3GPP TSG-RAN WG2 #118-e R2- 22xxxxx

Electronical meeting, 9 May – 20 May 2022

Agenda Item: 6.15.3

Source: Ericsson

Title: Summary of [709][V2X/SL] SL DRX and L2 relay in Rel-17 (Ericsson)

Document for: Discussion, Decision

# Introduction

This document is to summarize the inputs from companies on SL DRX and L2 relay in order to resolving the issues.

* [AT118-e][709][V2X/SL] SL DRX and L2 relay in Rel-17 (Ericsson)

 **Scope:** Discuss whether there are real technical blocking issues that cannot apply SL DRX into L2 relay. Companies not supporting SL DRX should identify the technical blocking issues and companies supporting SL DRX can argue why they’re not real technical blocking issues (or if they can be easily solved by CR implementation). Based on each side arguments and analysis, check companies’ views whether there is real technical blocking issue or not.

 **Intended outcome:** Summary discussion in R2-2206305.

**Deadline:** 5/16 10:00am UTC

The discussion includes two phases.

– Phase I is to collect companies views on the issues as captured in open issue list. The suggested deadline for companies' feedback: Friday W1, 2022-05-13 0800 UTC.

– Phase II is to summarize the companies’ views and provide a summary report. The deadline is Monday W2, 2022-05-16 1000 UTC.

# Summary

## Contact information

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| --- | --- | --- |
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## Issues to resolve

Regarding to the combination of SL DRX and relay, the following agreements were reached in RAN2#116-e meeting:

**Agreements on SL-DRX for ProSe:**

1: RAN2 confirm R17 SL-DRX design can support non-relay-related ProSe communication directly without additional specific solution discussion / specification effort.

2: RAN2 confirm the R17 SL-DRX design can support non-relay-related ProSe discovery by reusing SL default-DRX configuration used for communication without further additional specific solution discussion / specification effort.

**Agreements on SL-DRX for ProSe:**

1: RAN2 confirms Rel-17 SL-DRX design can be reused for relay-related ProSe communication in layer-3 relay without additional specific solution discussion/specification effort.

2: Keep RAN2 previous agreement (prioritize the non-relay case without consideration of relay specific optimization in Rel-17) but we’re not going to make any conclusion if L2 relay-related ProSe communication is supported or not in Rel-17 now.

3: RAN2 confirms Rel-17 SL-DRX design can be reused for L3 relay-related ProSe discovery without additional specific solution discussion/specification effort (by applying SL default-DRX configuration). No conclusion if L2 relay-related ProSe discovery is supported or not in Rel-17 now. RAN2 does not specify any restriction now.

Contributions and CRs on the issue are summarized in the below table

|  |  |
| --- | --- |
| Source | Proposals/changes |
| R2-2204588 | **Proposal 1:** Rel-17 specifications can support sidelink DRX in Layer-2 UE-to-Network relay with the current specification (which does not exclude the possibility to take small enhancement applied to both L2 relay and L3 relay case).**Proposal 2:** Send an LS to RAN to inform the agreement of Proposal 1**Rapp->** the proposed changes will be left out from this email discussion. The detailed potential changes can be discussed depending on outcome of this email discussion. |
| R2-2205179 | **Proposal 1:** RAN2 to study SL DRX in R18 to address paging issues.**Proposal 2:** RAN2 to study SL DRX in R18 to address SI issues.**Proposal 3:** RAN2 to study SL DRX in R18 to address issues for initial link setup. |
| R2-2205269 | Changes to TS 38.300 to reflect SL DRX**Rapp->** the proposed changes will be left out from this email discussion. The detailed potential changes can be discussed depending on outcome of this email discussion. |
| R2-2205272 | Proposal 1: Take the merged draft CR R2-2206047 to implement SL DRX configuration report for Sidelink Relay purpose. |
| R2-2206047 | Changes to 38.331 for the description of the initiation of the SL DRX reporting and its corresponding actions for Tx UE and Rx UE. Changes to ASN.1 that gNB is aware of the accepted or preferred SL DRX configuration for the relay link and then may be able to configure optimal SL DRX parameter the relay communication. **Rapp->** the proposed changes will be left out from this email discussion. The detailed potential changes can be discussed depending on outcome of this email discussion. |
| R2-2204946 | **Proposal 1:** Suggest RAN2 to discuss whether the combination of SL DRX, discovery and relay-related communication should be reflected in Rel-17 specs.**Proposal 2:** If the combination of SL DRX, discovery and relay-related communication should be reflected in Rel-17 specs, suggest RAN2 to discuss how to handle the L2 U2N relay when modifying the specs since there is no agreement on whether SL DRX can be supported for L2 U2N relay. |

Regarding the issue on whether SL DRX can be applied for L2 U2N relay, both sides have different arguments. In the following sections, arguments of both sides are described respectively.

**Note**

**Given that this is the last meeting of R17 / the WI has completed 100%, all potential spec changes to make the feature to work should be minimal.**

**The intention of this email discussion is to see if we can make consensus on the issues. If possible, we can find a way forward for compromise.**

### Arguments of not supporting SL DRX for L2 U2N relay in R17

As described [2], the following issues are identified to be addressed in order to not support SL DRX for L2 U2N relay in R17.

There was an issue related to setting up the SL DRX for the unicast connection, was raised by some companies during RAN#95.

During the connection establishment procedure, the gNB configures remote UE with proper mapping between Uu RBs and PC5 RLC channels, also configures relay UE with proper channel mapping between Uu RLC channels and PC5 RLC channels.

A natural issue would be whether to support SL DRX for control signaling during RRC connection establishment for remote UE**.** RAN2has studiedthe similar issue for PC5 connection establishment.

**Issue 1: same as the issue of whether SL DRX should be applied for DCR and PC5 RRC signalling, whether to support SL DRX for control signalling during RRC connection establishment for remote UE given the PC5 link is already established?**

**Issue 2: If the answer of Issue 1 is yes, how to set a proper SL DRX configuration for control signalling?**

For DL direction, in case of Mode 2 RA, according to agreements made in R17, it is relay UE that is to determine SL DRX for the direction from relay UE to remote UE.

For UL direction, remote UE supports only Mode 2 RA, according to agreements made in R17, it is remote UE that is to determine SL DRX for relay UE.

In R17, in addition to LCH priority, relay UE are only aware of split PDB has no knowledge of DL traffic pattern for a E2E flow for a certain E2E flow, which is not sufficient for UE to derive SL DRX.

For unicast, TX UE can determine SL DRX for RX UE considering traffic pattern and associated QoS requirement, in addition to assistance information provided by RX UE. This will be challenge for relay UE since relay UE has no knowledge of DL traffic pattern.

**Issue 3: In case of Mode 2 RA, UE (especially relay UE) is only aware of split PDB but has no knowledge of DL traffic pattern for a E2E flow, which is not sufficient for UE to derive SL DRX.**

Meanwhile**,** the gNB is feasible to configure SL DRX regardless of Mode 1 or Mode 2 scheduling since gNB has enforced break down of E2E QoS and therefore has full knowledge of PC5 QoS, however, in order to make it happen, RAN2 needs to make additional agreements, which would lead to additional spec changes.

**Issue 4: in case of Mode 2 RA, given gNB has full knowledge of PC5 QoS, RAN2 needs to agree that gNB can configure SL DRX for UE, which needs additional spec changes.**

Regarding paging, there are the following issues.

**Issue 5: whether to support SL DRX for paging forwarding via PC5-RRC in case of L2 U2N relay?**

**Issue 6: If SL DRX is applied for PC5-RRC carrying paging message, how to set a proper SL DRX configuration for PC5-RRC carrying paging message?**

Similar as paging, in L2 U2N relay, relay UE needs to forward SI to remote UE, it is important to ensure SI to be forwarded to remote UE. Therefore, RAN2 needs to address the following issues for SI forwarding in case of L2 U2N relay

**Issue 7: whether to support SL DRX for SI forwarding via PC5-RRC in case of L2 U2N relay?**

**Issue 8: If SL DRX is applied for PC5-RRC carrying SI message, how to set a proper SL DRX configuration for PC5-RRC carrying SI request/message?**

### Arguments of supporting SL DRX for L2 U2N relay in R17

Meanwhile, arguments of supporting SL DRX for L2 U2N relay in R17 are described in [1],

With regard to SL DRX for L2 Relay scenario, our analysis is as below.

a. For the remote UE in RRC\_CONNECTED case, the relay UE is informed of the PDB split and there is also assistance information from the remote UE.

b. For the remote UE in RRC\_IDLE / RRC\_INACTIVE case, the forwarded traffic only includes SI and paging, which have no QoS profile, but the relay UE is aware of the general CP latency requirements and the remote UE’s paging DRX cycle.

c. For CP forwarding, someone may question that the performance will not be guaranteed for paging, signalling, SI with critical latency requirements (as discussed within Q1 of the intermediate round of RP-220884). However, it should be noted that there’s no guaranteed performance today on Uu. There are some requirements like the maximum paging gap during cell reselection. But there’s no requirement saying that “a signalling message transmitted by the gNB shall be received by the UE within X ms”. Even if one assumes there is some requirement, as stated above, it is not dynamic and thus can be handled by relay UE implementation as stated above.

d. For UP forwarding, based on the understanding above, we think in case of mode 2 operation, the relay UE can determine sidelink DRX based on PC5 QoS configuration directed configured by gNB and the assistance information from the remote UE. In case of mode 1 operation, the sidelink DRX configuration is anyway determined by gNB, which has all the information.

### Companies views on issues

**Issue 1: same as the issue of whether SL DRX should be applied for DCR and PC5 RRC signalling, whether to support SL DRX for control signalling during RRC connection establishment for remote UE given the PC5 link is already established?**

RAN2 has discussed whether to support SL DRX for DCR, PC5-S signaling and PC5-RRC during SL unicast link setup procedure. Similarly, for remote UE in case of L2 U2N relay, remote UE may need to setup its RRC connection to the network via relay UE. RAN2 can discuss the necessity of this issue.

***Q1-1:* same as the issue of whether SL DRX should be applied for DCR and PC5 RRC signaling, do companies agree that RAN2 needs to study whether to support SL DRX for control signaling during RRC connection establishment for remote UE given the PC5 link is already established*?***

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments |
| Ericsson | Yes | RAN2 needs to discuss whether SL DRX should be supported or not for control signaling during RRC connection establishment of remote UE. |
| OPPO | No | Basically, we understand the issue can be generalized as how to handle the SL-DRX setting w.r.t the Uu-SRB(s) (carried via SL-RLC for relay traffic). And our understanding is that the SL-DRX setting for UC list does not differentiate between radio bearer(s) / RLC-channels, as in legacy Uu. |
| MediaTek | No | We have the same understanding as OPPO |
| InterDigital | Yes | There is currently no mechanism to avoid delays associated with RRC connection establishment of a remote UE as a result of SL DRX being set up between the relay and the remote UE.  |
| Apple | No | MAC layer DRX mechanism does not need to differentiate the SLRBs carrying SL UC traffic after PC5 link established. The only exception is for DCR. |

**Issue 2: If the answer of Issue 1 is yes, how to set a proper SL DRX configuration for control signalling?**

If companies think RAN2 needs to discuss whether SL DRX should be applied for control signaling during RRC connection establishment for remote UE, companies can give their views on possible solutions.

***Q1-2: if* support SL DRX for control signaling during RRC connection establishment for remote UE*,* how to set a proper SL DRX configuration for control signaling?**

|  |  |  |
| --- | --- | --- |
| Company | solutions | Comments |
| Ericsson | If SL DRX is supported, RAN2 needs to discuss whether TX profile needs to be configured. |  |
| OPPO |  | TX profile is not applicable to UC messages except for UC-based DCR, since we can always rely on UE capability for UC messages after link establishment. |
| MediaTek |  | We have the same understanding as OPPO |
| InterDigital | Solution should be inspired from what was agreed for DCR. |  |
| Apple |  | Not sure why UC SL-DRX is not proper in the first place, we have PC5-RRC signaling to negotiate the SL-DRX configuration. |

For unicast, TX UE can determine SL DRX for RX UE considering traffic pattern and associated QoS requirement, in addition to assistance information provided by RX UE. This will be challenge for relay UE since relay UE has no knowledge of DL traffic pattern.

Meanwhile, the other side thinks that the relay UE can determine sidelink DRX based on PC5 QoS configuration directed configured by gNB and the assistance information from the remote UE.

**Issue 3: In case of Mode 2 RA, UE (especially relay UE) is aware of split PDB for a E2E flow but has no knowledge of DL traffic pattern, which is not sufficient for UE to derive SL DRX.**

***Q2-1:* do companies agree that in case of Mode 2 RA, UE (especially relay UE) is aware of split PDB for a E2E flow but has no knowledge of DL traffic pattern, this is not sufficient for UE to derive SL DRX*?***

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments |
| Ericsson |  Yes | Since relay UE has no knowledge of DL traffic pattern, it will be challenging for relay UE to set a proper SL DRX considering only PDB, LCH priority and assistance information from remote UE. |
| OPPO | No | So, the root question is whether traffic pattern would lead to a big difference in terms of DRX setting. While we understand:1. Nowadays DRX setting is mostly optimized base on assumption of busty traffic (regardless of various traffic types), so traffic pattern info does not play a key role of DRX setting tunning.
2. And relay-UE can anyway get assistance information from remote UE to decide on the cycle/on-duration timer setting (which would reflect the traffic pattern information as well).
 |
| MediaTek | No | a. For the remote UE in RRC\_CONNECTED case, the relay UE is informed of the PDB split and there is also assistance information from the remote UE. b. For the remote UE in RRC\_IDLE / RRC\_INACTIVE case, the forwarded traffic only includes SI and paging, which have no QoS profile, but the relay UE is aware of the general CP latency requirements and the remote UE’s paging DRX cycle. |
| InterDigital | Yes | We think the current assumptions of the TX UE deciding the DRX configuration based on UE implementation is unacceptable for Uu traffic. |
| Apple | No | As explained in MTK, we think the UC DRX mechanism is sufficient for this issue.  |

Companies can give their views on possible solutions on how UE set proper SL DRX for its peer UE in case of Mode 2 RA.

***Q2-2: In case of Mode 2 RA,* how does UE (especially relay UE) set proper SL DRX for its peer UE*?***

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| --- | --- | --- |
| Company | solutions | Comments |
| Ericsson  | 1. For remote UE, when remote UE sets up PC5 connection, remote UE has no information on PC5 QoS breakdown, therefore, SL DRX provided to relay UE may be not suitable. After remote UE has received QoS info for PC5 link, remote UE may have to reconfigure the SL DRX.
2. For relay UE,
	1. information on DL traffic pattern may need to provide to relay UE by gNB.
	2. Remote UE needs to provide assistance information to relay UE at good time, trigger condition may be updated.
	3. Whether relay UE configures SL DRX to remote UE at the time when PC5 link is established or after relay UE has received RRCReconfiguration from gNB carrying DL traffic pattern, and/or QoS parameter for PC5 link
 |  |
| OPPO |  | W.r.t the additional QoS info to be provided to relay/remote UE, it seems have been discussed in the AI of QoS, and at least in R17, companies only see clear value / benefit from PDB / priority as key QoS input.  |
| MediaTek | We think in case of mode 2 operation, the relay UE can determine sidelink DRX based on PC5 QoS configuration directed configured by gNB and the assistance information from the remote UE, which is supported already by Rel-17 SL DRX. The Relay UE behavior as listed by Ericsson is UE implementation based on the framework of Rel-17 SL DRX . |  |
| InterDigital | We should specify some gNB involvement for mode 2 RA. |  |
| Apple |  | Not sure why this issue is different from L3 relay UE. Do we try to optimize the performance only for L2 relay case? |

Meanwhile**,** the gNB is feasible to configure SL DRX regardless of Mode 1 or Mode 2 RA since gNB has enforced break down of E2E QoS, however, in order to make it happen, RAN2 needs to make additional agreements, which would lead to additional spec changes.

**Issue 4: in case of Mode 2 RA, given gNB has full knowledge of PC5 QoS, RAN2 needs to agree that gNB can configure SL DRX for UE, which needs additional spec changes.**

***Q2-3:* in case of Mode 2 RA, given gNB has full knowledge of PC5 QoS, RAN2 needs to agree that gNB can configure SL DRX for UE, which needs additional spec changes, do companies agree this*?***

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments |
| Ericsson | Yes | Since gNB has full knowledge of PC5 QoS, it is more suitable for gNB to provide SL DRX configuration to remote UE or relay UE regardless of RA mode. |
| OPPO |  | When we discussed SL-DRX setting for mode-2, the camp who support UE-based SL-DRX setting decision was more considering that gNB has no info on resource allocation at UE side. So we assume even if we reopen the discussion, the result still is a trade-off taking into account of different factors / concerned aspect.  |
| InterDigital | Yes | Given the traffic is Uu traffic, the outcome of this discussion should be different compared to the non-relay case. |
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Regarding paging, there are the following issues.

**Issue 5: whether to support SL DRX for paging forwarding via PC5-RRC in case of L2 U2N relay?**

***Q3-1:* do companies agree that RAN2 needs to study whether to support SL DRX for paging forwarding via PC5-RRC in case of L2 U2N relay*?***

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| --- | --- | --- |
| Company | Yes or No | Comments |
| Ericsson | Yes | RAN2 needs to first discuss whether SL DRX will be supported for paging. If the answer is yes, what DRX configuration can be applied. In addition, Remote UE may receive paging in any RRC state. DRX cycles including paging cycle, PC5 SL DRX cycle and/or Uu DRX cycle may need to be aligned. |
| OPPO | No | So similar to Q1-1, basically, we understand the issue can be generalized as how to handle the SL-DRX w.r.t PCCH (carried via SL-SRB3, *UuMessageTransferSidelink*). As replied to Q1-1, our understanding is that the SL-DRX setting for UC list does not differentiate between radio bearer(s), as in legacy Uu. |
| MediaTek | No  | We did not see any specific issue for SL DRX with regard to paging forwarding. The issue can be generated as signaling forwarding. |
| InterDigital | Yes | SL DRX is intended for connected-mode like traffic, and not for paging. RAN2 should at least discuss how to take into account paging when SL DRX is configured. |
| Apple | No | We do not see any special issue specific for L2 Relay case. |

**Issue 6: If SL DRX is applied for PC5-RRC carrying paging message, how to set a proper SL DRX configuration for PC5-RRC carrying paging message?**

***Q3-2:* If SL DRX is applied for PC5-RRC carrying paging message, how to set a proper SL DRX configuration for PC5-RRC carrying paging message*?***

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| --- | --- | --- |
| Company | solutions | Comments |
| Ericsson | Procedure texts in RRC may need to update if SL DRX is supported for paging.Some signaling changes to achieve alignment of DRX cycles may be necessary. |  |
| OPPO |  | Relay UE can already acquire the paging cycle information from remote UE, i.e., sufficient input for SL-DRX setting derivation. Yet we are not sure if there is latency requirement for paging delivery even in legacy network. |
| MediaTek |  | We did not see the need to make the thing complicated and to discuss the specific solution.It should be noted that there’s no guaranteed performance today on Uu. There’s no requirement saying that “a signalling message transmitted by the gNB shall be received by the UE within X ms”. Even if one assumes there is some requirement, it is not dynamic and thus can be handled by relay UE implementation. |
| InterDigital | Alignment of DRX cycles, and consideration of paging-type DRX. |  |
| Apple |  | No, we do not see a strong need optimize this case. |

Similar as paging, in L2 U2N relay, relay UE needs to forward SI to remote UE, it is important to ensure SI to be forwarded to remote UE. Therefore, RAN2 needs to address the following issues for SI forwarding in case of L2 U2N relay.

On the other side, some companies think that for the remote UE in RRC\_IDLE / RRC\_INACTIVE case, the forwarded traffic only includes SI and paging, which have no QoS profile, but the relay UE is aware of the general CP latency requirements and the remote UE’s paging DRX cycle.

**Issue 7: whether to support SL DRX for SI forwarding via PC5-RRC in case of L2 U2N relay?**

***Q4-1:* do companies agree that RAN2 needs to study whether to support SL DRX for SI forwarding via PC5-RRC in case of L2 U2N relay*?***

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| --- | --- | --- |
| Company | Yes or No | Comments |
| Ericsson | Yes | RAN2 needs to first discuss whether SL DRX will be supported for SI. If the answer is yes, what DRX configuration can be applied. With a bad SL DRX configuration, SI delivery may be delayed. |
| OPPO | No | So similar to Q1-1, basically, we understand the issue can be generalized as how to handle the SL-DRX w.r.t BCCH (carried via SL-SRB3, *UuMessageTransferSidelink*). As replied to Q1-1, our understanding is that the SL-DRX setting for UC list does not differentiate between radio bearer(s), as in legacy Uu. |
| MediaTek | No  | We did not see any specific issue for SL DRX with regard to SI forwarding. The issue can be generated as signaling forwarding together with paging forwarding. |
| InterDigital | Yes | Same issues of paging apply to system information. |
| Apple | No | Same as Paging |

Similar as paging, in L2 U2N relay, relay UE needs to forward SI to remote UE.

On the other side, some companies think that for the remote UE in RRC\_IDLE / RRC\_INACTIVE case, the forwarded traffic only includes SI and paging, which have no QoS profile, but the relay UE is aware of the general CP latency requirements and the remote UE’s paging DRX cycle.

**Issue 8: If SL DRX is applied for PC5-RRC carrying SI message, how to set a proper SL DRX configuration for PC5-RRC carrying SI message?**

***Q4-2:* If SL DRX is applied for PC5-RRC carrying SI message, how to set a proper SL DRX configuration for PC5-RRC carrying SI message*?***

|  |  |  |
| --- | --- | --- |
| Company | solutions | Comments |
| Ericsson | Procedure texts in RRC may need to update if SL DRX is supported for SI forwarding.Some signaling changes to achieve alignment of DRX cycles may be necessary. |  |
| OPPO |  | If the proponents are thinking about *si-Periodicity* as SI-related cycle information, relay UE can get that info by reading SIB1, so this input should be available. Yet we are not sure if there is latency requirement for SI delivery even in legacy network. |
| MediaTek | No  | We did not see the need to make the thing complicated and to discuss the specific solution. |
| InterDigital | Same issues of paging apply to system information |  |
| Apple |  | The bottom line is there is no clear latency requirements for SI delivery. If relay UE or remote UE feels some issue, the SL-DRX UC can be updated or turned off easily with existing Rel-17 mechanism. |

**Rapporteur summary**

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

1. xxxxxxx

# Conclusion

We have the following proposal:

[Proposal 1 xxxxxxx](#_Toc103025986)

3.1 Proposals in priority order

# Reference

1. R2-2204588 Discussion on Sidelink DRX for Sidelink Relay MediaTek Inc., APPLE, OPPO discussion Rel-17 NR\_SL\_relay-Core
2. R2-2205179 Issues of SL DRX for L2 U2N relay Ericsson discussion Rel-17 NR\_SL\_enh-Core
3. R2-2205269 Corrections on the Sidelink DRX NEC Corporation CR Rel-17 38.300 17.0.0 0457 - F NR\_SL\_enh-Core
4. R2-2205272 Way forward for Sidelink DRX configuration report for Relay purpose MediaTek Inc. discussion Rel-17 NR\_SL\_relay-Core Late
5. R2-2206047 Correction on SL DRX configuration for SL Relay MediaTek Inc., Huawei, ZTE, OPPO draftCR Rel-17 38.331 17.0.0 NR\_SL\_relay-Core
6. R2-2204946 Combination of SL DRX, Discovery and relay-related Communication CATT discussion Rel-17 NR\_SL\_enh-Core

# Appendix