**3GPP TSG RAN WG2 Meeting #116-e R2-210xxxx  
Electronic Meeting, 1st - 12th, Nov 2021**

**Agenda item: 8.x.x**

**Source: CATT**

**Title: [Draft] [POST115-e][716][V2X/SL] Identified FFS/open issues (CATT)**

**Document for: Discussion and Decision**

# Introduction

This email discussion is for the below offline discussion:

* [POST115-e][716][V2X/SL] Identified FFS/open issues (CATT)

**Scope:** Discuss identified FFS/open issues including: 1) FFS whether a TX profile identifies a release, or one or more sidelink feature groups, 2) FFS whether a TX profile needs to be provided with service type information or L2 id when upper layer indicates to AS layer, 3) FFS on slot or symbol where the start of SL-specific drx-HARQ-RTT-Timer and SL-specific drx-RetransmissionTimer, 4) FFS on the specific values of HARQ RTT that can be used for HARQ disabled case, 5) How to handle cases when a transmission may cause these timers to be running at the RX UE is FFS. FFS on groupcast. FFS on whether any spec impact (in agreement 14 and 15 in SL DRX timer maintenance, 6) what information is included in the assistance information from RX UE to TX UE? 7) Need of SL DRX assistance information REQ from TX UE to RX UE, 8) If SL DRX assistance information REQ is needed, what information is included? 9) FFS on the interpretation if assistance information is not provided, 10) FFS on the following TX/RX UE behaviours when reject happens, 11) FFS on whether the new rejection cause for SL DRX needs to be defined, 12) FFS on whether RRCReconfigurationFailureSidelink or RRCReconfigurationCompleteSidelink is used in Step 2, 13) Need of down-selection for SL DRX configuration when multiple QoS profiles are associated for same DST L2 ID, 14) Common or separate default SL DRX configuration for GC and BC? 15) FFS on whether default SL BC DRX configuration or which SL BC DRX configuration for DCR message should be used, 16) Whether SL DRX is applied after DCR message and before SL unicast DRX configuration is applied? 17) Whether we can confirm the WA that DRX configuration for V2X group management signaling is out of RAN2 scope.

**Intended outcome:** Discussion summary

**Deadline:** Long email discussion. 1st phase: check companies’ views for the simple/general question, collect candidate options from the companies for the question including multiple options before checking all companies’ views for each option. 2nd phase: check companies’ views for all questions (no restriction). Checking the rapporteur summary is done from the end of 2nd phase to tdoc submission.

The above email discussion is divided in three phases:

* **Phase I**: Companies are invited to check the questions and provide your option for each question if it is not included in the candidate options by 26th Sep 10:00 UTC. Please pay attention, no feedback on the questions is needed in Phase I. Rapporteur will reshape the questions and options in this email discussion based on companies’ comments.
* **Phase II:** During this phase, a complete questionnaire will be published and companies are invited to provide feedback on the questions by 14th Oct 10:00 UTC.
* **Phase III:** Rapporteur submits a summary based on phase II’s feedback, and companies can comments on the summary by deadline of submission for RAN2#116-e.

# Identified FFS/open issues from [Post114-e][704]

## FFS whether a TX profile identifies a release, or one or more sidelink feature groups?

According to the description in [2], in Rel-15, in order to solve the compatible issue,“TX profile” was introduced to indicate whether a Rel-15 UE shall use Rel-14 compatible format or shall use Rel-15 format to transmit the corresponding V2X packet. In RAN2#115-e meeting, the compatible issue of SL DRX was discussed and RAN2 reached the agreement that for BC/GC, TX profile is introduced in Rel-17 for sidelink enhancement. But it is still FFS whether a TX profile identifies a release, or one or more sidelink feature groups?

During the RAN2#115-e online session, some companies raised that if TX profile is associated with release, there may be forward compatible issue (e.g., sidelink DRX may not be mandatory capability for sidelink UEs in future releases. If TX profile is R18, it may indicate CA or packet duplication operation, while doesn’t mean sidelink DRX is applied for this transmission. It’s unclear whether service associated with R18 should apply DRX or not) and TX Profile associated with a feature is a future proof solution. And some companies raised that sidelink features are not a good approach since increased sidelink feature combinations.

**Question 2.1-1:** **Whether a TX profile identifies a release, or one or more sidelink feature groups? Which option do you prefer and please give your comments.**

* **Option 1: A Tx profile identifies a release.**
* **Option 2: A Tx profile identifies one or more sidelink feature groups (If this option is selected, please give your view on which sidelink feature/feature groups should be considered).**
* **Option 3: Leave the decision to SA2/CT1.**

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| **Companies** | **Option** | **Comments** |
| OPPO | Option 3 | Tx profile is defined in SA/CT spec, it is not appropriate for RAN2 to decide this issue directly. |
| Xiaomi | Option 2 | Option 1 is not future proof. In future release, sidelink DRX may not be madatory capability. For example, if TX profile is set to R18 or R19, it’s still not clear whether DRX should be applied for corresponding service. Option 2 is more future proof. We could send LS with RAN2’s preference to SA2/CT1 to guide their design. |
| LG | Option 3 | RAN2 cannot define Tx profile directly. It has been handled in SA/CT spec. |
| Ericsson | Option 2 | Share the same view as Xiaomi. Option 2 is the best option to address the coexistence issue in current release and future releases.  Regarding Option 3, we don’t think the decision shall be made in SA2/CTI. How to address coexistence issue is capured in the WID that RAN2 shall address the issue. For other work groups, they don’t study SL DRX, how can they make decision? |
| vivo | Option 1 or Option 3 | Firstly, it is noted that this issue is not new, which was discussed in Rel-15 LTE V2X. And the RAN2 agreement was to adopt the Released based solution like Option 1 instead of Option 2 as in below box. We think the LTE V2X solution can be largely reused here.  RAN2#102 Agreements  1: At least the following TX profiles are supported:  i) TX profile 1: UE shall use Rel-14 compatible format (use Rel-14 MCS table, not to use Rel-15 feature)  ii) TX profile 2: UE shall use Rel-15 format which is not compatible with Rel-14 (rate matching is used. use Rel-15 MCS table)  Regarding the concern raised by Xiaomi, we believe there would be no problem by carefully designing the TX Profile signalling. For example, for further releases like Rel-18, we can introduce more TX profile pointers instead of only one to additionaly indicate whether it is compatible with legacy releases like Rel-16 or not. Consequently, it’s very clear whether SL DRX should be applied for corresponding service. The singalling example is shown as below.   * TX profile 3: UE shall use Rel-18 format which is compatible with Rel-16 (not use Rel-17 SL DRX feature) * TX profile 4: UE shall use Rel-18 format which is not compatible with Rel-16 or compatible with Rel-17 (use Rel-17 SL DRX feature)   However, if consensus cannot be reached by RAN2, we are also acceptable to inform SA2/CT1 about the candidate solutions and leave the final decision to them. |
| Huawei, HiSilicon | Option 2 | We share the understanding of Xiaomi and Ericsson. It is AS originated issue, we don’t think it is a good choice to leave it to SA2/CT1 who may or may not have thorough understanding on AS feature/feature groups.  It is not clear to us how more TX profile pointers in future release (e.g. Rel-18) could solve this issue. |
| Sharp | Option 3 |  |
| MediaTek | Option 2 | We share same view with Xiami, Ericsson, and Huawei. |
| ZTE | Option 3 | Option 1 shall be excluded first since sidelink DRX may not be madatory capability for a future release. However, whether option2 can be adopted shall be decided by SA2/CT1. RAN2 cannot make the decision for them. |
| Intel | Option 3 | Agree with OPPO |
| Nokia | Option 3 |  |
| Qualcomm | Option 2 | For Rel 17, there is no difference with either Op 1 or 2; but for future releases with more features, Op 2 seems more clear. |
| Apple | Option 2 or Option 3 | This needs to be jointly decided by SA2 and RAN2. For Option 1, the problem is that there may be more than one feature introduced in a new release. |

## FFS whether a TX profile needs to be provided with service type information or L2 id when upper layer indicates to AS layer?

During RAN2#115-e meeting, RAN2 reached the below agreement [1]:

A TX profile is indicated from upper layer to AS layer. FFS whether a TX profile needs to be provided with service type information or L2 id.

For the FFS, the original question during online discussion is whether the service type is visible to AS layer or not. In upper layer, the service type is mapped to Tx profile, and the Tx profile is indicated to AS layer. For AS layer, for a given cast type and destination ID, which Tx profile is used should be considered. One company raised that maybe the L2 ID associated to the service type should accompany with the TX profile. Another company argued that in LTE, service type information is directly provided by the upper layer for each data unit.

**Question 2.2-1: Whether a TX profile needs to be provided with service type information or L2 id? Which option do you prefer? Please give your comments.**

* **Option 1:** **A Tx profile needs to be provided with service type information.**
* **Option 2: A Tx profile needs to be provided with L2 ID.**
* **Option 3: Leave the decision to SA2/CT1.**

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| **Companies** | **Option** | **Comments** |
| OPPO | Option 3 | Tx profile is defined in SA/CT spec, it is not appropriate for RAN2 to decide this issue directly. |
| Xiaomi | Option 3 | We understand this could be decided by SA2/CT1. |
| LG | Option 3 | RAN2 cannot define Tx profile directly. It has been handled in SA/CT spec.  In legacy rel-16 operation, when a packet is delivered from the upper layer to AS layer, L2 ID is basically provided to AS layer. Adding to this, if TX profile is provided, we can deduce implicitly the linkage between TX profile and packet. We think it’s not necessary to make a new linkage mechanism between them. Anyway, it’s up to SA2/CT1 decision. |
| InterDigital | Option 2 | We think if RAN2 can decide this, then it should. |
| Ericsson | Option 3 | In addition to the mapping between TX profiles and release or features, TX profile also needs to map to service type or L2 ID, this can be decided by SA2/CTI. |
| vivo | Option 2 or Option 3 | As illustrated in Question 2.1-1**,** We prefer to simply reuse the LTE V2X solution i.e., TX profile to L2 ID mapping.  However, if consensus cannot be reached by RAN2, we are also acceptable to inform SA2/CT1 about the candidate solutions and leave the final decision to them. |
| Huwei, HiSilicon | Option 2 | While we see the point by the companies selecting Option 3, we are not convinced with the necessity of “service type information”. According to Rel-16 framework, service type is transparent to AS. What AS knows and uses is the L2 ID.  We suggest to think from the perspective for a mechanism to solve the DRX compatibility issue, not necessarily to think about the legacy TX profile mechanism. |
| Sharp | Option 3 |  |
| MediaTek | Option 3 |  |
| ZTE | Option 3 |  |
| Intel | Option 3 |  |
| Nokia | Option 3 |  |
| Qualcomm | Option 2 or 3 |  |
| Apple | Option 3 |  |

# Identified FFS/open issues from [Post114-e][705]

## FFS on slot or symbol where the start of SL-specific drx-HARQ-RTT-Timer and SL-specific drx-RetransmissionTimer?

During RAN2#115-e meeting, RAN2 reached the below agreements [1]:

Agreements on Uu DRX timer impacts:

1: When sl-PUCCH-Config is configured but the PUCCH is not transmitted due to UL/SL prioritization, the TX UE should start the SL-specific drx-HARQ-RTT-Timer in Uu for the corresponding SL HARQ process in the first slot/symbol after the end of the corresponding PUCCH resource. FFS on slot or symbol.

3:SL-specific drx-RetransmissionTimer is started at the first symbol after the end of last PSSCH resource scheduled through one DCI (with the assumption RAN2 agrees not to support SL-specific drx-HARQ-RTT-Timer but to support SL-specific drx-RetransmissionTimer when sl-PUCCH-Config is not configured, when sl-PSFCH-Config is configured). FFS the SL-specific drx-RetransmissionTimer is started at the first slot after the end of last PSSCH resource scheduled through one DCI instead.

4:SL-specific drx-RetransmissionTimer is started at the first symbol after the end of last PSSCH resource scheduled through one DCI (with the assumption RAN2 agrees not to support SL-specific drx-HARQ-RTT-Timer but to support SL-specific drx-RetransmissionTimer when sl-PUCCH-Config is not configured, when sl-PSFCH-Config is not configured). FFS the SL-specific drx-RetransmissionTimer is started at the first slot after the end of last PSSCH resource scheduled through one DCI instead.

During the RAN2#115-e online session, the majority was fine with the intention of the proposal, while not sure about the start point “in/at the first symbol/slot after the end of”. The proponent of slot raised that compared with Uu, the difference of PC5 is that the PHY channels are defined in the granularity of slots instead of symbols, so it is preferred at least for SL-DRX timers to be defined in slots [3]. The opponent of slot raised that for Uu DRX, it is “symbol” used in the MAC spec for Uu DRX, it is better to use the time unit of “symbol” in the proposals, and also in the procedure texts in the spec.

**Question 3.1-1: When sl-PUCCH-Config is configured but the PUCCH is not transmitted due to UL/SL prioritization, which option should be selected as the starting time granularity of the SL-specific drx-HARQ-RTT-Timer for Tx UE? Please give your comments.**

* **Option 1:** **The starting timing of SL-specific drx-HARQ-RTT-Timer is referring to slot.**
* **Option 2: The starting timing of SL-specific drx-HARQ-RTT-Timer is referring to symbol.**

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| **Companies** | **Option** | **Comments** |
| OPPO | Option 1 |  |
| Xiaomi | Option 2 | The SL-specific RTT timer is maintained to trigger SL-specific retransmissin timer and both timers are running on Uu interface. So we prefer symbol granularity to aligned with Uu DRX. |
| LG | Option 1 | RAN2 has already agreed to use the slot as the granularity for the start point of the RTT timer when PUCCH has been transmitted. Therefore, even if PUCCH transmission is dropped, this agreement can be applied equally. |
| InterDigital | Option 2 | Uu DRX timers should be symbol granularity to be consistent with existing Uu timers. |
| Ericsson | Option 2 | We share the same view as Xiaomi |
| vivo | Option 2 | Agree with above comments. |
| Huawei, HiSilicon | Option 2 | It is the timer for Uu DRX, not for SL DRX. We don’t understand why we would constrain the Uu transmission/reception to slot granularity.  A possible consequence to use slot granularity in Uu is that, as UE sleeping/waking-up behaviour is the result of both SL specific timers and legacy Uu timers, the slot granularity of SL specific timers could “force” UE to eventually act with slot granularity in Uu, which could negatively impact UE power-saving efficiency. On the other hand, we don’t see any harm to use symbol granularity. |
| Sharp | Option 2 |  |
| MediaTek | Option 2 |  |
| ZTE | Option 1 | Agree with LG, moreover, according to current specification, the minimum resource allocation unit in the time domain is a slot for sidelink, so we prefer slot granularity to aligned with SL DRX. |
| Intel | Option 1 | As LG mentioned, since slot level granularity has been agreed to be used for RTT timer, it makes sense to use the same here. |
| Fraunhofer | Option 2 | In order to be aligned with the UU DRX definition where RTT timer is based on symbol granularity it is better to follow the same when sl-PUCCH is configured. |
| Nokia | Option 2 |  |
| Qualcomm | Option 2 | PUCCH is symbol based on Uu. |
| Apple | Option 2 | We think there is no harm to align with Uu timer granualrity. |

In the phase I discussion, some companies think that when sl-PUCCH-Config is configured, the starting time granularity of SL-specific drx-HARQ-RTT-Timer should be same regardless whether PUCCH is transmitted and not.

In RAN2#114-e meeting, it was agreed that:

7: When sl-PUCCH-Config is configured (and the PUCCH is transmitted), the UE should start the SL-specific drx-HARQ-RTT-Timer in Uu for the corresponding SL HARQ process in the first slot after the end of the corresponding transmission carrying the SL HARQ feedback via the PUCCH.

**Question 3.1-2: Do you agree that the agreement in RAN2#114-e (When sl-PUCCH-Config is configured (and the PUCCH is transmitted), the UE should start the SL-specific drx-HARQ-RTT-Timer in Uu for the corresponding SL HARQ process in the first slot after the end of the corresponding transmission carrying the SL HARQ feedback via the PUCCH.) needs to be reverted to align with the agreement for Question 3.1-1? Please give your comments.**

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| **Companies** | **Yes/No** | **Comments** |
| OPPO | No |  |
| Xiaomi | Yes | Since we prefer option 2 in 3.1-1, this agreement should be revered to achieve unified design. |
| LG | No |  |
| InterDigital | Yes |  |
| Ericsson | yes |  |
| vivo | Yes | We understand that the main motivation behind above agreement is due to that the PC5 PHY channels are defined in the granularity of slots instead of symbols as Uu. But we are discussing here about SL related Uu-DRX timers, but not about the SL-DRX timers to be defined in slots, so it is slightly preferred that we can align with the Uu spec for the SL related Uu-DRX timers. |
| Huawei, HiSilicon | Yes |  |
| Sharp | Yes |  |
| MediaTek | Yes |  |
| ZTE | No | There is no strong reason to revert the agreement. |
| Intel | No |  |
| Fraunhofer | Yes |  |
| Nokia | Yes |  |
| Qualcomm | Yes | PUCCH on Uu is symbol based. |
| Apple | Yes |  |

**Question 3.1-3: In case of SL-specific drx-HARQ-RTT-Timer is not supported but to support SL-specific drx-RetransmissionTimer, which option should be selected as the starting time granularity of the SL-specific drx-RetransmissionTimer for Tx UE? Please give your comments.**

* **Option 1:** **The starting timing of SL-specific drx-RetransmissionTimer is referring to slot.**
* **Option 2: The starting timing of SL-specific drx-RetransmissionTimer is referring to symbol.**

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| **Companies** | **Option** | **Comments** |
| OPPO | Option 1 |  |
| Xiaomi | Option 2 | SL-specific retransmissin timer is running on Uu interface. So we prefer symbol granularity to aligned with Uu DRX. |
| LG | Option 1 | RAN2 agreed on the starting point of the RTT timer as the slot level (i.e., when PUCCH is transmitted). We prefer to apply the starting point of the retransmission timer to the slot level such as the RTT timer. |
| InterDigital | Option 2 | Should be the same as other Uu timers. |
| Ericsson | Option 2 | We share the same view as Xiaomi |
| vivo | Option 2 | Same comments as in Question 3.1-1 and Question 3.1-2. |
| Huawei, HiSilicon | Option 2 |  |
| Sharp | Option 2 |  |
| MediaTek | Option 2 |  |
| ZTE | Option 1 |  |
| Intel | Option 1 |  |
| Fraunhofer | Option 2 |  |
| Nokia | Option 2 |  |
| Qualcomm | Option 2 | Symbol based on Uu |
| Apple | Option 2 |  |

# Identified FFS/open issues from [Post114-e][706]

## FFS on the specific values of HARQ RTT that can be used for HARQ disabled case?

In RAN2#115-e meeting, RAN2 reached the below agreement [1]:

Proposal 10 – HARQ RTT is supported for both HARQ enabled and HARQ disabled cases by allowing HARQ RTT timer to be set to different values. FFS on the specific values that can be used for HARQ disabled case.

Based on the above agreement, it is still FFS when HARQ feedback is disabled, how to determine the value of HARQ RTT timer. In the email discussion [4], four options were given, but only seven companies gave their view on this issue. Hence in the current email discussion, RAN2 will further discuss this issue to gather more companies’ view on this question.

**Question 4.1-1:** **How to determine the value used for the HARQ RTT timer when HARQ feedback is disabled? Which option do you prefer? Please give your comments.**

* **Option 1: The value of zero.**
* **Option 2: The value of non-zero.**

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| **Companies** | **Option** | **Comments** |
| OPPO | Option 1 and option 2 | It is fully to network configuration and there is no need to fix.  The non-zero value is useful especially in mode-1 where the gNB may have no accurate information on the FB-disabled/enabled status which is dependent on LCH selection decision by Tx-UE. |
| Xiaomi | Both | We understand both options are possible depending on resource scheduing/selection implementation, as long as both TX UE and RX UE are aligned. |
| LG | Option 1 | If it is a non-zero value, there will be restrictions on R16 resource allocation. For example, there may be restrictions that prevent resource scheduling during the RTT timer. |
| InterDigital | Both |  |
| Ericsson | Option 1 | Share the same view as LG. Also, option 1 is most simple solution. In this case, it can be captured in the spec in a hard coded fashion. In addition, for option 2, how will the value be configured to the UE? Will UE apply the same value for both harq enabled and disabled cases? If not, how to configure/signal two different values in a same DRX configuration? |
| ASUSTeK | Option 1 and 2 | We think the value can be based on configuration. Another question that should be addressed is when to start HARQ RTT timer for a HARQ disabled transmisison. |
| vivo | Both | We think it doesn’t have to be fixed to 0. Alternatively, it can also be set to other values like the FB enabled case or derived based on SCI. It is worthwhile noting that, setting value to be zero does not impact the retransmission timer, i.e., the retransmission timer is started either immidutately or after HARQ RTT timer expires. |
| Huawei, HiSilicon | Both | Agree with Xiaomi. We think the selection of exact value is up to the implementation of TX UE or TX UE’s gNB. |
| Sharp | Option 1 | Share the same view with LG and Ericsson. |
| MediaTek | Both | Agree with Xiaomi. The non-zero value could be upd to network configuraiton. |
| ZTE | Option 1 and 2 | We think the value can be based on NW configuration. |
| Intel | Both | Agree with ZTE |
| Fraunhofer | Option 1 and option 2 |  |
| Nokia | Option 1 |  |
| Qualcomm | Op 1 and 2 |  |
| Apple | Both | Depends on TX UE is mode 1 or mode 2 |

## How to handle cases when a transmission may cause these timers to be running at the RX UE is FFS. FFS on groupcast. FFS on whether any spec impact (in agreement 14 and 15 in SL DRX timer maintenance).

In RAN2#115-e meeting, RAN2 reached the below agreement [1]:

14: For unicast, the TX UE selects the resources for the initial transmission associated with any active time (e.g. on duration timer or inactivity timer, or retransmission timer) at the RX UE. How to handle cases when a transmission may cause these timers to be running at the RX UE is FFS. FFS on groupcast. FFS on whether any spec impact.

15: For unicast, the TX UE can select the resources for the retransmission associated with any active time (e.g. on duration timer or inactivity timer, or retransmission timer) at the RX UE. How to handle cases when a transmission may cause these timers to be running at the RX UE is FFS. FFS on groupcast. FFS on whether any spec impact.

According to the above agreement 14 and agreement 15, for unicast, it is clear that no matter for initial transmission or retransmission, it can be sent when any of the DRX timers (including on-duration timer, inactivity timer or retransmission timer) is running at the Rx UE. In the rapporteur’s understanding, the first FFS (how to handle cases when a transmission may cause these timers to be running at the RX UE is FFS) is to address the case that the active time of Rx UE may be changed upon receiving transmission from Tx UE. In the rapporteur’s understanding, this FFS has some relationship with the “future active time” which was mentioned in the following agreement 13:

13: When data is available for transmission to one or more RX UE in DRX, TX UE selects the resources taking into account the active time (current or future) of the RX UE(s) determined by the timers maintained at the TX UE. Details are FFS. FFS whether RAN1 or RAN2 implement this restriction. Send LS to RAN1.

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. If RAN1 considered the current or future active time in RAN1, no further work is needed in RAN2. Since LS has been sent to RAN1, RAN2 had better wait for RAN1 LS reply before we discuss this issue further.

**Question 4.2-1: For sidelink unicast, do companies agree that RAN2 can wait for RAN1 LS reply before RAN2 discuss how to handle the cases when a transmission may cause these timers (inactivity timer or retransmission timer) to be running at the RX UE when mode 2 Tx UE performs resource selection? Please give your comments.**

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| **Companies** | **Yes/No** | **Comments** |
| OPPO | Yes | It is related to the general issue that whether RAN1 or RAN2 implement the restriction of SL DRX on resource selection, which can only be decided after RAN1’s reply. |
| Xiaomi | Yes |  |
| LG | Yes |  |
| InterDigital | No | The LS to RAN1 was on the restriction and not on the current/future active time. This aspect is a RAN2 discussion. |
| Ericsson | Yes |  |
| ASUSTeK | Yes |  |
| vivo | Yes |  |
| Huawei, HiSilicon | No | We have concern on the work progress if we still choose to wait at this stage. We prefer to have some discussion on RAN2 related aspects, e.g., whether to limit the retransmission grant to current active time. We think such kind of principles should be determined by RAN2. |
| Sharp | No | In our understanding, actions for RAN1 in the LS were for informing RAN2 how RAN1 intends to reflect the restriction already agreed. For the FFS part, it should be discussed first in RAN2. |
| MediaTek | Yes |  |
| ZTE | No |  |
| Intel | Yes |  |
| NEC | Yes |  |
| Fraunhofer | Yes |  |
| Nokia | Yes |  |
| Qualcomm | Yes | Need to know RAN1’s view on resource candidate selection. |
| Apple | No | RAN2 need discuss and find a solution. This is not a RAN1 issue |

**Question 4.2-2: If the answer of Question 4.2-1 is No, how to handle the cases when a transmission may cause these timers (inactivity timer or retransmission timer) to be running at the RX UE when mode 2 Tx UE performs resource selection? Which option do you prefer? Please give your comments.**

* **Option 1: Ensure all resources (transmission and retransmission) occur in the active time determined at the time of resource selection.**
* **Option 2: Ensure at least one (transmission, and possibly one or more retransmissions) occur in the active time determined in the active time at the time of resource selection.**

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| **Companies** | **Option** | **Comments** |
| InterDigital | Option 2 | If option 1 is selected, there would be no usefulness of the inactivity timer/retransmission times to begin with. RAN2 should discuss how many transmissions/retransmissions should be in the current active time. |
| Huawei, HiSilicon | Option 2 with comments | Initial transmission should be in current active time.  Retransmission can be in future active time. |
| Sharp | Option 2 | If option 1 is selected, we fail to understand how the RTT timer works, since every resource of a MAC PDU is within active time. |
| Apple | Option 2 | Only initial transmission need to be within the current active time. |

For the second FFS (FFS on groupcast), during the RAN2#115-e online session, some company raised that it is more complicated for groupcast scenario compared to unicast which is one to one mapping. The core concern is that for groupcast, there may be another Tx UE. The misalignment of the active time of Tx UE and Rx UE(s) may be more serious.

During the Phase I discussion, some companies thinks the active time definition for sidelink groupcast has not been discussed, but in the rapporteur’s understanding the agreement on active time definition reached in RAN2#113bis-e can be applied to both unicast and broadcast/groupcast:

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.

Hence, we can directly discuss whether the agreement reached for unicast can be reused for groupcast.

**Question 4.2-3: Do you agree that for groupcast, the same agreement (agreement 14 and agreement 15) reached for unicast can be reused? Please give your comments.**

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| **Companies** | **Yes/No** | **Comments** |
| OPPO | Yes |  |
| Xiaomi | Yes | Although the timer handling may be different for groupcast, the active time defined by on-duration, inactivty, retransmission timer, is the same as unicast. The same handling should be applied. |
| LG | Yes |  |
| InterDigital | Yes |  |
| Ericsson | No | Agreement 14 and 15 are adressing **when the UE can send transmission to RX UE**, **nothing about definition of active time**. Since there is FFS for groupcast, RAN2 of course needs further discussion. Theerfore, we think this question shall be delayed. |
| ASUSTeK | Yes |  |
| vivo | Yes with comments | We understand that the Question is asking about whether the active time definition for sidelink groupcast follows the same as unicast in agreement 14 and agreement 15. |
| Huawei, HiSilicon | Yes with comments | We agree with reusing the principle for groupcast as baseline. |
| Sharp | Yes |  |
| MediaTek | Yes |  |
| ZTE | Yes |  |
| Intel | Yes |  |
| NEC | No | Share the same view with Ericsson. |
| Fraunhofer | Yes |  |
| Nokia | No | Further discussion needed |
| Qualcomm | Yes/No comment | Yes, on principle.  No, The Rx UE(s) may not be known to a Tx UE, e.g., distance based groupcast. |
| Apple | No | Pending on how active time is defined for GC case.e.g, whether inactivity timer is used in GC. |

For the last FFS (FFS on whether any spec impact), one company raised concern that for the agreed proposal, whether the current Agreements 14&15 is separated with Agreement 13. Then the FFS part was added.

Agreements in RAN2#115-e:

13: When data is available for transmission to one or more RX UE in DRX, TX UE selects the resources taking into account the active time (current or future) of the RX UE(s) determined by the timers maintained at the TX UE. Details are FFS. FFS whether RAN1 or RAN2 implement this restriction. Send LS to RAN1.

14: For unicast, the TX UE selects the resources for the initial transmission associated with any active time (e.g. on duration timer or inactivity timer, or retransmission timer) at the RX UE. How to handle cases when a transmission may cause these timers to be running at the RX UE is FFS. FFS on groupcast. FFS on whether any spec impact.

15:For unicast, the TX UE can select the resources for the retransmission associated with any active time (e.g. on duration timer or inactivity timer, or retransmission timer) at the RX UE. How to handle cases when a transmission may cause these timers to be running at the RX UE is FFS. FFS on groupcast. FFS on whether any spec impact.

**Question 4.2-4: Regarding to the Agreements 14&15 for unicast, whether companies think there is specification impacts in RAN2?**

|  |  |  |
| --- | --- | --- |
| **Companies** | **There is/There isn’t** | **Comments** |
| OPPO | See comments | We understand agreement 13/14/15 are related to each other, and thus should wait for RAN1’s reply LS before deciding the spec impact of agreement 13/14/15 in RAN1 or RAN2. |
| Xiaomi | Comment | According to Q4.2-1, Ran2 should wait LS from RAN1. |
| LG | Comment | RAN2 discussion may depend on whether the physical layer indicates the candidate set of resources to the MAC layer considering the active time of the Rx UE or whether to indicate the candidate set of resources to the MAC layer without any restrictions such as a legacy procedure. Therefore, we have to wait for RAN1's decision. |
| InterDigital | There is | As answered in **Question 4.2-2**, if we do not specify anything, there seems to be no need for the timers we have defined in RAN2. |
| Ericsson | comment | Share the same view as other companies. RAN2 has to wait for RAN1’s LS reply. |
| ASUSTeK | Comment | Agree with other companies that RAN2 has to wait for RAN1’s reply. |
| vivo |  | Wait for LS response from RAN1. |
| Huawei, HiSilicon | There is | See the answer to Question 4.2-2 |
| Sharp | Comment | Agree with other companies that RAN2 has to wait for RAN1’s reply. |
| MediaTek | Comment | Wait for RAN1’s LS reply. |
| ZTE | Comment | We can wait for RAN1’s reply. |
| Intel |  | Ok to wait for RAN1 response |
| NEC | comment | Share the same view as other companies. RAN2 has to wait for RAN1’s LS reply. |
| Fraunhofer | Comment | The discussion would depend on the response of RAN1 to the LS. |
| Nokia |  | Agree with majority to wait for RAN1 |
| Qualcomm | Comment | Wait for RAN1’s LS, e.g., if the resource candidates are selected within the active time or not. |
| Apple | Yes. There is impact |  |

# Identified FFS/open issues from [AT115-e][702]

## What information is included in the assistance information from RX UE to TX UE?

RAN2 reached the below agreement in RAN2#115-e meeting [1]:

2: For SL unicast, RX UE may include its desired SL DRX configuration in the assistance information which is transmitted to TX UE.

But it is FFS what information should be included in the assistance information. Before RAN2 discuss what should be included in the assistance information, it should first make clear how the Rx UE determines its desired SL DRX configuration.

**Question 5.1-1: How does the Rx UE determine its desired SL DRX configuration? Please give your comments.**

* **Option 1: Up to Rx UE’s implementation.**
* **Option 2: It should consider TX UE’s traffic pattern.**
* **Option 3: It should consider the SL DRX configuration of the other PC5-S connections of this Rx UE.**
* **Option 4: It should consider the Uu DRX configuration of this Rx UE.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Option** | **Comments** |
| OPPO | Option 1 with comments | Both Option 3 and 4 can be already reflected by “desired SL DRX configuration”, and actually it is hard to specify how these factors impact the“desired SL DRX configuration” considering the uncertainty, e.g. the number/status of the existing DRX configuration for Uu and SL. Therefore it is feasible and much easier to leave it to UE implementation.  For option-2, it is not useful since logically, the TX traffic pattern reflect the desired DRX from Tx perspective, even if it is sent to Rx before Rx generating desired SL DRX configuration, it may still happen that the Tx/Rx desired is quite different/colliding so cannot be solved/harmonized. Then there is no clear motivation / necessity for option-2. |
| Xiaomi | Option 3 and 4 | For Option 2, TX UE’s traffic pattern is not available at RX UE.  RX UE could consider option 3 and 4 to derive the desired SL DRX configuration. However, RX UE could also derive the desired SL DRX configuration based on subset of these information, which means it’s unnecessary to madate RX UE to get all these information before determining the desired SL DRX configuration. |
| LG | Option 2, 3 and 4 | To generate desired SL DRX configuration on the RX side, the RX UE needs to know options 2, 3, 4, and other information(e.g., QoS profile). The final desired SL DRX configuration will be made by RX UE implementation.  But, option 2 has a spec impact on the TX side. And Option 3 and 4 don’t have any spec impact. |
| InterDigital | Option 2, 3, and 4 | We think all of this information would be useful for the RX UE to use. |
| Ericsson | Option 1 | Share the same view as OPPO. In addition, it is the TX UE that takes the final decision on how to configure SL DRX. It is sufficient for TX UE to consider traffic pattern and/or Rx UE’s information on preference of power saving. It is not mandatory for TX UE to must provide TX traffic pattern to RX UE. |
| ASUSTeK | Option 1 | Agree with OPPO and Ericsson. |
| vivo | Option 1 | For Option 2, we think it is only known to TX UE and thus only considered by TX UE when configuring appropriate SL DRX to RX UE.  For Option 3 and Option 4, we think they are both useful. Besides, there are also many other factors at the RX UE that may be taken into account e.g., the power saving preference and the service QoS profiles. It is not realistic to exhaustively specify all factors. Thus, we suggest to adopt Option 1 i.e., leave it to RX UE implementation. |
| Huawei, HiSilicon | Option 1 | Considering the spec impact, we think option1 is sufficient from the perspective of RX UE. |
| Sharp | Option 1 | Agree with OPPO and Ericsson. |
| MediaTek | Option 1 | Share same view with OPPO and Ericsson. |
| ZTE | Option 3 and 4 | Agree with Xiaomi, for Option 2, TX UE’s traffic pattern is not available at RX UE. According to our understanding, since the UE assistant information is provided by the RX UE and SL DRX configuration is decided by the TX UE, the RX UE shall carry all the information that can help decide SL DRX configuration in the assistant information, then the TX UE can decide SL DRX configuration based on the assistant information and its traffic pattern. |
| Intel | Option 1 | It seems straightforward that option 3 and 4 can already be handled by Option 1 |
| NEC | Option 1 | Considering the desired SL DRX configuration from Rx UE is an optional **assistance** information and finally the Tx UE will determine the SL DRX configuration, we prefer to leave it to Rx UE implementation.  Either or not to consider other SL DRX configuration/Uu DRX configuration is up to Rx UE implementation. |
| Fraunhofer | Option 3 and Option 4 | The RX UE should be aware of the DRX configuration of the other established PC5 connections as well as the Uu DRX configuration. The RX UE can then choose from the subset of known DRX configurations a suitable one. |
| Nokia | Option 1 |  |
| Qualcomm | Option 1 | It may be based on 2, 3, 4, and/or others, but up to Rx UE’s implementation. |
| Apple | Option 3,4 | Agree with Xiaomi and ZTE |

And then, it should further discuss whether the desired SL DRX configuration in the assistance information is defined by the conventional SL DRX parameters.

**Question 5.1-2: Do companies agree that the desired SL DRX configuration in the assistance information is defined by the conventional SL DRX parameters (e,g, DRX cycle, onduration timers, RTT timers and etc)? Please give your comments.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes/No** | **Comments** |
| OPPO | Yes | How the parameters are provided can be further discussed. |
| Xiaomi | Yes, with comments | One question needs to clarify is whether the desired SL DRX configuration is one set of SL DRX parameters or could be multiple sets.  According to our answer to Q5.1-1, the active time determiend by Uu DRX and other SL DRX could be desired SL DRX. However, the DRX cycle, start offst and on-duration timer may be different in Uu DRX and other SL DRX configuration. So, it’s difficult to derive one set of DRX configuration to cover all active time determined by Uu DRX and other SL DRX.  We prefer to send multiple sets of SL DRX configuration which could cover the acitve time determined by Uu DRX and other SL DRX. |
| LG | Yes, with comment | DRX cycle, DRX cycle offset and on-duration values should be included in desired DRX configuration at least.  The DRX cycle and on-duration values are related to the average RX power consumption. And the values are semi- static values. But, the other DRX related parameters, for example, inactivity timer, retransmission timer, or RTT timers, are seemed to be values related to the QoS value on the TX side. |
| InterDigital | Yes, but | There may be a need for only a subset of the parameters, and further, the RX UE may need to provide multiple of these sets to the TX UE. |
| Ericsson | Yes | RAN2 perhaps no need to overspecify every detail in the assistance information. It is sufficient to capture in the spec that the assistance information may contain one or multiple SL DRX configuration, which may contain all parameters of the DRX configuration. Eventally, it is up to TX UE’s implementation or TX UE’s gNB implementation on how to determine the final SL DRX configuration. |
| ASUSTeK | Yes |  |
| vivo | Yes with comments | Generally, we are OK with intention of this Question. But we think the key point is that we need to decide whether the RX UE can suggest any SL DRX parameters as it wishes, or only some of them can be included in the assistance information by RX UE. |
| Huawei, HiSilicon | Yes |  |
| Sharp | Yes |  |
| MediaTek | Yes |  |
| ZTE | Yes |  |
| Intel | Yes |  |
| NEC | Yes | From the framework point of view, the answer is yes. If the Rx UE has no preference or requirement on some parameters, then the Rx UE does not include them in the assitance informatiom. It is up to Rx UE implementation. |
| Fraunhofer | Yes |  |
| Nokia | Yes |  |
| Qualcomm | Yes |  |
| Apple | Yes with comment | We agree with InterDigital that this could be a subset of parameters |

**Question 5.1-3: If the answer of the Question 5.1-2 is No, please give your detailed description on how to define the desired SL DRX configuration in the assistance information?**

|  |  |
| --- | --- |
| **Companies** | **Please give your detailed description on how to define the desired SL DRX configuration in the assistance information** |
|  |  |
|  |  |
|  |  |

**Question 5.1-4: If the answer of the Question 5.1-2 is Yes, whether the onduration timer should be included in the RX UE’s desired SL DRX configuration? Please give your comments.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes/No** | **Comments** |
| OPPO | Yes |  |
| Xiaomi | Yes | There could be multiple onduration timers, each is equal to onduration timer in Uu DRX and other SL DRX configuration. |
| LG | Yes |  |
| InterDigital | No | The purpose of UE assistance is for alignment of the DRX cycles. This is more to do with the offset than any other parameter. |
| Ericsson | Yes | See our comments for **Question 5.1-2** |
| ASUSTeK | Yes |  |
| vivo | Yes | It is useful from RX UE power saving purpose. |
| Huawei, HiSilicon | Yes |  |
| Sharp | Yes |  |
| MediaTek | Yes |  |
| ZTE | Yes |  |
| Intel | Yes |  |
| NEC | Yes | See our comments for **Question 5.1-2** |
| Fraunhofer | Yes |  |
| Nokia | Yes |  |
| Qualcomm | Yes |  |
| Apple | Yes | onDuration/DRX-cycle ratio determines the power-efficiency. RX UE need have a say on this. |

**Question 5.1-5: If the answer of the Question 5.1-2 is Yes, whether the DRX start offset should be included in the RX UE’s desired SL DRX configuration? Please give your comments.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes/No** | **Comments** |
| OPPO | Yes |  |
| Xiaomi | Yes | There could be multiple DRX start offsets, each is equal to start offsets in Uu DRX and other SL DRX configuration. |
| LG | Yes | Refer to our answer on the question 5.1-2 |
| InterDigital | Yes |  |
| Ericsson | Yes | See our comments for **Question 5.1-2** |
| ASUSTeK | Yes |  |
| vivo | Yes | Offset can be suggested by RX UE to align the starting time of all SL DRX configuration at RX UE for power saving gain as much as possible.. |
| Huawei, HiSilicon | Yes |  |
| Sharp | Yes |  |
| MediaTek | Yes |  |
| ZTE | Yes |  |
| Intel | Yes |  |
| NEC | Yes | See our comments for **Question 5.1-2** |
| Fraunhofer | Yes |  |
| Nokia | Yes |  |
| Qualcomm | Yes |  |
| Apple | Yes |  |

**Question 5.1-6: If the answer of the Question 5.1-2 is Yes, whether the DRX cycle should be included in the RX UE’s desired SL DRX configuration? Please give your comments.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes/No** | **Comments** |
| OPPO | Yes |  |
| Xiaomi | Yes | There could be multiple DRX cycles, each is equal to DRX cycles in Uu DRX and other SL DRX configuration. |
| LG | Yes | Refer to our answer on the question 5.1-2 |
| InterDigital | Yes |  |
| Ericsson | Yes | See our comments for **Question 5.1-2** |
| ASUSTeK | Yes |  |
| vivo | Yes | However, unreasonable DRX parameters proposed by RX UE can be ignored for example in casethat DRX cycle lengthsuggested is much larger than the PDB (Packet Delay Budget in QoS profile) and so on. |
| Huawei, HiSilicon | Yes |  |
| Sharp | Yes |  |
| MediaTek | Yes |  |
| ZTE | Yes |  |
| Intel | Yes |  |
| NEC | Yes | See our comments for **Question 5.1-2** |
| Fraunhofer | Yes |  |
| Nokia | Yes |  |
| Qualcomm | Yes |  |
| Apple | Yes |  |

**Question 5.1-7: If the answer of the Question 5.1-2 is Yes, whether the drx-inactivity timer should be included in the RX UE’s desired SL DRX configuration? Please give your comments.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes/No** | **Comments** |
| OPPO | Yes |  |
| Xiaomi | No | Inactivity timer is more related to traffic pattern, e.g. data arrival interval. This information is not available at RX UE. Furthermore, the inactivity timer is triggered in dynamical manner. We don’t see the need to align this timer with other DRX configuration. |
| LG | No | Refer to our answer on the question 5.1-2 |
| InterDigital | No | See answer to 5.1-4 |
| Ericsson | Yes | See our comments for **Question 5.1-2** |
| ASUSTeK | Yes |  |
| vivo | No | It is related to TX UE traffic pattern and can only be considered at the TX UE side. |
| Huawei, HiSilicon | No | In principle, inactivity timer is related to traffic pattern/scheduling decision, we don’t think RX UE should/could have a say on this. We can discuss the implications on the spec. |
| Sharp | Yes |  |
| MediaTek | Yes |  |
| ZTE | Yes | The inactivity timer may be related to UE power saving requirement which shall be decided by the RX UE. |
| Intel | Yes |  |
| NEC | Yes | See our comments for **Question 5.1-2** |
| Fraunhofer | Yes |  |
| Nokia | Yes |  |
| Qualcomm | Yes |  |
| Apple | Yes | The inactivity timer is related to UE power efficiecny which shall be decided by the RX UE. |

**Question 5.1-8: If the answer of the Question 5.1-2 is Yes, whether the HARQ RTT timer should be included in the RX UE’s desired SL DRX configuration? Please give your comments.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes/No** | **Comments** |
| OPPO | Yes |  |
| Xiaomi | No | RTT timer is more related to transmission resource pool configuration. This information is not available at RX UE. Furthermore, the RTT timer is triggered in dynamical manner. We don’t see the need to align this timer with other DRX configuration. |
| LG | No | Refer to our answer on the question 5.1-2 |
| InterDigital | No | See answer to 5.1-4 |
| Ericsson | Yes | See our comments for **Question 5.1-2** |
| ASUSTeK | Yes |  |
| vivo | NO | It is related to the TX UE resource allocation and can only be considered at the TX UE side. |
| Huawei, HiSilicon | No | In principle, RTT timer value is related to transmitter side processing latency, we don’t think RX UE should/could have a say on this either. We can discuss the implications on the spec. |
| Sharp | Yes |  |
| MediaTek | Yes |  |
| ZTE | No |  |
| Intel | Yes |  |
| NEC | Yes | See our comments for **Question 5.1-2** |
| Fraunhofer | Yes |  |
| Nokia | Yes |  |
| Qualcomm | Yes |  |
| Apple | No | In our view, the mode 2 HARQ RTT timer value isis solely provided in SCI, so there is no need to be configured by TX UE or RX UE. For mode 1, it is better for TX UE to decide. |

**Question 5.1-9: If the answer of the Question 5.1-2 is Yes, whether the HARQ retransmission timer should be included in the RX UE’s desired SL DRX configuration? Please give your comments.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes/No** | **Comments** |
| OPPO | Yes |  |
| Xiaomi | No | Retransmission timer is more related to transmission resource pool configuration and resource selection/scheduing implementation. This information is not available at RX UE. Furthermore, the retransmission timer is triggered in dynamical manner. We don’t see the need to align this timer with other DRX configuration. |
| LG | No | Refer to our answer on the question 5.1-2 |
| InterDigital | No | See answer to 5.1-4 |
| Ericsson | Yes | See our comments for **Question 5.1-2** |
| ASUSTeK | Yes |  |
| vivo | No | It is related to the TX UE resource allocation and can only be considered at the TX UE side. |
| Huawei, HiSilicon | No |  |
| Sharp | Yes |  |
| MediaTek | Yes |  |
| ZTE | No |  |
| Intel | Yes |  |
| NEC | Yes | See our comments for **Question 5.1-2** |
| Fraunhofer | Yes |  |
| Nokia | No |  |
| Qualcomm | Yes |  |
| Apple | Yes |  |

## Need of SL DRX assistance information REQ from TX UE to RX UE?

During the email discussion for this issue [5], 16 of 21 companies agreed that the SL DRX assistance information request message is not supported. The proponent of SL DRX assistance information REQ raised that without this procedure, the RX UE can’t set the desired/suggested DRX configuration and the RX UE can’t know if TX UE supports SL DRX or not. But no final conclusion was reached. Hence, this issue should be further discussed in this email discussion.

**Question 5.2-1: Whether it is necessary to introduce the SL DRX assistance information request from Tx UE to Rx UE? Please give your comments.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes/No** | **Comments** |
| OPPO | No |  |
| Xiaomi | No | RX UE can know TX UE’s capability via sidelink capability exchange. Therefore, RX UE could initiate the assistance informantion without request from TX UE. |
| LG | Yes, with comment | When traffic pattern information is changed on the TX side and the TX UE needs to receive desired DRX from RX UE, a procedure is required to get desired DRX from RX UE. The TX UE may request the desired DRX configuration to the RX UE explicitly via request message. Or, when the TX UE transmits traffic pattern information to the RX UE, the RX UE may interpret it implicitly the TX UE needs desired DRX. Anyway, a proper mechanism will be required for the TX UE to get desired DRX configuration from RX UE even though whether implicitly or explicitly. |
| InterDigital | Yes | We think if we support option 2 of Q5.1-1, this is needed. |
| Ericsson | No | As we commented in previous question, it is sufficient to leave to RX UE implementation on how to determine content of assistance information. Introduction of request message will increase design efforts for RAN2, however, the gain is unclear. |
| ASUSTeK | No | To reduce the standardization efforts, REQ is not needed. Upon having preference (and change of preference) on DRX parameters, the Rx UE could actively send the assistance information. |
| vivo | No | We don’t see the need to introduce the SL DRX assistance information request from TX UE to RX UE. The TX UE can send the SL DRX configuration to RX UE at anytime regardless of receiving the SL DRX assistance information or not. Potential solution on the FFS issue on the interpretation if assistance information is not provided is enough. |
| Huawei, HiSilicon | Yes | In Uu, the gNB can request the UE to provide Uu DRX related assistance information via RRCReconfiguration message. It is reasonable to follow this mechanism in sidelink, especially when the SL DRX configuration is generated by TX UE’s gNB, where the gNB shall be able to ask TX UE to acquire up to date assistance information from RX UE.  In other words, the legacy UE Assistance Information related behaviour is that, when gNB needs UAI and it will request and obtain “immediately” UAI from UE (at least for initial configuration). Without TXUE able to “request” SL DRX assistance information from RXUE, gNB would have to wait for some time for such SL DRX assistance information. We think this could lead to inconsistent UAI behaviour, especially for the case when gNB is to determine the SL DRX configuration.  In Uu the gNB can decide whether/when to send Uu DRX configuration to the UE and the gNB can send the Uu DRX configuration after the UE reports the ability of supporting Uu DRX, which means that the Uu DRX operation is initiated by the gNB. This principle shall be applicable to sidelink DRX meaning that the SL DRX operation should be initiated by TX UE. Accordingly, SL DRX assistance information request should be supported to enable TX UE to initiate the SL DRX configuration/operation.  Further, from the perspective of RRC CR rapporteur, we couldn’t see difficulties to implement “Request” via a “Configuration”, as this is similiar to Uu implementation. |
| Sharp | No |  |
| MediaTek | No | Rx UE can send the assistance information whenever needed, e.g., if Rx UE has preference change. A request message seems unnecessary. |
| ZTE | No | In our opinion, whether needing configure SL DRX to acquire power saving is the requirement of the RX UE, so whether configure SL DRX shall be decided by the SL DRX. If the TX UE does not configure SL DRX and the RX UE wants to configure SL DRX, or SL DRX configuration is not suitable and the RX UE wants to change it, it can send the SL DRX assistance information to the TX UE to configure or update the SL DRX. Thus, if RX UE does not want to configure or change current SL DRX, there is no need to send assistance information to the TX UE. That means if the TX UE does not have assistant information from RX UE, it does not need to configure SL DRX for the RX UE. We can see no reason why the TX UE need to send SL DRX assistance information request to the RX UE. |
| Intel | No | If provision of SL DRX assistance information is not mandatory, we do not think a request message needs to be defined. |
| NEC | No | The benefit of the SL DRX assistance information request from Tx UE to Rx UE is not clear. Obviously, introducing such a request will increase signalling overhead and delay. |
| Fraunhofer | No | We have a similar understanding as vivo. |
| Nokia | No |  |
| Qualcomm | No | No need to add a new message for a message which is optional. |
| Apple | Yes | If TX UE does not suport SL-DRX, the RX UE may not need to be bothered with generate asistacne information for DRX configuration at all. So, we think a REQ message is needed. RAN2 need specify the exact triggering conditons of assistance information procedure. |

## If SL DRX assistance information REQ is needed, what information is included?

If the answer of Question 5.2-1 is Yes, it should further discuss what information should be contained in the SL DRX assistance information request message.

**Question 5.3-1: If the answer of Question 5.2-1 is Yes, what information should be included in the SL DRX assistance information REQ message? Which option do you prefer? Please give your comments.**

* **Option 1: A request for SL DRX assistance information.**
* **Option 2: Traffic pattern information of the TX UE.**
* **Option 3: QoS information of the sidelink service(s) from Tx UE to Rx UE.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Option** | **Comments** |
| LG | Option 1 or 2 | Refer our answer on the question 5.2-1 |
| InterDigital | Option 2, 3 | The request for assistance could be considered implicit. |
| Huawei, HiSilicon | Option 1 | Both assistance information from RX UE and the traffic pattern can be used for TX UE to determine the SL DRX configuration. It is enough to taking this traffic pattern into account by TX UE itself.  QoS information would have been exchanged already via PC5-S signal between UEs for unicast connection, so not needed in the request. |
| Apple | Option 1 |  |

## FFS on the interpretation if assistance information is not provided?

In RAN2#115-e meeting, RAN2 reached the below agreement [1]:

1: For determining SL DRX configuration by TX UE, SL DRX capable RX UE is not mandatory to provide the SL DRX assistance information to TX UE. FFS on the interpretation if assistance information is not provided.

During the RAN2#115-e online session, some company raised concern that if the assistance information is not provided, it is not clear whether TX UE considers that RX UE does not want DRX operation or RX UE is ok with any DRX configuration. Hence, the above FFS part was added as a compromise.

**Question 5.4-1: When TX UE doesn’t receive any assistance information from RX UE, how to interpret it in Tx UE? Which option do you prefer? Please give your comments.**

* **Option 1: TX UE considers that RX UE does not want DRX operation.**
* **Option 2: TX UE considers that RX UE is ok with any DRX configuration.**
* **Option 3: TX UE considers that RX UE has not decided the desired DRX configuration yet.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Option** | **Comments** |
| OPPO | Option 1,2,3 with comment | Although we do not quite understand the difference between option-1 and 2. |
| Xiaomi | Option 2 | We understand option 2 is more logical. The motivation of option 1 is not clear to us. If RX UE is SL DRX capable, it is no harm to configure SL DRX to save power consumption. Even if RX UE really doesn’t want DRX, RX UE is still allowed to reject the DRX configuraiton. |
| LG | Option 2 | We think option 2 includes option 1. Option 2 can mean that RX UE doesn’t care to get any DRX configuration from TX UE. Or even more, it can mean RX UE doesn’t need any DRX configuration. |
| InterDigital | Option 2 |  |
| Ericssnon | Option 2 | Option 2 is more logical in this case, RX UE DRX configuration is fully up to TX UE’s decision. |
| ASUSTeK | Option 2 |  |
| vivo | Option 2 |  |
| Huawei, HiSilicon | Option 2 |  |
| Sharp | Option 2 |  |
| MediaTek | Option 2 |  |
| ZTE | Option 2 |  |
| Intel | Option 2 |  |
| NEC | Option 2 | When the Rx UE has no preference/requirement on the SL DRX configuration, the assistenace information is not needed. |
| Fraunhofer | Option 2 | As per our understanding Option 1 is covered by option 2. It can very well be the case that the RX UE does not need a DRX configuration. |
| Nokia | Option 2 |  |
| Qualcomm | Option 2 |  |
| Apple | See comment | If we choose option 2, does it mean the RX UE will never reject TX UE’s proposed SL-DRX confifguration? If we are not sure about that. then, there is no point to debate on Option1 or 2. Bascially, the RX UE will indicate its real intention later in the response of TX UE’s Reconfiguration message. Or we can introduce REQ message to force RX UE to disclose its intention clearly. |

## Open issues when Rx UE rejects the SL DRX configured by Tx UE?

This section covers the below three issues:

10) FFS on the following TX/RX UE behaviours when reject happens, 11) FFS on whether the new rejection cause for SL DRX needs to be defined, 12) FFS on whether RRCReconfigurationFailureSidelink or RRCReconfigurationCompleteSidelink is used in Step 2,

In RAN2#115-e meeting, it was agreed that [1]:

4: For unicast, a two-step process (i.e., RX UE accepts or rejects TX UE’s suggestion) is adopted as a baseline, i.e., FFS on the following TX/RX UE behaviours when reject happens.

• Step 1: TX UE sends RRCReconfigurationSidelink containing a SL DRX configuration to be applied by RX UE to RX UE

• Step 2: RX UE replies with a PC5-RRC signalling indicating acceptance or rejection for the SL DRX configuration. FFS on whether the new rejection cause for SL DRX needs to be defined. FFS on whether RRCReconfigurationFailureSidelink or RRCReconfigurationCompleteSidelink is used in Step 2.

When the SL DRX configuration is included in the *RRCReconfigurationSidelink* message, but the Rx UE rejects it, what is the Rx UE behaviour should be discussed.

**Question 5.5-1: When the Rx UE rejects the SL DRX configuration included in the RRCReconfigurationSidelink, which PC5-RRC signaling should be sent from Rx UE to Tx UE? Which option do you prefer? Please give your comments.**

* **Option 1: *RRCReconfigurationFailureSidelink*.**
* **Option 2: *RRCReconfigurationCompleteSidelink*.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Option** | **Comments** |
| OPPO | Option 2 |  |
| Xiaomi | Option 2 | Both could wok. But we prefer to include the reject indication in ***RRCReconfigurationCompleteSidelink***. ***RRCReconfigurationFailureSidelink*** is only transmitted upon sidelink configuration failure. |
| LG | Option 1 | Both could work. But we prefer to option 1. it seems to be awkward that the complete message includes a reject message. |
| InterDigital | Option 2 | There could be other parameters we may want to configured with the same reconfiguration message. |
| Ericsson | Option 1 |  |
| ASUSTeK |  | Both can work. Can follow majority. |
| vivo | Option 1 | Currently, *RRCReconfigurationFailureSidelink* is used due to SL radio bearer configuration failure. When the Rx UE rejects the SL DRX configuration, we think it means thatSL DRX configuration fails. From this perspective, SL DRX configuration failure is just another failure type and the same RRC message should be used. |
| Huawei, HiSilicon | Option 2 | According to the existing logic of configuration failure, the *RRCReconfigurationFailureSidelink* message is used only if the UE “is unable to comply with (part of) the configuration ...”. In the case that UE rejects the SL DRX configuration, we think it is different concept from “unable to comply with”. Therefore, we don’t think reconfiguration failure procedure should be used here. |
| Sharp | Option 2 |  |
| MediaTek | Option 2 |  |
| ZTE | Option 2 |  |
| Intel |  | Either option can work since it ultimately depends on the contents of the message |
| NEC | Option 2 | The SL DRX may not be mandatory. We agree with Xiaomi that it is necessary to distingusih faliure case and DRX rejection case. |
| Fraunhofer | Option 2 |  |
| Nokia | Option 1 |  |
| Qualcomm | Option 1 | Rejecting is a cause of failed to configurate. |
| Apple | Option 1 | It is bette for UE to incldue some addtional information to help TX UE to propose a new configuration whichis more suitable, |

If Option 1 is selected for Question 5.5-1, according to TS38.331, the contents of *RRCReconfigurationFailureSidelink* are as below:

|  |
| --- |
| – *RRCReconfigurationFailureSidelink*  The *RRCReconfigurationFailureSidelink* message is used to indicate the failure of a PC5 RRC AS reconfiguration. It is only applied to unicast of NR sidelink communication.  Signalling radio bearer: SL-SRB3  RLC-SAP: AM  Logical channel: SCCH  Direction: UE to UE  ***RRCReconfigurationFailureSidelink* message**  -- ASN1START  -- TAG-RRCRECONFIGURATIONFAILURESIDELINK-START  RRCReconfigurationFailureSidelink ::= SEQUENCE {  rrc-TransactionIdentifier-r16 RRC-TransactionIdentifier,  criticalExtensions CHOICE {  rrcReconfigurationFailureSidelink-r16 RRCReconfigurationFailureSidelink-IEs-r16,  criticalExtensionsFuture SEQUENCE {}  }  }  RRCReconfigurationFailureSidelink-IEs-r16 ::= SEQUENCE {  lateNonCriticalExtension OCTET STRING OPTIONAL,  nonCriticalExtension SEQUENCE {} OPTIONAL  }  -- TAG-RRCRECONFIGURATIONFAILURESIDELINK-STOP  -- ASN1STOP |

According to the above message, there is no failure cause indication in the *RRCReconfigurationFailureSidelink*. If Rx UE rejects the SL DRX configuration, whether new rejection cause should be introduced inthe *RRCReconfigurationFailureSidelink* can be further discussed.

**Question 5.5-2: If Option 1 is selected for Question 5.5-1, when the Rx UE rejects the SL DRX configuration included in the *RRCReconfigurationSidelink*, whether new rejection cause for SL DRX should be introduced in the *RRCReconfigurationFailureSidelink* message? Please give your comments.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes/No** | **Comments** |
| Ericsson | Yes | A new reason would help the TX UE to understand why the rejection was triggered. |
| vivo | Yes | Agree with Ericsson. And the new rejection cause is not mandatory. When the new rejection cause is not included in the *RRCReconfigurationFailureSidelink* message, it can be interpreted as the legacy SL radio bearer configuration failure. |
| Nokia | Yes |  |
| Qualcomm | Yes | A new reason code |
| Apple | Yes |  |

**Question 5.5-3: If Option 1 is selected for Question 5.5-1, when the Rx UE rejects the SL DRX configuration included in the *RRCReconfigurationSidelink*, besides the new rejection cause for SL DRX, whether other information can be included in the *RRCReconfigurationFailureSidelink* message?**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes/No** | **Comments** |
| Ericsson | No | It is sufficient to only indicate rejection reason in this release. Any additional information would increase design complexity, since RAN2 needs to define UE behaviors for each indicated new information element. |
| vivo | No | Additional information can be delivered by the SL DRX assistance information message. It is redundant to introduce the same content in two different RRC messages. |
| Nokia | No |  |
| Qualcomm | No | Keep it simple. |
| Apple | Yes | If UE can give addtiaonl information, the nit can save the overhead to send another assistance information message. |

If Option 1 is selected for Question 5.5-1, it should further discuss what are the Tx UE behaviors upon receiving the *RRCReconfigurationFailureSidelink*. According to the description in TS38.331, in Rel-16 V2X, the corresponding UE behaviors are as below:

|  |
| --- |
| 5.8.9.1.8 Reception of an *RRCReconfigurationFailureSidelink* by the UE  The UE shall perform the following actions upon reception of the *RRCReconfigurationFailureSidelink*:  1> stop timer T400 for the destination, if running;  1> continue using the configuration used prior to corresponding *RRCReconfigurationSidelink* message;  1> if UE is in RRC\_CONNECTED:  2> perform the sidelink UE information for NR sidelink communication procedure, as specified in 5.8.3.3 or sub-clause 5.10.15 in TS 36.331 [10]; |

**Question 5.5-4: If Option 1 is selected for Question 5.5-1, once the Tx UE received the *RRCReconfigurationFailureSidelink*，what is the Tx UE behavior? Which option do you prefer? Please give your comments.**

* **Option 1: Fully reuse the legacy Tx UE behaviors.**
* **Option 2: Tx UE applies the the parameters other than SL DRX which is included in the RRCReconfigurationSidelink, but continue using the SL DRX configuration used prior to corresponding RRCReconfigurationSidelink message if present.**
* **Option 3: Tx UE restarts the T400 and resends the RRC reconfiguration including a new DRX configuration.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Option** | **Comments** |
| LG | Option 2 and 3 | When TX UE receives the RRCReconfigurationFailureSidelink message, the TX UE keeps using the previous SL DRX configuration. In addition, the TX UE restarts the T400 timer and resends a new DRX configuration to the RX UE. The number of trials to provide a new DRX configuration to the RX UE can be pre-defined. |
| Ericsson | Option 2 and Option 4 | The option 4 is reffering to the option that Xiaomi added for **Question 5.5-6** |
| vivo | Option 2 with comments | Option 1 is applicable when only SL radio bearer configuration happens, therefore it should be excluded.  Regarding Option 3, we think different UE behaviors may happen at the TX UE side. For example, when the TX UE is in RRC CONNECTED, it should firstly report the SL DRX failure to the gNB as it is the gNB that is responsible for the SL DRX configuration. And then Option 3 would be performed only if the gNB sends the updated SL DRX configuration to the TX UE. While when the TX UE is in RRC\_IDLE or RRC\_INACTIVE, it is up to TX UE whether to perform Option 3 additionally. Relying on Option 2 with using the prior SL DRX configuration can be the baseline procedure. |
| Nokia | Option 2 |  |
| Qualcomm | Option 2 and others | Yes to option 2.  Others: may notice gNB if IC;  Op 3 is generally OK, but up to Tx UE’s implementation based on Rx UE’s Assistance info. |
| Apple | Option 2 |  |

If Option 2 is selected for Question 5.5-1, it should further clarify how the Tx UE aware the sidelink DRX rejection. As rapporteur thinks, in order to solve this question, some additional indication in the *RRCReconfigurationCompleteSidelink* message can be enhanced, and the Tx UE’s behavior for how to handle this new added indication is also needed.

**Question 5.5-5: If Option 2 is selected for Question 5.5-1, when the Rx UE rejects the SL DRX configuration included in the *RRCReconfigurationSidelink*, whether indication of SL DRX configuration rejection should be introduced in the *RRCReconfigurationCompleteSidelink* message? Please give your comments.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes/No** | **Comments** |
| OPPO | Yes |  |
| Xiaomi | Yes | Reject indicaiton should be included. |
| InterDigital | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Sharp | Yes |  |
| MediaTek | Yes |  |
| ZTE | Yes |  |
| Intel | Yes |  |
| NEC | Yes |  |
| Fraunhofer | Yes |  |

The current Tx UE behaviors upon receiving the *RRCReconfigurationCompleteSidelink* message are listed as below:

|  |
| --- |
| 5.8.9.1.9 Reception of an *RRCReconfigurationCompleteSidelink* by the UE The UE shall perform the following actions upon reception of the *RRCReconfigurationCompleteSidelink*:  1> stop timer T400 for the destination, if running;  1> consider the configurations in the corresponding *RRCReconfigurationSidelink* message to be applied. |

**Question 5.5-6: If Option 2 is selected for Question 5.5-1 and Yes is answered for Question 5.5-5, once the Tx UE received the *RRCReconfigurationCompleteSidelink* message，what is the Tx UE behavior? Which option do you prefer? Please give your comments.**

* **Option 1: Fully reuse the legacy Tx UE behaviors.**
* **Option 2: Tx UE applies the parameters other than SL DRX which is included in the RRCReconfigurationSidelink, but continue using the SL DRX configuration used prior to corresponding RRCReconfigurationSidelink message if present.**
* **Option 3: Tx UE restarts the T400 and TX UE resends the RRC reconfiguration including a new DRX configuration.**
* **Option 4: CONNECTED TX UE informs DRX rejection to gNB**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Option** | **Comments** |
| OPPO | Option 2 | For option-3, it is surely needed if Tx-UE is to send a new DRX configuration, but it is legacy Tx UE behavior, i.e., align with Option-1, and no need to mention here since it is already in the legacy spec. |
| Xiaomi | Option 2 and 4 | Option 1 is incorrect, since RX UE would not apply DRX configuraiton.  Option 3 is infeasible, since CONNECTED TX UE shall wait for gNB’s configuration, so can’t immediately resend new DRX configuration.  Furthermore, we understand CONNECTED UE should inform the rejection to gNB, since the SL DRX is configured by gNB as option 4. |
| InterDigital | At least Option 2 | We should first discuss whether the RX UE can send additional information in addition to the rejection. |
| Huawei, HiSilicon | Option 1 and Option 4 | Connected UE should inform this to gNB so that gNB is able to update the SL DRX configuration. Idle/inactive UE can reuse the legacy UE behaviour and update the SL DRX configuration later.  Regarding the TX and RX UE handling, we think there can be two options:   1. Apply the SL DRX configuraiton, even if it is not what the RX UE desires; 2. Apply previous configuraiton, i.e., using SL DRX configuraiton used prior to corresponding *RRCReconfigurationSidelink* message if present.   Option b) is the Option 2 listed above. In this case, if it is the first SL DRX configuraiton, it means the UEs should perform SL communicaiton wihtout SL DRX, which is not power efficient. In practice, TX UE or TX UE’s gNB updates SL DRX parameters if the previous configuraiton is no longer good. Under this assumption, we think it is better to apply the newly received SL DRX configuration. |
| Sharp | Option 2 |  |
| MediaTek | Option 2 |  |
| ZTE | Option 2 and Option 4 | If the RX UE rejects this SL DRX configuration,it may assume that the RX UE continue to use this valid SL DRX before.  If there is no valid SL DRX before, the Rx UE may use default SL DRX. After that, the TX UE can update the SL DRX configuration based on the assistant information and send again.  Option 4 is also needed since the gNB shall know the SL DRX configuration of the RX UE that can help allocate SL resource for the TX UE configured with mode 1. |
| Intel | Option 2 |  |
| NEC | See comments | If there is a DRX configuration applied between the TX and RX UEs pair, then the TX UE can continue using it, i.e., Option 2. If the SL DRX operation is not applied yet, the selection of option 1,3,4 can be left to TX UE implementation. |
| Fraunhofer | Option 2 |  |

# Identified FFS/open issues from [AT115-e][703]

## Need of down-selection for SL DRX configuration when multiple QoS profiles are associated for same DST L2 ID?

Regarding to the SL DRX configuration for BG/CG, the following agreements were reached in the past RAN2 meetings:

**RAN2#114:**

4: For GC/BC, DRX cycle is configured per QoS profile.

5a: For GC/BC, RAN2 understands that sl-drx-startoffset does not take QoS requirement into consideration.

5b: For GC/BC, For GC/BC, sl-drx-startoffset is set based on DST L2 ID.

**RAN2#115:**

2: For BC/GC, the on-duration timer length and inactivity timer length (only for GC) are configured per QoS profile.

3: For GC, do not pursue per-QoS or per-L2-ID configuration for RTT timer length and retransmission timer length.

5b: For GC/BC, For GC/BC, sl-drx-startoffset is set based on DST L2 ID.

Based on the above agreement, for BC/GC, if there are multiple QoS profiles associated for the same L2 DST, there may be multiple DRX cycles, and each DRX cycle is corresponding to one QoS profile. It will be complex for maintain the SL DRX active time. Hence, one question raised whether down-selection for SL DRX configuration is needed when multiple QoS profiles are associated for the same L2 DST.

Regarding to the down-selection, the views from different companies are divergent. The proponent of down-selection raised that since SCI only carries the destination ID related information for the associated TB, even when multiple SDUs of different logical channels associated with different QoS profiles are multiplexed into the same TB, the MAC entity at the RX side simply cannot operate separate DRX configurations respectively towards different QoS profiles of the data within a given TB, considering that DRX is performed for SCI reception which is at a per TB (not per LCH) level. If multiple DRX configurations are applied, considering UE is in active according to some QoS profiles but the data associated with those QoS profiles are not multiplexed in the TB, such design can easily defeat the purpose of power saving from DRX mechanism. Moreover, if multiple DRX configurations are applied for a given destination ID by the MAC, it would cause considerable challenge on UE implementation complexity, as there could be quite a few timers needed to be maintained in parallel. The opponent of down-selection thought that SL QoS have multiple dimensions, and the ordering of one dimension is not necessarily the same as the other dimension. So down-selection based on a single dimension of the QoS is not feasible.

According to the above agreements, there is already agreements that down-selection of inactivity timer is necessary. Hence, in the following, when RAN2 discuss whether down-selection should be performed, RAN2 can discuss the SL DRX parameters one by one:

**Question 6.1-1: For BC/GC, how to perform the down-selection for inactivity timer? Which option do you prefer? Please give your comments.**

* **Option-1: Select the inactivity timer associated with the QoS profile whose priority level is the highest.**
* **Option-2: Select the inactivity timer associated with the QoS profile whose PDB is the smallest.**
* **Option-3: Select the inactivity timer whose inactivity timer length is the largest.**
* **Option-4: Select the inactivity timer with the largest value among QoS profiles associated with the priority level indicated in SCI.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Option** | **Comments** |
| OPPO | Option-3 |  |
| Xiaomi | Option 3 | It’s not clear thether there is direct relation between inactivity timer length and priority/PDB. Inactivity timer is mainly used to provide transmission opportunity for next data arrival. So, option 3 is preferred to meet the longest data arrival interval. |
| LG | Option 4 | Selecting the inactivcity timer with the largest value among the QoS profiles related to the interested GC/BC service is to follow the RAN2's agreement. Simply choosing the largest value among all timer values associated with all QoS profiles allows the UE to use the inactivity timer mapped to a QoS profile that is not interested in its service. |
| InterDigital | Option 3 | The UE should remain awake for the worst case (largest) configured inactivity timer. |
| Ericsson | Option 3 | Although SCI indicates priority information, however, the TB itself may contain SDUs from logical channels which are not indicated in the SCI. |
| ASUSTeK | Option 3 |  |
| vivo | Option 3 | Agree with InterDigital. And in combination with Question 6.1-2, unexpected case may happen e.g., the down-selected DRX cycle is smaller than the down-selected inactivity timer, we deem it can also be handled as the worst case where the UE should remain awake. |
| Huawei, HiSilicon | Option 1, 2, 3 |  |
| Sharp | Option 3 |  |
| MediaTek | Option 3 |  |
| ZTE | Option 3 |  |
| Intel | Option 3 | Agree with InterDigital |
| Fraunhofer | Option 3 |  |
| Nokia | Option 3 |  |
| Qualcomm | Option 3 |  |
| Apple | Option 3 |  |

**Question 6.1-2: For BC/GC, do you think down-selection of the DRX cycle for BG/CG is necessary when multiple QoS profiles are associated with the same DST L2 ID? Please give your comments.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes/No** | **Comments** |
| OPPO | No | SL QoS have multiple dimensions, and the ordering of one dimension is not necessarily the same as the other dimension (one has to consider of non-standardized QoS and has to consider there might be new PQI added into the standardized PQI table). So down-selection based on a single dimension of the QoS is not feasible.  Another way-out is to select   * With the shortest DRX cycle within the ones corresponding to the QoS associated with the service; * With the longest on-duration timer within the ones corresponding to the QoS associated with the service;   Although this is a feasible way-out to derive a same / single DRX pattern for both Tx and Rx UE, it does not necessarily achieve better performance than following multiple DRX patterns, e.g., considering two associated QoS   * DRX1 for QoS1, shorter on-duration + shorter DRX cycle; * DRX2 for QoS2, longer on-duration + longer DRX cycle;   So, the final decided DRX of longer on-duration + shorter DRX cycle would have higher power consumption for both DRX1 and DRX2 – in the extreme case, if the longer on-duration timer length > shorter DRX cycle, UE may end up with no power saving gain at all. |
| Xiaomi | Yes | RAN2 agreed the startoffst is set based on L2 ID. However, according to following formulation, which is used for Uu DRX,  [(SFN × 10) + subframe number] modulo (*drx-LongCycle*) = *drx-StartOffset*  Different DRX cycle would result in corresponding onduration timer start in different timing position, even if the startoffset is the same. Therefore, multiple DRX cycle would increase the active time and result in low engergy saving gain.  Some companies think downselection would result in RX UE always wakeup. But we understand that’s caused by improper downselection. With proper down-selection, RX UE would only wake up according to DRX cycle and onduration timer belong to one set of DRX configuration. RX UE wouldn’t always wakeup. |
| LG | No | Same view with OPPO. |
| InterDigital | Yes | We think it would be simplest to have a single DRX behavior per L2 ID. There does not seem to be any value in maintaining multiple DRX cycles for a single L2 ID. |
| Ericsson | No | Share the same view as OPPO. Down-selection is not needed for DRX cycle. |
| ASUSTeK | Yes | Share the same view with InterDigital that a single DRX cylce for a L2 ID is the simplest solution. |
| vivo | Yes | For BC/GC with a specific L2 DST ID, it’s common case that UE may run multiple PQIs/QoS profiles for the same DST L2 ID. Given that DRX cycle is configured per PQI/QoS, there is ambiguity which DRX cycle should be applied when there is more than one available DRX cycle configuration for a specific L2 DST ID. The down-selection rule also simplifies the UE behavior by avoid running too many SL DRX configurations simultaneously in such case. Therefore, the down-selection rule needs to be specified. |
| Huawei, HiSilicon | Yes |  |
| Sharp | Yes |  |
| MediaTek | Yes | Agree with Xiaomi and InterDigital. |
| ZTE | No | Same view with OPPO. For DRX cycle and on-duration timer length, it seems no need to perform down-selection. the UE can be active during the time when any on-duration timer is running. |
| Intel | Maybe no with comment | At the end of the day, regardless of whether we have a single DRX cycle after downselection or not, the UE behavior is clear in that it needs to respect the active/inactive time restriction for the specific L2 DST ID. In that sense, we do not see a pressing need to spend effort specifying this downselection |
| Fraunhofer | Yes |  |
| Nokia | No |  |
| Qualcomm | Yes |  |
| Apple | Yes | We think down-selecion is needed. And UE need at least following the shortest DRX cycle among the QoS-based values for this L2 Addr. Since the start offset is decided basedon L2 Addr, it is easy for UE to simply choose the shortest DRX cycle to wake up for all different QoS. |

**Question 6.1-3: If the answer of Q6.1-2 is Yes, how to perform the down-selection for the DRX cycle? Which option do you prefer? Please give your comments.**

* **Option 1: Select greatest common divisor of the DRX cycle of multiple QoS profiles as DRX cycle.**
* **Option 2: Select the DRX cycle associated with the QoS profile whose priority level is the highest.**
* **Option 3: Select the DRX cycle associated with the QoS profile whose PDB is the smallest.**
* **Option 4: Select the DRX cycle whose DRX cycle is the smallest.**
* **Option 5: Select the DRX cycle whose DRX cycle is the longest.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Option** | **Comments** |
| Xiaomi | 4 | We understand there is direct relation betwen PDB and DRX cycle, which is smaller PDB requries smaller DRX cycle. So, in this sense, option 3 and 4 are the same. The smallest DRX cycle could fulfill the most strigendent PDB requirement. |
| InterDigital | 4 |  |
| ASUSTeK | 4 |  |
| vivo | Option 4 with comments | Generally, the down-selection rule needs to be based on the most stringent QoS requirement. But it complicates the discussion on the definition of what the most stringent QoS is e.g., the PQI whose priority level is highest in Option 2, and/or whose PDB is lowest in Option 3. Among all the candidate options, Option 4 is the most simple one and is preferred. |
| Huawei, HiSilicon | Option 2,3,4 |  |
| Sharp | Option 4 |  |
| MediaTek | Option 4 |  |
| Fraunhofer | Option 4 |  |
| Qualcomm | Option 4 |  |
| Apple | Option 4 |  |

**Question 6.1-4: For BC/GC, do you think down-selection of the length of the on-duration timer is necessary when multiple QoS profiles are associated with the same DST L2 ID? Please give your comments.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes/No** | **Comments** |
| OPPO | No | Same as Question 6.1-2 |
| Xiaomi | Yes | If multiple on-duration timer running, it’s possible RX UE would always wake up. Because on-duration timer may be longer than the down selected DRX cycle. |
| LG | No | Same as Question 6.1-2 |
| InterDigital | Yes |  |
| Ericsson | No | Same as the comments for Q 6.1-2 |
| ASUSTeK | Yes |  |
| vivo | No | Relying on the down-selection rule for the DRX cycle as commented in Question 6.1-2 is enough. Once the final DRX cycle is decided, the associated SL DRX configuration is decided where the on-duration timer is included as part of the associated SL DRX configuration. |
| Huawei, HiSilicon | Yes |  |
| Sharp | Yes |  |
| MediaTek | Yes |  |
| ZTE | No | Same as the comments for Q 6.1-2 |
| Intel | No | Same comment as in Q6.1-2 |
| Fraunhofer | Yes |  |
| Nokia | No |  |
| Qualcomm | Yes |  |
| Apple | No | We think the on-duration timer shall be configured as identical to ensure no matter which DRX cycle is followed, the onDuration always overlap. For example, the DRX cylce can be configured as T, 2T,4T…for different PQI. |

**Question 6.1-5: If the answer of Q6.1-4 is Yes, for BC/GC, how to perform the down-selection of the length of the on-duration timer, which option do you prefer? Please give your comments.**

* **Option-1: Select the length of the on-duration timer associated with the QoS profile whose priority level is the highest.**
* **Option-2: Select the length of the on-duration timer associated with the QoS profile whose PDB is the smallest.**
* **Option-3: Select the length of the on-duration timer whose on-duration timer length is the smallest.**
* **Option-4: Select the length of the on-duration timer whose on-duration timer length is the longest.**
* **Option-5: Select the length of the on-duration timer associated with the QoS profile, which is associated with the selected DRX cycle.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Option** | **Comments** |
| Xiaomi | Option 5 | Option 1-4 may result in selected on-duration timer is longer than down selected DRX cycle. Option 5 is the only option which could ensure RX UE would not always wake up. |
| InterDigital | Option 4 | The reasoning is the same as DRX cycle and inactivity timer. |
| ASUSTeK | Option 4 |  |
| Huawei, HiSilicon | Option 1,2,5 |  |
| Sharp | Option 4 |  |
| MediaTek | Option 4 |  |
| Fraunhofer | Option 5 | We agree with Xiaomi. |
| Qualcomm | Option 4 |  |

**Question 6.1-6: For GC, do you think down-selection of the length of the HARQ RTT timer is necessary when multiple QoS profiles are associated with the same DST L2 ID? Please give your comments.**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes/No** | **Comments** |
| OPPO | No | It is agreed the RTT and retransmission timer are not configured based on QoS. |
| Xiaomi | No | In last meeting, it’s agreed For GC, do not pursue per-QoS or per-L2-ID configuration for RTT timer length and retransmission timer length. So, there seems to be no need for RTT timer down selection. |
| LG | No | RAN2 already agreed that for GC, do not pursue per-QoS or per-L2-ID configuration for RTT timer length and retransmission timer length. |
| InterDigital | No |  |
| Ericsson | No | RAN2 has already agreed that for GC, do not pursue per-QoS or per-L2-ID configuration for RTT timer length and retransmission timer length. |
| ASUSTeK | No |  |
| vivo | No | Agree with above comments. |
| Huawei, HiSilicon | No |  |
| Sharp | No |  |
| MediaTek | No |  |
| ZTE | No |  |
| Intel | No |  |
| Fraunhofer | No |  |
| Nokia | No |  |
| Qualcomm | No | It’s not related to QoS. |
| Apple | No |  |

**Question 6.1-7: If the answer of Q6.1-6 is Yes, for GC, how to perform the down-selection of the length of the HARQ RTT timer, which option do you prefer? Please give your comments.**

* **Option-1: Select the length of the HARQ RTT timer associated with the QoS profile whose priority level is the highest.**
* **Option-2: Select the length of the HARQ RTT timer associated with the QoS profile whose PDB is the smallest.**
* **Option-3: Select the length of the HARQ RTT timer whose on-duration timer length is the smallest.**
* **Option-4: Select the length of the HARQ RTT timer whose on-duration timer length is the longest.**
* **Option-5: Select the length of the HARQ RTT timer associated with the QoS profile, which is associated with the selected DRX cycle.**

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| **Companies** | **Option** | **Comments** |
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**Question 6.1-8: For GC, do you think down-selection of the length of the HARQ retransmission timer is necessary when multiple QoS profiles are associated with thesame DST L2 ID? Please give your comments.**

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| **Companies** | **Yes/No** | **Comments** |
| OPPO | No | It is agreed the RTT and retransmission timer are not configured based on QoS. |
| Xiaomi | No | In last meeting, it’s agreed For GC, do not pursue per-QoS or per-L2-ID configuration for RTT timer length and retransmission timer length. So, there seems to be no need for retransmission timer down selection. |
| LG | No | Same as Question 6.1-6. |
| InterDigital | No |  |
| Ericsson | No |  |
| ASUSTeK | No |  |
| vivo | No |  |
| Huawei, HiSilicon | No |  |
| Sharp | No |  |
| MediaTek | No |  |
| ZTE | No |  |
| Intel | No |  |
| Fraunhofer | No |  |
| Nokia | No |  |
| Qualcomm | No |  |
| Apple | No |  |

**Question 6.1-9: If the answer of Q6.1-8 is Yes, for GC, how to perform the down-selection of the length of the HARQ retransmission timer, which option do you prefer? Please give your comments.**

* **Option-1: Select the length of the HARQ retransmission timer associated with the QoS profile whose priority level is the highest.**
* **Option-2: Select the length of the HARQ retransmission timer associated with the QoS profile whose PDB is the smallest.**
* **Option-3: Select the length of the HARQ retransmission timer whose on-duration timer length is the smallest.**
* **Option-4: Select the length of the HARQ retransmission timer whose on-duration timer length is the longest.**
* **Option-5: Select the length of the HARQ retransmission timer associated with the QoS profile, which is associated with the selected DRX cycle.**

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| **Companies** | **Option** | **Comments** |
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## Common or separate default SL DRX configuration for GC and BC?

In RAN2#115-e meeting, the following agreements were reached [1]:

4: For BC/GC, default DRX configuration(s) can be used for QoS profile(s) which cannot be mapped into DRX configuration configured for the dedicated QoS profile(s).

But it is still FFS whether only one common default SL DRX configuration is applied to both GC and BC or separate default SL DRX configuration should be defined for GC and BC?

**Question 6.2-1: Whether common or separate default SL DRX configuration should be used for GC and BC? Which option do you prefer? Please give your comments.**

* **Option 1: Common.**
* **Option 2: Separate.**

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| **Companies** | **Option** | **Comments** |
| OPPO | Option 1 | Considering option-2 would lead to extra power consumption, no need for separate default DRX configuration for GC and BC. |
| Xiaomi | Option 1 | Both could work. Option 1 is preferred due to overlapped active time could achieve higher power saving gain. |
| LG | Option 1 | Agree with OPPO |
| InterDigital | Option 1 | Its not clear why separate would be needed to begin with. |
| Ericsson | Option 1 | Agree with OPPO |
| ASUSTeK | Option 1 |  |
| vivo | Option 1 | We don’t see motivation to define separate default SL DRX configuration for GC and BC respectively. |
| Huawei, HiSilicon | Option1 |  |
| Sharp | Option 1 |  |
| MediaTek | Option 1 | Agree with OPPO. |
| ZTE | Option 1 |  |
| Intel | Option 1 | Slightly prefer option 1 but we agree that both can be made to work |
| Fraunhofer | Option 1 |  |
| Nokia | Option 1 |  |
| Qualcomm | Option 1 comment | Option 1 is generally OK with SL DRX cycle length, offset and On duration, but Groupcast may support Inactivity timer and HARQ related timers and broadcast doesn’t and thus the timer details may not be the same. |
| Apple | See comemnt | Similar view as QC. We think Option 1 only means share part of common parameters like “offset” and “DRX Cycle” in default configuration. It does not mean all the paramers are identical for BC and GC. For exanple, inactivity timer is not used in BC case. |

# Identified FFS/open issues from [AT115-e][704]

## FFS on whether default SL BC DRX configuration or Which SL BC DRX configuration for DCR message should be used?

In RAN2#115-e meeting, regarding to the DRX for DCR message, the following agreement was reached [1]:

3: For unicast, SL BC DRX configuration is applied for DCR message [20/22]. FFS on whether default SL BC DRX configuration or which SL BC DRX configuration for DCR message should be used.

Based on the above agreement, RAN2 agreed that SL BC DRX configuration is applied for DCR message, but it is FFS on which SL BC DRX configuration should be used for the DCR message.

**Question 7.1-1: Which SL BC DRX configuration should be used for the DCR message? Which option do you prefer? Please give your comments.**

* **Option 1: Use the default SL BC DRX configuration.**
* **Option 2: Define a DCR message dedicated DRX configuration (common for UEs).**
* **Option 3: Define a QoS profile for DCR message and use the DRX for this QoS profile.**
* **Option 4: Define TX profile for DCR to decide DRX application as additional consideration.**
* **Option 5: Use the default SL DRX configuration.**

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| **Companies** | **Option** | **Comments** |
| OPPO | Option 1 | Option 1 is the most feasible and simplest solution since AS layer has not got any QOS information from V2X layer when delivery of DCR message.  For Option 4, DCR message already associate with serivce type(s), which can be linked to Tx profile, so the concluded Tx profile based solution can be directly used here. I.e., by option-4, we understand it means the default DRX configuration is to be used if the associated Tx profile indicate a profile with DRX being necessary. |
| Xiaomi | Opton 1 and 4 | Default is prefered, since UE is likely to use default DRX. Reuse Default DRX could achivev higher power saving gain.  Futhermore, if R17 SL DRX capable UE always apply default DRX to DCR message transmission/reception, R17 UE may not be able to receiveR16 UE’s DCR message, so R16 and R17 UE can’t establish unicast connection. To resolve this coexistence issue, TX profile is agreed for broadcast. We believe this issue should also be resolved for DCR message. TX profile could also be defined for DCR message to decide DRX applicability. |
| LG | Option 5, see comment | The default DRX configuration does not need to be separated depends on the cast types (e.g., BC, GC, UC). And also, the PC5-S/RRC messages after the DCR message and before SL unicast DRC configuration applied can be also transmitted using the default DRX configuration. |
| InterDigital | Option 5 |  |
| Ericsson | Option 5 | Share the same view as LG. A common default DRX configuration is sufficient to be applied regardless of cast type. And applicable to all the scenario where a default DRX configuration is needed. |
| vivo | Option 1 with comments | We assume Option 1 and Option 5 means the same meaning considering that if common default SL DRX configuration is agreed in above Question 6.2-1. |
| Huawei, HiSilicon | Option 1,2 | Regarding option 1, it will limit that default SL BC DRX is always be configured. And we also agree with OPPO that Tx profile based solution can be directly used for DCR message.  Option 2 is also workable for DCR message, we are also fine to this solution. |
| Sharp | Option 5 |  |
| MediaTek | Option 5 |  |
| ZTE | Option 5 | Agree with LG. We think all the messages without QoS profile value should use the same default DRX configuration for GC/BC. |
| Intel | Option 1 | Same comment as vivo |
| Fraunhofer | Option 1 or Option 5 | Default DRX configuration is preferred. |
| Nokia | Option 5 |  |
| Qualcomm | Option 5 |  |
| Apple | Option 1/5 |  |

## Whether SL DRX is applied after DCR message and before SL unicast DRX configuration is applied?

Besides DCR, for the other PC5-S messages (SMC, DCA, etc.) that are transmitted between the two UEs, the L2 destination ID corresponding to these message is unicast L2 ID. For these messages, since PC5-RRC connection has not been established, whether and which SL DRX should be applied needs further discussion.

**Question 7.2-1: Do you agree that SL DRX should be applied for the PC5-S messages which are sent after the DCR message and before SL unicast DRX configuration is applied?**

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| **Companies** | **Yes/No** | **Comments** |
| OPPO | No | After DCR, not only the PC5-S messages but also the PC5-RRC messages before SL DRX is configured should be exchanged in a non-DRX manner to reduce the signalling latency. |
| Xiaomi | No | We prefer to not apply DRX, since the default DRX may collide with peer UE’s sidelink transmission and may not be optimal. It’s better to apply DRX after recieved DRX configuration. Furthermore, the DRX would delay the sidelink DRX negotiation procedure. |
| LG | Yes | There is no need to make a restriction depends on cast type (e.g., BC, GC, UC) for using the default DRX configuration. The DCR message and PC5-S/RRC messages after the DCR message and before SL unicast DRC configuration applied can use the default DRX configuration. Those messages don’t have any QoS profile. We think the messages without QoS profile value should use the default DRX configuration. |
| InterDigital | Yes | We don’t see a need to make a destinction between messages. |
| Ericsson | Yes | Agree With LG |
| vivo | Yes | We prefer that unified solution is applied to DCR and other messages (i.e., PC5-S, PC5-RRC, etc) before dedicated SL DRX configuration is successfully configured via PC5 RRC. In addition, considering the large size of RRC configuration and the sparsity of DRX On-duration (i.e., short on-duration and long DRX cycle), the extension period after on-duration associated with the dedicated SL DRX cycle should be taken into account, in order to shorten the latency of PC5 link establishment, and avoid the collision between the UEs who are involved in the different unicast links. |
| Huawei, HiSilicon | No | Agree with OPPO. |
| Sharp | No | Agree with OPPO. |
| MediaTek | No | Agree with OPPO. |
| ZTE | Yes | We don’t see strong reason to adopt different SL DRX schemes for different PC5-S message. |
| Intel | No |  |
| Fraunhofer | No |  |
| Nokia | No |  |
| Qualcomm | No | No for Rel 16 compatability: if UE monitors the responses from rel 16 within its SL DRX On duration, it may miss the response from a Rel 16 UE. |
| Apple | Yes |  |

**Question 7.2-2: If the answer of Question 7.2-1 is Yes, which DRX configuration should be used for PC5-S messages which are sent after the DCR message and before SL unicast DRX configuration is applied? Which option do you prefer? Please give your comments.**

* **Option 1: Use the default SL BC DRX configuration.**
* **Option 2: Define a dedicated DRX configuration.**
* **Option 3: Define a QoS profile for DCR message and use the DRX for this QoS profile.**
* **Option 4: Use the default SL DRX configuration.**
* **Option 5: Use the default SL DRX configuration with an extension timer.**

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| **Companies** | **Option** | **Comments** |
| LG | Option4 | There is no need to make a restriction depends on cast type (e.g., BC, GC, UC) for using the default DRX configuration. |
| InterDigital | Option 4 |  |
| Ericsson | Option 4 | Share the same view as LG. A common default DRX configuration is sufficient to be applied regardless of cast type. And applicable to all the scenario where a default DRX configuration is needed. |
| vivo | Option 5 | See comments in Question 7.2-1.  We believe that, in additon, it is dependent on the Tx UE and Rx UE behevous. The default SL DRX in either Option 1 or 4 has the property with the sparsity in general, that is running for all the time regardless of whether the UE has a service or not. Three options after the DCR transmission can be potentially considered.  Option-1: The PC5-S messages after DCR only can be sent in On-Duration of the default DRX. This belongs to Option-1 or 4, and perhaps incurs a longer delay for the link establishment.  Option-2: The Tx UE keeps waiting for the SMC reception after sending the DCR. Due to the uncertainty of the DCR reception and the SMC timing, the Tx UE (if power saving UE) has to give up the DRX associated with other services for reception. This increases the power consumption significantly if no response related to the DCR.  Option-3: The Tx UE sets a short timer for the SMC reception after sending the DCR. If the Tx UE receives the SMC within the timer, the Tx UE and the Rx UE keep being awake to accomplish the link establishment until the DRX associated with the newly established unicast link is configured. This belongs to Option-5. |
| ZTE | Option 4 |  |
| Apple | Option 4 | I assume Option 1 and 4 are the same |

## Whether we can confirm the WA that DRX configuration for V2X group management signaling is out of RAN2 scope?

As raised in [9], according to the procedure for groupcast mode of V2X communication over PC5[10], before running the groupcast service(s), the V2X application layer carries out V2X group management, and provides group identifier information (i.e., an application-layer V2X group identifier) as well as V2X application requirements for the groupcast communication.



Figure 6.3.2-1: Procedure for groupcast mode of V2X communication over PC5 reference point

As discussed in TS 38.287 [10], although V2X group formation is initiated by the V2X application layer, which is out of scope of 3GPP specification, the V2X group management is carried out in VAE and SEAL layers, which is within the scope of 3GPP specification.

During the email discussion [7], the majority companies (15/22) agreed that DRX configuration for V2X group management signaling is out of RAN2 scope. But during the RAN2#115-e online session, one company raised concern that SA2 is discussing that discovery message includes some GC related messages. RAN2 may need to check SA2 status further. Hence the above proposal changed to working assumption as below.

4: Working assumption: DRX configuration for V2X group management signaling is out of RAN2 scope.

**Question 7.3-1:** **After checking with SA2, shall RAN2 confirm the working assumption that DRX configuration for V2X group management signaling is out of RAN2 scope? Please give your comments.**

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| **Companies** | **Yes/No** | **Comments** |
| OPPO | Yes |  |
| Xiaomi | Yes |  |
| LG | Yes |  |
| InterDigital | Yes |  |
| Ericsson | comments | No strong views. Although the group management message is not needed to be identified in the AS, however, if SA2 indicates that the group management message can be associated with specific QoS profile or L2 ID, a specific DRX configuration can be configured for the indicated QoS profile or L2 ID, without additional design efforts. |
| vivo | See comments | Firstly, it is noted that V2X group management signaling is under discussion in the ProSe WID in SA2, so it is potentially in the RAN2 scope. However, we are open to discuss whether and how to apply SL DRX for the V2X group management signaling with minimized specification impact. For example, reuse the agreement made for the DCR message as much as possible. |
| Huawei, HiSilicon | Yes |  |
| Sharp | Yes |  |
| MediaTek | Yes |  |
| ZTE | Yes |  |
| Intel | Yes |  |
| Fraunhofer | Yes |  |
| Nokia | Yes |  |
| Qualcomm | Yes |  |
| Apple | Yes |  |

# Conclusion

# References

1. R2-2108838 Report from session on LTE V2X and NR SL Session Chair (Samsung)
2. R2-2107303 Summary of [POST114-e][704][V2X/SL] How to make sure Rel-16 UEs not supporting SL DRX are not involved in SL communication in DRX manner (Sharp) SHARP Corporation

1. [R2-2107159](C:\\Users\\zhaoyali\\AppData\\mtk16923\\Documents\\3GPP Meetings\\202108 - RAN2_115-e, Online\\Extracts\\R2-2107313.docx" \o "C:Usersmtk16923Documents3GPP Meetings202108 - RAN2_115-e, OnlineExtractsR2-2107313.docx) Summary of [POST114-e][705][V2XSL] Discussion on remaining FFSs and open issues in Uu DRX timer Huawei, HiSilicon

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2. R2-2108982 Summary of [AT115-e][702][V2X/SL] SL DRX configuration for UC Ericsson
3. R2-2108983 Summary of [AT115-e][703][V2X/SL] SL DRX configuration for GC/BC (OPPO) OPPO
4. R2-2108984 Summary of email [AT115-e][704][V2X/SL] Others ZTE
5. R2-2002501 Report of 3GPP TSG RAN2#109-e meeting, Online
6. R2-2108222 A Default PC5 DRX Configuration for Broadcast/Groupcast/Unicast vivo
7. 3GPP TS 38.287, Architecture enhancements for 5GS to support V2X services, V17.0.0, June, 2021