**3GPP TSG-RAN WG2 Meeting #116bis-e *R2-22xxxxx***

**Electronic, 17 – 25 Jan, 2022**

Agenda Item: 8.15.2

Source: Ericsson

Title: Summary of [Post116-e][718][V2X/SL] SL DRX configuration (Ericsson)

Document for: Discussion, Decision

# Introduction

This is to discuss the [718] as follows.

* [POST116-e][718][V2X/SL] SL DRX configuration (Ericsson)

**Scope:** Address and solve the remaining aspects based on P25 to P30 in R2-2109907, P11 to P13 in R2-2110062, and P12 in R2-2109801.

**Intended outcome:** Discussion summary

**Deadline:** Long email discussion

For rapporteur to have enough time drafting summary report, we would like to have the following two phases:

* Phase 1: collect companies’ views by 2021-12-14 2400 UTC
* Phase 2: rapporteur will finalize summary report based on inputs of phase 1 by 2021-12-17 0800 UTC

# Discussion

In the scope of this email discussion, the following proposals in [1][2][3] need to be addressed.

Proposals to discuss in [1] are listed as the following

***Proposal 25***  *For unicast, when a TX UE is in RRC\_CONNECTED, the serving gNB of the TX UE determines the SL DRX configurations for the RX UE, regardless of whether Mode 1 scheduling or Mode 2 resource allocation is adopted.*

***Proposal 26*** *For unicast, the serving gNB of a RX UE can either accept or reject the SL DRX configurations of the RX UE but cannot modify it.*

***Proposal 27*** *Alignment between Uu DRX of the Tx UE and SL DRX of the Rx UE is up to the serving gNB of the TX UE¸ regardless of whether Mode 1 scheduling or Mode 2 resource allocation is adopted.*

***Proposal 28*** *For alignment between Uu DRX of the Rx UE and SL DRX of the Rx UE, the serving gNB of the RX UE may adjust Uu DRX of the RX UE.*

***Proposal 29*** *For groupcast or broadcast, the TX UE and the RX UE may report assistance information (e.g., SidelinkUEInformationNR) to their serving gNB regarding traffic type (e.g., associated L2 ID or PQI).*

***Proposal 30*** *For groupcast or broadcast, no additional mechanism is needed in order to achieve alignment of Uu DRX and SL DRX.*

Proposals to discuss in [2] are listed as the following

***Proposal 11*** *mode-2 TX UE in RRC\_CONNECTED need not report RX UE’s assistance information for SL-DRX to its serving gNB.*

***Proposal 12*** *mode-2 TX UE in RRC\_CONNECTED need not obtain SL-DRX configuration for the unicast communication to an RX UE from its serving gNB, but determine SL-DRX configuration by itself.*

***Proposal 13*** *Mode-2 TX UE in RRC\_CONNECTED may inform its serving gNB about its decided SL-DRX configuration by including it in Sidelink UE Assistance information.*

Proposals to discuss in [3] are listed as the following

***Proposal 12*** *If the RRC CONNECTED UE is configured with sidelink DRX for SL groupcast/broadcast, it shall reports the related SL DRX configuration to the serving cell, then the serving cell can decides whether to update Uu DRX.*

The proposals are concerning the following questions:

1. **Question 1**: For SL unicast and TX UE in RRC CONNECTED, who provides configuration for SL DRX of RX UE?
2. **Question 2**: For SL unicast and TX UE in RRC CONNECTED, who determines alignment between Uu DRX of TX UE and SL DRX of RX UE?
3. **Question 3**: For SL unicast and RX UE in RRC CONNECTED, who determines alignment of Uu DRX of RX UE and SL DRX of RX UE?
4. **Question 4**: For SL groupcast or broadcast, how to align SL DRX and Uu DRX of UE who is interested with the service?

All the above proposals can be grouped into the following different cases (as shown in the table) for which the proposals are applicable. In the table, UE in RRC IDLE, RRC INACTIVE or out of coverage is treated as the same case, i.e., referred to as non RRC CONNECTED.

Table 1: Alignment cases of SL DRX for SL unicast

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Cases** | **TX UE RRC state** | **TX UE resource allocation (RA) mode** | **RX UE RRC state** | **status** |
| **Case 1** | RRC CONNECTED | Mode 1 | Non RRC CONNECTED | Not done |
| **Case 2** | RRC CONNECTED | Mode 2 | Non RRC CONNECTED | Not done |
| **Case 3** | RRC CONNECTED | Mode 1 | RRC CONNECTED | Not done |
| **Case 4** | RRC CONNECTED | Mode 2 | RRC CONNECTED | Not done |
| **Case 5** | Non RRC CONNECTED | Mode 2 | Non RRC CONNECTED | invalid |
| **Case 6** | Non RRC CONNECTED | Mode 2 | RRC CONNECTED | Not done |
| **Case 7** | SL DRX for groupcast and broadcast | | | Not done |

In addition, SL DRX for SL groupcast or broadcast is counted as **Case 7**.

**Notes**

1. For the above cases, rapporteur considers **case 5** invalid since there is no alignment issue in this case. TX UE will determine SL DRX based on existing RAN2 agreements.
2. **Question 1 and Question 2** will be checked jointly in all relevant cases of SL unicast since Q1 will not depend on RRC state of RX UE
3. **Question 3** will be checked jointly in all relevant cases of SL unicast since how RX UE’s gNB behaves will depend on neither RRC state nor RA mode of TX UE**.**
4. **Question 4** will be checked only in Case 7**.**

In the rest sections, we discuss the alignment issue, i.e., alignment between SL DRX and Uu DRX for different cases respectively.

## Question 1 – For SL unicast and TX UE in RRC CONNECTED, who provides configuration for SL DRX of RX UE

According to proposals in [1] and [2], RAN2 needs to discuss whether this question depends on RA mode of TX UE. The rapporteur therefore formulates the following questions accordingly.

**Note**: the following questions in this clause are corresponding to P25-P28 in [1].

***Q1-1: For unicast and TX UE in RRC CONNECTED and Mode 1 RA, do companies agree that the serving gNB of TX UE determines the SL DRX configurations for RX UE?***

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments |
| OPPO | Yes |  |
| Xiaomi | Yes | Since the transmission resource is scheduled by gNB, gNB should determine the SL DRX. |
| vivo | Yes | From our understanding, when TX UE in RRC CONNECTED and Mode 1 RA, it is a natural way that the serving gNB of TX UE determines the SL DRX configurations for RX UE since it is up to gNB to align between resource allocation and DRX pattern. |

In case of Mode 2 resource allocation, regarding who determines SL DRX for RX UE, the following two different options are proposed in [1] and [2] respectively.

Option 1: same as for Mode 1 scheduling, TX UE’s gNB determines SL DRX for RX UE

Option 2: TX UE determines SL DRX for RX UE

For Option 1, it is beneficial to achieve a unified treatment regarding how to provide SL DRX for RX UE regardless of Mode 1 scheduling or Mode 2 resource allocation is adopted.

Meanwhile the proponent of Option 2 states in [2] that

* Additional latency and signalling overhead for using SL DRX configuration will be introduced if mode 2 TX UE is mandated to obtain SL-DRX configuration from its serving gNB.
* gNB-determined SL-DRX configuration may cause unnecessary mode-2 resource reselections.
* Mandating an RRC\_CONNECTED mode-2 TX UE obtaining SL-DRX configuration from NW increases UE complexity.

For the first argument, rapporteur thinks that TX UE may typically perform SL DRX configuration before PC5-RRC connection/SL RB is established. Reconfiguration of SL DRX may be seldom triggered after PC5-RRC connection/SL RB is established. The additional latency and signalling overhead are expected to be small.

For the second argument, TX UE is able to report traffic pattern to the gNB based on which the gNB can provide a suitable DRX configuration fitting to the traffic pattern. Therefore, mode 2 resource reselection can be avoided.

For the third argument, as described in the above for Option 1, with option 1, UE only needs to implement a common mechanism to obtain SL DRX regardless whether Mode 1 scheduling or Mode 2 resource allocation is applied, this can actually simplify UE complexity, since UE will just rely on NW signalling/configuration.

Therefore, companies are welcome to give views on the above two options.

Rapporteur therefore formulates the following questions accordingly.

**Note**: the following questions in this clause are corresponding to P25-P28 in [1] and P11-P13 in [2].

***Q1-2: For unicast and TX UE in RRC CONNECTED and Mode 2 RA, which option do companies agree to adopt regarding who determines SL DRX for RX UE?***

**Option 1: same as for Mode 1 scheduling, TX UE’s gNB determines SL DRX for RX UE**

**Option 2: TX UE determines SL DRX for RX UE**

**Option 3: Other**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comments |
| OPPO | Option 1 | Firstly, we agree with rapporteur option 1 is beneficial to achieve a unified treatment.  Besides the formulations from rapporteur above, another point is the Tx resource pool is configured in a UE-specific manner for RRC\_CONNECTED UE. Which means Option 1 can achieve a joint decision by network for Tx-pool and DRX configuration. |
| Xiaomi | Option 1 | Apart from unified solution, we think option 1 is more future proof, considering mixed resource allocation may be introduced in future. |
| vivo | Option 1 | Agree with the rapporteur’s view.  Firstly, a unified solution between mode 1 and mode 2 can reduce UE’s complexity and simplify the spec without obvious performance degradation.  Furthermore, if the nodes that finally determine the SL DRX configurations for RX UE in Mode 1 and Mode 2 are different, when the RA mode is reconfigured by the gNB, DRX pattern should be also reconfigured and some unexpected or asynchronization scenarios may occur in the transition period, which may need further consideration and specification efforts. |

**Rapporteur summary**:

Rapporteur would like to try to reach at least a consensus about the above highlighted points and thus would like to suggest:

1. xxxxx

## Question 2 – For SL unicast and TX UE in RRC CONNECTED, who determines alignment between Uu DRX of TX UE and SL DRX of RX UE

This question is only valid in case TX UE applies Mode 1 RA.

However, RAN2 needs to further clarify whether TX UE’s gNB and/or RX UE’s gNB to take care of alignment of Uu DRX of TX UE and SL DRX of RX UE. Therefore, it is sufficient to only raise the following question.

***Q2-1: For unicast and TX UE in RRC CONNECTD, which option do companies agree to adopt regarding who determines* alignment between Uu DRX of TX UE and SL DRX of RX UE*?***

**Option 1: TX UE’s gNB**

**Option 2: RX UE’s gNB if RX UE is in RRC CONNECTED**

**Option 3: Other**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comments |
| OPPO | Option 1 with no spec impact | For the “alignment between Uu DRX of TX UE and SL DRX of RX UE”, considering Uu-DRX of Tx-UE is in control of network, we do not see another alternative other than letting Tx-UE’s gNB to do the alignment, i.e.,a joint configuration of SL grant and SL DRX of Rx UE. No spec impact is needed. |
| Xiaomi | Both option 1 and option 2 | TX UE would report RX UE’s assistance information to its gNB. So, TX UE’s gNB determines RX UE’s SL DRX taking assistance information into account. RX UE would report received SL DRX to its gNB. So, RX UE’s gNB determines RX UE’s Uu DRX taking SL DRX into account. Apparently, both side could achieve alignment by adjusting SL DRX or Uu DRX. |
| vivo | Option 1 | According to the above Q1-1 and Q1-2, it is the serving gNB of TX UE to determine the SL DRX of RX UE. Hence, it is a natural way for the serving gNB to align between Uu DRX of TX UE and SL DRX of RX UE. |

**Rapporteur summary**:

Rapporteur would like to try to reach at least a consensus about the above highlighted points and thus would like to suggest:

1. xxxxxxx

## Question 3 - For SL unicast and RX UE in RRC CONNECTED, who determines alignment of Uu DRX of RX UE and SL DRX of RX UE

According to the following RAN2 agreement,

In SL unicast, for DRX configuration of each direction where one UE as Tx-UE and the other as Rx-UE, when Rx-UE is in-coverage and in RRC\_CONNECTED state, Rx-UE report the DRX configuration received in signalling-2 (Tx->Rx) to the serving network.

A relevant question would be how RX UE reports a received SL DRX configuration to the gNB, i.e., using which signaling message.

***Q3-1: For unicast and RX UE in RRC CONNECTED, what signaling message does RX UE use to report a received SL DRX configuration to the gNB?***

***Option 1: existing Uu RRC signaling (e.g., SidelinkUEInformationNR)***

***Option 2: new Uu RRC signaling***

***Option 3: Other***

|  |  |  |
| --- | --- | --- |
| Company | Option | Comments |
| OPPO | Option 1 |  |
| Xiaomi | Option 1 |  |
| vivo | Option 1 | SL DRX configuration is also a kind of SL UE information. Hence, SidelinkUEInformationNR can also be reused to carry this. |

When RX UE signals a received SL DRX to its serving gNB, how to align Uu DRX of RX UE with SL DRX of RX UE will be up to RX UE’s gNB implementation. However, in order to be aligned with the existing RAN2 agreement made in RAN2#114

* *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.*

The gNB of RX UE shall be able to indicate acceptance or rejection to the received SL DRX configuration.

***Q3-2: For unicast and RX UE in RRC CONNECTED, do companies agree that the serving gNB of RX UE shall be able to indicate either acceptance or rejection to the received SL DRX configurations of RX UE?***

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments |
| OPPO | No | It should be Rx UE itself to decide whether the SL DRX configuration is accepted or not since   1. The gNB does not have full information of Rx-UE in terms of power consumption and DRX preference (active time of other links, half-duplex issue, desired DRX configuration, RF implementation…), which is the key input for Rx UE to derive the acceptance/rejection result 2. Unnecessary latency will be caused if rely on the serving gNB of RX UE to decide, it will take a long time to determine the SL DRX configuration. |
| Xiaomi | Yes | Received SL DRX may be conflict with gNB’s configuiration from resource scheduling point of view. For example, on duration time may be overlapped with configured grant. Note different unicast pair may configure different SL DRX cycle and offset. If gNB is not allowed to reject SL DRX, gNB may have to change the configured grant frequently or configured grant can’t be configured at all. |
| vivo | No, /see comments | We are not sure whether a SidelinkUEInformation message can be responded by acceptance or rejection, which is a little strange from the perspective of assistance information.  Furthermore, what is the RX UE’s behaviors after received rejection from its serving cell? It requires an additional specification effort on it. In our understanding, it can be left to RX UE’s implementation to respond TX UE a rejection via PC5 procedure, e.g. according to the Uu configuration from the serving cell of RX UE without explicit SL DRX rejection from its serving cell. |

A relevant question would be how the gNB signals “acceptance” or “rejection” to RX UE.

***Q3-3: If the answer of Q3-2 is Yes, for unicast and RX UE in RRC CONNECTED, what signaling message does the gNB use to signal “acceptance” or “rejection”*** ***to RX UE for the received SL DRX configuration?***

***Option 1: existing Uu RRC signaling please specify which message if choose Option 1***

***Option 2: new Uu RRC signaling***

***Option 3: Other***

|  |  |  |
| --- | --- | --- |
| Company | Option | Comments |
| Xiaomi | Option 1 | Reconfiguration message could be reused. |
|  |  |  |

How to align Uu DRX of RX UE with SL DRX of RX UE will be up to RX UE’s gNB implementation, i.e., whether to update Uu DRX or SL DRX of RX UE is up to gNB’s implementation.

Therefore, no additional spec change is foreseen. It is necessary to check companies’ views on this.

***Q3-4: For unicast and RX UE in RRC CONNECTED, how to align Uu DRX of RX UE with SL DRX of RX UE will be up to RX UE’s gNB implementation, i.e., no spec change is foreseen?***

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments |
| OPPO | Yes |  |
| Xiaomi | Yes |  |
| vivo | Yes |  |

**Rapporteur summary**:

Rapporteur would like to try to reach at least a consensus about the above highlighted points and thus would like to suggest:

1. xxxxx

## Question 4 - for SL groupcast or broadcast, how to align SL DRX and Uu DRX

For groupcast and broadcast, the SL DRX configuration can be configured by the gNB via SIB or preconfigured to the UE. In this case, the TX UE and the RX UE can report assistance information to its respective serving gNB on traffic type (e.g., associated L2 ID or PQI), the gNB therefore provides a proper Uu DRX configuration to the TX UE and the RX UE respectively according to the received assistance information. All these means are already existing. Therefore, no additional mechanism is needed for alignment of Uu DRX and SL DRX. It is necessary to check companies’ views on this. Therefore, rapporteur formulates the following questions correspondingly.

***Proposal 29*** *For groupcast or broadcast, the TX UE and the RX UE may report assistance information (e.g., SidelinkUEInformationNR) to their serving gNB regarding traffic type (e.g., associated L2 ID or PQI).*

***Proposal 30*** *For groupcast or broadcast, no additional mechanism is needed in order to achieve alignment of Uu DRX and SL DRX.*

***Proposal 12*** *If the RRC CONNECTED UE is configured with sidelink DRX for SL groupcast/broadcast, it shall reports the related SL DRX configuration to the serving cell, then the serving cell can decides whether to update Uu DRX.*

**Note**: the following questions in this clause are corresponding to P29-P30 in [1] and P12 in [3].

For GC or BC, we need to achieve alignment for the following two cases

TX UE: Uu DRX of TX UE is aligned with SL DRX of RX UE

RX UE: Uu DRX of RX UE is aligned with SL DRX of RX UE

For TX UE, in order to achieve alignment between Uu DRX of TX UE and SL DRX of RX UE in case of Mode 1 scheduling,

From rapporteur’s perspective, the existing content including L2 ID and PQI of the associated traffic/service shall be sufficient for TX UE to report. Since SL DRX for GC or BC shall be common for all UEs interested with the same service. The concerned SL DRX configuration can be either configured by network or preconfigured. gNB is able to obtain the concerned SL DRX configuration by itself based on the received L2 ID or PQI.

Rapporteur thinks it is necessary to check companies’ views.

***Q4-1: For groupcast or broadcast, do companies agree that the existing information content in the existing RRC signaling (e.g., SidelinkUEInformationNR) can be reused by TX UE if in RRC CONNECTED to report assistance information to the gNB in order to achieve alignment of Uu DRX of TX UE and SL DRX of RX UE?***

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments |
| OPPO | ~~No~~ update in comment | The existing information content (PQI and L2 ID) is used to report information on Tx traffic only, i.e., not applicable to Rx in R16.  Rapp: thanks for OPPO comment. For GC or BC, we need to achieve alignment for the following two cases  TX UE: Uu DRX of TX UE is aligned with SL DRX of RX UE  RX UE: Uu DRX of RX UE is aligned with SL DRX of RX UE  So, the existing information content is sufficient for TX UE, but not for RX UE as OPPO commented, I am going to add new question for TX UE.  [OPPO]: Thanks for considering our comments! For Tx UE, we think it is ok to allow implementation based on existing signalling. |
| Xiaomi | Yes |  |
| vivo | Yes with comments | For groupcast and broadcast, SL DRX configuration is determined by the PQI. If PQI is reported to the serving gNB, the gNB can deduce the SL DRX configuration correctly. Hence, it is feasible to reuse the existing reporting, i.e., *SidelinkUEInformationNR.*  However, our concern is whether the purposes of PQI reporting from TX UE and RX UE should be differentiated explicitly since TX UE takes in charge for resource allocation while RX UE for DRX alignment. |

For RX UE, it is sufficient for RX UE if in RRC CONNECTED to report SL DRX configurations associated with its interested services to the gNB. This is motivated by that RAN2 has already agreed to let RX UE to report received SL DRX configuration to gNB in case of unicast. In this case, we can use the same RRC signaling for RX UE to report SL DRX to gNB in case of both unicast and GC or BC.

***Q4-2: For groupcast or broadcast, do companies agree that RX UE if in RRC CONNECTED can report SL DRX configurations associated with its interested services to the gNB in order to achieve alignment of Uu DRX of RX UE and SL DRX of RX UE?***

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments |
| Xiaomi | Yes | We discussed this issue in R2-2110223.  For groupcast and broadcast sidelink DRX, the DRX parameters are determined by QoS profile of destinations which UE is interested in reception. In R16, UE would report the destination id for transmission and its QoS profile to gNB. For some destination, UE may be only interested in reception, but has no data for transmission. For example, in P2V, vehicle would only receive transmission from pedestrian but not transmit to pedestrian. Therefore, gNB can’t acknowledge the DRX configuration used for these reception only destination. Alignment between Uu DRX and SL DRX for groupcast and broadcast can’t be reached.  On the other hand, UE may not receive from the destination(s), which was reported to gNB via *SL-TxResourceReq-r16* in SUI. For example, pedestrian would only perform transmission to vehicle but not receive from vehicle.  With above observations, gNB may not be aware of the DRX configuration used by UE for groupcast and broadcast, by *SL-TxResourceReq-r16* in SUI.  To enable the alignment, UE shall report the sidelink DRX configuration for groupcast and broadcast destination. |
| OPPO | No | With the SL-DRX configuration being fixed for G/B-cast, we do not see much feasibility / benefit from changing Uu-DRX dynamically based on reported SL DRX, i.e., a more feasible solution is to take the static G/B-cast SL DRX configuration as input for Uu-DRX tuning from the very beginning.  For the P-UE based optimization, we understand the network can be aware of that from UE capability info (R1 is already defining capability reflecting different UE types). |
| vivo | See comments | Need further clarification whether reporting from TX UE and RX UE need be differentiated explicitly. |

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments |
| OPPO | No | Same as comments to Q4-1  Rapp: this question is not valid anymore. |
|  |  |  |

After receiving assistance information from UE, the gNB may update Uu DRX for the UE. This can be achieved via existing signaling. Therefore, no spec change is expected.

***Q4-3: For groupcast or broadcast, do companies agree the gNB can provide proper Uu DRX configuration to TX UE or RX UE according to the received assistance information?***

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments |
| OPPO | ~~No~~ update in comment | Same as comments to Q4-1  Rapp: question has been updated according to OPPO comment.  [OPPO]:We are fine with the intention of this question in case there is no spec impact finally. |
| Xiaoi | Yes | gNB could reconfigure Uu DRX, which is legacy procedure. |
| vivo | Yes | For groupcast and broadcast, SL DRX pattern can not be changed. The serving gNB can only align the Uu DRX configuration to the SL DRX pattern, which is left to smart gNB’s implementation. |

**Rapporteur summary**:

Rapporteur would like to try to reach at least a consensus about the above highlighted points and thus would like to suggest*.*

1. xxxx

# Conclusion

We have the following proposal:

[Proposal 1 xxxxx](#_Toc88655069)

[Proposal 2 xxxxxxx](#_Toc88655070)

[Proposal 3 xxxxx](#_Toc88655071)

[Proposal 4 xxxx](#_Toc88655072)

3.1 For chair notes (proposal in priority order)

**Easy Proposals for Block Approval**

**Proposals for Online discussion**

# Reference

[1] R2-2109907 Remaining aspects of SL DRX Ericsson

[2] R2-2110062 Discussion on Remaining issues of SL DRX Apple

[3] R2-2109801 Further consideration on SL DRX configuration ZTE Corporation, Sanechips

# Appendix