**3GPP TSG-RAN WG2 #116-e *R2-21xxxxx***

Electronic meeting, Nov 1 – 12, 2021

Agenda Item: 8.15.2

Source: Xiaomi

Title: Summary of [AT116-e][705][V2X/SL] SL DRX for SL-CSI reception

Document for: Discussion and Decision

# Introduction

This is to kick off following offline discussion,

**[AT116-e][705][V2X/SL] SL DRX for SL-CSI reception (Xiaomi)**

 **Scope:** Discuss SL DRX for SL-CSI reception covering the proposals in P10-P11/R2-2109907, P6/R2-2109937, P3-P4/R2-2110119, P4-P6/R2-2110273, P11-P13/R2-2110650, P1-P2/R2-2111008, P4 and P10/R2-2111065, P12/R2-2111204.

 **Intended outcome:** Discussion summary in R2-2111422

 **Deadline:** 11/8, 17:00 UTC

# Discussion

Following questions about SL DRX for SL-CSI reception are summarized based on companies’ contributions [1-8].

## Whether confirm the working assumption

In RAN2 113b meeting, following working assumption is agreed,

|  |
| --- |
| Working assumption: The slots when the UE is expected CSI report following a CSI request is considered as SL active time. |

[1][2][3][4][5][6][7][8] propose to confirm the working assumption. Because UE should be active to receive CSI report from peer UE, after SL-CSI request transmission.

**Q1: Do you agree to confirm the following working assumption,**

**Working assumption: The slots when the UE is expected CSI report following a CSI request is considered as SL active time.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| OPPO | Yes |  |
| Ericsson | Yes |  |
| InterDigital | Yes |  |
| Intel | Yes |  |
| vivo | Yes |  |
| MediaTek | Yes |  |
| Lenovo, Motorola Mobility | Yes |  |
| ASUSTeK | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Qualcomm | Yes |  |
| Apple | Yes |  |
| Sharp | Yes |  |
| Spreadtrum | Yes |  |
| Fujitsu | Yes |  |
| Nokia | Yes |  |
| CATT | Yes |  |
| ZTE | Yes |  |
| Xiaomi | Yes |  |

All companies agree to confirm the WA. Therefore,

**Proposal 1: Confirm the WA: The slots when the UE is expected CSI report following a CSI request is considered as SL active time. (18/18)**

If working assumption is confirmed, we can further discuss how to define the active time triggered by CSI request.

## How to model active time triggered by CSI request

The MAC entity maintains a *sl-CSI-ReportTimer* for each pair of the Source Layer-2 ID and the Destination Layer-2 ID corresponding to a PC5-RRC connection. *Sl-CSI-ReportTimer* is used for a SL-CSI reporting UE to follow the latency requirement signalled from a SL-CSI triggering UE. Note this timer is not maintained at SL-CSI triggering UE. Rapporteur would like to first discuss how to define active time at SL-CSI triggering UE following CSI request.

[1][2][3][4][6][8] propose to introduce a new timer at SL-CSI triggering UE to control active time. The active time includes the time while new timer running. To make the discussion clearer, the new timer is named as *drx-CSIReportTimerSL* in the discussion. The name can be changed during stage 3 discussion.

[5] think it is unnecessary to introduce a new timer for the triggering UE. The active time is defined by start event, e.g. CSI request is sent, and stop event, e.g. CSI report reception or period of *sl-LatencyBound-CSI-Report*.

**Q2: Which option do you prefer to model active time following CSI request,**

**Option 1: Introduce new timer, i.e. *drx-CSIReportTimerSL,* (per source-destination pair): the maximum duration until a SL CSI report is received. Active time includes the time *drx-CSIReportTimerSL* is running**

**Option 2: Active time is defined with description. Active time includes the time between SL-CSI request is sent and SL-CSI report reception or period of *sl-LatencyBound-CSI-Report*.**

**Option 3: Other**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comments |
| OPPO | Option 2 | Option 2 is a cleaner approach which avoids further discussion on the start point of the timer and it also follows the mechanism for SR in Uu DRX. |
| Ericsson | Option 1 | For SL DRX design perspective, introducing a new timer would be better. Together with other DRX timers (i.e., ON-Duration timer or inactivity timer), the UE can based on unified framework to derive the active time. |
| InterDigital | Option 2 | We have preference for option 2 due to avoiding the discussion of the starting point of the timer (as mentioned by OPPO). However, we think both options would work as long as the timer is assumed to be started when the SL-CSI request is transmitted. |
| Intel | Option 2 | Option 2 is preferred because we do not think we need to define a new timer here |
| vivo | Option 2 | Option 2 is clear enough for active time definition and UE behaviors without extra timer introduction. |
| MediaTek | Option 2 | We are fine to go for option 2 which could reduce the spec effort to specify the new timer operation. |
| Lenovo, Motorola Mobility | Option 2 | We don’t see a need for introducing a new timer. This would require further specification work on when to start/stop the timer etc.  |
| ASUSTeK | Option 1 | We think defining a new timer can provide a clearer indication in the spec on when to remain in SL active time (similar to how we define sl-CSI-ReportTimer for SL-CSI reporting). |
| Huawei, HiSilicon | Option 1 | We prefer to introduce a new timer for CSI reception, similar to the conventional way to manage such kind of behaviour, instead of using the perhaps cumbersome way of “description”. We think the discussion caused by the starting point of the timer is manageable. |
| Qualcomm | Option 1 | Timer is more clear and flexible for defining UE’s behavior. |
| Apple | Option 1 | Both can work but defining a new timer is acceptable to us as timers are used widely for many known timer periods in DRX operation (e.g. onDuraiton)  |
| Sharp | Option 2 | Option 2 is clear enough. |
| Spreadtrum | Option 2 | To avoid the discussion of start point of the active time, we are fine to go for Option 2. |
| Fujitsu | Option 2 | Option 2 is simple and it has less specification impact.  |
| Nokia | Option 2 | Option 2 seems sufficient as we already define other timers like the DRX on duration etc |
| CATT | Option 2 | Avoid discussing the definition to a new timer, we prefer option.2.  |
| ZTE | Option 2 | Option2 is enough to capture the intention. |
| Xiaomi | Option 2 | In option 1, the new timer is decided and maintained solely at TX UE. No signaling on Uu or sidelink is required. It seems to be more like UE implementation. In this case, option 2 is enough. |

Both options could work. 5 companies prefer to introduce new timer. They think it’s more aligned with other DRX timers. 13 companies prefer to describe the active time without new timer. They believe it’s simple and aligned with active time triggerd by SR in Uu. Rapporteur suggest to follow majority views.

**Proposal 2: Active time for SL-CSI recpetion is defined with description. Active time includes the time between SL-CSI request is sent and SL-CSI report reception or period of *sl-LatencyBound-CSI-Report*. (13/18)**

If option 1 is preferred in Q2, rapporteur would like to further discuss when to start the new timer.

After SL-CSI request transmission, peer UE may not immediately perform SL-CSI report, due to propagation delay or processing delay. Therefore, [1][4] propose to start the new timer with certain time delay after SL-CSI request transmission. This solution could further reduce the active time. On the other side, [1][4] propose to start the new timer right after SL-CSI request transmission. This solution is simpler.

**Q2-1, if option 1 is preferred in Q2, when to start the new timer, i.e. *drx-CSIReportTimerSL*,**

**Option 1: Start the *drx-CSIReportTimerSL* with delay after SL-CSI request transmission**

**Option 2: Start the *drx-CSIReportTimerSL* in the symbol/slot following the end of SL-CSI request transmission.**

**Option 3: Other**

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| --- | --- | --- |
| Company | Option  | Comments |
| Ericsson | Option 1 | As Rapporteur said, Option 1 is beneficial to further improve battery saving with SL DRX. |
| InterDigital | Option 2 | We think option 2 is sufficient – no need to optimize this to account for a negligible delay. |
| ASUSTeK | Option 2 | Agree with InterDigital. |
| Huawei, HiSilicon | Both | Both Options are good for us, slightly prefer Option 1. |
| Qualcomm | Option 1 | Rx UE needs time to process CSI report based on CSI RS measurement and to switch from receiving to transmitting to sense and select a resource for transmitting the CSI report. Tx UE also needs time to switch from transmitting to receiving for monitoring the CSI report. Therefore, UEs are not active for communication at least during this transition time and a delay is needed. |
| Apple | Option 2 |  |
|  |  |  |

**No proposal is made based on this question, since option 2 is concluded in Q2..**

If option 1 is preferred in Q2-1, rapporteur would like to further discuss how to model the delay. [1][4] propose to model the delay by another new timer, i.e.. *drx-CSIReportRTTTimerSL*. More specifically, *drx-CSIReportRTTTimerSL* starts after SL-CSI request transmission. *Drx-CSIReportTimerSL* starts upon *drx-CSIReportRTTTimerSL* expiry*.*

**Q2-2, if option 1 is preferred in Q2-1, how to model the delay,**

**Option 1: Introduce another new timer, i.e. *drx-CSIReportRTTTimerSL,* (per source-destination pair): the minimum duration before SL-CSI report is expected by the MAC entity.**

**Option 2: Other**

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| --- | --- | --- |
| Company | Option | Comments |
| Ericsson | Option 1 |  |
| Qualcomm | Option 1 | *drx-CSIReportTimerSL* is started when drx-*CSIReportRTTTimerSL* expires. |
|  |  |  |

**No proposal is made based on this question, since option 2 is concluded in Q2..**

Following Q2-2, rapporteur would like to further discuss how to handle the two new timers. [1] propose to handle two new timers like RTT and RTX timer.

**Q2-3, if option 1 is preferred in Q2-2, do you agree following procedure,**

**The UE starts *drx-CSIReportRTTTimerSL* in the symbol/slot following the end of SL-CSI request transmission. The UE starts *drx-CSIReportTimerSL* upon *drx-CSIReportRTTTimerSL* expiry.**

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| --- | --- | --- |
| Company | Yes/No | Comments |
| Ericsson | Yes with update | **the UE starts the drx-CSIReportRTTTimerSL associated to the DST L2 ID in the first slot after the end of the corresponding PSSCH transmission;** **start the drx-CSIReportTimerSL associated to the DST L2 ID in the first slot after the expiry of drx-CSIReportRTTTimerSL.**  |
| Qualcomm | Yes |  |
|  |  |  |

**No proposal is made based on this question, since option 2 is concluded in Q2..**

If option 1 is preferred in Q2, rapporteur would like to further discuss how to sop the new timer, i.e. *drx-CSIReportTimerSL*.

SL-CSI triggering UE may receive the SL-CSI report before new timer, i.e. *drx-CSIReportTimerSL,* expiry. [1][3][4][8] propose to stop the new timer, i.e *drx-CSIReportTimerSL*, if SL-CSI report is received. Active time could be further reduced by the early stop.

**Q2-4, if option 1 is preferred in Q2, do you agree to stop the new timer, i.e *drx-CSIReportTimerSL*, if SL-CSI report is received.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Ericsson | Yes |  |
| InterDigital | Yes |  |
| ASUSTeK | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Qualcomm | Yes |  |
| Apple | Yes |  |

**No proposal is made based on this question, since option 2 is concluded in Q2..**

## Ambiguous time

Ambiguity time was introduced for NR Uu DRX. UE determines whether to report CSI/SRS by considering DRX status until 4ms prior to current symbol n. In case symbol n would not be in Active Time, UE does not report CSI. [7] thinks the ambiguous time is not required, since there is currently no periodic reporting for SL, e.g. SL CSI, which may be affected by the DRX operation, i.e. switch from DRX to ActiveTime. Rapporteur understands current SL DRX is defined by PSCCH monitoring for data reception. SL-CSI report is not restricted by active time. Therefore, the ambiguous time may not be needed.

**Q3, do you agree to introduce DRX ambiguous time for SL-CSI report, i.e. in current symbol n, if UE would not be in Active Time considering all factors until 4 ms prior to symbol n when evaluating all DRX Active Time conditions, UE do not report SL-CSI.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| OPPO | No | Agree with rapporteur. |
| Ericsson | No | Agree with rapporteur |
| InterDigital | No |  |
| Intel | No |  |
| vivo | No |   |
| MediaTek | No | Agree with rapporteur |
| Lenovo, Motorola Mobility | No |  |
| ASUSTeK | No |  |
| Huawei, HiSilicon | No |  |
| Qualcomm | No | Agree with rapporteur |
| Apple | No |  |
| Sharp | No |  |
| Spreadtrum | No |  |
| Fujitsu | No |  |
| Nokia | No |  |
| CATT | No |  |
| ZTE | No |  |
| Xiaomi | No |  |

All companies prefer not to introduce ambiguous time. Therefore,

**Proposal 3: Ambiguous time is not introduced on sidelink for SL-CSI report. (18/18)**

If DRX ambiguous time for SL-CSI report is preferred, rapporteur would like to further discuss the value of ambiguous time on sidelink.

**Q3-1, how long is the ambiguous time on sidelink,**

**Option 1: 4 ms, same as Uu.**

**Opotin 2: other**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comments |
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# Conclusion

Based on companies responses, following proposals are made,

**Proposal 1: Confirm the WA: The slots when the UE is expected CSI report following a CSI request is considered as SL active time. (18/18)**

**Proposal 2: Active time for SL-CSI recpetion is defined with description. Active time includes the time between SL-CSI request is sent and SL-CSI report reception or period of *sl-LatencyBound-CSI-Report*. (13/18)**

**Proposal 3: Ambiguous time is not introduced on sidelink for SL-CSI report. (18/18)**

# Reference

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

[2] R2-2109937 Remaining Aspects on SL DRX Timers InterDigital Inc

[3] R2-2110119 Remaining issues on DRX timers for SL Unicast Spreadtrum Communications

[4] R2-2110273 Remaining issues of SL DRX MediaTek Inc

[5] R2-2110650\_Remaining issues for sidelink DRX vivo

[6] R2-2111008 Discussion on remaining issues on Sidelink DRX ASUSTeK

[7] R-2111065 Remaining issues for SL DRX timers Lenovo, Motorola Mobility

[8] R2-2111204 Remaining issues of the sidelink DRX for unicast Huawei, HiSilicon