**3GPP TSG-RAN WG2 #115-eR2-2108984**

**E-meeting, Aug 16-27 2021**

Agenda Item: 8.15.2

Source: ZTE(rapporteur)

Title: Summary of email [AT115-e][704][V2X/SL] Others

Document for: Discussion, Decision

# Introduction

This is to kick off following email discussion:

 **[AT115-e][704][V2X/SL] Others (ZTE)**

**Scope:** Discuss following FFS/TBD/open issues:

Q1: What’s RX UE behaviour on the reception of SL DRX MAC CE?

      Q2: Need to define when TX UE sends SL DRX MAC CE?

  Q3: How to handle DCR and other messages before SL DRX configuration is started/applied?

      Q4: When exactly should be the time SL DRX configuration is started/applied?

**Intended outcome:** Discussion summary in R2-2108984

**Deadline:**8/24 10:00am UTC

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

* Phase 1: collect companies’ views by 2021-08-20 22:00 UTC
* Phase 2: rapporteur will finalize summary report based on inputs of phase 1 by 2021-08-24 10:00am UTC

# Discussion

## 2.1 Q1: What’s RX UE behaviour on the reception of SL DRX MAC CE?

According to current 38.321 specification, during NR Uu, if a DRX Command MAC CE is received, the UE will stop drx-onDurationTimer and drx-InactivityTimer for each DRX group. Moreover, if long DRX cycle is configured, it will use the Long DRX cycle for each DRX group. Based on rapporteur’s understanding, the basic principle shall be inherited.

|  |
| --- |
| 1> if a DRX Command MAC CE or a Long DRX Command MAC CE is received:  2> stop *drx-onDurationTimer* for each DRX group;  2> stop *drx-InactivityTimer* for each DRX group.  1> if a DRX Command MAC CE is received:  2> if the Short DRX cycle is configured:  3> start or restart *drx-ShortCycleTimer* for each DRX group in the first symbol after the end of DRX Command MAC CE reception;  3> use the Short DRX cycle for each DRX group.  2> else:  3> use the Long DRX cycle for each DRX group.  1> if a Long DRX Command MAC CE is received:  2> stop *drx-ShortCycleTimer* for each DRX group;  2> use the Long DRX cycle for each DRX group. |

According to the paper [1][2]][4][5], most companies proposed that UE stops on-duration timer and inactivity timer for SL unicast on the reception of SL DRX MAC CE. And in paper [3], it proposed the RX UE shall not expect further data transmissions from that UE until the start of the next DRX cycle.

|  |
| --- |
| Proposal 7: For sidelink unicast, the DRX MAC CE can be used to stop the drx-onDurationTimer and/or the drx-InactivityTimer in order to let the UE fall into asleep.[1]  [Proposal 15 For SL unicast, upon receiving SL DRX command MAC CE, UE stop on-duration timer and inactivity timer.](#_Toc79143124)[2]  Proposal 6: Upon reception of SL DRX Command MAC CE from peer UE, the RX UE shall not expect further data transmissions from that UE until the start of the next DRX cycle.[3]  [Proposal 3]: For SL DRX operation in unicast, the UE stops any running SL DRX on-duration timer and SL DRX inactivity timer if SL DRX Command MAC CE is received.[8]  Proposal 5: Same as Uu DRX, for unicast, when a UE receive SL DRX command MAC CE from its peer UE, the UE stops on duration timer and inactivity timer for this link.[9] |

##### **Question 1-1: What’s RX UE behaviour on the reception of SL DRX MAC CE?**

Option1: UE stops on-duration timer and inactivity timer for SL unicast on the reception of SL DRX MAC CE.

Option2: UE shall not expect further data transmissions from that UE until the start of the next DRX cycle.

Option3: For SL unicast, UE stops on-duration timer and inactivity timer for the link where SL DRX MAC CE is received from peer UE.

Option4: others(Please clarify the solution)

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Xiaomi | Option1 | It’s not clear what the spec impact of option2 is. |
| Lenovo, MotM | Option1 |  |
| InterDigital | Option1 | Option 2 is not aligned with specification in Uu, so should not be considered behavior specified for SL. |
| Ericsson | Option 1 |  |
| Apple | Optino 1 with comments | The timers are to be stopped only if they are running |
| OPPO | Option 3 | For Option1, we are not very clear about the on-duration timer and inactivity timer here is all timers maintained at the Rx UE or only the on-duration timer and inactivity timer for the link where SL DRX MAC CE is received from peer UE. We think the DRX command MAC CE should only impact the on-duration timer and inactivity timer for the same link.  For Option2, we think it is not a Rx UE behaviour which should be specified, it is the reason for a Rx UE behaviour, i.e. stops on-duration timer and inactivity timer for the link where SL DRX MAC CE is received from peer UE. |
| Samsung | Option1 |  |
| Fujitsu | Option 3 | Agree with OPPO. |
| MediaTek | Option 1 |  |
| CATT | Option 3 |  |
| NEC | Option 1 | Prefer to align with Uu IF. |
| Nokia | Option 1 |  |
| Intel | Option 1 | As per definition |
| Spreadtrum | Option 1 |  |

## 2.2 Q2: Need to define when TX UE sends SL DRX MAC CE?

It is agreed that SL DRX Command MAC CE is introduced for SL DRX operation in unicast in RAN2#113e meeting. Whether need to define when TX UE sends SL DRX MAC CE is FFS. According to rapporteur’s understanding, if TX UE has no data or predict no data is coming for a long time, it shall send the SL DRX MAC CE to allow RX UE go sleep. During the NR Uu DRX, when to send DRX MAC CE depends on NW implementation. As regard to SL DRX, leaving it as TX UE implementation is the simplest way. However, it is difficult to ensure that TX UE will send this SL DRX Command MAC CE if it has no data or predict no data is coming for a long time, which may cause unnecessary power consume for the RX UE. Therefore, before we discuss the issue of whether need to define when TX UE sends SL DRX MAC CE, rapporteur suggests to discuss whether need to ensure that TX UE will send this SL DRX Command MAC CE if it has no data or predict no data is coming for a long time first.

##### **Question 2-1: Whether need to ensure that TX UE will send this SL DRX Command MAC CE if it has no data or predict no data is coming for a long time, the exact definition is FFS?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Xiaomi | Comments | We understand this is UE’s implementation. It’s difficult to define UE behaviour regarding data arrival prediction in AS. |
| Lenovo | No | We can rely on the Tx UE implementation to send this MAC CE only when required e.g., when the buffer is empty towards the peer Rx UE. |
| InterDigital | Comments | While on Uu, NW can handle this, it may be beneficial to consider some rules to avoid that one UE’s implementation affects the power savings of another UE. |
| Ericsson | No | As xiaomi and Lenovo commented, it is sufficient to leave to UE implementation. |
| Apple | Yes | In Uu C-DRX, this is up to gNB implementation. But we cannot simply equal the trustworthiness of a TX UE as same as the gNB. The TX UE triggering conditions for sending this MAC CE has to be clarified. |
| OPPO | See comments | We think it should be up to Tx UE implementation just like Uu DRX. |
| Samsung | See comments | Agree with Xiaomi. We would like to leave it to UE implementation. |
| Fujitsu | Yes | If it is up to TX UE’s implementation, the TX UE might not trigger the SL DRX Command MAC CE when there is no data for transmission, then the RX UE’s power will be wasted. |
| MediaTek | No | It should be up to TX UE implementation. |
| CATT | No | We prefer to leave it to UE implementation. |
| NEC | No | Similar to Uu IF, it can be left to TX UE implementation. |
| Nokia | No | This should be left to UE implementation. As a later question goes, there will be many potential cases in which the MAC CE may be sent, and we may not manage to cover them all. |
| Intel | No | We can rely on UE implementation |
| Spreadtrum | No | Leave to Tx UE implementation. |

Moreover, according to rapporteur’s understanding, during NR Uu, another ehavior on the reception of SL DRX MAC CE for a UE is to use the Long DRX cycle. This ehavior may be helpful to make the peer Ues keep the DRX configuration active in sync. For example, as show in figure 1, if the SL DRX configuration is updated based on the latest UE assistant information at time T1 when the inactivity timer is running, and the SL DRX cycle and on duration timer is changed for the new SL DRX configuration, then whether and what is the exact time to stop the old duration timer and inactivity timer is not clear. For this case, it is better for the TX UE to send the SL DRX MAC CE to the RX UE to stop the old on duration and inactivity timer and make the new configuration become effective.



Figure 1 an example of SL DRX configuration updated

##### **Question 2-2: Whether need to send the SL DRX MAC CE to stop the old on duration and inactivity timer after TX UE updates the SL DRX configuration?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Xiaomi | Comments | We understand it’s up to TX UE’s implementation. If onduration timer and DRX cycle are not changed in updated SL DRX configuration, TX UE doesn’t need to stop ‘old’ onduration timer. |
| Lenovo, MotM | Comment | Upon reception of the reconfiguration message reconfiguring the DRX configuration, the receiver releases the current/ old configuration and applies the new one immediately i.e., the on-duration, Inactivity timers currently running are stopped immediately. |
| InterDigital | No/Comment | The transition from one DRX configuration to another can be handled with the RRC message exchange itself (no need for additional MAC CE). |
| Ericsson | No | In case the assistance information has been changed, it is sufficient to leave to TX UE implementation on whether a new SL DRX configuration needs to be configured or to reconfigure the existing one. No need to add restriction on UE behaviors. |
| Apple | No | What needs to be done to clean up the old states can be included in the procedure description of processing of reception of PC5-RRC configuration message. There is no need to use another MAC CE to do this clean up. |
| OPPO | No | We already agreed the per-link DRX in unicast, which means Rx UE only maintains a single on duration timer and a single inactivity timer for a pair of source/destination L2 ID. When the new DRX configuration is settled, the old configurations (timers) are stopped already. |
| Samsung | See comments | Agree with Xiaomi. We would like to leave it to UE implementation. |
| Fujitsu | No | It can be up to TX UE’s implementation. If there is still long period of on-duration or inactivity timer, the DRX command MAC CE can be sent to save the RX UE’s power. |
| MediaTek | No | Agree with Apple. There is no need to apply SL DRC command MAC CE for timer stop. |
| CATT | No | We prefer to leave it to UE implementation. |
| NEC | No | According to discussions so far, our understanding is that TX UE shall update the SL DRX configuration by sending *RRCReconfigurationSidelink.* So we prefer to align TX UE and RX UE timer via RRC signaling (not MAC CE). |
| Nokia | No | As stated by Lenovo, and others, we see that this should have happened automatically, and there is no “old” configuration |
| Intel | No | We are not sure why MAC CE needs to be defined for this case. As is the case with overall sidelink PC5 design, RRC message exchange should handle this scenario if needed. |
| Spreadtrum | No | No need for MAC CE, in addition to RRC message exchange. |

##### **Question 2-3: Whether need to define when TX UE sends SL DRX MAC CE?**

Option1: yes

Option2: no, it is up to UE implementation.

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Xiaomi | Option 2 | Based on our answers to previous questions, option 2 is preferred. |
| Lenovo | Option 2 |  |
| InterDigital | Option 1 | We think option 1, where some straightforward rules are defined which define when the TX UE should/should not send the MAC CE, would ensure unform power savings. |
| Ericsson | Option 2 |  |
| Apple | Option 1 |  |
| OPPO | Option2 |  |
| Samsung | Option 2 |  |
| Fujitsu | Option 1 |  |
| MediaTek | Option 2 |  |
| CATT | Option 2 |  |
| NEC | Option 2 |  |
| Nokia | Option 2 | Please see Q2-1 |
| Intel | Option 2 | We are not sure if the intent of this question is any different form Q2-1? Perhaps the rapporteur can clarify In any case, based on answer to Question 2-1, option 2 is preferred |
| Spreadtrum | Option 2 |  |

If the answer of Question 2-3 is yes, besides above two possible conditions, companies are welcome to provide other possible conditions to trigger the TX UE sending SL DRX MAC CE.

##### **Question 2-4: If there are other trigger conditions of TX UE sending SL DRX MAC CE, please list here:**

Option1: others (Please clarify the solution)

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| InterDigital |  | Factors in Q2-1 can be considered baseline. |
| Apple |  | The TX UE needs to be sure that there is no incoming traffic for a certain period of time |
| Fujitsu |  | A period of time or timer can be specified for which the TX UE has no data or predict no data is coming. |

## 2.3 How to handle DCR and other messages before SL DRX configuration is applied?

### 2.3.1 Unicast

Before we discussing the details, it is worthwhile to illustrate all the messages exchanged between two UEs.



**Figure 2: Illustration of Sidelink signaling**

As shown in figure 1, since the DCR message is the first message during unicast link establishment, it is by nature transferred in the AS via broadcast, irrespective the destination L2 ID is a unicast ID or broadcast ID.

##### **Question3-1, for DCR message using broadcast, which DRX configuration should be used?**

1. Do not apply DRX configuration.
2. Configure a dedicate broadcast DRX configuration for DCR message, e.g. Set a broadcast DRX configuration without QoS profile.
3. Sharing the DRX with other broadcast services.
4. make use of the default DRX configuration for B-cast, i.e., the DRX configuration used when the associated QoS profile fails to map to a DRX configured for dedicated QoS profile
5. others

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Xiaomi | Option 3 | Option 1 would require all UEs to keep in active in order to receive potential DCR messages. It’s much power waste.  Option 2 would introduce new DRX configuration for DCR, which is not supported by R16 UEs. There would be coexistence issue between R16 and R17 UEs.  Option 3 has the benefit of unified solution for all broadcast transmission. TX profile could also be reused to resolve the coexistence issue between R16 and R17 UEs, from DCR transmission and reception. |
| Lenovo, MotM | Option 2 | Option 2 is more power optimized from the Rx UE’s perspective. The legacy issue that Xiaomi brought forward can be solved by assuming that DCRs use a DRX configuration on their own. |
| InterDigital | Option 3 | DCR can be aligned with other broadcast transmissions, and there is no need to handle this message in a unique way. |
| Ericsson | Option 2 | Option 1 is not power efficient. Option 3 seems to be not aligned with the RAN2 agreement, i.e., DRX configuration granularity per QoS profile or L2 ID. For option 2, it is better to call it “default” or “common DRX configuration” instead of “broadcast DRX configuration”, which is common or semi-static to all UEs. |
| Apple | Option 2 | Option 2 is a clean way to address the issue. The incompatibility issue raised by Xiaomi exist in both Option 2 and Option 3. This cannot be avoided unless SL-DRX is not used. |
| OPPO | Option4 with comment | Generally, we believe the broadcast DRX can be reused here  For Option1, it’s not power saving since Rx UE has to be active to monitor DCR message.  For Option2, we are not clear with “dedicate broadcast DRX configuration”, is it a per-link dedicated DRX or a DRX only for DCR message?  For Option3 can’t work since AS layer has not got any QOS information from V2X layer when delivery of DCR message.  So a default DRX can be used, i.e., option-4 (which is the same as the default DRX being discussion in [703]) |
| Samsung | Option-3 |  |
| Fujitsu | Option 3 |  |
| MediaTek | Option-3 or Option-4 | DCR could share the same SL DRX configuration with other broadcast service. And, if we support default SL DRX configuration for BC, it could be applied for DCR. |
| CATT | Option-3 |  |
| NEC | Option 3 |  |
| Nokia | Option 3 |  |
| Intel | Option 2 | We agree with Ericsson that a “default” (rather than “dedicate”) DRX configuration for broadcast can be defined to handle the DCR message |
| Spreadtrum | Option 3 |  |

For the other PC5-S messages (SMC, DCA, etc.) that are transmitted between the two UEs , different from DCR message, they are transferred when a RX UE has already received the DCR message from TX UE, and the destination L2 ID encapsulated in the message is unicast ID. However, PC5 RRC connection has not bee established, dedicated unicast DRX configuration can not been used. Therefore, how to design the DRX for such PC5-S signaling transfer can be further investigated by RAN2, and from rapporteur’s perspective, a unified solution can be applied for these message.

##### **Question3-2, for PC5-S messages (SMC, DCA, etc.) that are transmitted between the two Ues during unicast connection establishment, which DRX configuration should be used?**

1. Do not use DRX configuration.
2. Configure a dedicate broadcast DRX configuration for these messages, e.g. Set a broadcast DRX configuration without QoS profile.
3. Sharing the DRX with other broadcast services.
4. Others

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Xiaomi | Option 1 | These messages should follow unicast DRX configuration. Since the SL DRX configuration is not decided yet, no DRX is applied. |
| Lenovo, MotM | Option 2 | Same DRX configuration can be kept for these messages as well. |
| InterDigital | Option 3 | It is not clear why we would need to consider these messages any differently since the unicast link has not been setup yet. Any subsequent transmissions to the DCR would simply be sent during the active time of the RX UE, and the TX UE can handle it using transmissions similar to any other. |
| Ericsson | Option 2 | It is beneficial to have a unified solution for all initial control signalling messages if possible. For option 2, it is better to call it “default” or “common DRX configuration” instead of “broadcast DRX configuration”, which is common or semi-static to all Ues. |
| Apple | Option 2 | Option 1 is not good because it will kill power saving. The UE need wake up all the time after it receives DCR. This may be exploited by attackers to drain UE power by sending a single fake DCR message. |
| OPPO | Option1 | After DCR, not only the PC5-S messages but also the PC5-RRC messages before SL DRX is configured should be exchanged in a non-DRX manner to reduce the signalling latency. |
| Samsung | Option-1 |  |
| Fujitsu | Option 1 | Since DRX for unicast has not been configured, these message need not use DRX configuration, like Uu. |
| MediaTek | Option-1 | Since SL DRX configuration for unicast is not decided yet, UE can keep active to reduce latency for unicast connection establishment. |
| CATT | Option-1 | After receiving DCR message and before DRX configuration is configured successfully via PC5-RRC, the two UEs exchange data/signaling in non-DRX manner. |
| NEC | Option 1 | Agree with Xiaomi, these messages should follow unicast DRX configuration. |
| Intel | Option 2 | Same comment as above, i.e. option 2 should be called “default” configuration. Then, these messages can all use the same default DRX configuration until unicast connection is stablished and the UEs have agreed to a specific SL DRX configuration.  We agree that Option-1 can also work (albeit not optimal) |
| Spreadtrum | Option 1 |  |

After unicast link is established, PC5 RRC is connected from AS layer perspective. However, considering it was agreed that unicast SL DRX configuration is configured from TX UE to RX UE, we also need to differentiate the message into tow categories, one is the messages exchanged before unicast SL DRX is configured via PC5 RRC message and the another one is the messages exchanged after unicast SL DRX is configured. For unicast SL DRX is configured, we think it is straightforward that all message and service data should follow configured unicast SL DRX.

##### **Question3-3, for messages(i.e. PC5-S, PC5-RRC, etc) exchanged before DRX is activated, which DRX configuration should be used?**

1. Do not use DRX configuration.
2. Configure a dedicate broadcast DRX configuration for messages, e.g. Set a broadcast DRX configuration without QoS profile.
3. Sharing the DRX with other broadcast services.
4. PQI based DRX configuration (DCA confirms the PQI/ QoS profile to be used between the peer UEs)

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Xiaomi | Option 1 | These messages should follow unicast DRX configuration. Since the SL DRX configuration is not decided yet, no DRX is applied. |
| Lenovo, MotM | Option 2 or Option 4 is also acceptable. | If we use Option 2 same DRX configuration can be kept for these messages as well.  In addition, Option 4 also works since the Direct Communication Accept message includes some QoS Information, i.e., the information about the PC5 QoS Flow(s) requested by the initiating UE (Tx UE). |
| InterDigital | Option 1 | DRX cannot be applied for the unicast link if it has not been configured yet. |
| Ericsson | Option 2 | It is beneficial to have a unified solution for all initial control signalling messages if possible. For option 2, it is better to call it “default” or “common DRX configuration” instead of “broadcast DRX configuration”, which is common or semi-static to all UEs. |
| Apple | Option 2 | Prefer Option 2 as a clean solution. |
| OPPO | Option 1 | After DCR, not only the PC5-S messages but also the PC5-RRC messages before SL DRX is configured should be exchanged in a non-DRX manner to reduce the signalling latency. |
| Samsung | Option-1 |  |
| Fujitsu | Option 1 | Since DRX for unicast has not been configured, these message need not use DRX configuration, like Uu. |
| MediaTek | Option-1 | For latency reduction. |
| CATT | Option-1 |  |
| NEC | Option 1 |  |
| Nokia | Option 1 |  |
| Intel | Option 2 | Same comment as above |
| Spreadtrum | Option 1 |  |

##### **Question3-4, if option2 is selected in Question3-1, 3-2, 3-3, do you agree the dedicated broadcast DRX configuration in Question3-1, 3-2, 3-3 can be a same dedicated DRX Configuration.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Lenovo, MotM | Yes | The dedicated configuration must be same as the one broadcasted since the peer Ues may not be both RRC Connected to the same cell. |
| Ericsson | Yes | As we commented in previous three questions. |
| Apple | Yes |  |
| Intel | Yes | As per our comments above |

In RAN2 114-e, it was agreed that DRX cycle is configured per QoS profile. However,it was well known that different from the service data, those NAS signaling does not have corresponding QoS profile. Based on this agreements, if messages share the DRX configuration with other broadcast services, there is another issue that which DRX configuration with a specific QoS profile should be used for NAS signaling.

##### **Question3-5, if company choose option3 in Question3-1,3-2,3-3, then how to the handle the issue that messages do not have corresponding QoS profile?**

1. Set a dedicated QoS profile for these messages, it is FFS how to set the value in QoS profile.
2. Choose one of broadcast DRX configuration with QoS profile for theses messages. It is FFS how to choose one BC DRX configuration.
3. Others

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Xiaomi | option1 or 2 | Both options can work. But we understand this should be done in higher layers. |
| InterDigital | Option 3 | This can be left to UE implementation – the TX UE can transmit to the RX UE based on any QoS profile allowing the RX UE to receive the message. |
| Samsung | Option-3 | We think we can use default SL DRX configuration for any message/data that does not have corresponding QoS profile. |
| Fujitsu | Option 3 | One of the QoS profiles of broadcast services can be used as soon as the TX UE and the RX UE have the same understanding. |
| CATT | Option3 | A default DRX configuration can be used to solve this question. |
| Spreadtrum | Option 3 | Default DRX configuration can be used. |

Considering which signaling is used to configure the DRX configuration for BC has not been determined, rapporteur think we can confirm that which signaling(i.e. (pre-configuration), SIB, dedicated RRC signaling) is used to configure the DRX configuration for messages before SL unicast DRX configuration is applied follows the BC manner.

##### **Question3-6, if DRX needs to be configured for PC-5 messages exchanged before unicast DRX is configured, do you agree which signaling(i.e. (pre-configuration), SIB, dedicated RRC signaling) is used to configure the DRX configuration for these messages follows the Broadcast design?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Lenovo, MotM |  | Preconfigured or configured using broadcast SIB signalling as used for BC/ GC cases when using the QoS profiles as the basis for DRX configurations. |
| Ericsson |  | Pre-configuration or SIB, in addition, dedicated signaling carrying SIB configuration shall be also ok. |
| Apple |  | SIB & Pre-configuration |
| OPPO | Yes (Only for DCR message) |  |
| Samsung | Yes for pre-configuration and SIB | Yes with pre-configuration and SIB, but not sure if we’ll have dedicated RRC for groupcast/broadcast. |
| MediaTek |  | Pre-configuration and SIB. |
| CATT |  | Pre-configuration and SIB. |
| Intel |  | Pre-configuration and SIB (as per other SL configuration design) |
| Spreadtrum |  | Pre-configuration and SIB. |

### 2.3.2 groupcast

As raised in R2-2108222[11], according to the procedure for groupcast mode of V2X communication over PC5 [12], before running the groupcast service(s), the V2X application layer carries out V2X group management, and provides group identifier information (i.e., an application-layer V2X group identifier) as well as V2X application requirements for the groupcast communication.



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

As discussed in TS 38.287 [12], although V2X group formation is initiated by the V2X application layer, which is out of scope of 3GPP specification, the V2X group management is carried out in VAE and SEAL layers, which is within the scope of 3GPP specification.

##### **Question3-7, do you agree RAN2 needs to discuss the DRX configuration for V2X group management signaling?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Xiaomi | Yes |  |
| Lenovo, MotM | Yes |  |
| InterDigital | No | This can be left to UE implementation |
| Ericsson | Yes | As captured in the TS 23.304,  Editor’s note:    Whether to transmit the Application layer discovery messages as metadata in a PC5 direct discovery message or as user traffic depends on the size of the PC5 direct discovery message. The size of the PC5 direct discovery message or no size limit will be determined by RAN WG.  SA2 will decide whether to treat the management message as discovery or UP data, depending on RAN2 LS reply on discovery PDU size. It is likely that management message is treated as discovery, meaning they will be delivered in AS via SRB4. In this case, it is reasonable to treat all SRB signalling using a common DRX configuration. |
| Apple | No | VAE and SEAL protocol message shall just follow other user plane traffic and no special treatment is needed. |
| OPPO | No | The group management is invisible to 3GPP, and handled by upper layer. |
| Samsung | No | To our understanding, group management messages are considered as application groupcast data. |
| Fujitsu | No | These messages are out of 3GPP scope. The DRX configuration for them can be up to UE implementation. |
| MediaTek | Yes |  |
| CATT | No | Same view as OPPO. |
| NEC | No |  |
| Nokia | No | These should be possible to handle with existing configurations |
|  |  |  |
| Intel | No | We think this aspect needs to be de-prioritized, at least until work on unicast design is considered stable |
| Spreadtrum | No |  |

##### **Question3-8, if yes is selected in Question3-7, which solutions you prefer to use?**

1. Do not use DRX configuration.
2. Configure a dedicate DRX configuration for DCR message, e.g. Set a DRX configuration without QoS profile.
3. Sharing the DRX with other broadcast services.
4. Sharing the DRX with other groupcast services.
5. Others

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Xiaomi | Option 3 | Same as Q3-1 |
| Lenovo, MotM | Option 2 |  |
| Ericsson | Option 2 | It is better to have a unified solution. See our comments for Q3-7. |
| Samsung | Option 4 |  |
| MediaTek | Option 3 | Same as Q3-1 |
| Nokia | Option 3/4 |  |

##### **Question3-9, If option3 or option4 is selected in Question3-8,**

1. Set a dedicated QoS profile for the corresponding messages, it is FFS how to set the value in QoS profile.
2. Choose one of broadcast or groupcast DRX configuration with QoS profile for theses messages. It is FFS how to choose one one DRX configuration.
3. Others

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Xiaomi | Option 1 or 2 | Both options can work. But we understand this should be done in higher layers. |
| Samsung | Option-3 | We think we can use default SL DRX configuration for any message/data that does not have corresponding QoS profile. |
| MediaTek | Option-3 | We share same view with Samsung. Prefer to use default SL DRX configuration for broadcast, which is same as the unicast case. |
| Nokia | Option 1 or 2 |  |

##### **Question3-10, if DRX needs to be configured for groupcast management signaling DRX is configured, do you agree which signaling(i.e. (pre-configuration), SIB, dedicated RRC signaling) is used to configure the DRX configuration follows the broadcast or groupcast design?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Xiaomi | Yes |  |
| Lenovo, MotM |  | Preconfigured or configured using broadcast SIB signalling as used for BC/ GC cases when using the QoS profiles as the basis for DRX configurations. |
| Ericsson |  | Pre-configuration or SIB, in addition, dedicated ignalling carrying SIB configuration shall be also ok. |
| MediaTek | Yes |  |
| Nokia | Yes |  |

## 2.4 When exactly should be the time SL DRX configuration is applied?

In clause 2.3, we discuss how to handle the messages before SL DRX configuration is applied, however, it is still not clear When exactly should be the time SL DRX configuration is applied ,i.e. how UE judges the SL DRX configuration is applied, so that UE can identify which message is transmitted before SL unicast DRX configuration is applied.

According to current MAC Spec as shown in following, UE considers the DRX configuration is applied if the received RRC message includes following parameters.

|  |
| --- |
| RRC controls DRX operation by configuring the following parameters:  - *drx-onDurationTimer*: the duration at the beginning of a DRX cycle;  - *drx-SlotOffset*: the delay before starting the *drx-onDurationTimer*;  ......  When DRX is configured, the Active Time for Serving Cells in a DRX group includes the time while |

In this section, we will discuss when UE considers the SL DRX configuration for UC/GC/BC is applied.

### 2.4.1 Unicast

Considering that DRX configuration for Messages(i.e. DCR, DCA, SM command, SM complete, and some PC5-S, PC-5 RRC signaling) before SL unicast DRX configuration is applied has not been determined, therefore, rapporteur think we can discuss this question in next meeting,i.e. it is FFS when UE considers the DRX configuration for these messages is applied.

Proposal : For DRX configuration for Messages(i.e. DCR, DCA, SM command, SM complete, and other PC5-S, PC-5 RRC signaling) before SL unicast DRX configuration is applied has not been determined, it is FFS when UE considers the DRX configuration for these messages is applied.

It was agreed that unicast DRX is configured from TX UE to RX UE, and RX UE can provide the assistance information to TX UE. Therefore, rapporteur thinks some conditions used for RX UE to determine whether unicast DRX configuration is applied should be regarded as the restriction of sending DRX configuration to RX UE. For example, without the SL DRX capability information of RX UE, it is meaningless to configure the DRX to RX UE. In this case, it is not efficient that after receiving the DRX configuration, RX UE without SL DRX capability information considers this DRX is not applied. In other words, in this case, TX UE shall not send the DRX configuration to RX UE.

##### **Question4-1a, if serving gNB of TX UE determines the DRX configuration, when TX UE should send the unicast DRX configuration to RX UE:**

1. It’s up to TX UE implementation
2. Immediately

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Xiaomi | Option 2 | The question is not clear. What does ‘serving gNB of TX UE determines the DRX configuration’ mean? If the serving gNB determines DRX configuration means RRCReconfiguration message is received by TX UE, TX UE shall follow gNB’s control and sent unicast DRX configuration to RX UE accordingly. Even if the SL DRX is not appropriate, RX UE could reject. We don’t prefer TX UE to do filter or double check on gNB’s configuration. |
| Lenovo, MotM | Option 2 (immediately) | Why will the Tx UE wait to send the new DRX configuration received from the gNB? The Tx UE should not wait for the assistance from the Rx UE. |
| InterDigital | Option 2 – with comment | We are also not sure of the intention of the question. If the TX UE receives the DRX configuration from the network, then it should send it to the RX UE. We are not sure it is possible that the gNB configures DRX to the RX UE if the RX UE is not capable of DRX. |
| Ericsson | Option 2 | In this case, it is not beneficial to leave to UE implementation, since gNB would lose track of UE’s active status. |
| Apple | Option 2 with comment. | Not sure the question’s intention. There seems no spec impact. We do not need to code the “immediately” word in the spec. |
| OPPO | Option 2 | We assume there is no diff compared to legacy behaviour, i.e., as long as the Tx-UE get the configuration from network, it would send the PC5-RRC to Rx-UE as soon as possible. |
| Samsung | See comment | Based on the agreements made so far, the agreed procedure would be: 1st: A RX UE sends the assistance information to a TX UE, 2nd: The TX UE may send the received assistance information to its serving gNB, 3rd: The gNB may send the SL DRX configuration to the TX UE, 4th: The TX UE sends the received SL DRX configuration to the RX UE. To us, the question is not crystal clear, but if the question is when between 3rd and 4th, we don’t need to specify any condition, it’s up to TX UE. |
| Fujitsu | Option 2 | On receiving the DRX configuration from the serving gNB, the TX UE can send it to RX UE. |
| MediaTek | Option 2 | Tx UE should transmit the SL DRX configuration to Rx UE as soon as possible. |
| CATT | Option 2 | We wonder there will be spec impact for this proposal. |
| NEC | Option 2 |  |
| Nokia | Option 2 | Question is not clear, but if gNB configures, then it may be able to provide some kind of instructions on this |
| Intel | Option 2 | As other companies have commented above, if the intention is to ask whether TX UE needs to do something else after receiving the configuration from gNB, our view is that nothing else needs to be specified. |
| Spreadtrum | Option 2 |  |

##### **Question4-1b, if TX UE determines the DRX configuration, when TX UE should send the unicast DRX configuration to RX UE?**

1. After receiving the DRX capability information from RX UE that indicates RX UE is capable of SL DRX.
2. After receiving the (updated) SL DRX assistance information from RX UE.
3. After receiving the reject message of SL DRX configuration from RX UE, if reject message is agreed in RAN2.
4. It’s up to TX UE implementation.
5. Others

Note: Any combination of above options is feasible. Company can also select one or more combinations.

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Example | Option1,or  Option2 and 3, or  Option3 and 4 | …..... |
| Xiaomi | Option 4 | We understand option 1-3 are all possible. We can leave it to TX UE’s implementation. |
| Lenovo, MotM | Option 4 | Option 1 and Option 3 are important and may be there are other cases. So, we can leave this to Tx UE implementation. |
| InterDigital | Option 4 | We think UE implementation can handle all of the cases. If the RX UE does not support DRX, it can simply reject the configuration. |
| Ericsson | Option 4 | It is sufficient to leave to UE implementation. Since RX UE may not provide assistance information. |
| Apple | Option 2 or 4 | We think RX UE assistance information is needed, but no strong view about whether to define a strict timing requirements for TX UE to determine and send the SL DRX configuration to RX UE. |
| OPPO | Option4 | Although otion-1/2/3 are valid consideration, we do not see spec impact from that, so it ends up with the same as option-4 |
| Samsung | Option-4 or option-2 see comments | To us, the question seems not crystal clear. If we keep “should”, we think it’s up to TX UE implementation. If “should” is changed to “can”, and “when” is asking actual timing, we think option2 (possibly option3 also if we have reject procedure). |
| Fujitsu | Option 4 | We think option 1-3 are all possible. It can be up to UE implementation. |
| MediaTek | Option 4 | Option 1 to 3 are the valid triggers for TX UE to send SL DRX configuration to Rx UE. But “when” to transmit could be up to Tx UE implementation. |
| CATT | Option 4 |  |
| NEC | Option 2 & Option 4 | As stated in R2-2107238, our understanding is that both RX UE and TX UE can trigger unicast TX-UE centric DRX configuration negotiation procedure. For the RX UE initiated case, option 2 is reasonable whereas for the TX UE initiated case, we prefer option 4. |
| Nokia | Option 4 |  |
| Intel | Option 4 | Given that how TX UE determines the SL DRX configuration to be sent to the RX UE is upto implementation, when to send should follow the same vein. |
| Spreadtrum | Option 4 |  |

##### **Question4-1c, when RX UE considers the SL unicast DRX configuration is applied:**

1. Upon receiving the PC5 RRC message including SL DRX configuration.
2. Upon receiving the PC5 RRC message including SL DRX configuration, after sending SL DRX confirmation message to TX UE.
3. It’s up to RX UE implementation.
4. After receiving *RRCReconfigurationSidelink* including SL DRX configuration, and if Rx-UE accept the SL DRX configuration, before sending *RRCReconfigurationCompleteSidelink* message to Tx-UE.
5. Others

Note:Any combination of above options is feasible. Company can also select one or more combinations.

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Xiaomi | Option 2 | TX and RX UE should be synchronized on when the DRX configuration is applied. Otherwise, there may be data loss or power waste.  In option 1, RX UE reject the SL DRX configuration.  In option 3, TX and RX UE are not synchronized. |
| Lenovo, MotM | Option 1 | And the Rx UE has been able to comply/ apply the configuration (before sending the confirmation). |
| InterDigital | Option 2 | The RX UE can only apply DRX if it confirms accepting the DRX configuration. |
| Ericsson | Option 2 | Only when RX UE sends confirmation message to TX UE indicating SL DRX configuration is accepted. |
| Apple | Option 1 with comments | Only if RX UE agrees on the suggested DRX config. |
| OPPO | Option 4 | For Option1/2 we want to make them more clear since:   1. For Option1, RAN2 has already agreed the including of DRX configuration in *RRCReconfigurationSidelink*, so as for other field in the signalling, DRX configuration should take effect based on the reception of the signalling. 2. For Option2, the part that “after sending SL DRX confirmation message to TX UE”, although we understand that the intention may be to exclude the case where the DRX configuration is rejected by Rx-UE, but following the current spec (as we did in Uu), the applying of parameters in *RRCReconfigurationSidelink* happens before the delivery of complete message, so it is not correct to say the configuration applies only “after”. |
| Samsung | Option-2 |  |
| Fujitsu | Option 1 | On receiving the DRX configuration, the RX UE can apply the DRX configuration if it can comply with it. |
| MediaTek | Option-2 | Rx UE apply the configuration only if it confirms the SL DRX configuration (accepted). |
| CATT | Option2 | Once the Rx UE accepts the SL DRX configuration, it will apply it. |
| NEC | Option 2 |  |
| Nokia | Option 1 | If the reply is an accept, there is no need to wait to apply the configuration, and if it is a rejection, anyway the Tx UE will know |
| Intel | Option 1 | Assuming RX UE sends the preferred/suggested DRX configuration to the DRX, it should apply the configuration received via PC5 RRC. We don’t think any other conditions are needed |
| Spreadtrum | Option 1 | Only if Rx UE accepts the DRX configuration. |

### 2.4.2 Groupcast

##### **Question4-2, when UE considers the DRX configuration for SL GC communication is applied when:**

1. SL DRX configuration for GC is obtained.
2. UE is interested in receiving the GC service data from other UEs.
3. UE has power saving requirement.
4. UE is capable of sidelink GC DRX.
5. TX profile indicates that SL GC DRX is enabled.
6. It’s up to RX UE implementation.
7. Others.

Note: Any combination of above options is feasible. Company can also select one or more combinations.

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Xiaomi | Option 6 | Generally, we understand UE should take option 1-5 into account to decide GC DRX configuration. However, considering these options are internal UE implementation, we prefer to just specify how UE decide the GC DRX configuration, e.g. based on interest, PQI, DRX configuration, TX profile, and leave the process timing to UE implementation. |
| Lenovo, MotM | Option 6 | Agree with Xiaomi |
| InterDigital | Option 6 | We don’t think we need to over-specify these aspects. |
| Ericsson | Option 6 |  |
| Apple | Option 1 & 5 | The TX profile is used for RX UE to determine whether it should use SL DRX or not. Once this is determined and SL-DRX configuration is obtained, it has to enter SL-DRX. This is the assumption for the TX UE to behave accordingly. We cannot leave this unspecified. |
| OPPO | Option 6 | Option1, 2, and Option5 can be taken into account but no spec impact. When the UE interested in receiving the GC service data from other Ues and the GC service are DRX enabled, and the configuration is obtained  For other options,  Option 3 is not very clear;  Option 4 is related to UE capability discussion later  But finally, we do not think this discussion would impose a spec impact explicitly. |
| Fujitsu | Option 6 |  |
| MediaTek | Option 6 | Agree with Xiaomi. |
| CATT | Option 6 |  |
| NEC | Option 6 |  |
| Nokia | Option 6 |  |
| Intel | Option 6 |  |
| Spreadtrum | Option 6 |  |

### 2.4.3 Broadcast

##### **Question4-3, when UE considers the DRX configuration for SL BC communication is applied when:**

1. SL DRX configuration for BC is obtained.
2. UE is interested in receiving the BC service data from other UEs.
3. UE has power saving requirement.
4. UE is capable of sidelink BC DRX.
5. TX profile indicates that SL BC DRX is enabled.
6. It’s up to RX UE implementation.
7. Others.

Note: Any combination of above option is feasible. Company can also select one or more combinations.

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Xiaomi | Option 6 | Same as Q4-2 |
| Lenovo, MotM | Option 6 | Agree with Xiaomi |
| InterDigital | Option 6 | Same as Q4-2 |
| Ericsson | Option 6 |  |
| Apple | Option 1 & 5 | Same as Q4-2 |
| OPPO | Option 6 | Option1, 2, and Option5 can be taken into account but no spec impact. When the UE interested in receiving the BC service data from other Ues and the BC service are DRX enabled, and the configuration is obtained  For other options,  Option 3 is not very clear;  Option 4 is related to UE capability discussion later  But finally, we do not think this discussion would impose a spec impact explicitly. |
| Fujitsu | Option 6 |  |
| MediaTek | Option 6 | Agree with Xiaomi |
| CATT | Option 6 |  |
| NEC | Option 6 |  |
| Nokia | Option 6 |  |
| Intel | Option 6 |  |
| Spreadtrum | Option 6 |  |

## 2.5 Others:

##### **Question5-1, if company think there are any other issues need to be discuss, please list the questions here:**

|  |  |  |
| --- | --- | --- |
| Company | Issues | Comment |
|  |  |  |
|  |  |  |

# Conclusion

# Reference

1. R2-2106985 Leftover Issues for Sidelink Unicast DRX CATT discussion Rel-17 NR\_SL\_enh-Core
2. R2-2107190 Left issues on SL-DRX OPPO discussion Rel-17 NR\_SL\_enh-Core
3. R2-2107310 On SL DRX Configuration aspects Intel Corporation discussion Rel-17 NR\_SL\_relay-Core
4. R2-2108426 Discussion on TBD/FFS Samsung Research America discussion
5. R2-2108822 Remaining issues of SL DRX MediaTek Inc. discussion Rel-17 NR\_SL\_enh-Core
6. R2-2107433 Further consideration on DRX configuration ZTE Corporation, Sanechips discussion Rel-17 NR\_SL\_enh-Core
7. R2-2107041 Discussion on left issue from [704][705][706] OPPO discussion Rel-17 NR\_SL\_enh-Core
8. R2-2107155 Consideration on sidelink DRX for groupcast and broadcast Huawei, HiSilicon discussion Rel-17 NR\_SL\_enh-Core
9. R2-2107303 Summary of [POST114-e][704][V2X/SL] How to make sure Rel-16 UEs not supporting SL DRX are not involved in SL communication in DRX manner (Sharp) SHARP Corporation discussion NR\_SL\_enh-Core Late
10. R2-2108014 DRX Configuration for UC BC GC and its interaction with Sensing Lenovo Mobile Com. Technology discussion NR\_SL\_enh-Core
11. R2-2108222 A Default PC5 DRX Configuration for Broadcast/Groupcast/Unicast vivo discussion
12. 3GPP TS 38.287, Architecture enhancements for 5GS to support V2X services, V17.0.0, June, 2021.