**3GPP TSG-RAN WG2 #115-e *R2-210xxxx***

**E-meeting, August 2021**

Agenda Item: 8.x.x

Source: OPPO

Title: Summary of  [AT115-e][703][V2X/SL] SL DRX configuration for GC/BC (OPPO)

Document for: Discussion, Decision

# Introduction

This is for the following email discussion

* [AT115-e][703][V2X/SL] SL DRX configuration for GC/BC (OPPO)

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

Q1: Whether the dedicated RRC is also used to configure SL DRX configuration for GC/BC?

 Q2: How to configure SL DRX on-duration and inactivity timers for GC/BC?

 Q3: How to configure SL DRX RTT and retransmission timers for GC/BC?

 Q4: Need of down-select other DRX configurations for a specific L2 DST ID if the UE has multiple QoS profiles for same DST L2 ID? If needed, how to do down-selection?

 Q5: Need to define default DRX configuration for GC/BC?

 Q6: Need for SL DRX MAC CE for GC/BC?

 **Intended outcome:** Discussion summary in R2-2108983

# Discussion

## Q1: Whether the dedicated RRC is also used to configure SL DRX configuration for GC/BC?

According to RAN2#113e agreement,

3: For broadcast/groupcast, for in-coverage case, for RRC\_CONNECTED TX-UE/RX-UE can obtain DRX configuration from SIB. FFS on whether dedicated-RRC is also used.

the only FFS point for BC/GC DRX configuration is whether dedicated-RRC can be used for RRC\_CONNECTED TX-UE/RX-UE.

Firstly, rapp understand this issue is independent of the case of SIB delivery using dedicated-RRC, which is still based on the cell-specific SIB information, i.e., not UE-specific configuration.

RRCReconfiguration-v1530-IEs ::= SEQUENCE {

 masterCellGroup OCTET STRING (CONTAINING CellGroupConfig) OPTIONAL, -- Need M

 fullConfig ENUMERATED {true} OPTIONAL, -- Cond FullConfig

 dedicatedNAS-MessageList SEQUENCE (SIZE(1..maxDRB)) OF DedicatedNAS-Message OPTIONAL, -- Cond nonHO

 masterKeyUpdate MasterKeyUpdate OPTIONAL, -- Cond MasterKeyChange

 dedicatedSIB1-Delivery OCTET STRING (CONTAINING SIB1) OPTIONAL, -- Need N

 dedicatedSystemInformationDelivery OCTET STRING (CONTAINING SystemInformation) OPTIONAL, -- Need N

 otherConfig OtherConfig OPTIONAL, -- Need M

 nonCriticalExtension RRCReconfiguration-v1540-IEs OPTIONAL

}

**Q2.1-1: For SL BC and GC, for in-coverage case, do you agree RRC\_CONNECTED TX-UE/RX-UE can obtain DRX configuration from SIB which is delivered via dedicated RRC signalling?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comment |
| Xiaomi | Agree |  |
| InterDigital | Agree |  |
| Ericsson | Agree |  |
| Apple | Agree |  |
| OPPO | Agree | As in legacy |
| vivo  | Disagree | We don’t think it is necessary, although the UEs who are in IC can receive the RRC (re)configuration.We believe, the situation in a groupcast or broadcast is more complicated than in unicast; some UEs are in IC with (re)configuration and some are in OOC with pre-configuration, this could result in somewhat mismatching of DRX configuration in between. |
| Lenovo, MotM | Agree |  |
| Samsung | Agree |  |
| Nokia | Agree |  |
| MediaTek | Agree |  |
| CATT | Agree |  |
| ZTE | Agree |  |
| Intel | Agree |  |
| LG | Agree |  |
| Spreadtrum | Agree |  |
| ASUSTeK | Agree |  |
| Huawei, HiSilicon | Agree |  |

Secondly, as we did for Rx pool, which is normally delivered via SIB instead of dedicated-RRC, one exceptional case is handover

SL-BWP-PoolConfig-r16 ::= SEQUENCE {

sl-RxPool-r16 SEQUENCE (SIZE (1..maxNrofRXPool-r16)) OF SL-ResourcePool-r16 OPTIONAL, -- Cond HO

sl-TxPoolSelectedNormal-r16 SL-TxPoolDedicated-r16 OPTIONAL, -- Need M

sl-TxPoolScheduling-r16 SL-TxPoolDedicated-r16 OPTIONAL, -- Need N

sl-TxPoolExceptional-r16 SL-ResourcePoolConfig-r16 OPTIONAL -- Need M

}

|  |  |
| --- | --- |
| Conditional Presence | Explanation |
| *HO* | This field is optionally present, need M, in an *RRCReconfiguration* message including *reconfigurationWithSync*; otherwise it is absent, Need M. |

I.e., it can be delivered to UE in a dedicated RRC during handover procedure, i.e., in an *RRCReconfiguration* message including *reconfigurationWithSync*

**Q2.1-2: For SL BC and GC, for in-coverage case, do you agree RRC\_CONNECTED TX-UE/RX-UE can obtain DRX configuration from dedicated RRC signalling during handover, i.e., in an *RRCReconfiguration* message including *reconfigurationWithSyn*?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comment |
| Xiaomi | Agree |  |
| InterDigital | Agree |  |
| Ericsson | Agree |  |
| Apple | Agree |  |
| OPPO | Agree | As in legacy |
| vivo  | Disagree | Same as in Q2.1-1, to avoid the mismatching between the UEs. |
| Lenovo | Agree | As long as the handover command signals the same DRX configuration as broadcasted in the target cell => **Network implementation.** |
| Samsung | Agree |  |
| Nokia | Agree |  |
| MediaTek | Agree |  |
| CATT | Agree |  |
| ZTE | Agree |  |
| Intel | Agree |  |
| LG | Agree |  |
| Spreadtrum | Agree |  |
| ASUSTeK | Agree |  |
| Huawei, HiSilicon | Agree | As DRX configuration is needed at RX UE side, it could be handled in a way similar to Rx Pool.  |

Other than the two cases above, one may ask whether there is any other left use case for dedicated RRC signalling.

**Q2.1-3: For SL BC and GC, for in-coverage case, other than the two cases in Q2.1-1/2, is there any other use case for RRC\_CONNECTED TX-UE/RX-UE to obtain DRX configuration from dedicated RRC signalling?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Xiaomi | Yes | We understand it’s optional for NW to include SL BC/GC DRX in SIB, even NW is capable of SL DRX. If NW choose not to include these in SIB, dedicated signalling shall be used to carry SL BC and GC DRX configuration to CONNECTED UE. Otherwise, SL DRX capable gNB is mandated to include BC/GC DRX configuration in SIB. |
| InterDigital | No |  |
| Ericsson | No |  |
| Apple | No | We need ensure the common DRX configuration is consistent among UEs in broadcast, even for RRC\_CONNECTED Ues. The legacy *SL-configDedicated* IE defined in R16 does not guarantee that as the RRC spec is very ambiguous about this aspect (e,g. it is unclear whether a resource pool configured in the dedicated ignalling is the same common pool used in SIB), so we prefer to not reuse dedicated RRC IE for this DRX configuration. |
| OPPO | No | As clarified in 8830, whether UE-specific RRC is feasible:* it is obviously not feasible for Rx-UE, since data delivery of group-cast and broadcast is naturally not per-UE;
* it could be feasible for Tx-UE, i.e., it can be used to configure per-UE TX resources, as a subset of RX time occasions allowed by the DRX configuration for RX-UE;

But then if one for the latter point goes for the UE-specific DRX configuration, it should be achievable already by configuring UE-specific TX pool (mode-2) or via UE-specific SL grant provisioning (mode-1). |
| Vivo | No |  |
| Lenovo | No | Dedicated signalling is not so necessary and can even lead to trouble if all the Ues would need to establish RRC Connection just to receive the DRX configuration. |
| Samsung | No |  |
| Nokia | No |  |
| MediaTek | No |  |
| CATT | No |  |
| ZTE | No |  |
| Intel | No |  |
| LG | No |  |
| Spreadtrum | No |  |
| ASUSTeK | No |  |
| Huawei, HiSilicon | Yes | DRX configuration is needed for both Tx UE and Rx UE. The two cases in Q2.1-1/2 may be enough for RX UE, but for TX UE, follow R16 logic, TX UE in RRC\_CONNECTED can obtain SL configuration via dedicated signalling if gNB supports it. It is better not to restrict on how RRC\_CONNECTED TX UE to obtain DRX configuration from dedicated RRC signalling in other use cases. When DRX configuration is not UE specific, NW implementation can ensure the SIB-based configuration and dedicated RRC based configuration are aligned.  |

## Q2: How to configure SL DRX on-duration and inactivity timers for GC/BC?

Based on the RAN2#114 agreement,

4: For GC/BC, DRX cycle is configured per QoS profile.

5a: For GC/BC, RAN2 understands that sl-drx-startoffset does not take QoS requirement into consideration.

5b: For GC/BC, For GC/BC, sl-drx-startoffset is set based on DST L2 ID.

So there are left issues on the configuration granularity for on-duration timer length and inactivity timer length.

**Q2.2-1: For BC/GC, what is the granularity for configuration of on-duration timer length?**

**Option-1: Per QoS profile**

**Option-2: Per DST L2 ID**

**Option-3: Others (if this option is selected, please indicate the preferred granularity)**

|  |  |  |
| --- | --- | --- |
| Company | Option(s) | Comment |
| Xiaomi | Option-1 | We prefer common solution. |
| InterDigital | Option-1 | We think the QoS has an effect on the on-duration (similar to the DRX cycle) |
| Ericsson | Option-1 | Agree with Interdigital |
| Apple | Option-1 |  |
| OPPO | Option-1 |  |
| vivo  | Option-1 | The granularity of DRX cycle is already agreed relying on the QoS profile.However, regardless of single or multiple QoS profiles, however, the SL DRX on-duration timers should be finally condensed to a single configuration, mapped to L2 destination ID. |
| Lenovo | Option-1 |  |
| Samsung | Option-1 |  |
| Nokia | Option-1 |  |
| MediaTek | Option-1 |  |
| CATT | Option-1 |  |
| ZTE | Option-1 | The on-duration timer length shall be configured together with DRX cycle, since the DRX cycle is configured per QoS profile, the on-duration timer length shall also be configured per QoS profile. |
| Intel | Option-1 |  |
| LG | Option-1 |  |
| Spreadtrum | Option-1 |  |
| ASUSTeK | Option-1 |  |
| Huawei, HiSilicon | Option-1 |  |

Considering the following agreement, inactivity time is not applicable to BC

15: SL Inactivity timer is not supported for broadcast transmissions.

**Q2.2-2: For GC, what is the granularity for configuration of inactivity timer length?**

**Option-1: Per QoS profile**

**Option-2: Per DST L2 ID**

**Option-3: Others (if this option is selected, please indicate the preferred granularity)**

Option-4: a single value

|  |  |  |
| --- | --- | --- |
| Company | Option(s) | Comment |
| Xiaomi | Option-1 |  |
| InterDigital | Option-1 | We think the QoS has an effect on the inactivity timer (similar to the DRX cycle) |
| Ericsson | Option-1 |  |
| Apple | Option-1 |  |
| OPPO | Option-1 |  |
| vivo  | Option-1 | The granularity of DRX cycle is already agreed relying on the QoS profile.However, regardless of single or multiple QoS profiles, the SL DRX inactivity timers should be finally condensed to a single configuration, mapped to L2 destination ID. |
| Lenovo | Option-1 |  |
| Samsung | Option-1 |  |
| Nokia | Option-1 |  |
| MediaTek | Option-1 |  |
| CATT | Option-1 |  |
| ZTE | Option-4 | It is agreed that *the SL inactivity timer value may take into consideration the QoS. Whether any specification impacts are needed is FFS.* That does not mean the SL inactivity timer needs to be configured per QoS. Moreover, it is also agreed that *TX UE maintains a timer corresponding to the SL Inactivity timer in the RX UE for groupcast L2 destination ID*. Considering that a groupcast L2 destination ID may relate to multiple Qos profiles, thus, we think the SL inactivity timer can not be configured per Qos profile for groupcast. The simplest way is to configure a single value of inactivity timer for groupcast. |
| Intel | Option-1 |  |
| LG | Option-1 |  |
| Spreadtrum | Option-1 |  |
| ASUSTeK | Option-1 |  |
| Huawei, HiSilicon | Option-1 | The sl-drx-slotoffset should also be configured with granularity per QoS profile.  |

## Q3: How to configure SL DRX RTT and retransmission timers for GC/BC?

The issue here is similar to Q2 above. Besides, considering that although the need of RTT/Re-tx timer for BC is still FFS, pending on the conclusion in [POST114-e][706], but it is of clear majority support, rapp understand the questions for Q3 can be limited to GC for now.

Proposal 13 –SL HARQ RTT timer and SL Retransmission timer are not used for broadcast transmissions [13/15].

**Q2.3-1: For GC, what is the granularity for configuration of RTT timer length?**

**Option-1: Per QoS profile**

**Option-2: Per DST L2 ID**

**Option-3: Per retransmission mode**

**Option-4: Others (if this option is selected, please indicate the preferred granularity)**

**Option-5: Too early to decide**

|  |  |  |
| --- | --- | --- |
| Company | Option(s) | Comment |
| Xiaomi | Option-3 | We understand the RTT timer is decided in following way. RTT is configured per resource pool considering the PSFCH allocation in feedback based retransmission. RTT timer should be a fixed value in blind retransmission. RTT timer is selected per retransmission mode.We don’t see the relation between RTT and QoS profile, since the RTT is to describe the round trip time. |
| InterDigital | Option-4 (others) | RTT timer length can does not depend on QoS profile, but can have granularity that goes beyond L2 ID. Namely, HARQ RTT should depend at least on **whether SCI contains the a retransmission resource**, **whether HARQ is enabled/disabled**. Note: these aspects have already been discussed in [706] and pending RAN1 LS, so suggest to not discuss HARQ RTT in this email discussion.  |
| Ericsson | comments | Uncertain whether a configuration granularity is needed. It is obvious that neither QoS profile nor L2 ID is suitable. |
| Apple | Neither 1 or 2 | We do not think Option1/2 is right. But it is too early to decide how to determine “granularity” for GC or even whether there is a need to introduce multiple granularity. We prefer to discuss this after SL unicast solutions is fully resolved. |
| OPPO | Option-4 | We do not think either per-QoS or per-L2-ID configuration is needed, **a QoS/L2-ID agnostic configuration is sufficient**, i.e., a single value, which is especially helpful for mode-1 scheduling where it is hard for the network to know the associated QoS to derive the length of RTT/Re-tx timer correctly. |
| vivo  | Option-2 | The RTT timer is not related to the QoS profile. For simplicity, the granularity for configuration of RTT timer length is based on DST L2 ID.As working assumption (waiting for RAN1 to feedback), meanwhile, SL HARQ RTT timer can be derived from the retransmission resource timing when the SCI indicates a retransmission resource, as option-3. |
| Lenovo | Option-5 | Too early to decide now. First, we need to understand how to apply the HARQ RTT timer e.g., when SCI has 2/ 3 resources reserved. |
| Samsung | Neither 1 nor 2Option-4 (others) | We think RTT timer has no relation to neither QoS profile nor DST L2 id. Instead, we think it is configured independently. Multiple candidate values may be configured for different cases, e.g. dependent on HARQ enabled/disabled or per resource pool.  |
| Nokia | comments | We share companies’ view, that for determining the value of HARQ RTT none of the option is suitable. |
| MediaTek | Option-3 and 4 | We share the view from Xiaomi, OPPO, and Samsung. RTT timer is not QoS or L2 ID related. |
| CATT | Option-4 | The granularity for configuration of RTT timer length has nothing relation with QoS profile or L2 DST ID, we think configured values can be used.  |
| ZTE | Option-4 | Neither 1 or 2. We think a single value is enough. |
| Intel | Option-4 | Agree with OPPO that a single value for the HARQ RTT timer is sufficient and the gains for having it configured specific to the QoS/L2-ID is not clear to us |
| LG | comments | RTT timer length is not related to QoS profile/DST L2 ID. RTT timer can be configured considering various factors (e.g., resource pool considering PSFCH allocation, HARQ feedback mode, resource information on SCI and etc).  |
| Spreadtrum | Option-4 | Neither QoS nor L2 ID is suitable. We prefer a single value for RTT timer length. |
| ASUSTeK | Option-3 or 4 | The RTT timer should not be based on QoS. The UE uses a fixed value configured for all cases by NW. |
| Huawei, HiSilicon |  | We prefer to discuss this timer value after other timer aspects are designed.  |

**Q2.3-2: For GC, what is the granularity for configuration of re-transmission timer length?**

**Option-1: Per QoS profile**

**Option-2: Per DST L2 ID**

**Option-3: Others (if this option is selected, please indicate the preferred granularity)**

**Option-4: Too early to decide**

|  |  |  |
| --- | --- | --- |
| Company | Option(s) | Comment |
| Xiaomi | Option-1 |  |
| InterDigital | Option-3 (Others) | Similar response to previous question. |
| Ericsson | comments | Uncertain whether a configuration granularity is needed. It is obvious that neither QoS profile nor L2 ID is suitable. |
| Apple | Neither 1 or 2 | Same concern as Q2.3-1 |
| OPPO | Option-3 | We do not think either per-QoS or per-L2-ID configuration is needed, **a QoS/L2-ID agnostic configuration is sufficient**, i.e., a single value, which is especially helpful for mode-1 scheduling where it is hard for the network to know the associated QoS to derive the length of RTT/Re-tx timer correctly. |
| vivo  | Option-2 | The re-transmission timer is *not tightly* related to the QoS profile. For simplicity, the granularity for configuration of re-transmission timer length is based on DST L2 ID. |
| Lenovo | Option-4 | Too early to decide now. First, we need to understand how to apply the HARQ Re-Tx timer e.g., when SCI has 2/ 3 resources reserved. |
| Samsung | Neither 1 nor 2Option-4 (others) | We think re-transmission timer has no relation to neither QoS profile nor DST L2 id. Instead, we think it is configured independently. Multiple candidate values may be configured for different cases, e.g. dependent on HARQ enabled/disabled. |
| Nokia | comments | For determining the value of HARQ RTT none of the option is suitable. |
| MediaTek | Option-3 | As we mentioned in Q2.3-1, the HARQ retransmission timer may be more related to HARQ retransmission operation and have less relation with QoS profile or L2 ID. |
| CATT | Option-3 | The granularity for configuration of re-transmission timer length has nothing relation with QoS profile or L2 DST ID, we think configured values can be used. |
| ZTE | Option-3 | Neither 1 or 2. We think a single value is enough. |
| Intel | Option-3 | Same comments as above |
| LG | comments | Retransmission timer can be configured considering various factors (e.g., HARQ retransmission operation, PDB and etc).  |
| Spreadtrum | Option-3 | Similar to RTT timer, a single value for retransmission timer length is enough. |
| ASUSTeK | Option-3 | Retransmission timer should be a fixed value (per transmission mode or per UE) configured by NW. |
| Huawei, HiSilicon |  | Same as our comment for Q2.3-1 |

## Q4: Need of down-select other DRX configurations for a specific L2 DST ID if the UE has multiple QoS profiles for same DST L2 ID? If needed, how to do down-selection?

So far, R2 has already conclude on the need of per-QoS configuration for DRX cycle, so this question is at least valid for DRX cycle.

**Q2.4-1a: If the UE has multiple QoS profiles, and thus they associate with different DRX cycle length value(s), for same DST L2 ID, do you think TX/RX UE has to down-select to a single associated DRX cycle length value?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Xiaomi | Yes | Without down selection, the UE has to wake in multiple DRX cycle, so the power saving gain is marginal. |
| InterDigital | Yes | The MAC layer cannot see QoS profile, and so down selection to a single DRX cycle length per L2 ID is needed for the MAC layer to manage this timer. |
| Ericsson | No | In our views the down-selection is not needed, as it will increase design complexity without any clear benefit. If a UE has multiple QoS profiles for the same DST L2 ID, the UE could just have multiple DRX cycles configured at the same time, the UE will be in active time if any of the on-duration timers associated to the DRX cycles is running.  |
| Apple | No with comments | In regards of saving power, it is reasonable to achieve a single on-duration ( aligned in time domain) period for the L2 address in this case even when multiple different DRX cycles are used. Therefore, the DRX cycle per QoS profile needs to be configured in some form like T, 2T, 4T, 8T so that wake-up time can overlaps automatically. Then, there is no need for down-selection. |
| OPPO | No | As clarified in 8830, SL QoS have multiple dimensions, and the ordering of one dimension is not necessarily the same as the other dimension (one has to consider of non-standardized QoS and has to consider there might be new PQI added into the standardized PQI table). So down-selection based on a single dimension of the QoS is not feasible.Another way-out is to select* With the shortest DRX cycle within the ones corresponding to the QoS associated with the service;
* With the longest on-duration timer within the ones corresponding to the QoS associated with the service;

Although this is a feasible way-out to derive a same / single DRX pattern for both Tx and Rx UE, it does not necessarily achieve better performance than following multiple DRX patterns, e.g., considering two associated QoS* DRX1 for QoS1, shorter on-duration + shorter DRX cycle;
* DRX2 for QoS2, longer on-duration + longer DRX cycle;

So, the final decided DRX of longer on-duration + shorter DRX cycle would have higher power consumption for both DRX1 and DRX2 – in the extreme case, if the longer on-duration timer length > shorter DRX cycle, UE may end up with no power saving gain at all.  |
| vivo | Yes | We prefer to have single DRX configuration condensed per L2 destination ID. |
| Lenovo | No | Firstly, we think multiple QoS profiles for same DST L2 ID is a rare case. Secondly, even if there are multiple QoS profiles and multiple DRX cycles, down-selecting one of the multiple DRX cycles may not fulfil the QoS requirement of all services. |
| Samsung | Yes | Considering this issue is not only for SL DRX cycle length, but also for other SL DRX timers (e.g. inactivity timers, on-duration timer), we think down-selection would be better in UE power saving. Also considering SL DRX timers run per DST L2 id for GC/BC, we think down-selection is needed.  |
| Nokia | comments | A single DRX configuration per L2 destination ID seems favourable, however we are not sure if a down-selection (based on yet to be defined criteria) is really necessary. |
| MediaTek | Yes | We prefer to maintain one SL DRX configuration per L2 destination ID for GC/BC. |
| CATT | Yes | Similar with Uu DRX, there will be multiple sl-drx-cycles due to per PQI DRX cycle configuration, but there will be just only one cycle can be derived. The choosing and converting from multi-to-single can be left to implementation (algorithm, no spec impacts). Besides, there will be good to reduce the Implementation complexity for UE to use multiple values of sl-drx-cycle. |
| ZTE | No | Down selecting DRX cycle will increase design complexity but has no obvious benefit. If multiple cycles are configured, the UE will be in active time if any of the on-duration timers associated to the DRX cycles is running.  |
| Intel | See Comment | In our view, if UE has multiple QoS profiles and they are associated with different DRX cycle length value(s), ultimately the UE shall end up with a single overall DRX cycle (which will look like a combination of the DRX cycles corresponding to the different QoS profiles). So, the down-selection seems like just a modeling issue to us and no real behavioral change in terms of DRX active/inactive time is foreseen one way or another |
| LG | No | Same view with OPPO and Lenovo. Down-selecting one of the multiple DRX cycles may not fulfil the QoS requirement of all services. |
| Spreadtrum | No | It is sometimes not efficient to derive a single DRX pattern based on different DRX cycle and on-duration values. |
| ASUSTeK | Yes | It is preferable one DRX configuration per DST L2 ID. |
| Huawei, HiSilicon | Yes | Since SCI only carries the destination ID related information for the associated TB, even when multiple packets associated with different QoS profiles are multiplexed into the same TB, the MAC entity at the RX side simply cannot operate separate DRX configurations respectively towards different QoS profiles of the data within a given TB, considering that DRX is performed for SCI reception which is at a per TB (not per LCH) level. If multiple DRX configurations wear applied, considering UE is in active according to some QoS profiles but the data associated with those QoS profiles are not multiplexed in the TB, such design can easily defeat the purpose of power saving from DRX mechanism.Moreover, if multiple DRX configurations were applied for a given destination ID by the MAC, it would cause considerable challenge on UE implementation complexity, as there could be quite a few timers be maintained in parallel. We would rather use some complexity on the down-selection to a single DRX configuration. We doubt this down-selection would really cause problem for UE, comparing with the case that UE has to handle multiple timers and can often have various overlapping on/off time periods, for which certain down-selection mechanism for handling overlapping on/off time periods with multiple timers would be needed anyway. (here by overlapping on/off periods, we mean that one on period overlaps with another on/off period based on different DRX configurations)Considering all the above, only one DRX configuration should be applied by the MAC entity at a given time for each destination ID. |

If one answer Yes to Q2.4-1a, how to do the down-selection? Rapp observed some proposals in companies submitted tdocs

* Select the DRX configuration associated with the QoS profile whose priority level is the highest
* Select the DRX configuration associated with the QoS profile whose PDB is the smallest
* Select the DRX configuration whose DRX cycle is the smallest

**Q2.4-1b: If one answer Yes to Q2.4-1a, how to do the down-selection**

**Option-1: Select the DRX configuration associated with the QoS profile whose priority level is the highest**

**Option-2: Select the DRX configuration associated with the QoS profile whose PDB is the smallest**

**Option-3: Select the DRX configuration whose DRX cycle is the smallest**

**Option-4: Others (if this option is selected, please indicate the preferred granularity)**

**Option-5:** Select greatest common divisor of the DRX cycle of multiple QoS profiles as DRX cycle.

|  |  |  |
| --- | --- | --- |
| Company | Option(s) | Comment |
| Xiaomi | Option-3 | We understand option-2 and option-3 should be the same in practice. Small PDB requires small DRX cycle. Regarding option-1, high priority level doesn’t necessarily equire small DRX cycle. If a long DRX cycle is selected, the delay requirement may not be fulfilled for the low priority QoS profile which requires low latency. |
| InterDigital | Option-3 | We think this approach is the simplest to specify in the MAC, since the MAC layer is not aware of the QoS profile. |
| Apple | Option 4 | Given that there may multiple service types mapped to the same L2 address, using Option 3 does not guarantee the Ues are still wake-up at the same time because the “smallest” DRX cycle may be different among the Ues. It is still reasonable to ensure DRX cycle is configured in a exponential sequence so that the onDurations are always overlapping. |
| Vivo | Option-2 | It should rely on the minimum PDB among the QoS profiles. |
| Samsung | Option-3 |  |
| MediaTek | Option-3 | Prefer the simplest way. |
| CATT | Option-5 |  |
| ASUSTeK | Option-3 |  |
| Huawei, HiSilicon | Option 1/2/3 |  |

The same issue is applicable to the other DRX settings.

For on-duration timer length:

**Q2.4-2a: If one selected option-1 for Q2.2-1, and if the UE has multiple QoS profiles, and thus they associate with different on-duration timer length value(s), for same DST L2 ID, do you think TX/RX UE has to down-select to a single associated on-duration timer length value?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Xiaomi | Yes | Since we prefer to down select to one DRX cycle, on-duration timer should also down-select to one. |
| InterDigital | Yes | Same reasoning as our response for **Q2.4-1a** |
| Ericsson | No | Same reasoning as our response for **Q2.4-1a** |
| Apple | No | As explained in Q2.4-1, the key is to make sure the on-Duration overlaps (with the same offset), no need of the down-selection. |
| OPPO | No | As clarified in 8830, SL QoS have multiple dimensions, and the ordering of one dimension is not necessarily the same as the other dimension (one has to consider of non-standardized QoS and has to consider there might be new PQI added into the standardized PQI table). So down-selection based on a single dimension of the QoS is not feasible.Another way-out is to select* With the shortest DRX cycle within the ones corresponding to the QoS associated with the service;
* With the longest on-duration timer within the ones corresponding to the QoS associated with the service;

Although this is a feasible way-out to derive a same / single DRX pattern for both Tx and Rx UE, it does not necessarily achieve better performance than following multiple DRX patterns, e.g., considering two associated QoS* DRX1 for QoS1, shorter on-duration + shorter DRX cycle;
* DRX2 for QoS2, longer on-duration + longer DRX cycle;

So, the final decided DRX of longer on-duration + shorter DRX cycle would have higher power consumption for both DRX1 and DRX2 – in the extreme case, if the longer on-duration timer length > shorter DRX cycle, UE may end up with no power saving gain at all.  |
| Vivo | Yes | Regardless of single or multiple QoS profiles, the SL DRX on-duration timers are finally condensed to a single configuration, mapped to L2 destination ID. |
| Lenovo | No | Similar comments as in Q2.4-1a |
| Samsung | Yes | See our input in Q2.4-1a |
| Nokia | No |  |
| MediaTek | Yes |  |
| CATT | Yes |  |
| ZTE | No | Similar comments as in Q2.4-1a |
| Intel | No |  |
| LG | No |  |
| Spreadtrum | No |  |
| ASUSTeK | Yes |  |
| Huawei, HiSilicon | Yes | See our comments for Q2.4-1a |

**Q2.4-2b: If one answer Yes to Q2.4-2a, how to do the down-selection**

**Option-1: Select the DRX configuration associated with the QoS profile whose priority level is the highest**

**Option-2: Select the DRX configuration associated with the QoS profile whose PDB is the smallest**

**Option-3: Select the DRX configuration whose on-duration timer length is the largest**

**Option-4: Select the on-duration timer associated with the QoS profile, which is associated with the selected DRX cycle.**

**Option-5: Others (if this option is selected, please indicate the preferred granularity)**

|  |  |  |
| --- | --- | --- |
| Company | Option(s) | Comment |
| Xiaomi | Option-4 | As DRX cycle has been selected as in Q2.4-1b, the on-duration timer, which is associated with the same QoS profile, should also be selected. Otherwise, there may be the case that on-duration timer is longer than DRX cycle and UE can’t go to sleep. Initial transmission is restricted within the on-duration timer running. Inactivity timer could provide extended wakeup time for subsequent transmission. |
| InterDigital | Option 3 | Same reasoning as our response for **Q2.4-1b** |
| vivo | Option-3 |  |
| Samsung | Option-3 |  |
| MediaTek | Option-3 | For satisfying the QoS requirement of all QoS profile. |
| CATT | Option-3 |  |
| ASUSTeK | Option-3 |  |
| Huawei, HiSilicon | Option 1/2/3 |  |

For inactivity timer length:

**Q2.4-3a: If one selected option-1 for Q2.2-2, and if the UE has multiple QoS profiles, and thus they associate with different inactivity timer length value(s), for same DST L2 ID, do you think TX/RX UE has to down-select to a single associated inactivity timer length value?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Xiaomi | Yes | MAC entity is not aware of the QoS profile of the received MAC PDU. It’s not feasible for MAC to start different inactivity timer based on QoS profile. |
| InterDigital | Yes | Same reasoning as our response for **Q2.4-1a** |
| Ericsson | No | Same reasoning as our response for **Q2.4-1a.** in addition,the SCI carries the priority information, which may be used to identify the associated QoS profile. |
| Apple | No | If multiple inactivity timers are configured, the RX UE only need to (re)start the corresponding timer based on SCI priority. We do not see a need for further restriction of UE behaviour. |
| Vivo | Yes | Regardless of single or multiple QoS profiles, the SL DRX inactivity timers are finally condensed to a single configuration, mapped to L2 destination ID. |
| Samsung | Yes | See our input in Q2.4-1a |
| Nokia | No | Same as for Q2.4-1a and Q2.4-2a |
| MediaTek | Yes | Agree with Xiaomi. |
| CATT | Yes |  |
| Spreadtrum | No |  |
| ASUSTeK | Yes |  |
| Huawei, HiSilicon | Yes | As we comment in Q2.4-1a |
| LG | No |  |

**Q2.4-3b: If one answer Yes to Q2.4-3a, how to do the down-selection**

**Option-1: Select the DRX configuration associated with the QoS profile whose priority level is the highest**

**Option-2: Select the DRX configuration associated with the QoS profile whose PDB is the smallest**

**Option-3: Select the DRX configuration whose inactivity timer length is the largest**

**Option-4: Others (if this option is selected, please indicate the preferred granularity)**

|  |  |  |
| --- | --- | --- |
| Company | Option(s) | Comment |
| Xiaomi | Option-3 | The largest length should be selected to cover the longet interval between initial and ubsequent transmission.  |
| InterDigital | Option-3 | Same reasoning as our response for **Q2.4-1b** |
| vivo | Option-3 |  |
| Samsung | Option-3 |  |
| MediaTek | Option-3 | For satisfying the QoS requirement of all QoS profile. |
| MediaTek | Option-3 |  |
| ASUSTeK | Option-3 |  |
| Huawei, HiSilicon | Option 1/2/3 |  |

For RTT timer length:

**Q2.4-4a: If one selected option-1 for Q2.3-1, and if the UE has multiple QoS profiles, and thus they associate with different RTT timer length value(s), for same DST L2 ID, do you think TX/RX UE has to down-select to a single associated RTT timer length value?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| InterDigital | No | The HARQ RTT timer and retransmission timers are determined per HARQ process, based on the factors we commented in Q2.3-1, so there is no discussion of down-selection needed for this question. |
| Ericsson | No | See our comments for Q2.3-1 |
| Apple | No | We are not sure multiple granularity is needed in the first place. |
| OPPO | No | See our comments for Q2.3-1 |
| Lenovo | No | See our comments for Q2.3-1 |
| Samsung | No |  |
| Nokia | No |  |
| MediaTek | No | We think HARQ RTT timer length is not related to QoS profile, so there is no need to down-select because HARQ transmission for traffic of all QoS profile apply the same HARQ RTT timer length (given the same HARQ retransmission mode). |
| CATT | No |  |
| ZTE | No |  |
| LG | No |  |
| Spreadtrum | No |  |
| ASUSTeK | No | RTT timer should not be related to QoS profile. |
| Huawei, HiSilicon |  | It can be discussed why there are different RTT timer lengths for different QoS profiles, then RAN2 can discuss how to down-select if decide to do so.  |

**Q2.4-4b: If one answer Yes to Q2.4-4a, how to do the down-selection**

**Option-1: Select the DRX configuration associated with the QoS profile whose priority level is the highest**

**Option-2: Select the DRX configuration associated with the QoS profile whose PDB is the smallest**

**Option-3: Select the DRX configuration whose RTT timer length is the smallest**

**Option-4: Others (if this option is selected, please indicate the preferred granularity)**

|  |  |  |
| --- | --- | --- |
| Company | Option(s) | Comment |
| Huawei, HiSilicon | Option 1/2/3 | Ref. to our comment in Q2.4-4a. If choose to down-select, Option 1/2/3 would work. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

For Retransmission timer length:

**Q2.4-5a: If one selected option-1 for Q2.3-2, and if the UE has multiple QoS profiles, and thus they associate with different Retransmission timer length value(s), for same DST L2 ID, do you think TX/RX UE has to down-select to a single associated Retransmission timer length value?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Xiaomi | Yes |  |
| InterDigital | No | The HARQ RTT timer and retransmission timers are determined per HARQ process, based on the factors we commented in Q2.3-1, so there is no discussion of down-selection needed for this question. |
| Ericsson | No | See our comments for Q2.3-1 |
| Apple | No | We are not sure multiple granularity is needed in the first place. |
| OPPO | No | See our comment for Q2.3-2 |
| Lenovo | No | See our comments for Q2.3-1 |
| Samsung | No |  |
| Nokia | No |  |
| MediaTek | No | See our comments for Q2.4-4a. |
| CATT | No |  |
| ZTE | No |  |
| Intel | No |  |
| LG | No |  |
| Spreadtrum | No |  |
| ASUSTeK | No |  |
| Huawei, HiSilicon | Yes | Retransmission timer length would be related to the resource scheduled. Compared with RTT timer length, it makes more sense for retransmission timer having different lengths associated with multiple QoS profiles.  |

**Q2.4-5b: If one answer Yes to Q2.4-5a, how to do the down-selection**

**Option-1: Select the DRX configuration associated with the QoS profile whose priority level is the highest**

**Option-2: Select the DRX configuration associated with the QoS profile whose PDB is the smallest**

**Option-3: Select the DRX configuration whose Retransmission timer length is the largest**

**Option-4: Others (if this option is selected, please indicate the preferred granularity)**

|  |  |  |
| --- | --- | --- |
| Company | Option(s) | Comment |
| Xiaomi | Option-3 | The largest length should be selected to cover the longest transmission duration. |
| Huawei, HiSilicon  | Option 1/2/3 | We understand Option 3 would be most straightforward. |
|  |  |  |
|  |  |  |
|  |  |  |

## Q5: Need to define default DRX configuration for GC/BC?

As raised in [7], a default DRX configuration is helpful so that in case a QoS profile cannot be mapped to the configured QoS-to-DRX mapping (considering it is difficult for network configuration to exhaust all possible QoS profiles), it can be mapped to the default DRX configuration.

**Q2.5-1: Do you agree to introduce a default DRX configuration for GC/BC, so that in case a QoS profile cannot be mapped to the DRX parameters configured for the dedicated QoS profiles, it can be mapped to the default DRX configuration.**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comment |
| Xiaomi | Agree |  |
| InterDigital | Agree |  |
| Ericsson | agree | We think RTT timer and retransmission timer can be mapped to the default DRX configuration. |
| Apple | Agree |  |
| OPPO | Agree |  |
| vivo | Agree | There are two purposes to introduce a default DRX configuration for GC/BC.One is, as interpreted in Q2.5-1, it can be used in case that a QoS profile cannot be mapped to the DRX parameters.The other is, more efficiently, we can define a default DRX configuration for GC/BC, whereby the Rx UEs can operate the DRX cycle with the minimum power consumption, independently of the service types and the destination Layer 2 IDs. This is because either considering the down-selected DRX configuration or DRX configuration corresponding to multiple QoS profiles leads the Rx Ues to be awake on most occasions, and results in an inefficient power saving. It is noted that, as long as the Rx UE(s) receives the first packet in On-duration of the default DRX cycle, the Rx UE(s) can start to run the DRX pattern configured with the QoS profile(s) and L2 destination ID, parallelly in the default DRX pattern. |
| Lenovo | Agree | As a SIB signalling optimization so that one default configuration can be used for multiple QoS Profiles. |
| Samsung | Agree |  |
| Nokia | Agree |  |
| MediaTek | Agree |  |
| CATT | Agree |  |
| ZTE | Agree |  |
| Intel | Agree |  |
| LG | Agree |  |
| Spreadtrum | Agree |  |
| ASUSTeK | Agree |  |
| Huawei, HiSilicon | Agree | This is similar to default SLRB configuration in Rel-16.  |

## Q6: Need for SL DRX MAC CE for GC/BC

DRX MAC CE was adopted for Uu in unicast case, it is questionable whether it should be adopted for GC/BC case for SL.

**Q2.6-1: Do you agree NOT to adopt DRX MAC CE for sidelink GC/BC case in Rel-17?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comment |
| Xiaomi | Agree |  |
| InterDigital | Agree |  |
| Ericsson | Agree |  |
| Apple | No MAC CE for GC/BC |  |
| OPPO | Agree, i.e., no MAC CE for GC/BC |  |
| vivo | Disagree |  |
| Lenovo | Agree |  |
| Samsung | Agree |  |
| Nokia | Agree |  |
| MediaTek | Disagree | We think DRX MAC CE for sidelink GC/BC would be power efficient for the use case of SL relay. For example, * if a relay UE has no DL traffic to further forward to its remote UE, the relay UE can send the SL DRX command MAC CE for GC.
* When a remote UE receives SL DRX command MAC CE from its relay UE (i.e. source id is the id of the relay UE, and destination ID is the L2 ID specific for relay), the remote UE can stop on duration timer and inactivity timer for the link between the relay UE and remote UE.

We understand that companies have mainly two concerns:* **Concern 1**: The SL DRX command MAC CE should only be transmitted by the group lead. However, it is not clear in AS layer how a UE know who is the group lead, which may depend on further SA2 progress.
* **Concern 2**: A group may consist of multiple TX UE and thus it does not make sense for a TX UE to stop transmission of other TX UE.

For concern 1, in case of SL relay, we think a remote UE always considers its relay UE as the group lead. Therefore, there is no further group information needed from the upper layer. Or to put it differently, the relay UE and remote UEs forms a virtual group.For concern 2, it is not an issue in SL relay. This is because in a virtual group of SL relay, each remote UE only talks with the relay UE. In other words, since there is no relay traffic between two remote Ues, if the relay UE sends SL DRX command MAC CE for GC, and the remote UE has no further relay traffic to transmit, then the remote UE can sleep because relay traffic from other relay UE/remote UE is not expected.Finally, although previously we agree that no specific SL DRX design is for SL relay, we think it is a low-hanging fruit to improve power saving efficiency for SL relay. Thus, we hope that companies could support this feature in Rel-17. |
| CATT | Agree |  |
| ZTE | Agree |  |
| Intel | Agree |  |
| LG | Agree |  |
| Spreadtrum | Agree |  |
| ASUSTeK | Agree |  |
| Huawei, HiSilicon | ~~Disagree~~ Agree | We’ve updated our answer to “agree” in v19\_Huawei\_2.  |

1. xxx.

# Conclusion

We have the following proposals

[Proposal 1 xxx.](#_Toc62216175)

# Reference

1. R2-2106985 Leftover Issues for Sidelink Unicast DRX CATT discussion Rel-17 NR\_SL\_enh-Core
2. R2-2106986 Leftover Issues for Sidelink Groupcast and Broadcast DRX CATT discussion Rel-17 NR\_SL\_enh-Core
3. R2-2106987 Further Issues Regarding to the Tx Profile CATT discussion Rel-17 NR\_SL\_enh-Core
4. R2-2106988 Impacts of SL DRX on Other Procedures CATT discussion Rel-17 NR\_SL\_enh-Core
5. R2-2107041 Discussion on left issue from [704][705][706] OPPO discussion Rel-17 NR\_SL\_enh-Core
6. R2-2107151 NR SL DRX Fraunhofer IIS, Fraunhofer HHI discussion Rel-17
7. R2-2107155 Consideration on sidelink DRX for groupcast and broadcast Huawei, HiSilicon discussion Rel-17 NR\_SL\_enh-Core
8. R2-2107156 Remaining issues on the sidelink DRX for unicast Huawei, HiSilicon discussion Rel-17 NR\_SL\_enh-Core
9. R2-2107157 Discussion on SL communication impact on Uu DRX Huawei, HiSilicon discussion Rel-17 NR\_SL\_enh-Core
10. R2-2107190 Left issues on SL-DRX OPPO discussion Rel-17 NR\_SL\_enh-Core
	* Revised in R2-2108830
11. R2-2108830 Left issues on SL-DRX OPPO discussion Rel-17 NR\_SL\_enh-Core
12. R2-2107191 Discussion on SL-DRX impact to mode-1 scheduling OPPO discussion Rel-17 NR\_SL\_enh-Core
13. R2-2107238 Leftover issues on overall flow of unicast TX-UE centric mechanism NEC Corporation discussion
14. R2-2107239 Discussion on DRX suspend/resume mechanism NEC Corporation discussion
15. R2-2107242 Further discussion on Uu/SL DRX timer LG Electronics France discussion Rel-17 NR\_SL\_enh-Core
16. R2-2107269 Resource Allocation Considering DRX InterDigital discussion Rel-17 NR\_SL\_enh-Core
17. R2-2107270 Open Issues on SL DRX Timers InterDigital discussion Rel-17 NR\_SL\_enh-Core
18. R2-2107271 DRX Configuration Determination in Unicast InterDigital discussion Rel-17 NR\_SL\_enh-Core
19. R2-2107310 On SL DRX Configuration aspects Intel Corporation discussion Rel-17 NR\_SL\_relay-Core
20. R2-2107311 Discussion on SL DRX Timers Intel Corporation discussion Rel-17 NR\_SL\_enh-Core
21. R2-2107312 On DRX wake-up time alignment Intel Corporation discussion Rel-17 NR\_SL\_enh-Core
22. R2-2107355 Remaining issues on DRX Timers for SL Unicast Spreadtrum Communications discussion Rel-17
23. R2-2107432 Consideration on Backward compatibility for SL DRX ZTE Corporation, Sanechips discussion Rel-17 NR\_SL\_enh-Core
24. R2-2107433 Further consideration on DRX configuration ZTE Corporation, Sanechips discussion Rel-17 NR\_SL\_enh-Core
25. R2-2107434 Discussion on SL DRX timer ZTE Corporation, Sanechips discussion Rel-17 NR\_SL\_enh-Core
26. R2-2107472 Remaining aspects of SL DRX Ericsson discussion Rel-17 NR\_SL\_enh-Core
27. R2-2107474 Handling coexistence between UEs supporting different releases Ericsson discussion Rel-17 NR\_SL\_enh-Core
28. R2-2107626 Discussion on remaining issues of SL DRX configurations Apple discussion Rel-17 NR\_SL\_enh-Core
29. R2-2107627 Discussion on remaining issues of SL impact of Uu-DRX Apple discussion Rel-17 NR\_SL\_enh-Core
30. R2-2107653 Remaining details on HARQ RTT and Retransmission Timer for SL DRX Fujitsu discussion Rel-17 NR\_SL\_enh-Core R2-2105400
31. R2-2107654 SL DRX impact on LCP Fujitsu discussion Rel-17 NR\_SL\_enh-Core R2-2105401
32. R2-2107968 DRX impact on Uu Xiaomi communications discussion
33. R2-2107969 Discussion on Sidelink DRX for unicast Xiaomi communications discussion
34. R2-2107970 Discussion on Sidelink DRX for broadcast and groupcast Xiaomi communications discussion
35. R2-2108014 DRX Configuration for UC BC GC and its interaction with Sensing Lenovo Mobile Com. Technology discussion NR\_SL\_enh-Core
36. R2-2108016 DRX coordination between Uu and SL Lenovo Mobile Com. Technology discussion NR\_SL\_enh-Core
37. R2-2108072 Proposals for Sidelink DRX Sony discussion Rel-17 NR\_SL\_enh-Core
38. R2-2108151 Consideration on TX centric SL DRX configuration and alignment LG Electronics Inc. discussion Rel-17 NR\_SL\_enh-Core
39. R2-2108214 Discussion on Compatible Issues with Rel 16 UEs Qualcomm Finland RFFE Oy discussion
40. R2-2108215 Discussion on RLF and PC5 RRC Connection with SL DRX Qualcomm Finland RFFE Oy discussion
41. R2-2108217 Discussion on Remaining Issues Qualcomm Finland RFFE Oy discussion
42. R2-2108222 A Default PC5 DRX Configuration for Broadcast/Groupcast/Unicast vivo discussion
43. R2-2108223 DRX duration calculation vivo, Xiaomi, ZTE corporation discussion
44. R2-2108224 Remaining issues on SL DRX for unicast/groupcast/broadcast vivo discussion
45. R2-2108426 Discussion on TBD/FFS Samsung Research America discussion
46. R2-2108427 Further consideration for SL DRX operation in groupcast Samsung Research America discussion
47. R2-2108428 Further consideration for SL DRX and Uu DRX alignments Samsung Research America discussion
48. R2-2108469 Discussion on alignment of mode 1 RA of Tx UE and SL DRX of Rx UE Nokia, Nokia Shanghai Bell discussion NR\_SL\_enh-Core
49. R2-2108470 Further Issues on Sidelink Traffic Pattern for SL DRX Configuration Nokia, Nokia Shanghai Bell discussion Rel-17 NR\_SL\_enh-Core R2-2105958
50. R2-2108471 SL DRX for SL groupcast Nokia, Nokia Shanghai Bell discussion NR\_SL\_enh-Core
51. R2-2108765 SL DRX enabled UE Mode 2 operation ITL discussion Rel-17
52. R2-2108822 Remaining issues of SL DRX MediaTek Inc. discussion Rel-17 NR\_SL\_enh-Core