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 issues   1. 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 general  Proposal 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. |
| Xiaomi | No | We understand this question refers to OOC UE, since IC UE would not relay on preconfiguraiton.  As RX UE would provide assistant information, pre-configed inactivity timer may conflict with assistant information. Assistant information should be considered with higher priority. If assistant information is not provided, the benefit of preconfigured inactivity timer is also not clear compared with TX UE implementation. Therefore, we prefer pre-configuration doesn’t include unicast sidelink inactivity timer. |
| LG | See comments | According to the RAN2 agreement, the RRC connected UE can receive the SL DRX configuration of Rx UE from its serving gNB. However, idle / inactive / OOC Tx UE can determine the SL DRX configuration of the Rx UE itself by themselves considering the QoS profile / traffic characteristics. |
| Qualcomm | Comment | For Idle/Inactive/OOC, UE may be preconfigured with an Inactivity value based on QoS of a service. But Rx UE’s input may be taken into consideration also. |
| CATT | See comments | For RRC\_CONNECTED UE, the value of SL inactivity timer should be configured by network.  For IDLE/INACTIVE/OOC UE, how to determine the SL inactivity timer length can be totally left to Tx UE’s implementation. E,g., it should at least take the Rx UE’s assistant information into account. We are open on the issue whether network pre-configuration should be taken into account. |
| Nokia | No | Preconfiguration of SL inactivity timer seems to be too inflexible and appropriate to balance power saving vs. latency with a preconfigured value (= length of the SL inactivity timer). Since the length of the timer needs to match the actual traffic need, it may be better to leave it up to TX-UE implementation and/or based on RX-UE sidelink assistance information. |
| ASUSTeK | Yes with comment | For Tx UE in RRC\_CONNECTED, the Tx UE transmits assistance information received from Rx UE to gNB, and the gNB provides DRX configuration for this unicast connection to the Tx UE.  For OOC and IDLE/INACTIVE cases, the Tx UE can select a proper value of the inactivity timer from value(s) in the (pre-) configuration based on assistance information from Rx UE. The Tx UE can select from pre-configured values of inactivity timers based on QoS which is negotiated with the Rx UE during the unicast link establishment. |
| vivo | Yes with comments | We understand for OOC UE, the pre-configuration as well as RX UE assistance information can be taken into account for deciding the final value inactivity time. |
| Huawei, HiSilicon | Yes with comments | For RRC\_CONNECTED UE, the value of SL inactivity timer is configured by gNB.  For RRC\_IDLE/RRC\_INACTIVE and OOC case, the Tx UE can determine the SL inactivity timer based on SIB or pre-configuration, taking the assistance information if any from Rx UE into account. |

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**

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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. |
| Xiaomi | None | Regarding E, we understand inactivity timer is optional included in the assistance information, furthermore the assistance information is optional. If this assistance information is not available, it’s up to TX UE’s implementation to decide the inactivity timer. |
| LG | E | Idle / inactive / OOC Tx UE can determine the SL DRX configuration of the Rx UE by themselves considering the QoS profile / traffic characteristics (i.e., Tx UE implementation issue). However, the Tx UE may transmit only one determined SL DRX configuration to the Rx UE. |
| Qualcomm | Comment | For Idle/Inactive/OOC, UE may be preconfigured with an Inactivity value based on QoS of a service. But Rx UE’s input may be taken into consideration also. |
| CATT | See comments | As commented in Q1.1. In our understanding, the final SL inactivity timer length should be determined by Tx UE implementation. We are open on the issue whether network pre-configuration should be introduced.  If most companies support to introduce it, A) is more proper in order to align the SL DRX configuration for SL unicast and SL broadcast/groupcast. |
| ASUSTeK | A or B | As we replied in Q1.1, the Tx UE can select a proper value of the inactivity timer from value(s) in the (pre-) configuration. We think the (pre-) configured value(s) of inactivity timer should be per QoS profile. |
| vivo | A | In our understanding, A would be enough to configured the inactivity timer. And with agreeing A, the assistance information from RX UE can also be considered at the same time.  And we think we should consider the DRX parameters as a whole (like the cycle, inactivity timer length, on-duration timer length, etc.) when discussing the granularity of configuration for IDLE/INACTIVE and OOC case. |
| Huawei, HiSilicon | A | From the perspective for simpler configuration, a single value would be sufficient as a baseline. |

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. |
| Qualcomm | Comment | OK to use the max but also need to consider Rx UE’s input.. |
| CATT | See comments | How to determine the inactivity timer length is totally up to UE implementation. |
| ASUSTeK | See comment | We think it can be up to UE implementation to select the proper one of values of inactivity timer in the (pre-) configuration. |
| vivo | C | As we mentioned in Q1.2, we should consider the DRX parameters as a whole (like the cycle, inactivity timer length, on-duration timer length, etc.) when discussing the granularity of configuration, so option-C can be a principle for this, which we propose in our contribution R2-2105352. |
| Huawei, HiSilicon | See comments | Both A and B are OK to be a baseline. |

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 |
| Xiaomi | A | Destination id is the smallest granularity to maintain inactivity timer. |
| LG | A |  |
| Qualcomm | A | For each group (destination ID), all UEs of a group maintain the same value for Inactivity timer for synchronization within the group. |
| CATT | A |  |
| Nokia | A |  |
| ASUSTeK | A |  |
| vivo | A |  |
| Huawei, HiSilicon | A |  |

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. |
| Xiaomi | C | The inactivity timer could be configured by gNB for IC UE. Any further limitation we put on the inactivity timer configuration would be applicable to gNB, which is not implementation in RAN specification. If gNB provides an inactivity timer in a unwanted scenario, what is the consequences? |
| LG | C | It is impossible to achieve 100% synchronizing the inactivity timer in groupcast (both in the Feedback enabled case and the Feedback disable case). Thus, we support common solution in the groupcast. That is, the inactivity timer can be supported in both HARQ feedback enabled and disabled case. |
| Qualcomm | C | Inactivity timer is supported for both HARQ enabled and disabled. |
| CATT | C | In our understanding, the Rx UE cannot aware whether the data is correctly received by other Rx UE or not, and it can only start the inactivity timer based the SL PSCCH/PSSCH reception of itself. Hence, no matter which option is used, it is impossible to guarantee 100% synchronization of the inactivity timer running state between different Rx Ues. Hence, a simple method is preferred, that is option C). |
| Nokia | C |  |
| ASUSTeK | C | Both FB enabled and disabled scenarios should support inactivity timer. |
| Vivo | C |  |
| Huawei, HiSilicon | C |  |

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. |
| Xiaomi | No | When we review the conditions, it’s much complex to cover all cases. The benefit doesn’t justify the complexity put on UE and specification. Considering this conflict seems to be a rare case, we prefer not to introduce additional mechanism. |
| LG | No | Since the L1 destination ID is a large enough value with 16 bits, the probability of a false alarm is low. So we do not want to introduce a new complex procedure for the inactivity timer. In addition, when introducing the stopping operation, we should define the different procedure according to whether there is an inactivity timer running or not on the UE side. This increases the complexity of UE operation compared to the power saving gain. Thus, as mentioned, prefer to not introduce the stopping the operation of the inactivity timer. |
| Qualcomm | N | Similar to Uu DRX, based in SCI decoding |
| CATT | No | We share the same view as Apple and Xiaomi. It will introduce additional complexity and we fail to see the intension to introduce this at all. |
| Nokia | No |  |
| vivo | No with comments | We are fine that MAC layer can stop the inactivity timer when the L2 destination (or source, for unicast) are not correct, but the conditions should be discussed further. E.g. the condition can be simple as ‘when L2 IDs in MAC header is found mismatched and the inactivity timer is not restarted by the second SCI reception’, as inactivity timer is per-link. |
| Huawei, HiSilicon | No | Share same view as Apple and Xiaomi. |

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. |
| Xiaomi | D | First we understand this FFS refers to whether specify TX UE’s behavior about maintaining RX UE’s sidelink DRX timer.  Regarding the question proposed by rapporteur, we understand lack of HARQ feedback may be caused by SL/UL prioritization. If we use this information to adjust inactivity timer running at TX UE side, RX UE side shall also be enhanced in this case. As other companies mentioned, this is an optimization. The complexity doesn’t justify the gain. |
| LG | D | Similar view with Ericsson. |
| Qualcomm | D | For NACK only feedback, Tx UE cannot identify if it’s an ACK or it’s an undetected SCI at the Rx UE. |
| CATT | D |  |
| Nokia | D or E | We do not see this as a critical issues that needs to be treated in specification. |
| ASUSTeK | D | Agree with Ericsson. |
| Vivo | A or D or E | We understand A can address the inactivity timer mismatch problem if and only if when there is a HARQ feedback.  For other cases, it can be left to UE implementation or non-solved. But we are also fine if the entire mismatch problem is based on D/E. |
| Huawei, HiSilicon | D or E |  |

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. |
| Xiaomi | Comments | We don’t understand the question. From rapporteur’s description, this question comes from proposal 14b in [2]. Proposal 14b in [2] responses to the question that **which should be considered as valid time(s) in where the SL inactivity timer at the TX UE.**  However, in RAN2#113bis, RAN2 had agreed,  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.  Seems this question is not related to option A in Q1.7 and we shall not challenge the agreement. |
| LG | See comment | Although it is a question of the re-transmission timer, this question is related to the LS sent to RAN1 because it is related to the resource information of SCI. Thus, it is desirable to hold the discussion until the response of the LS sent to RAN1 receives. |
| Qualcomm | N | Retransmission based on HARQ feedback can be supported with HARQ retransmission timer, no need for Inactivity timer. Similar to Uu DRX. |
| CATT | See comments | Agree with Ericsson. |
| Nokia | No | Agree with Qualcomm |
| ASUSTeK | See comments | We think it is not needed to have further enhancement for inactivity timer mismatch between Tx and Rx UE. |
| Vivo | No | We understand this is an unnecessary optimization which is not needed and can be discussed in later Release. |
| Huawei, HiSilicon | See comments | No optimization is needed. |

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?**

|  |  |  |
| --- | --- | --- |
| 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. |
| Xiaomi | Y | Inactivity timer is not related to HARQ feedback. |
| LG | Y | The Rx UE may start an inactivity timer when receiving a new TB, and the Tx UE may start an inactivity timer when transmitting a new TB. |
| Qualcomm | Y | Yes, still need to support blind retransmissions with Inactivity timer. |
| CATT | Y |  |
| Nokia | Y |  |
| ASUSTeK | Yes |  |
| vivo | Yes |  |
| Huawei, HiSilicon | Yes |  |

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.**

|  |  |  |
| --- | --- | --- |
| 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. |
| Xiaomi | N |  |
| LG | N | In the Feedback disabled case, the Tx UE can start the timer when transmitting a new TB and the Rx UE can start the timer when receiving a new TB. In addition, it is sufficient for the inactivity timer to operate by configuring the network or Tx UE to set an appropriate timer length (i.e., Tx UE/Network implementation). No further enhancements are needed. |
| Qualcomm | N | Inactivity timer is used only when the blind retransmissions out of the On duration. No further enhancement for this case. |
| CATT | N |  |
| Nokia | N |  |
| ASUSTeK | No | As answered above, no further enhancement is needed. |
| Vivo | No | There seems no constructive solution to solve this mismatch problem in HARQ-disabled case. |
| Huawei, HiSilicon | No |  |

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?**

|  |  |  |
| --- | --- | --- |
| 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. |
| Xiaomi | Y | We understand this is the straightforward consequence to support inactivity in groupcast. Otherwise, TX would not transmit consequent transmission in the active time extended by inactivity timer. RX UE just waste power to monitor SCI in the active timer extended by inactivity timer. |
| LG | Y | In the same groupcast service (per same Destination ID), the Tx UE performs a transmitter operation as well as a receiver operation. Therefore, there is no reason that the Tx UE and the Rx UE cannot use the same timer for the same destination ID. |
| Qualcomm | Y | All UEs in a group (L2 destination ID) reset the Inactivity timer based on receiving or transmitting an SCI for an initial transmission. |
| CATT | Y |  |
| Nokia | Y |  |
| ASUSTeK | Yes | Agree with Ericsson, and the reception in the question should be limited to new transmission. |
| vivo | Yes when it is for initial transmission | As pointed out by Ericsson and ASUSTek, it should be clarified this is only for new transmission. |
| Huawei, HiSilicon | Yes | Agree with Ericsson |

## 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?**

|  |  |  |
| --- | --- | --- |
| 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 cases  Proposal 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 |
| Xiaomi | No | In this case, the retransmission timer starts in the first slot after SCI reception, which is exactly the same as inactivity timer. We can rely on inactivity timer in this case to provide active time for retransmission reception. RTT and RTX timer are not used in this case. |
| LG | N | If the SL HARQ RTT timer is introduced in the HARQ feedback disabled MAC PDU transmission case, resource selection mechanism can be impacted. For example, in HARQ Feedback disabled MAC PDU transmission, Tx UE can select any resource for blind transmission after the first resource. However, if the SL HARQ RTT timer is introduced in the HARQ disabled case, there may be a restriction that the Tx UE should select the blind transmission resource by limiting the resource after the HARQ RTT time GAP. So we do not support HARQ RTT Timer in HARQ feedback disabled MAC PDU transmission. |
| Qualcomm | No | It’s less confusing without HARQ RTT time if HARQ is disabled. |
| CATT | Yes | Either no HARQ RTT timer or set HARQ RTT timer =0 can work. If the first one is used, it should further discuss how to start the retransmission timer and if the second is used, it has no impact on the drx-retransmission timer. Hence, the second one is slightly preferred. |
| Nokia | No | Share Qualcomm’s view |
| ASUSTeK | No with comments | We’d prefer a unified behavior on starting the retransmission timer for both FB enable and disabled cases; that is, upon expiry of RTT timer. Therefore, the RTT timer should be used for FB disabled cases. However, whether the value should be fixed to 0 or can be set to other values (different from FB enabled or based on SCI) can be discussed. |
| Fujitsu | Yes | We share the same view with Apple. |
| Vivo | No with comments | We think the question is sort of misleading by taking the premise that no HARQ RTT is needed in HARQ disabled case.  In our understanding, as long as there is SCI indicating the next (re)transmission the HARQ RTT timer may be derived by the information in SCI and doesn’t have to be 0. If no such information in SCI then we can discuss a timer with 0 ms or simply saying the UE doesn’t start HARQ RTT timer, and we are both ok. |
| Huawei, HiSilicon | Yes | Share rapporteur’s view. For mode 1, even if the HARQ FB is disabled in SL, the TX UE, based on its own decision, may still request retransmission resources from the gNB, and thus have to wait for a period of time to get the resources scheduled by the gNB before sending the retransmission to the RX UE. As to the blind retransmission, it is also possible that the transmission and retransmission are not in subsequent slots in practical use. So the main argument of “the transmission and retransmission may be in subsequent slots” for NO HARQ RTT timer is not strong. In order to simplify UE implementation, we prefer to pursue a uniform timer handling for HARQ enabled and disabled cases on HARQ RTT timer and retransmission timer. |

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**

|  |  |  |
| --- | --- | --- |
| 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 follows   1. 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. |
| CATT | D |  |
| ASUSTeK | A, B, C and D | When SCI does not indicate a retransmission resource,  For connected Tx UE, RTT timer is configured by NW and provides to Rx UE.  For OOC/IDLE/INACTIVE, the RTT timer is provided by Tx UE (based on pre-configuration)  When SCI indicates a retransmission resource,  RTT timer can be set based on the SCI-provided information (if WA is confirmed), or can be set based on (pre-)configured value provided by NW or Tx UE, if a unified solution is preferable.  The value can be set to 0 based on the above configurations/indications. |
| Fujitsu | D |  |
| vivo | C or D | As replied in Q2.2, as long as there is SCI indicating the next (re)transmission the HARQ RTT timer may be derived by the information in SCI and doesn’t have to be 0. If no such information in SCI then we can accept a HARQ RTT timer with 0ms. |
| Huawei, HiSilicon | A or B or C or D |  |

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. |
| Xiaomi |  | We prefer to have common behavior on RTT and RTX timer running, i.e. the retransmission timer is only triggered by RTT timer expiry and doesn’t need to differentiate whether there is uncertainty. |
| LG |  | Same view with OPPO.  The definition of no uncertainty is unclear. 100% no uncertainty cannot be guaranteed (e.g., due to LTE/NR SL prioritization and etc).  Moreover, although it is a question of the re-transmission timer, this question is related to the LS sent to RAN1 because it is related to the resource information of SCI. Thus, it is desirable to hold the discussion until the response of the LS sent to RAN1 receives. |
| Qualcomm | Y | Based on the indication in SCI. |
| CATT | Y |  |
| Nokia | Y |  |
| ASUSTeK | Yes |  |
| Fujitsu |  | In this case, we think both defining the single slot which is indicated by the SCI as “active time” or setting of a retransmission timer (by the TX or RX UE) to a predefined value (i.e. one slot) can be considered. |
| Vivo | Yes |  |
| Huawei, HiSilicon | Yes |  |

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. |
| Xiaomi | N | Same as Ericsson, we prefer to have common behavior on RTT and RTX timer setting, i.e. up to configuration. |
| LG | See comment | Although it is a question of the re-transmission timer, this question is related to the LS sent to RAN1 because it is related to the resource information of SCI. Thus, it is desirable to hold the discussion until the response of the LS sent to RAN1 receives. |
| Qualcomm | N | No need for a defined value. Can be derived from the SCI. |
| CATT | No | The length of the retransmission timer should be dependent on DRX configuration, not fixed. |
| Nokia | N |  |
| ASUSTeK | No | Agree with Ericsson. |
| Fujitsu | Yes with comments | If the answer in Q2.3) is “Yes”, we also prefer “Yes” here. Because in this case UE may only need to be “active” in the single slot indicated by the SCI, and do not need to be “active” during a continuous period, which can obviously obtain power saving benefits. |
| vivo | No | We don’t have to limit the length to one slot:  1. the uncertainty is very likely to happen and we can have a unified solution for both cases  2. even more than one slot is adopted the retransmission timer can anyway be stopped when retransmission is received. |
| Huawei, HiSilicon | No | We don’t see the necessity of the constrain with a fixed value. |

**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 |  |
| Xiaomi | N |  |
| LG | See comment | Although it is a question of the re-transmission timer, this question is related to the LS sent to RAN1 because it is related to the resource information of SCI. Thus, it is desirable to hold the discussion until the response of the LS sent to RAN1 receives. |
| Qualcomm | N | No need for a defined value. Can be derived from the SCI. |
| CATT | N |  |
| Nokia | N |  |
| ASUSTeK | No |  |
| Fujitsu | Y | Same with Q2.4). |
| vivo | No | Same as above. |
| Huawei, HiSilicon | No |  |

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 |  |
| Xiaomi | Y | Although there may be blind retranssmion for groupcast/broadcast, the retransmission can occur in the first slot after initial SCI reception, which is exactly the same as inactivity timer. We can rely on inactivity timer in this case to provide active time for retransmission reception. RTT and RTX timer are not used in this case. This is aligned with our answer in Q2.1. |
| LG | N | Although the HARQ RTT timer is not supported in the broadcast, at least retransmission timer should be configured to support blind transmission. Also, since there may be resource reselection based on preemption, RAN2 should support the retransmission timer in SL broadcast. |
| Qualcomm | Y | No HARQ supported, no HARQ related timers. Inactivity timer may be used for blind retransmissons. |
| CATT | Y |  |
| Nokia | Y |  |
| ASUSTeK | Yes |  |
| Fujitsu | Y |  |
| vivo | Yes |  |
| Huawei, HiSilicon | 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. |
| Xiaomi | N | We believe the appropriate DRX timer configuration could cover this case. TX UE or TX UE’s gNB shall ensure the active timer determined by DRX timers could cover all the periodic transmissions. |
| LG | Y with comment | We think that this question is not in the scope of this e-mail discussion. Anyway, the answer to the question is “Yes”. |
| Qualcomm | N | Rx UE wouldn’t have time to sleep for SPS based transmissions if support it, |
| CATT | See comments | It should further clarify which the announced periodic transmissions refer to since the Tx UE may correspond with many Rx UEs or may have different PC5-S connections with one Rx UE. |
| Nokia | No | TX-UE should align with RX-UE’s SL DRX configuration to avoid this case, i.e. the TX-UE should only reserve periodic transmissions in the RX\_UE’s active time. |
| ASUSTeK | Yes |  |
| Fujitsu | Yes | The periodic reserved slot for announced periodic transmission should be defined as “active time”, which can make the Rx UE wake up in the periodic reserved slots to perform reception. |
| vivo | No | Agree with Xiaomi and Nokia. |
| Huawei, HiSilicon | Yes | Agree with rapporteur |

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. |
| Xiaomi | No | We believe the appropriate DRX timer configuration could cover this case. However, if majority companies support this, we could also accept. |
| LG | Y with comment | We think that this question is not in the scope of this e-mail discussion. Anyway, the answer to the question is “Yes”. |
| Qualcomm | Y | For directional SL DRX, delay between Tx UE’s SL DRX On duration with CSI request in SCI and the Rx UE’s SL DRX On duration for reporting CSI may be more than required CSI report latency. |
| CATT | Y |  |
| Nokia | Y |  |
| ASUSTeK | Yes |  |
| Fujitsu | Y |  |
| vivo | No with comments | It should be clarified how this works in unidirectional service when there is no DRX configuration for TX UE’s receiving direction. Do we need this ‘active time’ concept for TX in this case only for CSI aspect? |
| Huawei, HiSilicon | 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 |  |
| LG | See comment | If Q3.2 is supported, operation without the timer is possible. Anyway, we have no specific preference for whether to support the timer in the SL DRX behavior associated with CSI report. |
| Qualcomm | Y | New timers may be defined for extending active time for CSI report.  CSIReportRTT timer for Rx UE to sense and select resource to report CSI on PSSCH.  CSIReport timer for Rx UE to transmit and Tx UE to monitor the CSI report. |
| CATT | Yes |  |
| Nokia | Y |  |
| ASUSTeK | Yes |  |
| Fujitsu | Y |  |
| vivo | No with comments | Don’t understand the necessity to have a new timer. We can follow the legacy Uu definition for SR to simply say the UE is in active time when CSI request is sent:  *When a DRX cycle is configured, the Active Time for Serving Cells in a DRX group includes the time while:*  - *drx-onDurationTimer* or *drx-InactivityTimer* configured for the DRX group is running; or  - *drx-RetransmissionTimerDL* or *drx-RetransmissionTimerUL* is running on any Serving Cell in the DRX group; or  - *ra-ContentionResolutionTimer* (as described in clause 5.1.5) or *msgB-ResponseWindow* (as described in clause 5.1.4a) is running; or  - a Scheduling Request is sent on PUCCH and is pending (as described in clause 5.4.4); or |
| Huawei, HiSilicon | Yes | We support a new timer and we think the length of this timer could be the latency bound of the expected CSI report. |

## 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. |
| Xiaomi | Yes for 2 | The destination UE is selected during LCP. In option 1, how L1 can know the selected destination in case there are available data to multiple destination UEs? |
| LG | 2 | We think that the questions of 2.4 (resource selection enhancement) is not in the scope of this e-mail discussion.  Anyway, the answer to the question is “2)”. |
| Qualcomm | Y |  |
| CATT | 2 | Whether the resource configuration should be aligned with DRX can be depends on RAN1 discussion. |
| Nokia | Y |  |
| ASUSTeK | 2, not sure about 1 | RAN2 can only ensure LCP and resource selection, while how resources are provided by PHY should be decided by RAN 1. |
| Fujitsu | Y | In our view, at least one DRX configuration should be noticed from MAC layer to PHY layer, to ensure that at least the initial transmission is within the “active time” of Rx UE.  Tx UE should take the DRX configuration of Rx UE into account when it performs resource selection procedure to ensure the transmission(s) is within the “active time” of Rx UE. |
| vivo | 2 | Agree with Apple. The resource selection part has dependence on RAN1. |
| Huawei, HiSilicon | Yes with comments | We can wait for the further progress from RAN1. |

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**
5. **Resources 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 |  |
| Xiaomi | A, B, C | MAC shall only consider the resource falls into active time of RX UE. |
| LG | E | Tx UE can select an initial resource in any time belonging to the active time. |
| Qualcomm | A and  B comment | Unicast: A and B  Groupcast: A, FFS B |
| CATT | A,B,C |  |
| Nokia | A,B,C |  |
| ASUSTeK | A, B |  |
| Fujitsu | A,B,C |  |
| vivo | See comments | Agree with the intention but whether this can be realized should be confirmed by RAN1.  Moreover, B and C is only valid for groupcast when the TX and RX can align with each other on the understanding of starting of inactivity and retransmission timer. |
| Huawei, HiSilicon | 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. |
| Xiaomi | A, B, C | MAC shall only consider the resource falls into active time of RX UE. |
| LG | See comment | Since the Tx UE selects all transmission resources (i.e., initial and retransmission) when selecting the initial transmission resource, it can select the retransmission resource of the inactive time from the current time (i.e., the selection time of initial resource). |
| Qualcomm | A, B, C | Rx UE’s active time. |
| CATT | A,B,C |  |
| Nokia | A,B,C |  |
| ASUSTeK | A B C |  |
| Fujitsu | A,B,C |  |
| vivo | A,B,C with comments | See reply in Q4.2. |
| Huawei, HiSilicon | A,B,C |  |

**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 |  |
| Xiaomi | A | Depends on which timer is supported for broadcast. For now, only on-duration timer is supported for broadcast. |
| LG | A |  |
| Qualcomm | A |  |
| CATT | A |  |
| Nokia | A |  |
| ASUSTeK | A |  |
| Fujitsu | A |  |
| vivo | A with comments | See reply in Q4.2. |
| Huawei, HiSilicon | A |  |

**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. |
| Xiaomi | A | Depends on which timer is supported for broadcast. For now, only on-duration timer is supported for broadcast. |
| LG | See comment | Since the Tx UE selects all transmission resources (i.e., initial and additional) when selecting the initial transmission resource, it can select the additional/retransmission resource of the inactive time from the current time (i.e., the selection time of initial resource). |
| Qualcomm | A and B | If supporting Inactivity timer for blind retransmissions. |
| CATT | A |  |
| Nokia | Comment | In broadcast there is no retransmission – the question is not applicable. |
| ASUSTeK | A |  |
| Fujitsu | A only | We share the same view with Apple. |
| vivo | A with comments | See reply in Q4.2. |
| Huawei, HiSilicon | A |  |

# 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