**3GPP TSG-RAN WG2 #113-e *R2-210xxxx***

**E-meeting, January 2021**

Agenda Item: 8.15.2.1

Source: OPPO

Title: Summary of [AT113-e][707]

Document for: Discussion, Decision

ZT

# Introduction

This is for the following email discussion

* [AT113-e][707][V2X/SL] Who will decide SL DRX pattern? (OPPO)

 **Scope:** discuss who (TX UE, RX UE or gNB) will decide SL DRX pattern or configuration in various scenarios (scenario by scenario) considering whether SL DRX is for SL unicast, groupcast or broadcast, TX and RX UEs’ RRC state (including OOC), and whether TX and RX UE’s in the same or different serving cells (including IC and OOC).

 **Intended outcome:** discussion summary and proposals in R2-2102183

 **Deadline:** Feb 02 1245 (UTC)

# Discussion

## Group-cast/Broadcast

Based on the discussion in [702], rapporteur observes that (see the observation in Annex) the majority view seems to be

* For in-coverage case: rely on gNB;
* For out-of-coverage case: rely on Pre-configuration

The reason is that w/o PC5 signaling, there seems no much options available, i.e., the UEs have to rely on (pre)configuration for DRX/DTX alignment.

**Q1-1: For broadcast/groupcast, for out-of-coverage case, do you agree that TX-UE/RX-UE obtain DRX configuration from pre-configuration?**

|  |  |  |
| --- | --- | --- |
| Company | Agree / Not-agree | Comment |
| OPPO | Agree |  |
| Xiaomi | Agree |  |
| Nokia | Agree, with comments | At least DRX cycle and DRX on duration timer of DRX configuration can be pre-configured to OoC UEs. Other DRX configurations for broadcast/groupcast can be discussed later when the corresponding parameters are agreed by RAN2. |
| InterDigital | Agree, with comments | Considering the there may be multiple DRX configurations based on granularity, each of these should be provided in pre-configuration. |
| Ericsson (Min) | Agree |  |
| LG | Agree |  |
| Intel | Agree | This is inline with how other sidelink related configurations are procured as well |
| MediaTek | Agree |  |
| CATT | Agree |  |
| HW | Agree | Similar as how the OOC UEs obtain the SL configurations in Rel-16.  |
| vivo | Agree |  |
| Spreadtrum | Agree |  |
| Philips | Agree |  |
| Qualcomm | Agree |  |
| Fraunhofer | Agree with comments | It is possible that a UE might have multiple DRX configurations and selects one DRX configuration e.g. based on service type or QoS. Additionally, for groupcast, we think it is too early to rule out dynamic DRX configurations per group.  |
| ZTE | Agree |  |
| ASUSTeK | Agree with the case all UEs in either IC or OOC | We think the options are available in case all UEs in either IC or OOC. However, it is questionable if some UEs in IC and some UEs in OOC. |
| Sony | Agree |  |
| Lenovo | Agree |  |
| Apple | Agree |  |

Rapporteur comment:

Agree: All

1. For broadcast/groupcast, for out-of-coverage case, TX-UE/RX-UE obtain DRX configuration from pre-configuration.

**Q1-2: For broadcast/groupcast, for in-coverage case, do you agree that RRC\_IDLE/INACTIVE TX-UE/RX-UE obtain DRX configuration from SIB?**

|  |  |  |
| --- | --- | --- |
| Company | Agree / Not-agree | Comment |
| OPPO | Agree |  |
| Xiaomi | Agree |  |
| Nokia | Agree |  |
| InterDigital | Agree | Similar comment made for Q1-1 applies also to SIB |
| Ericsson (Min) | Agree |  |
| LG | Agree |  |
|  Intel  | Agree |  |
| MediaTek | Agree |  |
| CATT | Agree |  |
| HW | Agree |  |
| vivo  | Agree |  |
| Spreadtrum | Agree |  |
| Philips | Agree |  |
| Qualcomm | Agree |  |
| Fraunhofer | Agree with comments | Agree for broadcast. For groupcast see comment Q1-1 |
| ZTE | Agree |  |
| ASUSTeK | Agree |  |
| Sony | Agree |  |
| Lenovo | Agree | NW need to guarantee that DRX configuration from SIB is same as pre-configuration for the alignment for partial coverage scenario |
| Apple | Agree |  |

Rapporteur comment:

Agree: All

1. For broadcast/groupcast, for in-coverage case, RRC\_IDLE/INACTIVE TX-UE/RX-UE obtain DRX configuration from SIB.

For RRC\_CONNECTED UE, there seems two opinions:

* One is to follow the legacy manner for Tx pool configuration, i.e., to rely on dedicated RRC;
* The other is to follow the legacy manner for Rx pool configuration, i.e., to rely on SIB;

The point of the latter one is that since for B-cast/G-cast, the DRX configuration cannot be per-UE decision (i.e., otherwise, there is no way to notify the neighbouring UEs who may be in another cell, or in RRC\_IDLE/INACTIVE state, or out of coverage), common configuration via SIB is sufficient.

**Q1-3: For broadcast/groupcast, for in-coverage case, for RRC\_CONNECTED TX-UE/RX-UE, how to obtain DRX configuration?**

* **Option-1: from SIB;**
* **Option-2: from dedicated RRC;**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| OPPO | 1 | We have not identified feasible solution to support per-UE configuration via dedicated RRC for B-/G-cast. |
| Xiaomi | 1 and 2 | In R16, sidelink UE has to apply the sidelink configuration via dedicated RRC, even if there is sidelink configuration included in SIB. We think the same principle should be followed. Furthermore, it’s allowed for gNB to only provide sidelink configuration via dedicated RRC, not via SIB. Option 1 seems to unnecessarily preclude this option. |
| Nokai | 1 and 2 |  |
| InterDigital | 1 | Since the configurations needs to synchronized between all UEs involved in groupcast/broadcast, we don’t see much in option 2. |
| Ericsson (Min) | 1 | We think Option 1 is sufficient. Option 2 has several potential issues. First, option 2 may cause signalling overhead. Second, gNB may not aware of the UE subscription for a group, which makes the dedicated signalling to be infeasible. |
| LG | 1 and 2 |  |
| Intel | 1 and 2 | At this stage, we think both options can be applicable, specifically if we have a per-service type/PQI configuration of DRX parameters for SL groupcast/broadcast |
| MediaTek | 1 and 2 | If TX UE is RRC\_CONNECTED, we think the TX UE should be able to obtain DRX configuration via dedicated RRC, and Rx UE just follow to monitor the transmission pattern of the TX UE regardless of whether Rx UE is OOC or not. In this stage we do not see the need to exclude option 2. |
| CATT | 1  | Since there is no dedicated PC5-RRC signalling for sidelink broadcast/groupcast, SIB is feasible to align the Tx and Rx UE configuration.  |
| HW | 1 and 2 | If no dedicated RRC configuration received, then the UE should follow the configuration in SIB however if dedicated RRC configuration is received, then the UE should follow the dedicated configuration, this is similar as in Rel-16. It is up to NW to ensure the configurations signalled via SIB and dedicated RRC signalling are aligned.  |
| vivo | 1 or 2, both can be acceptable | Option 1 is the simplest way to align DRX pattern between TX-UE and RX-UE, e.g. semi-statically management in a certain area or between different gNBs.Option 2 is more aligned with the legacy configuration framework. But when TX-UE and RX-UE obtain DRX pattern via dedicated RRC signalling separately from its serving cells, e.g. two different cells, it needs to be solved how to align these two sets of DRX parameters. If the content of dedicated RRC signalling is also semi-statically managed between different gNBs, SIB delivery is more efficient than dedicated RRC from the signalling overhead perspective. |
| Spreadtrum | 1 | Dedicated configuration may case misalignment between Tx UE and Rx UE in broadcast/groupcast. |
| Philips | Option 1 |  |
| Qualcomm | 1 and 2 |  |
| Fraunhofer | 1 and 2 | Prefer option 1 for broadcast and option 2 for groupcast. |
| ZTE | 1 | We think only common DRX configuration can be used for BC/GC, no need to send DRX configuration for BC/GC via dedicated RRC. |
| ASUSTeK | 2, but we are also fine with 1 | In Rel-16 SL, UE in RRC\_CONNECTED receives SLRB configuration from gNB via dedicated signalling. Thus, to follow the principle of R16 SL, RRC\_CONNECTED TX-UE/RX-UE could also receive the DRX configuration from gNB via dedicated signalling.  |
| Sony | 1 and 2 |  |
| Lenovo | 1 | Alignment among UEs for option 2 is hard |
| Apple | 1 and 2 |  |

Rapporteur comment:

1: All

2: 12

1. For broadcast/groupcast, for in-coverage case, for RRC\_CONNECTED TX-UE/RX-UE can obtain DRX configuration from SIB. FFS on usage of dedicated-RRC.

## Unicast

Based on the discussion in [702], rapporteur observes that (see the observation in Annex), the view seems diverse in terms whether it is Rx-UE or the Tx-UE to decide on the DRX configuration.

Furthermore, based on the online discussion today, there seems an unclear aspect w.r.t whether it is per-link configuration or per-direction configuration.

Proposal 2.2-2. For SL unicast (after SL unicast link is established), SL DRX configuration can be configured per a pair of source/destination. FFS whether SL DRX operates per direction or for both directions.

So before going towards solution down-selection, it might be helpful to clarify the options on the table.

But to look into the core issue, rapporteur suggest the following simplification for the scenario:

* Start from OOC scenario to avoid the discussion on gNB involvement as a start point;
* Do not touch the failure handling or the negotiation procedure (i.e., in case the DRX configuration is not preferred by the peer UE) in this discussion;
* Do not touch the assistance information (information from peer UE to assist the DRX configuration decision) in this discussion;

Based on the assumption above, firstly we can look at the options on the table.

**Option-A: Per-direction DRX configuration**

Option-A1: Per-direction DRX configuration + Tx-centric manner, i.e., it is the Tx-UE who decide the DRX configuration of Rx-UE, and send it to Rx-UE.

NOTE: in the figure below, the timing for UE1/2 send out the configuration is not restricted.



Figure 1 Per-direction DRX configuration + Tx-centric manner

Option-A2: Per-direction DRX configuration + Rx-centric manner, i.e., it is the Rx-UE who decide the DRX configuration of Rx-UE, and send it to Tx-UE.

NOTE: in the figure below, the timing for UE1/2 send out the configuration is not restricted.



Figure 2 Per-direction DRX configuration + Rx-centric manner

**Option-B: Per-link DRX configuration**

It is one UE who decide the DRX configuration of both UEs, i.e., the DRX of itself and the peer UE.

NOTE: the figure below does not touch which UE should be the controlling UE.



Figure 2 Per-link DRX configuration

**Q2-1: Is there any other options which cannot be categorized as one of the options above?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| OPPO | No |  |
| Xiaomi | No |  |
| Nokia | Partly, with comments | We agree that these are the available modes of operation, but we do not necessarily agree that the decision should be either/or. It may be that the controlled UE (Rx UE in Tx-centric configuration, and vice versa) is the one with the most links, or a certain requirement for the DRX. Hence, we may never get an optimal configuration by strictly defining either as the controlling UE.Also, we are not sure whether Figure 2 is actually misleading, and wonders whether there is any reason relying on figures in this current state where i.e. the assistance information is not taken into accout. |
| InterDigital | Yes | While we agree with limiting the discussion for simplicity, we think that removing the negotiation procedure does not result in enumerating all of the options to help determining which UE selects the configuration and how. Error handling and gNB involvement can be discussed later, as suggested. We suggest considering the signal flows for these cases also.To the above options, we should add:* **Option A3**: Per direction DRX configuration, TX centric, using information from the RX UE. Here, the TX UE first receives information from the RX UE, decides the DRX configuration for the RX UE based on the information provided, and sends the DRX configuration to the RX UE.
* **Option A4:** Per direction DRX configuration, RX centric, using information from the TX UE. Here the RX UE first receives information from the TX UE, decides its DRX configuration from the received information, and sends its DRX configuration to the TX UE.
* **Option B2:** Per link DRX configuration using information from the peer UE. In this option, one UE, receives information from another UE, decides the DRX configuration of itself and the other UE, and sends the DRX configuration to the other UE.
 |
| Ericsson (Min) | Yes | we need to make it clear that, the question is for the two UEs having the same service of the same link. After RAN2 has concluded the questions for the same service of the same link, RAN2 can further discuss: UE having multiple services of the same link.  |
| LG | No |  |
| Intel | No | Regarding the options outlined by InterDigital, we agree that consideration of negotiation between peer UEs is important, but we think that at least for now, it can still be lumped together (as the rapporteur has pointed out) under the respective umbrellas of whether the procedure is TX or RX centric and whether it is per direction or per link |
| MediaTek | No |  |
| CATT | No |  |
| HW | No |  |
| vivo  | No |  |
| Spreadtrum | No |  |
| Philips | Yes | We agree with the suggestions made by InterDigital. We understand the intention of the rapporteur (reduce complexity for the discussion) but at the same time we should not leave out the negotiation between the peer UEs. |
| Qualcomm | Yes | Agree with Ericsson: it’s for the same service of the same link. |
| Fraunhofer | Yes with comments | Assistance information of UEs in per link DRX configuration should be taken into account.  |
| ZTE | No |  |
| ASUSTeK | No |  |
| Sony | No | We agree with Nokia that the non controlling UE should be able to have an impact on the DRX configuration |
| Lenovo | No with comments | We understand rapporteur’s option includes assistance information from peer UE. But we still would like to echo IDT’s option B2, that before determining the per-link DRX configuration, UE exchange the assistance information of each other, and then determine the per-link DRX configuration and send to peer UE |
| Apple | No | The negotiation between the UEs to determine the SL-DRX is a valid option too (e.g, Option B2 in InterDigital answer), which may not be able to completed with the two-way exchange.  |

**Rapporteur comment:** All companies seems agree with the 3 options are on the table, but there are also comments on the need of assistance data.

**Rapporteur suggestion:** Since the intention is clarified that the 3 options does not exclude the assistance data exchange but just categorized within the 3 options, rapporteur suggest to start from the 3 options for following discussion.

Besides, it is helpful to understand how for the UE who sends out the DRX configuration, i.e.,

* UE1 and UE2 in option-A1/2 (who sends out the DRX configuration for different directions respectively);
* UE1 in option-B (who sends out the DRX configuration for both directions);

To decide on the DRX configuration (NOTE that we are limited to OOC scenario for unicast case in this discussion), the available options seem to be

* Either up to the UE itself;
* Or rely on the pre-configuration of the UE;

**Q2-2: Regardless of the preference on the options (as listed above, option-A1/A2/B), for OOC scenario, how for the UE who sends out the DRX configuration to decide on the DRX configuration?**

* **Option-1: Decided by the UE itself;**
* **Option-2: Rely on pre-configuration;**
* **Option-3: Consider information from the other UE**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| OPPO | 1 | Although theoretically can be per-UE configuration, in practice, pre-configuration can only achieve common configuration. So option-2 means there is no need for PC5-RRC signalling.And even if pre-configuration is per-UE, it cannot work since it means the same DRX configuration would be used for all involved unicast links for this UE. |
| Xiaomi | 2 | In our understanding, the DRX could be pre-configured per destination or QoS for unicast, which doesn’t mean all involved unicast links for this UE is the same. |
| Nokia | 1 preferred | Choosing 1 at the current state does not preclude the UE taking into account the pre-configuration of broadcast and groupcast, hence we think 1 is a good choice. |
| InterDigital | 1, 2, and 3 | Technically selection using only one of these may not be feasible if we consider granularity and power savings. For example, the UE may select a DRX configuration from the set of configurations provided in pre-configuration by selecting the one which is associated with the specific QoS. Furthermore, selecting a DRX configuration without considering the information from the peer UE would lead to limited power savings when multiple unicast links are setup between different UEs, or a UE has other groupcast/broadcast transmissions to consider with their own DRX configuration. Therefore, information from the other UE should be considered.  |
| Ericsson (Min) | 1 | Share the same view as the rapporteur |
| LG | 1 and 2 |  |
| Intel | 1 | For the OOC case, we think it is reasonable to have the UE decide the DRX configuration by itself since it is only the UEs themselves that have the most accurate picture with respect to sidelink traffic pattern, battery power and concurrent connections to other peer UEs in the vicinity. |
| MediaTek | 1 | We share same view with Nokia that option 1 can cover option 2 and thus allows more flexibility for UE to configure preferred configuration allowing balance between power saving and latency performance. |
| CATT | 1 and 3 | For sidelink unicast, OOC UE can determine the sidelink DRX configuration by itself. When the OOC UE determines the sidelink DRX configuration, its peer UE can provide some information as assistance information. |
| HW | 1 with comments | We think the DRX configuration should be determined by the UE but it does not mean the DRX configuration is determined all by the UE itself without consideration of the assistance information from the peer UE. As assistance information is not within the scope of this email discussion, we can go with option 1 and FFS assistance information exchange for this case.  |
| vivo  | Most of DRX parameters by option-2 and e.g. offset, by option-1 | From our understanding, most of DRX parameters which strongly affect QoS and performance, e.g. DRX cycle, onDuration timer, should come from pre-configuration, i.e. similar to legacy SLRB configuration.Furthermore, to avoid all of UEs with same services using the same pattern to cause high-probability resource collision, some DRX parameters which does not affect QoS and performance, e.g. cycle offset, can be selected by UE itself. |
| Spreadtrum | 1 and 2 |  |
| Philips | 3 | We think that option 3 is the only one that can really lead to limited power consumption. Option 1 does not consider the other UE needs and option 2 is static and even if several pre-configurations are defined it may not cover the QoS or energy demands of the UE |
| Qualcomm | 1 and 2 | Decided by UE itself based on pre-configuration |
| Fraunhofer | 1, 2 and 3 | In our understanding for OOC scenario, the configuration can be decided by the UE itself e.g. based on pre-configuration. Taking into account assistance information as in Option 3 might be beneficial. |
| ZTE | 1 | For unicast, regardless of the preference on the options, the peer UE may provide some assistant information, the UE can decides the DRX configuration based on the assitant information from the peer UE. If supports pre-configuration solution, the UE can only use a common DRX configuration for unicast, which is not flexible. |
| ASUSTeK | 1 and 2 |  |
| Sony | 1  | The UE should e.g. be able to align the DRX with other DRX configurations for this UE that are configured via RRC. There is no reason to align the DRX of all Unicasts. |
| Lenovo | 1, 3 | Agree with OPPO, that pre-configuration only achieve common DRX configuration which usually used for B-/G-cast which cannot exchange information to align DRX configuration, and for unicast UE can adjust/select/determine DRX configuration according to e.g. traffic information thus decided by the UE itself is more flexible.And information from peer UE is also important to determine the per-direction or per-link DRX configuration, e.g. traffic arrival time etc. Although rapporteur may already implicitly include such possibility, we also would like to explicitly point this out. |
| Apple | 1,3 | It needs to be pointed out, the decision can be made with a tie-breaker machanims embedded in the PC5-RRC signalling itself, which I hope this is not excluded by Opiton 1.  |

**Rapporteur comment:**

1: 18

2: 8

3: 6

1. For unicast, for OOC scenario, the UE who sends out the DRX configuration decides on the DRX configuration by itself. FFS on usage of pre-configuration and the assistance information from the peer UE.

Before going into down-selection, rapporteur would like to point out that in R16 (where there is no DRX configuration), the PC5-RRC procedure is designed in a way like option-A1 above, i.e.,

* The AS-layer configuration signalling from UE1 is for UE1 => UE2 direction;
* While the AS-layer configuration signalling from UE2 is for UE2 => UE1 direction;



Figure 1 Per-direction DRX configuration + Tx-centric manner

**Q2-3a: Within the 3 options above, which option(s) you prefer?**

* **Option-A1**
* **Option-A2**
* **Option A3**
* **Option A4**
* **Option-B**
* **Option-B2**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| OPPO | A1 | To align with R16 signalling framework.In other words, if for a same direction (e.g., for UE2 => UE1), some parameters are decided by UE2 (as in R16) while others are decided by UE1 (e.g., as in option-A2 or option-B), it may bring configuration collision since AS parameters are implicitly coupled with each other, and thus it is preferred to rely on a single entity to decide on it. |
| Xiaomi | A1 | The DRX configuration would restrict the transmission resource selection in TX UE, which means only the transmission resource overlapped with wake-up time of RX side could be selected. RX UE is not aware of the resource allocation of TX UE, so sidelink DRX should be decided by TX UE. |
| Nokia | A1 and A2 | We see advantages for both of the solution in different scenarios, as it depends on the scenario for both UEs. We are not sure whether the final decision should be taken until we have also touched the topic of assistance information, as also mentioned in 2-1.We think it would lead to optimal configuration if we instead agree on both as optional, and then discuss when either is most beneficial instead of whether one or the other is best.  |
| InterDigital | A3 and A4 | We think using information related to the other UE (regardless if it is TX centric or RX centric decision) is preferred to having the decision be made unilaterally without considering the other UE. |
| Ericsson (Min) | B | For a same type of service of the same link, the related QoS characteristics are the same for both directions. Therefore, there is no need to apply directional DRX configurations for the same service of the same link.With directional DRX configurations for the same service of the same link, the drawback is that UE has to maintain more DRX configurations, this will degrade performance of power saving (due to non-overlapped active time). In addition, RAN2 can further discuss if UE can be configured with multiple DRX configurations for the same link, and each configuration may be associated with different services. |
| LG | A2 | It is better to decide DRX configuration in receiver UE since the DRX behaviour is a reception behaviour. For alignment with transmission for TX UE, the receiver UE needs to receive assistance information (e.g., traffic pattern) from Tx UE. |
| Intel | A1 | We prefer to go with A1, i.e. TX-centric per-direction configuration, for reasons mentioned by OPPO and Xiaomi with respect to alignment with R16 framework and dependence on TX UE’s resource selection. However, we do think that this does not preclude the need for some assistance information (which so far has not been considered as per the set of assumptions listed by the email rapporteur) and that can be discussed later. |
| MediaTek | A1 and A2 > A1 | We share same view with Nokia that A1 and A2 have their own advantage. Maybe we can keep open now for the two options until we see obvious drawbacks on either one.However, if the majority view is to downselect now, then we prefer A1. |
| CATT | A1 |  |
| HW | A2 | In Rel-17, we are discussing about DRX, of which is to reduce the RX UE’s power consumption. RX UE centric mechanism is the most power-saving mechanism as the RX UE only needs to determine and maintain only one or limited number of DRX configurations (much less than TX centric mechanism) as per its demand of power saving. However if we adopt TX centric mechanism, then due to multiple to one nature, one RX UE needs to maintain multiple DRX configurations from different TX UEs, and the ”wake up” time configured by these TX UEs may spread over most of the whole time domain, leading to DRX unrealistic at all. Therefore, we think it does not make sense to follow the Rel-16 signalling framework at the cost of consuming more UE power，which is not aligned with the intention of this objective. Regarding to xiaomi’s comments, we think even the DRX configuration is determined by the RX UE, the TX can send some assistance information to the RX UE to assist the RX UE to make the decision and the resource allocation of TX UE can be considered to be included in the assistance information.  |
| vivo | A1 with comments | To align with the legacy configuration framework in PC5.TX-UE has more accurate information about service QoS and pattern. Hence TX-UE is the decision node. In the second step, RX-UE‘s preference or assistance can also be considered. For example, instead of accepting all DRX parameters and sending complete message, RX UE may send updated DRX parameters, e.g. DRX cycle offset, to TX UE for negotiation purpose. Then TX UE can accept or reject it. |
| Spreadtrum | A1 | It is the Tx UE having the QoS information, so Tx-centric solution is more sensible. |
| Philips | A3 and A4 | We agree with InterDigital |
| Qualcomm | B | Like Uu DRX, a UE wakes up for a DRX On duration for either transmitting and/or receiving. With directional DRX configuration, a UE has to wake up for transmitting or wake up for receiving separately, which is not efficient for power saving. |
| Fraunhofer | A1 and A2 | We think the exchange of additional information from the other UE might be beneficial depending on the scenario or condition, which can be discussed as next step as indicated in option A3 & A4. |
| ZTE | A2 | For Tx-centric manner, if different TX UE configure different SL DRX active time, it may lead the UE to be awake on most occasions, which is not desirable in terms of power saving. And it is difficult to make the DL DRX to be aligned with SL DRX. So we think Rx-centric manner is better. |
| ASUSTeK | A1 and A2 | Basically, A1 is baseline since TX UE knows traffic pattern. However, A2 could be also needed for RX UE to adjust SL DRX due to e.g. alignment of Uu active time and SL active time. Thus, we think both A1 and A2 should be supported. |
| Sony | A1 | One UE should make the decision, as in R16. We also agree with Nokia the other UE should have an opportunity to provide assistance information about e.g. other DRX configurations. |
| Lenovo | A, B with comments | We see A and B has its own pros and cons. We could like to select the options after the pros and cons are discussed and clearly identified1. A – pros: will achieve more power efficiency. DRX pattern can adapt each UE’s traffic pattern and can accurately control the reception time and transmission time2. A – cons: introduce much complexity, since UE needs to maintain two sets of DRX parameters and procedures for specific unicast link. Consider there may multiple unicast links for one SL UE, this is more complex.3. B – pros: simple solution, that UE only maintain single set of DRX parameter and procedure, which is similar to legacy Uu DRX and can fully reuse the mechanism from legacy Uu DRX mechanism.4: B – cons: one pattern for both transmission and reception. May increase active time compared with solution A |
| Apple | Option A4 & B2 | We do not think per-direcitonal uni-lateral configuration should be pursued. This needs to be a negotiation between two UEs. |
|  |  |  |

**Q2-3b: Within the 3 options above, which option(s) you cannot accept?**

* **Option-A1**
* **Option-A2**
* **Option A3**
* **Option A4**
* **Option-B**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| OPPO | B | This brings asymmetric role to PC5, which breaks the design principle/premise since LTE.. The reason we started from symmetric framework is to avoid deadlock type thing in distributed network: e.g.,Issue-1: for a triangle topology (where one UE as the controlling UE, the other as the controlled UE, * Unicast link between UE1 and UE2;
* Unicast link between UE1 and UE3;
* Unicast link between UE2 and UE3;

This would lead to circular decision chain, i.e., the decision power is that UE1 > UE2 > UE3 > UE1..Issue-2: for a same unicast UE pair, it could happen that there are multiple logical PC5-S connection running at the same time:* Connection-1 where UE1 as the initiating UE;
* Connection-2 where UE2 as the initiating UE;

Option-B would lead to separate decision entity even for the same direction  |
| Xiaomi | B | Option B is not preferred for following reasons,1. The traffic characteristic may be different on different directions, which require different DRX configuration.
2. It’s possible only one of the pair UEs require DRX. For example, in V2P, only the pedestrian requires DRX.
 |
| Nokia | B | As mentioned in the above comments, allowing a single UE to determine all DRX configurations may result in bad behaviour |
| InterDigital | B | We think the traffic characteristics of the two direction may be different at any given time, and assuming that they are always the same is too limiting. |
| Ericsson (Min) | A1, A2, A3, and A4 | For a same type of service of the same link, the related QoS characteristics are the same for both directions. Therefore, there is no need to apply directional DRX configurations for the same service of the same link.With directional DRX configurations for the same service of the same link, the drawback is that UE has to maintain more DRX configurations, this will degrade performance of power saving (due to non-overlapped active time). In addition, RAN2 can further discuss if UE can be configured with multiple DRX configurations for the same link, and each configuration may be associated with different services. |
| LG | B |  |
| Intel |  | We believe it can still be possible to work with Option B, even if it is not as flexible as the per-direction DRX configuration approach |
| MediaTek | B | As mentioned by companies, we think option B cannot support asymmetric traffic which may require different SL DRX configuration for different direction. Besides, we share same view with OPPO that option B has a problem on who decides the SL DRX configuration.  |
| CATT | B |  |
| HW | B | We think DRX is to control the monitoring behaviour from the reception UE’s point of view. So it is not reasonable to have a common DRX configuration applied to both directions as for each direction the recipient is different and the power saving requirement as well as the traffic pattern for different recipients may be different. Therefore, it is too limited to have only one DRX configuration for both directions.  |
| vivo | B | Option B cannot accept due to:1．The service diversity: there may be bi-directional services with similar or different characteristics between two directions and uni-directional services. A single UE cannot have whole accurate service information completely. Hence DRX configuration from a single UE may be not accurate.2．Not align with legacy configuration framework. That is to say, for SLRB configuration there is a PC5 procedure/rule and for DRX configuration there is another PC5 procedure/rule. |
| Spreadtrum | B |  |
| Philips | BA1 and A2 are not preferred but we could accept | We think that the SL UE should not make unilateral decisions. For instance, one UE may have multiple SL connections and another UE just one. If the UE with just one connection is the one unilaterally deciding the DRX configuration it will add extra burden to the UE with already multiple connections. A negotiation will be more efficientIn addition, for B, we agree with the other companies that the nature of PC5 is per direction and not per link |
| Qualcomm | A1, A2, A3, and A4 | Option As cause a UE to maintain more DRX configurations and reduce power saving efficiency with more wakeups. |
| Fraunhofer | B |  |
| ZTE | B | Agree with OPPO. |
| Sony | B | The Tx UE knows the traffic characteristics better than the Rx UE. Could in many cases be good to align the DRX configurations in both directions, but that can be done anyway by taking the first DRX configuration into account when deciding the other one.  |
| Lenovo | None | We are open to all solutions before the pros and cons are clearly identified and discussed |
| Option  | A1, A2, A3 with comments | It is wrong to assume the DRX is determined by traffic pattern in TX UE. If this is the objective, then the latency concern has trumped the power savings. The receiving UE may be engaged with multiple transmitters, If a UE was forced to wake up because any of TX UE has traffic, then there is no power savings. For asymmetric traffic case, if both UEs has traffic which cannot be transmitted at the same onDuraiton, It is perfectly fine for UE to not agree on SL-DRX configuration as there is no proposed configurations which can result any power savings from the UE perspective.We general oppose per-directional SL-DRX configuration because it will hurt power savings. We also agree with Lenovo that the solutions need to be evaluated and compared further with technical analysis. |

Rapporteur comment: 21 companies provide the input.

A1/A3: 14 preferred, 3 not acceptable

A2/A4: 11 preferred, 3 not acceptable

B/B2: 4 preferred, 14 not acceptable

If we further combine A1/2/3/4

A1/2/3/4: 18 preferred, 3 not acceptable

B/B2: 4 preferred, 14 not acceptable

1. For unicast, for OOC scenario, adopt per-direction DRX configuration. FFS on whether it is TX-centric or Rx-centric.

# Conclusion

We have the following proposals

[Proposal 1 For broadcast/groupcast, for out-of-coverage case, TX-UE/RX-UE obtain DRX configuration from pre-configuration.](#_Toc62854178)

[Proposal 2 For broadcast/groupcast, for in-coverage case, RRC\_IDLE/INACTIVE TX-UE/RX-UE obtain DRX configuration from SIB.](#_Toc62854179)

[Proposal 3 For broadcast/groupcast, for in-coverage case, for RRC\_CONNECTED TX-UE/RX-UE can obtain DRX configuration from SIB. FFS on usage of dedicated-RRC.](#_Toc62854180)

[Proposal 4 For unicast, for OOC scenario, the UE who sends out the DRX configuration decides on the DRX configuration by itself. FFS on usage of pre-configuration and the assistance information from the peer UE.](#_Toc62854181)

[Proposal 5 For unicast, for OOC scenario, adopt per-direction DRX configuration. FFS on whether it is TX-centric or Rx-centric](#_Toc62854182)

# Reference

1. R2-2101727 Summary of [POST112-e][702][SLe] High-level principles for SL DRX LG Electronics France discussion Rel-17 NR\_SL\_enh-Core Late

# Annex:

Based on the comments, rapporteur understands as follows:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Company | Options | Comments | Group/Broadcast | Unicast |
| CATT | Option 1) for IC Tx UE in RRC\_CONNECTED state;Option 2) for other cases. | Tx UE centric SL DRX configuration is preferred (Option 1 and Option 2).* If the Tx UE is in RRC\_CONNECTED, in order to align the Uu and SL DRX configurations, the gNB can determine the SL DRX configuration for Tx UE;
* If the Tx UE is IC but in RRC\_IDLE or inactive, since there is no interactivity between UE and gNB, gNB can’t aware the SL service requirement in UE, hence it had better let Tx UE determine the SL DRX configuration by itself;
* If the Tx UE is OOC, there is no need to align the SL DRX configuration between Uu and SL, hence Tx UE can determine the SL DRX configuration.
 |  | Tx-centric manner |
| Lenovo, MotM | 4) and 5)2) for UC based later adjustments of DRX configuration only. | 1) does not work since peer UEs where one is in coverage of a gNB and the other is not (another gNB or OOC). This problem applies for already other configurations in SL and so instead of solving this, we should not make it any further critical.2) for UC based later adjustments of DRX configuration.5): Specified might be useful as well if the DRX patterns are to be known universally. | Pre-configuration/Specified-configuration? | Tx-centric manner |
| OPPO | For broadcast/groupcast, option-1/4For unicast, option-1/2 | For broadcast and groupcast, we believe a common DRX configuration is feasible (FFS it is per-QoS or not), for which UE can rely on SIB/pre-configuration for in/out-of-coverage case.For unicast, for the DRX after link establishment, we believe a link/direction-specific DRX configuration is necessary (as replied to Q2.2-2), for which the decision can be by TX-UE or the serving gNB of the TX-UE (depending on whether the TX-UE is in RRC\_CONNECTED or not). | SIB/Pre-configuration | Tx-centric manner |
| Xiaomi | Option 2 + 1 for IC UEOption 2+4 for OOC UEFFS for option 3 | In Uu, the DRX is configured by gNB, since gNB is aware of the traffic pattern and in charge of resource scheduling. gNB could provide appropriate DRX configuration to fulfil the QoS without much delay.On sidelink TX UE is aware of the traffic pattern. TX UE’s gNB and pre-configuration is in charge of sidelink resource allocation.But I also see some benefit of RX determined DRX configuration. Maybe we could have some further discussion on how to harmony these two options. |  | Tx-centric manner (but also point of Rx-centric manner) |
| ASUSTeK | See comment Different options for different scenarios | **For In-Coverage unicast UEs:** Option 1) gNB (e.g. UE-specific configuration to peer UEs)Option 2) UE performing the SL TXOption 3) UE performing the SL RX**For in-Coverage broadcast/groupcast UEs:**Option 1) gNB (e.g. for common SL DRX configuration per resource pool)Option 6) Upper layer (e.g. V2X layer)**For out-of-coverage unicast UEs:** Option 2) UE performing the SL TXOption 3) UE performing the SL RXOption 4) Use pre-configuration SL DRX parameters (e.g. for common SL DRX configuration per resource pool)**For out-of-coverage broadcast/groupcast UEs:**Option 4) Use pre-configuration SL DRX parameters (e.g. for common SL DRX configuration per resource pool)Option 6) Upper layer (e.g. V2X layer) | IC:gNB OOC:Preconfiguration | Tx-centric or Rx-centric |
| HW  | 3 for unicast 1 or 4 for broadcast/groupcast | For unicast, we slightly prefer UE performing the SL RX determines the SL DRX configuration as this is the most power-saving mechanism and based on some coordinated information between the TX UE(s) and the RX UE, the RX UE can determine a proper DRX configuration applying to all the connected TX UEs or determine multiple DRX configurations applying to different TX UEs. For broadcast/groupcast, we think it should be the NW (dedicated RRC signalling for connected mode and SIB for idle/inactive mode) to configure the dedicated resource pool(s) or the mapping relationship between different service/QoS profile and the corresponding dedicated resource pool for the UEs IC and for UEs that are OOC, they should use predefined dedicated resource pool configuration for SL DRX operation.  | IC:gNB:OOC:Pre-configuration | Rx-centric manner |
| Apple | 3 for unicast DRX configurations1 & 4 for common DRX configuration | We agree with Huawei that RX UE is more suitable to determine how to achieve power saving from SL-DRX. We prefer RX-driven decisions for each PC5 link.Common DRX configurations are provided via SIB or pre-configurations.  | IC:gNB:OOC:Pre-configuration | Rx-centric  |
| InterDigital | Option 1 & 4 for groupcast/broadcastOption 3 for unicast (with comments) | Similar to other groupcast/broadcast parameters on SL, gNB should configure DRX for in coverage, and preconfiguration should be used for OOC.For unicast, the RX UE should select the final DRX configuration(s) to ensure efficient power savings for multiple active unicast links (with different UEs). However, since the TX UE is aware of the characteristics of the data to be transmitted, and could also be an RX UE for other unicast links, the TX UE should be involved in such decision (e.g. by sending a suggested configuration(s) or other information used by the RX UE for selection). | IC:gNB:OOC:Pre-configuration | Rx-centric |
| vivo | Option 1, 2, 4see comments | For groupcast and broadcast, the UE common DRX configuration can be part of the SLRB configuration as in Rel-16 V2X, i.e., by **Option 1** for In-Coverage UEs and **Option 4** for Out-of-Coverage UEs.For unicast, as we replied in Section 2.2**,** there may be UE common DRX Configuration before unicast link establishment and link specific DRX after unicast link establishment. Therefore:- Before unicast link establishment, the DRX configuration can simply follow the method for groupcast and broadcast as above.- After unicast link establishment, the link specific DRX configuration is defined by **Option 2**, i.e., the Tx UE sets up the initial DRX configuration and the Rx UE may decide whether to accept/reject/modify the initial DRX configuration from TX UE. This DRX negotiation between TX and RX can reuse similar QoS negotiation procedure defined in Rel-16 V2X. | IC:gNB:OOC:Pre-configuration | Tx-centric |
| Ericsson (Min) | Option 1+2 for IC UEOption 2+4 for OOC UE | For IC UE in RRC CONNECTED, it is the gNB of TX UE or TX UE that determine the SL DRX configuration.For IC UE in RRC IDLE and INACVIVE, it is TX UE that determines the SL DRX configuration.For OOC UE, it is TX UE that determines the SL DRX configuration based on preconfigured DRX configurations.  |  | Tx-centric manner |
| Fujitsu | Option 1, 2, 3, and 4 with comments | Option 1 works in IC, with RRC-CONNECTED.Option 2 and 3 work for unicast in OOC. Once a unicast link is established, the pair-UEs should negotiate their DRX parameters.Option 4 works for groupcast and broadcast in OOC. | OOC:Preconfiguration | Tx-centric or Rx-centric |
| MediaTek | Option 2 or 3 for unicast;Option 1 for IC RRC connected UEOption 4 for OOC UEOption 6 for groupcast/broadcast | In our view, option 2 and option 3 have their own benefit and we suggest more discussion on how to balance the performance between latency and power saving.For a UE in RRC connected, the SL DRX configuration can be configured either by NW (option 1) or determined by UE itself (option 2 or 3).For a OOC UE, its SL DRX configuration could be based on option 4, or be based on the exchanged SL DRX configuration from peer UEs (option 2 or 3).For groupcast/broadcast, the SL DRX configuration may also come from higher layer, which satisfy the QoS requirement of this groupcast/broadcast service. |  | Tx-centric or Rx-centric |
| Intel | Option 1, 2, 3 and 4 with comments | For in coverage CONNECTED case, we can rely on gNB to provide the SL DRX configuration for both unicast and groupcast/broadcast cases. For unicast case out of coverage, both option 2 and 3 can be applicable once the unicast link has been established and whether we go with a TX UE or RX UE centric approach needs to be further discussed. Regardless of whether it is TX UE or RX UE centric, PC5-RRC signalling can be used to exchange the DRX configuration to be used for the SRC/DST pair (once the link is established).For groupcast/broadcast out of coverage case, since we cannot rely on PC5-RRC, option 4 can be applicable. | IC:gNB:OOC:Pre-configuration | Tx-centric or Rx-centric |
| Samsung | Option 2. | Traffic pattern is determined in TX UE.  | OOC:Pre-configuration | Tx-centric manner |
| Fraunhofer | Options 1,2,4 | In case of in-coverage, UE in RRC-CONNECTED state gNB can determine the DRX configuration. While for the UEs in RRC IDLE or INACTIVE state, the initiating UE can determine the DRX configuration. While for an out of coverage scenario the UEs can use a pre-configured DRX configuration.Additionally, for groupcast UEs, a UE within the group can also provide the DRX configuration. |  |  |
| Qualcomm | 1, 2, and 4 | IC UEs: 1 & 2 OOC UEs: 2 & 4 |  | Tx-centric manner |
| LG | Option 1 or Option 3 for UE specific SL DRX (e.g., unicast) Option 1 or option 4 for Common SL DRX (e.g., groupcast/broadcast) | UE specific SL DRX can be determined by the gNB or the UE. In RRC Connected state, the gNB can decide UE specific SL DRX, and in RRC Idle/Idle state or OOC, the UE can determine UE specific SL DRX (in this case, we prefer that the SL DRX configuration can be determined by the RX UE.). Also, we prefer the Common SL DRX configuration to be determined by the gNB or pre-configuration parameters are used. | IC:gNBOOC:Pre-configuration | Rx-centric |
| ITL | See comments | For in coverage UE, Option 1 could be considered for SL DRX configuration decision.For out of coverage UE, Option 2, 3, 4 could be considered for SL DRX configuration decision for different case. | IC:gNBOOC:Pre-configuration | Tx-centric or Rx-centric |
| Spreadtrum | Option 1, 2 and 4  | Option 1 for IC UEOption 2 and 4 for OOC UE | IC:gNBOOC:Pre-configuration | Tx-centric or Rx-centric |
| Nokia | Option 2 and 6 | Although we see the benefit of using 1 for in-coverage UEs, we think that specifying two different behaviours now may not be the best move. Therefore, it does make sense to allow the UE(s) to coordinate internally based on i.e. service, or maybe let higher layer provide requests for certain DRX parameters |  | Tx-centric? |
| Convida Wireless | Option 1,4 for common SL DRX configurationOption 3 for UE specific SL DRX configuration | For common SL DRX configuration, the UEs should know the SL DRX configuration without peer UE communication. In-Coverage UEs could determine the SL DRX parameters from the gNB/scheduler (for example through dedicated signaling or through system information). Out-of-Coverage UEs could determine the SL DRX parameters through pre-configuration.For UE specific SL DRX configuration, our preference is that the SL DRX parameters be determined by the RX UE. We do think that a negotiation step prior to the SL DRX configuration could help optimize the configuration for the QoS requirements of the traffic, as well as maximize the potential power savings. For example when a UE has multiple parallel unicast links (with different UEs). |  | Rx-centric |
| Philips | Option 1, 2, 3, 4 or 6 depending on the case | For IC UE:* Unicast: option 1 if in RRC connected, otherwise option 2 or 3 after some negotiation between TX and RX UE.
* Groupcast/broadcast: option 1, i.e. via SIB

For OoC UE:* Unicast: option 2 or 3 after some negotiation between TX and RX UE.
* Groupcast/Broadcast: option 4

On top of all the above, the upper layer i.e. the application layer, can always suggest DRX configurations as it occurs in LTE-M or NB-IoT for the eDRX negotiation | IC:gNBOOC:Pre-configuration | Tx-centric or Rx-centric |
| SONY | 1) for broadcast when UEs are in coverage2 or 3) for unicast 1. For broadcast when UEs are out of coverage

FFS for Groupcast | For Broadcast there should be a common configuration for all UEs, which could be changed through RRC signalling/SIB from gNB. For Unicast the SL DRX should be decided between the UEs.For Groupcasts there are several aspects, therefore this should be studied further |  | Tx-centric or Rx-centric |
| ZTE | Option 1) for dedicated SL DRX configuration for UE in RRC\_CONNECTED state; and default DRX configuration for IC UE.Option 4) for default DRX configuration for OC UE.Option 3) for dedicated SL DRX configuration for UE in RRC\_idle and inactive state | Option 1 or 4 can be used to configure common DRX configuration for broadcast/groupcast.In addition, for the UE in RRC\_CONNECTED state,the network shall be responsible for the SL DRX configuraion.for dedicated SL DRX configuration for UE in RRC\_idle and inactive state, we think RX UE is more suitable to determine how to achieve power saving from SL-DRX . | IC:gNBOOC:Pre-configuration | Tx-centric or Rx-centric |