is observed by UE per L2 address pair, but the SLRB is per RB. This is not a one-to-one match because there may be multiple SLRBs of different QoS between a pair of L2 addresses. For simplicity, there is neither real need to limit the choice to some discrete values here nor specify them per QoS. I think min/max value can be specified as optional bounds for SL inactivity timer.  |

A single value of the inactivity timer is applied to each SRC/DEST L2 ID. If the UE can be (pre)configured multiple such values (possibly per QoS) how the inactivity timer is determined by the UE should be discussed.

**Q1.3) If the answer to Q1.1 is yes, and the UE can be provided different inactivity timer(s) associated with each QoS profile/SLRB, for unicast, how does the UE select from different inactivity timer value(s) configured?**

1. **Use the maximum of the inactivity timer(s) configured for each QoS profile/SLRBs**
2. **Use the value configured for the QoS profile/SLRB with the highest priority**
3. **Other**

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| Company | Response  | Comments |
| Ericsson | none | Similar comments as q1.1 and q1.2, we think it is sufficient up to TX UE’s implementation, i.e., may consider QoS profile, and/or other information (e.g., resource pool configuration) configured or preconfigured.In addition, this question Q1.3 has confirmed our understanding that, this would incur extra design efforts for RAN2, which is unnecessary. |
| OPPO | See comments | As replied above, there will be no such issue if based on assistance information from Rx-UE only. |
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For groupcast, a similar approach to unicast can be assumed where a single inactivity timer can be maintained for each groupcast L2 ID. This was supported by a majority of companies in the previous email discussion on timers [2]. Another alternative would be to use the granularity of QoS. However, since the inactivity timer is started by the PHY layer, this approach would require that the inactivity timer is maintained per L1 priority.

**Q1.4) For groupcast, the RX UE maintains a separate inactivity timer for each**

1. **L2 destination ID**
2. **L1 Priority**
3. **Other**

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| Company | Response  | Comments |
| Ericsson | A | We think it is sufficient to assume most DRX parameters shall be configured per L2 ID for GC and BC. To save design efforts, we shall not discuss DRX parameter one by one.  |
| OPPO | A |  |
| Apple | A | Group address is the L2 destination address |

In the previous email discussion [2], it was agreed to support inactivity timer for groupcast, but was left open whether it would be restricted to certain scenarios. The main reason to restrict inactivity timer usage is to avoid or minimize the problem of unsynchronized inactivity timer between RX UEs of a group. As noted in the first email discussion, while this is a problem also for unicast, it can be an even larger problem for groupcast because groupcast may not have a stable topology that is controlled by a link monitoring scheme (like SL RLF). Specifically, a UE may join a group (or be in range to receive groupcast transmissions) at a time when the on duration is not running but one or more TX UEs are transmitting.

In the email discussion, restricting the use of inactivity timer for groupcast was discussed based on the following options:

* Inactivity timer is applied to HARQ-enabled groupcast transmissions only
* Inactivity timer is applied to groups configured with group size/member ID
* Inactivity timer is applied to certain types of group transmissions (e.g. QoS/priority)

Of the options above, the first two received the most support in the first email discussion (11 and 8 companies respectively). It can therefore be considered whether either/both of these options should be supported.

**Q1.5) In which scenario(s) should SL inactivity timer be supported for groupcast?**

1. **HARQ feedback enabled**
2. **Groups configured with group size/member ID**
3. **All groupcast transmissions**
4. **HARQ feedback is enabled and ACK-NACK based feedback option is adopted**

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| Company | Response  | Comments |
| Ericsson | C | It is simpler to always support the timer to avoid introducing additional configurational/operational complexity. In addition, in order to mitigate the misalignment issue in a group, which may cause packet loss, a TX UE is only allowed to transmit new data during ON-duration time. this just introduces small additional spec design efforts. |
| OPPO | D with comments | To avoid the unsynchronized inactivity timer issue addressed by rapp above, NACK-only feedback is not sufficient, i.e., a Rx-specific Ack-Nack HARQ feedback (as specified in MAC spec below) is needed for Tx-UE to differentiate / detect the topology status for each Rx-UE. NOTE 4: Selection of positive-negative acknowledgement or negative-only acknowledgement is up to UE implementation. |
| Apple | A | Wet think only HARQ FB enabled case has an impact to SL inactivity timer.  |

In RAN2#113bis-e [1], the following agreements were made on when the RX UE restarts the inactivity timer.

9: For unicast, the RX UE (re)starts the inactivity timer upon reception of a new SL data transmission from the RX UE perspective for that pair of src/dest L2 ID.

10: For unicast, the RX UE (re)starts the inactivity timer based on information in SCI (SCI1+SCI2). FFS if the MAC layer can stop the inactivity timer.

While the inactivity timer is logically associated with L2 IDs (both for unicast and groupcast), it was agreed to (re)start the inactivity timer based on information in the SCI (SCI1+SCI2) only. This can result in a mismatch case: the UE unnecessarily monitoring PSCCH due to (re)starting the inactivity timer when the L1 ID matches the src/dest ID but the L2 ID does not match.

Several contributions to RAN2#114-e have discussed stopping the inactivity timer at the MAC layer when the mismatch is detected [3][4][5][6]. In the proposals, the companies have clarified that we should avoid stopping the inactivity timer if it is running due to a non-mismatch reception. Effectively, this corresponds to ensuring that the following conditions are met:

* 1) The inactivity timer was not already running when it was started by reception of the SCI associated with a mismatch in L2 ID
* 2) The inactivity timer was not restarted by another SCI reception while the PDU associated with the mismatch was being decoded

**Q1.6) Do you agree that the MAC layer can stop the inactivity timer when the L2 destination (or source, for unicast) are not correct, and both conditions 1) and 2) above are met?**

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| Company | Response (Y/N)  | Comments |
| Ericsson | Y with comments | We understand the intention of this question generally. However, for the condition 2), due to wording issue, we are uncertain if we understand it. Suggest Rapporteur to further clarify the condition 2). |
| OPPO | We are OK to support the timer stopping, but the condition needs to be discussed | Agree with that the stopping of incorrectly started inactivity timer is needed.But we understand condition-1 + condition-2 does not cover all the case, as clarified in our paper R2-2104835, we believe the following condition covers all cases.Proposal 22 For SL unicast and groupcast, inactivity timer is stopped if all the MAC PDUs associated with SCI received previously within the length of inactivity timer, if any, are decoded as not from the correct source address (for unicast only) and/or not to the correct destination address (for unicast and groupcast).. I.e., even if the timer is already running before the reception of SCI, or if the timer has been restarted by another SCI, there is still a case where the timer can be stopped. |
| Apple | No with comment | The L2 ID mismatch is a rare and error case. There is no need to optimize the UE behavior for this. The UE should ignore this error and continue to behave as if it did not occur. So, if inactivity timer is currently running, the timer is supposed to continue the running and not to be stopped.  |

In RAN2#113bis-e[1], the following were agreed for the TX UE behaviour associated with the inactivity timer:

12: For unicast, the TX UE maintains a timer corresponding to the SL Inactivity timer in the RX UE for each pair of src/dest L2 ID, and uses the timer as part of criterion for determining the allowable transmission time for the RX UE.

 13: For unicast, the TX UE (re)starts its timer corresponding to the SL inactivity timer at the RX UE at the slot following an SCI transmission indicating a new data transmission. FFS the specific spec impacts needed at the TX side.

17: As a baseline, agreements 7-13 inclusive are applied to SL inactivity timer for groupcast, with the difference that “src/dest L2 ID pair” is replaced with “groupcast L2 destination ID or src/dest L2 id pair” (dependent on the conclusion of proposal 17). Any specific handling which may be needed for synchronization of inactivity timers for the groupcast case is FFS.

An FFS in the above agreements related to synchronization of the inactivity timers was included for groupcast. Based on current agreements, the timer at the TX UE is (re)started following a new data transmission. One way to synchronize the inactivity timers due to RX UE misdetection is to use HARQ feedback. HARQ feedback (or lack thereof) can be used to either stop or restart the TX UE equivalent of the inactivity timer at the RX UE. However, it may be difficult for the TX UE to differentiate misdetection of SCI by the RX UE, and PSFCH not transmitted (due to UL/SL prioritization).

Alternatively, the baseline conditions agreed for (re)starting the timer at the TX UE corresponding to the SL inactivity timer can be maintained, and instead, HARQ feedback (or lack thereof) can be used to adapt TX UE transmissions (e.g. to avoid new transmissions when the TX UE is unsure that the inactivity timer at the RX UE is running).

**Q1.7) Which use of HARQ feedback can be agreed to address the inactivity timer mismatch between TX and RX UE (for both unicast and groupcast)?**

1. **Stop/Restart the timer at the TX UE corresponding to the inactivity timer using HARQ feedback (or lack thereof)**
2. **Adapt TX UE transmissions based on HARQ feedback (or lack thereof)**
3. **Others**
4. **None**
5. **Up to Tx UE implementation**

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| Company | Response (Y/N) | Comments |
| Ericsson | D | We do not think such improvement is necessary due to the following reasons:* The same issue is already existing in Uu, however there is no special treatment in Uu DRX.
* Handling the inactivity timer in condition to whether RX UE has received a SCI successfully would cause additional complexity to SL DRX maintenance.
* RAN2 shall focus on the basic DRX functionalities in Rel-17. Any enhancement shall be left for future release.
 |
| OPPO | E | The unsynchronized issue exists due to a lot of reasons for both GC and UC, for example:* For GC, the DRX state of different Rx UE maybe not sync-ed with each other;
* For both UC and GC,
	1. the Rx UE may miss SCI information;
	2. the FB is not transmitted due to prioritization;
	3. the FB is wrongly-decoded by the Tx UE;
	4. FB disabled

 …The Tx side handling for each unsynchronized case can be different, it is unrealistic to specify the detailed mechanism (when/whether (re)start or stop the corresponding timer) for every case. Therefore, it can be left to Tx UE implementation to achieve the synchronization and make sure the transmissions will not be missed by the Rx UE considering not only HARQ FB but also other possible references. |
| Apple | E(no spec impact) | Option A or B allow TX UE to stop new transmission when it is aware of that peer RX UE’s inactivity timer expires. On the other hand, lack of HARQ feedback can be interpretated as the other UE is moving out of communication range. In this case, the TX UE of SL groupcast can also choose to continue to transmit new TB for the remaining RX UEs. There is no best solution for this case.So, how TX UE tracks RX UE inactivity timer in SL groupcast can be left to UE implementation. There is no specification impact no matter which option is used. |

Whether the TX (re)starts the timer following SCI transmissions to the RX UE indicating a retransmission could not be agreed in the first email discussion, and the following proposal was suggested [2].

* *Proposal 14b – For unicast, RAN2 discusses whether the TX UE (re)starts the timer following an SCI transmission to the RX UE indicating a retransmission.*

This question, however, seems more related to whether HARQ feedback is used in the maintenance of the timers at the TX and RX UE, since the main motivation of restarting the TX UE equivalent of the inactivity timer is to handle the case where the RX UE did not receive the initial transmission.

If option A) in the above question is not supported, it would seem unnecessary for the TX UE to (re)start the timer following SCI transmission indicating a retransmission.

**Q1.8) Do you agree that (re)starting the timer at the TX UE (associated with the RX UE inactivity timer) following an SCI transmission indicating a retransmission is needed only if option A in Q1.7 is supported? If not, please indicate the usefulness of restarting the timer upon retransmission.**

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| Company | Response (Y/N) | Comments |
| Ericsson  | Yes with comments | Same comments as Q1.7, we don’t think it is necessary for RAN2 to spend efforts to study any enhancement regarding TX and RX misalignment of inactivity timer.  |
| OPPO | See comments | As replied in Q1.7, the unsynchronized cases are varied, it is unrealistic to specify the detailed mechanism for every case. Therefore, it can be left to Tx UE implementation to achieve the synchronization and make sure the transmissions will not be missed by the Rx UE.  |
| Apple | No | We do not think the timer handling in TX UE side needs to be specified in both options. |

If mismatch can be resolved/addressed by HARQ feedback, how to handle HARQ disabled transmissions should further be discussed. One proposal in [4] is to start inactivity timer only when HARQ feedback is enabled, even for the case of unicast.

**Q1.9) Should inactivity timer be started/used when HARQ feedback is disabled for unicast?**

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| Company | Response (Y/N) | Comments |
| Ericsson | Y with comments | In RAN2#113, RAN2 has already agreed to support inactivity timer for unicast regardless of whether HARQ feedback is enabled or disabled. At least, On-duration timer and Inactivity timer are supported in SL unicast.There is no need to reopen the discussion. |
| OPPO | Y | As replied in the above Qs, it should be up to Tx UE implementation to achieve the synchronization, therefore there is no need to differentiate the scenario with/without HARQ FB for unicast. |
| Apple | No | For SL unicast, the SL inactivity timer of RX UE is still used when HARQ FB disabled. There is no need to differentiate those two cases in SL unicast. |

If inactivity timer is started/used when HARQ feedback is disabled, further enhancements may be needed to address the inactivity timer mismatch due to misdetection at the RX UE. Such enhancements can be used to increase the reliability of transmissions to ensure the RX UE (re)starts the inactivity timer when expected.

**Q1.10) Should RAN2 pursue further enhancements at the TX UE to address the inactivity timer mismatch due to SCI misdetection at the RX UE to address the HARQ feedback disabled case? Please elaborate.**

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| Company | Response (Y/N) | Comments |
| Ericsson | N | We do not think such improvement is necessary due to the following reasons:* The same issue is already existing in Uu, however there is no special treatment in Uu DRX.
* Handling the inactivity timer in condition to whether RX UE has received a SCI successfully would cause additional complexity to SL DRX maintenance.
* RAN2 shall focus on the basic DRX functionalities in Rel-17. Any enhancement shall be left for future release.
 |
| OPPO | N | As replied above, it should be up to Tx UE implementation. |
| Apple | No | As indicated in our answer to Q1.6, the RX UE behavior for L2 ID mismatch is to ignore the mismatch and not stop inactivity timer. If the TX UE stop its inactivity timer earlier compared to RX UE, there is no problem. |

Another aspect of inactivity timer synchronization specific to groupcast is whether to align the timer corresponding to the SL inactivity timer at all TX UEs. For unicast, the TX UE resets its timer corresponding to the SL inactivity timer upon transmission. For groupcast, any UE in the group can be a TX UE. If a TX UE with pending transmissions to a groupcast L2 ID receives data for that same L2 ID, it can assume that the inactivity timer at each RX UE is running and reset its own timer corresponding to the SL inactivity timer for that L2 ID. This allows the TX UE to benefit from additional time for transmission and avoid having to wait unnecessarily for the next DRX cycle.

**Q1.11) Can the TX UE (re)start its timer corresponding to the SL inactivity timer for a groupcast L2 ID upon reception for the same groupcast L2 ID?**

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| Company | Response (Y/N) | Comments |
| Ericsson | Y | For GC, the inactivity timer is configured per L2 ID, so, if the TX UE receives a SCI indicating new transmission, it is reasonable for the TX UE to start/restart the inactivity timer, since for GC, there is no directional RB configuration as in unicast. |
| OPPO | N | As clarified in R2-2104835, assume there are UE1/2/3 in a group-cast session, where UE1 initial send a packet to UE2/3, and thus an inactivity timer is started @ UE1 **(I,e., allowing UE1 to send subsequent packets)**, and @ UE2/3 **(I,e., allowing UE2/3 to receive subsequent packets)**, then:If UE1 receives one new transmission from UE2 and thus (re)start the inactivity timer, whether UE1 can perform subsequent **transmission** when the said timer is running, by assuming all the other UEs in the group are in active state. The answer is NO, since as analyzed above, there is no guarantee that UE2 transmission can always **reach UE3 as well**. Hence, UE1 can**not** always assume all the other Rx-UEs in the group are in active time and perform subsequent transmission freely. So **separate timer for transmission/reception** is needed. |
| Apple | Yes with comment | But this is based on the specified RX UE behavior as the same UE conducts both TX and RX for the same group. How a TX UE utilize this information to maintain TX side timer is up to UE implementation and there is no specification impact. |

## 2.2 Remaining Issues on HARQ RTT and Retransmission Timers

HARQ RTT timer and retransmission timers are supported for cases where SL HARQ feedback is enabled. For transmissions without HARQ feedback, support of the HARQ RTT timer is still open. The relevant agreements taken at RAN2#113bis-e are as follows [2]

21: For unicast, sidelink retransmission timer can be supported for at least some cases of HARQ disabled transmissions. FFS whether HARQ RTT is supported or not.

22: For transmissions with HARQ feedback, the RX UE starts the SL HARQ RTT timer in the symbol/slot following the end of PSFCH transmission.

23: If the RX UE does not transmit PSFCH for a HARQ enabled transmission (e.g. due to UL/SL prioritization) the RX UE still starts the HARQ RTT timer in the symbol/slot following the end of PSFCH resource.

25: Retransmission timer can be started upon expiry of the HARQ RTT timer.

In the previous email discussion [2], a majority of companies believed there is some benefit in supporting a HARQ RTT timer when HARQ feedback is disabled.

* *Proposal 22 [14/21]Sidelink HARQ RTT and sidelink retransmission timer can be supported for at least some cases of HARQ disabled transmissions. FFS on the cases, or whether it is supported for all cases. FFS if HARQ RTT is represented with a timer or explicit UE behavior. FFS on cases/scenarios where HARQ RTT time is pre-defined for HARQ disabled transmissions.*

Specifically, the view was that there may be at least some scenarios where the UE can microsleep following (re)transmission of a HARQ process. In rapporteur’s understanding, at least following scenarios were discussed by those companies:

* The NW can provide a mode 1 UE with transmission and retransmission resources which are always separated by some minimum time and configure a HARQ RTT as the minimum such time.
* If RAN2 confirms the working assumption related to setting the HARQ RTT using the information in the SCI, this can be applicable also for HARQ disabled case.
* A TX UE in unicast mode 2 can, by implementation or limitations, require a minimum time between blind retransmissions, and may communicate this minimum in the DRX configuration to the RX UE

On the other hand, some companies mentioned that in most cases, the transmission and retransmission may be in subsequent slots and HARQ RTT timer is therefore not needed. For this reason, they preferred that the HARQ RTT timer is not supported for HARQ disabled transmissions, and the UE immediately starts the retransmission timer upon SCI reception.

Rapporteur sees this second option can be realized by setting with a HARQ RTT timer to zero (i.e. a timer that expires as soon as it is started), without any difference in functionality. The advantages of this modelling are that 1) it is closely aligned with Uu behaviour of supporting both these timers, and 2) that the retransmission timer has a single starting point (expiry of the HARQ RTT timer). In addition, it seems to provide a compromise solution which realizes both views. Rapporteur therefore suggests using this modelling unless there is a major technical issue.

**Q2.1) Can companies agree to model the cases where no HARQ RTT is needed for HARQ feedback disabled cases as the use of a HARQ RTT timer with value of zero?**

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| Company | Response (Y/N) | Comments |
| Ericsson  | N with comments | In case the HARQ is disabled, the need for HARQ RTT timer is less clear. In case of blind retransmissions with resource reservation, it is possible for the Rx UE set an HARQ RTT timer based on the resource reservation information in the SCI. However, in case of blind retransmissions without resource reservation, e.g., Mode-1 transmissions, it is safer for the Rx UE to skip a HARQ RTT timer and triggers the retransmission timer directly (possibly with some fixed small delay after the PSSCH reception, e.g., to take into account the processing delay), to ensure that the retransmissions are not missed. If we see that it is unnecessary to support HARQ RTT for HARQ disabled case, we can capture this explicitly in the spec. we don’t see the real merits to model the timer value as zero.However, we are also open if majority companies support this. |
| OPPO | see comment | “..model… as RTT timer with value of 0” is not a clear proposal to us..As clarified in R2-2104835, we are open to both casesProposal 26 For SL unicast, RAN2 discusses either 1) support RTT timer for FB enabled case but not for FB disabled case, or 2) or support RTT timer for both FB enabled / disabled cases, but with different timer length.I.e., we see a need to differentiate the length of RTT timer for FB enabled/disabled case, either remove it for FB-disabled case directly, or to allow separate timers setting (so that the configured value can be either same or different). |
| Apple | Yes | I think those two are equivalent. We are fine to model the case as HARQ RTT timer = 0 so that the Retransmission timer is immediately triggered |

The remaining question is then which scenarios (if any) can the RX UE use a non-zero HARQ RTT timer when HARQ feedback is disabled.

**Q2.2) If the answer to Q2.1 is yes, to what value(s) can the HARQ RTT timer be allowed to be set when HARQ feedback is disabled, and under what condition(s)?**

1. **A NW configured value**
2. **A TX UE configured value**
3. **A value based on information in the SCI (if RAN2 confirms the WA)**
4. **The value of zero**

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| Company | Response (A, B, C, and/or D) | Comments (conditions where each can be used) |
| Apple | C or A or D (See comments) | When SCI indicates the ReTx timeslot, the HARQ RTT value is based on information from SCI.When SCI does not indicate the ReTx time slot, the HARQ RTT value is set as follows1. For mode 1, NW configured value consider that there some time gap between transmission and retransmission due to the need of get a new SL DG from gNB.

For mode 2, the retransmisisno can occur any time after initial retransmission, so that the value can be set to zero.  |
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The discussion on retransmission timer in the initial timer email discussion [2] was divided into the cases where there is uncertainty or not in the timing of the retransmission resource. For the case where there is uncertainty in the timing of the retransmission resource, the following agreement was taken:

24: For cases where there is some uncertainty in the timing of a retransmission for a HARQ process (e.g. due to no retransmission resource indicated in the SCI, or possible reselection by the TX UE) the RX UE uses a configured retransmission timer.

In the case where there is no uncertainty in the timing of the retransmission resource (e.g. mode 1 transmission with indicated retransmission resource, mode 2 transmission with pre-emption disabled), the majority of companies preferred to still use the retransmission timer behaviour rather than explicitly indicate that the UE monitors only the slot associated with the retransmission. Specifically, the following proposal had majority support but was not agreed in RAN2#113bis-e due to lack of time and was re-proposed in the revised summary for RAN2#114-e [7].

* *Proposal 27 [15/21] For cases where there is no uncertainty in the timing of a retransmission for a HARQ process the RX UE uses a retransmission timer. FFS on how to set the retransmission timer (e.g. predefined or configured) and when it is started*

**Q2.3) Do companies agree with the majority view that for cases where there is no uncertainty in the timing of a retransmission for a HARQ process, the RX UE starts/uses a retransmission timer?**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments |
| Ericsson | Y |  |
| OPPO |  | “No uncertainty” is lack of a definition: in the description above, it seems point to the case of(e.g. mode 1 transmission with indicated retransmission resource, mode 2 transmission with pre-emption disabled)Yet mode-1/2 is not known by Rx UE, and even in case of mode-1, there is the case where DCI did not indicate the next re-tx SL grant, and for mode-2, pre-emption-disabled does not mean there is no resource reselection.. |
| Apple | Yes | We are fine to follow the majority view to have a ReTx timer running in this case even it may just expire in a single slot. |

For the cases where there is no uncertainty, there seems to be no need for the RX UE to monitor PSCCH for a period of time defined by a NW/UE configured inactivity timer applicable to the uncertainty case, since this would consume unnecessary power at the RX UE. In this case a predefined value can be used to ensure that the retransmission timer is running for a single slot only (corresponding to the planned retransmission resource). For unicast, whether there is uncertainty or not can be communicated by the TX UE to the RX UE during the configuration of the unicast link, or the TX UE can configure the RX UE with a retransmission timer having the predefined value. For groupcast, however, this may require additional specification effort due to the lack of RRC signalling between the UEs in the group.

**Q2.4) For unicast, do companies agree with the setting of the retransmission timer (by the TX or RX UE) to a predefined value (i.e. one slot) for the cases where there is no uncertainty in the timing of the retransmission for a HARQ process?**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments |
| Ericsson | N | We prefer to have a unified solution, i.e., up to DRX configuration. Although we agree with the Rapporteur, setting the retransmission to only 1 slot, may give some power saving, however, this also introduces more spec impacts. We don’t see why it is needed, RAN2 shall focus on the basic DRX functionalities in Rel-17. Any enhancement shall be left for future release |
| OPPO | N | The value of retx timer should be configurable, the pre-defined one-slot value retx timer cannot work as replied to Q2.3:* Firstly, we don’t think the no-uncertainty scenario for mode-2 is valid considering Rx UE doesn’t know whether pre-emption is configured or not (no restriction on the same configuration for Tx pool and Rx pool) and there are other reasons for resource reselection like prioritization.

Secondly, for mode-1, if NW did not schedule the next re-tx SL grant, the retransmission resource is uncertain. But whether the NW schedules single or multiple resource at a time can’t be predicted.  |
| Apple | Yes | Agreed with the rapporteur that the uncertainty can be eliminated due to the signaling change in PC5-RRC connection between UEs in a SL unicast.  |

**Q2.5) For groupcast, do companies agree with the setting of the retransmission timer (by the TX or RX UE) to a predefined value (i.e. one slot) for the cases where there is no uncertainty in the timing of the retransmission for a HARQ process?**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments |
| Ericsson | N | Same comments as for Q2.4 |
| OPPO | N | Besides our reply to Q2.4 which also holds for G-cast, there are more issues for setting of the retransmission timer (by the TX or RX UE) to a predefined value (i.e. one slot) for GC – as clarified in R2-2104835* It is not feasible for Tx-UE in mode-1, since network has no information on RTT/Re-tx timer, and how for network to differentiate the usage of different RTT/Re-tx timer length.

Different from unicast, there is no PC5-RRC signalling between Tx and Rx UE, so there is no method to configure RTT/Re-transmission timer differently (i.e., based on mode-1/2 of Tx-UE). The only way-out for G-cast is to configure a common value for the DRX timers, Proposal 11 For SL groupcast, the length of inactivity timer and RTT/Re-transmission are configured commonly (i.e., neither per-PQI/QoS nor per L2 destination ID).From that perspective, for mode-1, a common value of single-slot apparently does not work. |
| Apple | Yes |  |

In addition, the following proposal had majority support but was not agreed in RAN2#113bis-e due to lack of time and was also proposed in the revised summary for RAN2#114-e [7].

* *Proposal 30 – [15/21] SL HARQ RTT timer and SL Retransmission timer are not used for broadcast transmissions. RAN2 discusses how to handle retransmissions at the TX UE for broadcast in this case.*

Rapporteur again suggests that we can go with majority view for this aspect unless there are specific technical concerns.

**Q2.6) Do companies agree with majority view that SL HARQ RTT timer and SL Retransmission timers are not used for broadcast?**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments |
| Ericsson | N  | Since the broadcast in SL has no HARQ feedback, we believe that the same principle for unicast/groupcast with HARQ disabled can be applied to broadcast. In our mind, * For SL broadcast, the HARQ RTT timer is not supported*.*
* For SL broadcast, the retransmission timer is always supported.
* For broadcast, the UE starts the retransmission timer directly after reception of the PSSCH.

We would like to recommend Rapp to have separate questions to discuss RTT timer and retransmission timer respectively.  |
| OPPO | Y |  |
| Apple | Yes |  |

## 2.3 Remaining Other Issues on Active Time

In the previous email discussion on timers [2], majority of companies agreed to include the periodically reserved resources in the active time of the RX UE.

* *Proposal 32 – The SL active time of the RX UE includes:*
* *[14/21] – The slots associated with announced periodic transmissions by the TX UE (as per SCI)*

One issue which was discussed online was that the periodic resource reservation is not necessarily always used for the same RX UE or groupcast/broadcast L2 ID. However, the only drawback is that the RX UE may monitor PSCCH unnecessarily for a small number of slots (associated with the periodic reservation). The advantage of allowing the TX UE to define perform transmissions with a period that is independent of the DRX cycle may effectively outweigh this limitation. Here also, rapporteur suggests to go with majority view.

**Q3.1) Do companies agree with majority view that the SL active time of the RX UE includes the slots associated with the announced periodic transmissions by the TX UE?**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments |
| Ericsson | Y | Agree with the Rapp |
| OPPO | N | This issue is related to the ongoing LS to RAN1, i.e., whether the time information in SCI (not only for re-transmission time gap, but also for reservation period) can be used by the Rx UE for reception. We should wait for RAN1 reply first. |
| Apple | No | The resource selection could reserve a sequence of resources shared by many different SL destinations and different cast types, so if RX UE mark all those reservations as its own Active Time, then it may unnecessarily wake up at a time when TX UE transmit to other UEs. The TX UE shall ensure its schedule transmission resource falls into the *onDuration* cycles of RX UE. There is no need to do the inverse way by forcing RX UE to stay ACTIVE by follow any of the TX UE’s resource reservations.  |

At RAN2#113bis-e, the following working assumption was made:

28: Working assumption: The slots when the UE is expected CSI report following a CSI request is considered as SL active time.

While CSI request is associated with TX UE behaviour, and may require inputs from RAN1. On the other hand, reception of the CSI report is specific to the RX UE, and from that perspective, it may be possible to confirm the WA without RAN1 inputs.

**Q3.2) Do companies agree to confirm the WA that the slots where the UE is expecting CSI reports following a CSI request can be included in the definition of the active time?**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments |
| Ericsson | Y | The UE that sends CSI request (i.e., the triggering UE), will receive the corresponding CSI report from the reporting UE. The triggering UE will be in active during the window when the CSI report is expected. It is reasonable to count this time period as active time, i.e., this is from reception preparative for the triggering UE.  |
| Apple | Yes | We support to confirm the WA. |
|  |  |  |

Most companies that addressed this issue in contributions suggested that the UE starts a timer upon transmission of a CSI request, and includes the time in which this timer is running in the active time of the RX UE [8][9][10][3][5][6].

**Q3.3) If the answer to 3.2 is yes, do companies agree with defining a new timer related to the expected time for receiving CSI report, and include the time when this timer is running in the active time associated with the RX UE?**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments |
| Ericsson | Yes but with comments | We suggest adding the below parameters in SL DRX configuration.* *drx-CSIReportTimerSL:* the maximum duration until a SL CSI report is received.
* *drx-CSIReportRTTTimerSL:* the minimum duration before a SL transmission grant on PSCCH for CSI report is expected by the MAC entity*.*

Correspondingly, the related procedure may be defined as below: * if a MAC PDU including a SL CSI report request is transmitted to a certain DST L2 ID:
	+ the UE sending the MAC PDU starts the drx-CSIReportRTTTimerSL associated to that DST L2 ID in the first symbol/slot after the end of the corresponding PSSCH transmission;
* if drx-CSIReportRTTTimerSL expires:
	+ start the drx-CSIReportTimerSL associated to the DST L2 ID in the first symbol/slot after the expiry of drx-CSIReportRTTTimerSL.
* If a SL CSI report is received from the DST L2 ID:
	+ stop drx-CSIReportTimerSL associated to the DST L2 ID.
 |
| Apple | Yes |  |
|  |  |  |

## 2.4 Resource Selection Enhancements

In RAN2#113bis-e, an FFS point on resource (re)selection enhancements was agreed as follows [1]:

29: RAN2 assumes LCP enhancements for ensuring a TX UE transmits data in the active time of an RX UE are needed. FFS on the resource (re)selection enhancements (e.g. limiting the resources to the active time for peer UE).

For a mode 1 TX UE communicating with one or more RX UEs in SL DRX, the gNB of the mode 1 UE should be aware of the DRX active time of the peer UEs and will allocate resources based on this knowledge.

In mode 2, the TX UE MAC receives a set of available resources from the PHY layer and performs random selection on these available resources to select a transmission and retransmission resource(s) from this set of available resources. The set of available resources is determined by the PHY layer based on sensing results and information on the pending transmission (e.g. priority) at the time when resource selection was triggered by the MAC layer.

LCP enhancements, as agreed above, should ensure that a grant which is outside of the active period of a UE is not used for transmissions to that UE. However, to maintain the MAC layer behaviour described above, the UE should also ensure that at least some resources are selected from the active time of the RX UE(s) in DRX.

**Q4.1) Considering mode 2 resource selection at the MAC layer, should the TX UE ensure that:**

1. **MAC layer is provided resources in the active time of the RX UE**
2. **MAC layer selects resources taking into account the active time of the RX UE**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments |
| Ericsson | Yes |  |
| OPPO | See comments | RAN1 is working on the relationship between resource selection and DRX, no need to double work in RAN2 which may cause some collision between WGs. |
| Apple | 2, not sure about 1 | Not sure how L1 can ensure the resource candidates matching the active time, when the intended ProSe destination is not even known by PHY layer. Only the MAC layer can this issue into resource selection procedure to avoid transmitting in a resource out of RX UE’s active time window. |

What constitutes the active time from the point of view of resource selection should further be discussed. In RAN2#113bis-e, we agreed that the SL active time of the RX UE (for unicast) includes the time in which any of the sl-drx-OnDuration, sl-drx-InactivityTimer, or sl-drx-RetransmissionTimer are running. It was further agreed for that the TX UE maintains a timer corresponding to the SL inactivity timer in the RX UE and uses that timer as part of determining the allowable transmission time. The retransmission timer is only started by the RX UE following reception of an SCI for the initial transmission. However, at the TX UE, resource selection can be performed for both the initial transmission and retransmission resource at the same time. The allowable resources for selection may therefore depend on whether the resource is for the initial transmission or the retransmission. In addition, it may also depend on the cast type of the transmission, since the inactivity timer and the retransmission timer (assuming majority view in Q2.6) are not applicable for broadcast.

**Q4.2) For unicast and groupcast, which resources should be considered/allowed for selection of resources by the MAC layer for the initial transmission?**

1. **Resources associated with time in which the on-duration at the RX UE is running**
2. **Resources associated with the time in which the inactivity timer at the RX UE is running**
3. **Resources associated with the time in which the retransmission timer is running**
4. **Resources not in the active time**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments |
| Ericsson |  | for unicast, it is reasonable to based on A) and B) for the initial transmission, since inactivity timer mis alignment is less critical.For groupcast, TX UE only considers A) for initial transmission. Since inactivity timer mis alignment is more problematic. |
| OPPO  | See comments | RAN1 is working on the relationship between resource selection and DRX, no need to double work in RAN2 which may cause some collision between WGs. |
| Apple | A, B, C |  |

**Q4.3) For unicast and groupcast, which resources should be considered/allowed for selection of resources by the MAC layer for the retransmission resource?**

1. **Resources associated with time in which the on-duration at the RX UE is running**
2. **Resources associated with the time in which the inactivity timer at the RX UE is running**
3. **Resources associated with the time in which the retransmission timer is running**
4. **Resources not in the active time**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments |
| Ericsson | A), B) and C) |  |
| OPPO | See comments | RAN1 is working on the relationship between resource selection and DRX, no need to double work in RAN2 which may cause some collision between WGs. |
| Apple | A,B,C,D | In this case, the resources not in the active time can also be reserved assuming the RX UE will maintain a retransmission timer to extend the wake up time in case a retransmission is needed.  |

**Q4.4) For broadcast, which resources should be considered/allowed for selection of resources by the MAC layer for the initial transmission?**

1. **Resources associated with time in which the on-duration at the RX UE is running**
2. **Resources associated with the time in which the inactivity timer at the RX UE is running**
3. **Resources associated with the time in which the retransmission timer is running**
4. **Resources not in the active time**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments |
| Ericsson  | A |  |
| OPPO | See comments | RAN1 is working on the relationship between resource selection and DRX, no need to double work in RAN2 which may cause some collision between WGs. |
| Apple | A only |  |

**Q4.5) For broadcast, which resources should be considered/allowed for selection of resources by the MAC layer for the retransmission resource?**

1. **Resources associated with time in which the on-duration at the RX UE is running**
2. **Resources associated with the time in which the inactivity timer at the RX UE is running**
3. **Resources associated with the time in which the retransmission timer is running**
4. **Resources not in the active time**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments |
| Ericsson | A and C |  |
| OPPO | See comments | RAN1 is working on the relationship between resource selection and DRX, no need to double work in RAN2 which may cause some collision between WGs. |
| Apple | A only | We do not think there is a reTx timer agreed for SL broadcast HARQ process. |

# 4 Agreements from RAN2#113bis-e

Agreements on details of timer

1: The following parameters are supported as part of the SL DRX configuration for all cast types: sl-drx-StartOffset, sl-drx-Cycle, sl-drx-onDurationTimer, and sl-drx-SlotOffset.

2: The RX UE determines the symbol/slot/subframe associated with the start of the DRX cycle using the configured sl-drx-Cycle, sl-drx-StartOffset. FFS on details.

3: The RX UE starts the sl-drx-onDurationTimer after sl-drx-slotOffset from the beginning of the subframe.

4: The RX UE’s active time includes the time in which sl-drx-on-DurationTimer is running.

5: For unicast, the TX UE behaviors should be specified to keep aligned with the RX UE regarding the DRX Active time. FFS the specific Spec impacts needed at the TX side.

6: For unicast, the RX UE maintains a separate SL inactivity timer for each pair of src/dest L2 ID.

7: For unicast, the SL inactivity timer value may take into consideration the QoS. Whether any specification impacts are needed is FFS.

8: For unicast, RX UE starts/restarts the inactivity timer with the value configured for that pair of src/dest L2 ID.

9: For unicast, the RX UE (re)starts the inactivity timer upon reception of a new SL data transmission from the RX UE perspective for that pair of src/dest L2 ID.

10: For unicast, the RX UE (re)starts the inactivity timer based on information in SCI (SCI1+SCI2). FFS if the MAC layer can stop the inactivity timer.

11: For unicast, the RX UE (re)starts the inactivity timer in the first slot after SCI (SCI1+SCI2) reception.

12: For unicast, the TX UE maintains a timer corresponding to the SL Inactivity timer in the RX UE for each pair of src/dest L2 ID, and uses the timer as part of criterion for determining the allowable transmission time for the RX UE.

13: For unicast, the TX UE (re)starts its timer corresponding to the SL inactivity timer at the RX UE at the slot following an SCI transmission indicating a new data transmission. FFS the specific spec impacts needed at the TX side.

14: SL Inactivity timer is supported for groupcast. FFS on the scenarios where it is supported.

15: SL Inactivity timer is not supported for broadcast transmissions.

16: The RX UE is active on sidelink (monitors SCI1+SCI2) as long as at least one of the SL inactivity timers associated with unicast or groupcast (if supported) is running.

17: As a baseline, agreements 7-13 inclusive are applied to SL inactivity timer for groupcast, with the difference that “src/dest L2 ID pair” is replaced with “groupcast L2 destination ID or src/dest L2 id pair” (dependent on the conclusion of proposal 17). Any specific handling which may be needed for synchronization of inactivity timers for the groupcast case is FFS.

18: SL HARQ RTT timer and SL HARQ retransmission timer are maintained per SL HARQ process at the RX UE.

19: Working assumption: SL HARQ RTT timer can be derived from the retransmission resource timing when the SCI indicates a retransmission resource. FFS whether explicitly configured SL HARQ RTT timer may be still required. If big problem is identified next meeting, we can revisit it.

20: The value(s) of the SL HARQ RTT Timer, when explicitly configured and not determined via SCI (if agreed to do so), is determined by UE or NW implementation.

21: For unicast, sidelink retransmission timer can be supported for at least some cases of HARQ disabled transmissions. FFS whether HARQ RTT is supported or not.

22: For transmissions with HARQ feedback, the RX UE starts the SL HARQ RTT timer in the symbol/slot following the end of PSFCH transmission.

23: If the RX UE does not transmit PSFCH for a HARQ enabled transmission (e.g. due to UL/SL prioritization) the RX UE still starts the HARQ RTT timer in the symbol/slot following the end of PSFCH resource.

24: For cases where there is some uncertainty in the timing of a retransmission for a HARQ process (e.g. due to no retransmission resource indicated in the SCI, or possible reselection by the TX UE) the RX UE uses a configured retransmission timer.

25: Retransmission timer can be started upon expiry of the HARQ RTT timer.

26: The value(s) of the SL retransmission timer can be determined by UE or NW implementation.

27: The SL active time of the RX UE includes the time in which any of its applicable sl-drx-OnDuration(s), sl-DRXInactivityTimer(s), or sl-drx-RetransmissionTimer(s) are running.

28: Working assumption: The slots when the UE is expected CSI report following a CSI request is considered as SL active time.

29: RAN2 assumes LCP enhancements for ensuring a TX UE transmits data in the active time of an RX UE are needed. FFS on the resource (re)selection enhancements (e.g. limiting the resources to the active time for peer UE).

# 5 References

1. RAN2#113bis-e chairman notes – RAN2 chairman
2. R2-2102801 - Summary of [POST113-e][703][V2X/SL] Details of Timer (InterDigital) – InterDigital
3. R2-2105352 – Left Issues on SL DRX – Vivo
4. R2-2104835 – Discussion on DRX configuration and DRX Timers – OPPO
5. R2-2105493 – Remaining Aspects of SL DRX – Ericsson
6. R2-2104866 – Open Issues on SL DRX – InterDigital
7. R2-2104865 – Updated Summary of [POST113-e][703][V2X/SL] Details of Timer (InterDigital)
8. R2-2105023 – Further discussion on SL DRX operation - Intel Corporation
9. R2-2105073 – DRX Configuration for UC BC GC and its interaction with sensing – Lenovo, Motorola Mobility
10. R2-2105132 – Discussion in remaining issues of SL DRX – Apple