**3GPP TSG RAN WG1 #106bis-e R1-2110511**

**e-Meeting, October 11 –19, 2021**

**Source: Moderator (InterDigital)**

**Title: Moderator summary for [106bis-e-NR-R17-Sidelink-03] Reply LS to R1-2108710**

**Agenda item: 8.11.1**

**Document for:** **Discussion and Decision**

Introduction

This document provides discussion on the following approved email thread as part of RAN1#106bis-e Release 17 SL enhancement WI discussion.

[106bis-e-NR-R17-Sidelink-03] Discuss incoming LS on resource selection for a possible reply LS by October 18 – Moonil (InterDigital)

Collection of outcomes

To be collected once agreement / conclusion is reached.

Discussion on resource selection with DRX

## Round 1

**Background**: According to the received LS in [1], RAN2 made the following agreements in RAN2#115-e.

Agreements:

When data is available for transmission to one or more RX UE in DRX, TX UE selects the resources taking into account the active time (current or future) of the RX UE(s) determined by the timers maintained at the TX UE. Details are FFS. FFS whether RAN1 or RAN2 implement this restriction.

For unicast, the TX UE selects the resources for the initial transmission associated with any active time (e.g. on duration timer or inactivity timer, or retransmission timer) at the RX UE. How to handle cases when a transmission may cause these timers to be running at the RX UE is FFS. FFS on groupcast. FFS on whether any spec impact.

For unicast, the TX UE can select the resources for the retransmission associated with any active time (e.g. on duration timer or inactivity timer, or retransmission timer) at the RX UE. How to handle cases when a transmission may cause these timers to be running at the RX UE is FFS. FFS on groupcast. FFS on whether any spec impact.

For broadcast, the TX UE can select the resources for the initial transmission associated with any active time supported by broadcast (i.e. on duration) at the RX UE.

For broadcast, the TX UE can select the resources for the retransmission associated with any active time supported by broadcast (i.e. on duration) at the RX UE.

RAN2 also asked RAN1 to provide inputs whether/how to reflect the restriction for the resource selection with DRX [1]:

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| **ACTION:** RAN2 respectfully asks RAN1 to take the above agreements into account and inform RAN2 whether/how RAN1 intends to reflect the restriction in the following RAN2 agreement *“When data is available for transmission to one or more RX UE in DRX, TX UE selects the resources taking into account the active time (current or future) of the RX UE(s) determined by the timers maintained at the TX UE. Details are FFS. FFS whether RAN1 or RAN2 implement this restriction* |

Based on reviewing the submitted contributions [2-15], we observed the following issues for the discussion to reply the LS:

* Issue #1: whether PHY layer to apply the restriction for resource selection with DRX active time of Rx UE?
  + Alt-1: RAN1 replies that PHY layer should apply the restriction based on DRX active time of Rx UE provided by MAC layer [E///][Vivo][OPPO][Samsung][CATT][QC][IDCC]
    - If restriction is not performed in PHY layer, the reported candidate resource set may not include any resource within DRX active time of the RX UE
  + Alt-2: RAN1 replies that PHY layer does not apply the restriction for the resource selection based on DRX active time of RX UE [ZTE][HW][LG][Nokia]
    - Not able to finish the work within the remaining time for Rel-17
    - Too much specification work for RAN1
    - The benefit of providing active time information of Rx UE to PHY layer is unclear
  + Alt-3: RAN1 replies that both L1 and L2 based solutions may not work [Intel]
    - Both RAN1 and RAN2 solutions may not work if SL-DRX active time is not aligned with traffic generation

**Question #1: please provide preferred alternative. If preferred alternative is not listed, please add/describe in the following table:**

* **Alt-1: RAN1 replies that PHY layer should apply the restriction based on DRX active time of Rx UE provided by MAC layer**
* **Alt-2: RAN1 replies that PHY layer does not apply the restriction for the resource selection based on DRX active time of Rx UE**
* **Alt-3: RAN1 replies that both L1 and L2 based solutions may not work from RAN1 perspective**

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| Company | Alt-1/2/3 | Comments |
| vivo | Alt-1 | Firstly, the benefit of Alt-1 is clear: it is to avoid the case that PHY layer cannot report enough candidate resources to MAC layer for resource selection. Re-evaluation may not help in this case because the problem is not caused by insufficient sensing results.  Secondly, we don’t think much difference on the specification effort between Alt-1 and Alt-2 (not sure what changes Alt-3 requires). In fact, Alt-2 may requires more works (either RAN1 or RAN2) to handle the abovementioned issue of insufficient candidate resources reported by PHY layer.  Thirdly, the issue of how to align the SL DRX active time and the traffic generation is currently handled by RAN2 (i.e., by provisioning of the DRX timer at TX UE side). We don’t need to discuss it in RAN1. |
| NTT DOCOMO | Either Alt 1 or Alt 2 | If time is allowed, Alt 1 is preferred. |
| OPPO | Alt-1 | As explained in the sub-bullet in Alt-1, if there is no restriction at PHY, the reported S\_A may not include any candidate resource within DRX active time. Then higher layer will trigger phy layer to report S-A again and again which will increase the delay. |
| Ericsson | Alt-1 | As presented in our contribution and captured above in the question, Alt-1 has a clear advantage of avoiding selecting irrelevant resources to be reported to MAC layer from the beginning. |
| Samsung | Alt-1 |  |
| Fujitsu | Alt 1 | If PHY layer does not apply the restriction, it cannot be guaranteed that there are available resources overlapped with SL DRX active time of Rx UE, which is needed to be reported to MAC layer to perform random selection, then packet loss will not be fully avoided. |
| CATT, GOHIGH | Alt-1 | As mentioned by the FL, if PHY layer doesn’t perform any restrictions, how to ensure that the MAC layer can select resources that are within the DRX active time of the Rx UE? Leaving this restriction completely to RAN2 implementation will lead to potential resource selection issues, such as packet loss due to inappropriate resource selection. Hence, Alt-1 is the most reasonable choice. |
| Xiaomi | Alt 1 | We think RAN1 is able to apply the restriction as this has already been taken into account in the previous agreements in RAN1. |
| Intel | Alt.3 + Alt.1 | In our understanding, both solutions may not work properly if traffic generation by a higher layer is not aware about active time of receivers. Irrespective of the solution RAN1 can agree, we propose to add this observation to reply LS in RAN2 to reflect dependency of the solutions on traffic generation. |
| ZTE, Sanechips | Alt 2 | For Alt 2, Our understanding is that DRX can be taken into account by MAC in the resource selection procedure as a whole. In case Alt 1 is agreed, RAN1 needs to further discuss how to restrict the candidate resource set within DRX active time, which is unknown to PHY in the first place. Even in MAC layer, the active time depend on the timer of retransmission timer and inactivity timer can only be determined based on the selected resources. |
| Panasonic | Alt-1 or 2 | We prefer alt 1 if time allows. Otherwise, MAC layer should be sufficient. |
| Fraunhofer | Alt 1 |  |
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| Lenovo&MotM | Alt-1 | The resource selection restriction can be implemented by RAN1. After that, the reported candidate resource set can include the resource located within DRX active time of RX UE. Higher layer select resource from reported candidate resource set directly. With such procedure, the number of candidate resource reported within the active time by PHY will be more compared to the Alt-2. |
| MediaTek | Alt-1 | As mentioned, RAN1 should implement the restriction as the other approach (Alt-2) has a clear risk of not reporting any valid candidate resources from PHY to MAC. |
| Qualcomm | Alt1 | As captured above too, Alt1 enables the UE to select only the resources that are within the DRX active time of the Rx UE. Otherwise, the PHY layer could identify resources as available which cannot even be used for transmission.  The UE’s upper layer could give sufficient information about the DRX active time of the Rx UE; the resources not in the intersection of the selection window and the set indicated by the upper layer are considered as unavailable by the PHY layer. |
| InterDigital | Alt-1 | Similar concerns with other companies that the provided candidate resource set from PHY layer may not include resource within active time of the Rx UE if the restriction is not applied in PHY layer |
| Convida Wireless | Alt-1 | RAN1 could reply that PHY layer should apply the restriction based on DRX active time of Rx UE provided by MAC layer. This is from candidate resources point of view that it should be sufficient. |
| Nokia, NSB | Alt 4 | Alt 4: Further study the benefit of introducing new information about Rx UE active time into the L1 resource selection procedure.  One possible benefit of introducing new information about Rx UE active time for L1 would be the enhancement of the resource selection procedure. The Tx UE could report to higher layers based on the reported resource set with consideration of Rx UE active time. This could eliminate possible scenarios that the reported falls into the Rx UE’s inactive time. On the other hand, higher layer (Mac) has the information about the Rx UE’s inactive time. It is a question whether higher layer needs this extra information from L1.  Further study on these benefits is needed, given that there are limited remaining Rel-17 meetings |
| Apple | Alt 1 | When PHY layer applies the restriction based on DRX active time of Rx UE, it could select the proper candidate resource set. Otherwise, not all the selected candidate resource set at PHY layer can be used. |
| Sharp | Alt-1 |  |
| Huawei, HiSilicon | Alt-2 | We support Alt-2.  If Alt-1 was applied, PHY layer would need accurate active time to determine the candidate resource set. However, the active time is dynamic changing since it may be extended by different timers. Hence, it is not clear whether MAC can deliver the active time to PHY accurately and timely whilst a lot of inter-layer interaction is needed. On the contrary, MAC layer knows the active time of RX UE more precisely and makes the final decision on resource selection. So it is more appropriate to reflect the restriction in MAC layer.  Furthermore, if RAN1 took the restriction from RAN2 for further design, quite a lot standard efforts would be needed on resource selection window determination, Y candidate slots selection, and candidate resource set determination, etc., which analysed in our contribution R1-2110365. As only one meeting is left for Rel-17, we do not think RAN1 is suitable to reflect the restriction in further resource selection design. |
| LG Electronics | Alt-2 (first preference) or Alt 1 (depending how much additional RAN1 specification work is necessary for optimization) |  |
| Futurewei | Alt 1 or 2 | We prefer alt 1 as there are clear benefits for Alt 1 in term of PRR and power saving performance (no or minimum unnecessary sensing slots). But if time is tight for additional discussions, we are ok with Alt. 2 |

* Issue #2: how PHY layer applies the restriction for resource selection with DRX active time of Rx UE (if supported)?
  + Option 1: PHY layer selects and reports candidate resources only within active time of the RX UE [vivo][Samsung][QC][E///]
  + Option 2: PHY layer selects and reports candidate resources in which at least a subset of the candidate resources is within active time of the RX UE [OPPO][IDCC]
  + Option 3: PHY layer selects and reports an additional candidate resource set which includes candidate resources within active time of the RX UE [CATT]

**Question #2: please provide preferred option. If preferred option is not listed, please add/describe in the following table**

* **Option 1: PHY layer selects and reports candidate resources only within active time of the RX UE**
* **Option 2: PHY layer selects and reports candidate resources in which at least a subset of the candidate resources is within active time of the RX UE**
* **Option 3: PHY layer selects and reports an additional candidate resource set which includes candidate resources within active time of the RX UE**

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| Company | Option 1/2/3 | Comments |
| vivo | Option 1,  Option 2 | We prefer to option 1 or option 2. |
| NTT DOCOMO | Option 1 or 2 |  |
| OPPO | Option 2 | PHY layer reports resource set which includes candidate resource within active time to higher layer, higher layer can select resource for initial transmission within active time based on RX UE’s DRX configuration. The initial transmission can trigger to start related DRX timer, such as drx-inactivitityTimer or drx-retransmission timer to extend the active time so that TX UE can select retransmission resource.  For option 1: if the active time means current active time (related to Q3), such as active time determined by drx-onDurationTimer, that will be very restrictive because RX UE can extend the active time (future active in Q3) which can provide more candidate resources. If the active time means both current and future active time, the future active time which is determined by drx-inactivitityTimer or drx-retransmissionTimer is not known by PHY layer since the resource is selected by MAC. Then we preferred option 2. |
| Ericsson | Option 1 | We prefer Option 1. However, we also see the need to consider future Active Time which may not be visible to PHY until the resources for a transmission (e.g., the initial transmission) is selected. Hence, we are open to discussing Option 2. |
| Samsung | Option 1 |  |
| Fujitsu | See comments | We think the “active time” here should be firstly clarified, and it is related to our answer in Question #3.  If it represents only “current active time” in Question #3, our preference is Option 3 here, i.e., an additional candidate resource set which includes candidate resources within “current” active time of the RX UE should be reported to make sure the initial transmission of Tx UE within active time of the RX UE.  If it represents “current and future active time” in Question #3, our preference is Option 1 here, but we still think that at least two candidate resource sets should be reported to MAC layer, and one of them should make sure the initial transmission of Tx UE within active time of the RX UE. |
| CATT, GOHIGH | Option 3 (or 2) with comments | It seems that all of the above options are about how PHY layer selects and reports candidate resources. However, in order to have some candidate resources within the DRX active time of the Rx UE, **there is a prerequisite that the resource selection window should at least partially overlap with the DRX active time of the Rx UE**. Under this condition, it can be guaranteed that the PHY layer can find candidate resources corresponding to the DRX active time of the RX UE and perform candidate resource selection and report.  Therefore, we support Option 3 with the following modification:  **Option 3’: PHY layer adjusts the resource selection window to at least partially overlap with the DRX active time of the Rx UE, and then selects and reports an additional candidate resource set which includes candidate resources within active time of the RX UE**  We can also support Option 2 with the same modification above, if it is the majority view, i.e.:  **Option 2’: PHY layer adjusts the resource selection window to at least partially overlap with the DRX active time of the Rx UE, and then selects and reports candidate resources in which at least a subset of the candidate resources is within active time of the RX UE**  Option 1 is not ok for us. Only select and report candidate resources which are within active time of the RX UE may cause channel congestion leading to reliability decrease. In addition, this option leaves RAN2 no space to select resources that may be within the extended/future active time (e.g. the resources within the activated *drx-retransmission-timer*). |
| Xiaomi | Option 1 or option 2 | We think option 2 is reasonable as at least the first selected resource should be within the DRX\_active time of Rx UE(s). Later reserved resource(s) for repetition transmissions can be out of DRx\_active time if the Rx UE DRx\_on duration is small. |
| Intel |  | Among proposed options we prefer Option 1 |
| ZTE, Sanechips | Comment | We don’t think any option works given the reply to Question 1. |
| Panasonic | Option 1 or 2 | We share similar view with Fujitsu that the “active time” needs to be clarified.  If PHY layer restriction needs to be applied, we prefer option 1 or 2. |
| Fraunhofer | Option 1, Option 2 |  |
| Lenovo&MotM | comment | As mentioned in Q3, we need to clarify “current active time” and “future active time” firstly before deciding on the option.  Whether our understanding of the current and future active below is correct ?  Current Active time = time between points A and C (i.e., the on-duration timer)  Future Active time = time between points C and D (i.e., a part of the Inactivity timer hanging outside on-duration timer)  if MAC gives time between A and D (i.e., active time in RAN2 agreement) to PHY, then PHY might select resources between C and D –  which will be creating problem since the Rx is sleeping during this time as it did not start an Inactivity timer (since PHY did not select resources within A and C).  Problem is that MAC cannot provide A to D (i.e., active time in RAN2 agreement) as an input to the PHY resource selection as it does not know whether it will start the inactivity timer in advance, So the input should always be between A and C and PHY should select resource only btw A and C. |
| MediaTek | Option-1 | Seems to be the simpler approach. |
| Qualcomm | Option 1 | We are open to discuss Option 2 as well. In particular, if the resources within the DRX ON period of the Rx UE are used to reserve resources outside of the ON duration, hence the inactivity timer of the Rx UE starts running, Option 2 could also work. But, some details as mentioned here should first be discussed. |
| InterDigital | Option-2 | As mentioned by several companies, the candidate resources provided by PHY layer shouldn’t be limited to the resources within the current active time since it is good enough to guarantee that the initial transmission uses resource within the active time and then the retransmission resources could be outside current active time but will be part of the future active time. |
| Convida Wireless | Option 1,  Option 2 | We prefer either option 1 or option 2. |
| Nokia, NSB | Option 3 | If DRX active time information is signalled by MAC layer, the UE at the PHY layer uses this information to exclude resource for , which will be reported to the higher layer. Option 1 is too restrictive. |
| Apple | Option 1 | This is the simplest approach. |
| Sharp | Option 1 |  |
| Huawei, HiSilicon | With comments | Before consensus of question 1 is reached, it is not necessary to discuss how to reflect the restriction in RAN1. A response to the LS does not require a decision on this. |
| LG Electronics | Option 2 with comment, if RAN1 decides to introduce optimization) | For Option 2, our understanding is that PHY layer reports only one S\_A set to MAC layer. If this is correct, we are supportive of Option 2.  Option 1:  From a technical point of view, since the SL DRX operation is semi-statically configured in consideration of the reduction in the power consumption of RX UE, it would be difficult to completely cover all the aperiodic packets with only the current active time of SL DRX (e.g., on-duration period). Furthermore, in case when the aperiodic packet is generated almost near the end of current active time of SL DRX, if its resource selection is limited to be performed only considering the current active time, it could be difficult to select the number of transmission resources required for the successful packet delivery. This can lead to the problem that the service-related QoS requirement is not met. Considering these aspects, we think that the mechanism for TX UE to select the resources taking into account both the current and future active time of RX UE should be supported. So, Option 1 is not preferred.  Option 3:  In terms of performance, it seems that there is no critical difference between Option 2 and Option 3, but rather Option 2 has complexity in that PHY layer should report two S\_A sets to MAC layer, which is different from Rel-16 operation. So, Option 3 is not preferred. |
| Futurewei | Option 2 | Since current active time (determined by drx-onDurationTimer) may be small and RX UE can extend the active time, option 2 is preferred. Also, future active time can be considered when Rx UE is in DRX inactive time, the drx-inactivitityTimer is known.  If the current active time is large enough, the candidate resources can be all within the active time of the Rx UE |
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* Issue #3: whether RAN1 provides preference on which DRX active time should be taken into account for the resource selection (e.g., current active time and/or future active time)
  + ***[LG]: From the point of view of RAN1, it is preferred that the mechanism for TX UE to select the resources taking into account both the current and future active time of RX UE is supported and the relevant procedure is specified in the RAN2 specification.***

**Question #3: should RAN1 provide preference on which active time has to be taken into account for the resource selection (e.g., current active time vs. current and future active time)?**

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| Company | Yes/No | Comments |
| vivo | comment | The additional information (i.e., current and/or future active time) is useful for resource selection according to RAN2’s agreement. In order to provide candidate resources to MAC layer for resource selection during retransmission timer, the current and future active should be taken into account. |
| NTT DOCOMO | Question | What is expected outcome? RAN1 discusses which active time is preferred? It will be dependent on situations, so how can we conclude which active time is preferred?  We would like to get more information to say our preference. |
| OPPO | Yes for current active time | It is up to higher layer for resource selection so that higher layer can control whether to select resource within current or further active time. PHY layer has no info which resource will be selected when determining candidate resource set. Then we propose RAN1 only consider current active time. |
| Ericsson | Comment | The intention of this question is not very clear to us. Matters related to which Active Time MAC should be considered are part of FFS in RAN2 and we believe it is better to leave it to RAN2’s discussion. |
| Samsung | No | Not sure its benefit. We think this issue go beyond the scope of discussion. |
| Fujitsu | See comments | Maybe it is needed to clarify what is the meaning of “current active time” and “future active time” firstly.  For example, before the initial transmission is received, only OnDuration timer is running, is this duration should be defined as “current active time”? And then, inactivity and/or retransmission timer will be running triggered by the initial transmission, is this subsequent active time should be defined as “future active time”?  If the above understanding is correct, we prefer both “current” and “future” active time shall be taken into account for the resource selection of Tx UE. |
| CATT, GOHIGH | Yes for current active time | From our perspective, it would be more clear and help RAN2 make progress better if RAN1 can provide the information that RAN1 performs candidate resources selection based on which kind of active time.  Considering that resource selection and DRX timer maintenance are both implemented by MAC, PHY layer may not have the accurate information of the future active time. Thus, RAN1 should select and report the candidate resources based on the current active time, and leave it to RAN2 implementation of selecting resources within the future active time. |
| Xiaomi |  | We think this question is not directly related to RAN2 LS question. And it can be discussed in later RAN1 or RAN2 discussions, but not now for the LS reply. |
| Intel | Comments | At least current active time should be considered. As for future active time it requires L2 / L1 interactions and can be decided by RAN2 |
| ZTE, Sanechips | Comment | RAN2 agreement made differentiates on duration and other active timer depending on unicast and broadcast. Prefer to leave the discussion regarding future active time in RAN2. |
| Panasonic | Yes | We think at least current time needs to be considered. |
| Lenovo&MotM | Commets | Need to clarify “current active time” and “future active time” |
| MediaTek | Yes | From RAN1 perspective, RAN1 should perform restriction for candidate resource reporting based on the provided active time by MAC. It is up to MAC how to report the “DRX active time of Rx-UE” information to PHY for resource selection. If MAC wants to select resources from “future active time”, MAC can report “current and future active time” to PHY. If MAC wants to select resources from only “current active time“, MAC can report current active time information of Rx-UE to PHY. In either case, RAN1 shall follow the provided active time information to perform the restriction for candidate reporting. |
| Qualcomm | See comments | As mentioned by some other companies too, we do not think that this question is within the scope of the LS reply discussion. |
| InterDigital | No | It is out of scope of the LS reply discussion. |
| Convida Wireless | See comments | We do not think it is necessary for this as part of LS. This issue is not within the scope of the LS reply as far as we know. |
| Nokia, NSB | comments | RAN2 asks: “whether/how RAN1 intends to reflect the restriction in the following RAN2 agreement *“When data is available for transmission to one or more RX UE in DRX, TX UE selects the resources taking into account the active time (current or future) of the RX UE(s) determined by the timers maintained at the TX UE. Details are FFS. FFS whether RAN1 or RAN2 implement this restriction*”.  If the intention is to ask whether the various timers at higher layer can be used for L1, there is no study in RAN1 to address this. RAN1 needs to FFS if we need to address this issue. |
| Apple | Comments | We do not think this question is in the scope of the LS reply. |
| Sharp |  | We don't think the preference is within the scope of LS as mentioned by companies. |
| Huawei, HiSilicon | No | As our answer to Q1, RAN1 will not take the restriction into account for the resource selection. Thus, RAN1 has no needs nor enough information to provide the reference to RAN2.  Moreover, we also share the views from other companies, this question is out of scope of the LS reply |
| LG Electronics | Yes with comment | First of all, **we emphasize that whether only the current active time or both the current active time and future active time are considered for resource selection is also related to determine which technical option is introduced in Question 2**. For example, in case when MAC layer performs the resource selection taking into account both the current active time and future active time, it should be avoided for PHY layer to report the set of candidate resources only targeting the current active time. In other words, depending on which type of active time is considered, a suitable solution could be different. So, **we don't see the problem in providing RAN2 with at least information about the active time type assumed in the solution introduced by RAN1**. |
| Futurewei | comments | Current active time determined by drx-onDurationTimer can be taken into account. Future active time can also be considered, if Rx UE is in inactive time and drx-inactivitityTimer of Rx is known. |

## Round 2

**Regarding the Question #1:**

Summary:

* Majority number of companies showed the preference on Alt-1 (i.e., PHY layer applies the restriction based on DRX active time of RX UE provided by MAC layer) but there are still few companies showed preference on Alt-2 (i.e., PHY layer doesn’t apply the restriction) due to the time limitation.
  + Alt-1: vivo, OPPO, E///, SS, Fujitsu, CATT, Xiaomi, Intel, FH, Lenovo, MTK, QC, IDCC, Convida, Apple, Sharp, Futurewei
  + Alt-1 if time allows: NTT, Pana, LG (depends on specification impact)
  + Alt-2: ZTE, HW, LG, Futurewei (if no time)
  + Alt-4 (further study): Nokia
* The main reason to support Alt-1 was that if PHY layer doesn’t apply the restriction, the candidate resources reported to MAC layer may not include any resource within active time of the RX UE.
* The main concern on Alt-1 was specification impact which may not be finished within the remaining time of Rel-17.

Observation:

* The problem when PHY layer doesn’t apply the restriction for candidate resource selection with the active time of RX UE seems to be clear and majority companies consider that the required specification impact is manageable within the remaining time of the Rel-17.

Moderator’s suggestion for Issue #1:

* RAN1 replies that PHY layer should apply the restriction based on DRX active time of RX UE provided by MAC layer

**Regarding the Question #2:**

Summary:

* No clear majority is observed for a specific option
  + Option 1: vivo, NTT, E///, SS, Xiaomi, Intel, Pana, FH, MTK, QC, Convida, Apple, Sharp
  + Option 2: vivo, NTT, OPPO, Xiaomi, Pana, FH, IDCC, Convida, LG, Futurewei
  + Option 3: Fujitsu, CATT, Nokia
  + No option until the decision made for the Question #1: ZTE, HW
* Several companies supporting Option 2 showed a strong concern on Option 1 since the candidate resources are limited to the current active time although the MAC layer still can use resources outside current active time if those resources are within future active time
* A question raised regarding which active time is used for the options
  + From moderator’s perspective, RAN1 may not need to discuss which active time is used to restrict the resources as it is up to RAN2 discussion. We can simply provide information how PHY layer selects candidate resources with the active time information provided by MAC layer. However, the options are listed based on the assumption that current active time is provided by MAC layer for the sake of simplicity. Also, not sure if future active time information is available in MAC layer when the PHY layer performs candidate resource selection.
* There was a clarification question on current active time and future active time
  + Based on moderator’s understanding from RAN2 agreements, the current active time and future active time are defined as following:
    - Current active time: active time at the RX UE (as maintained at TX UE) at the time in which the resource selection is performed
    - Future active time: active time at the RX UE (as maintained at TX UE) after the future transmission by the TX UE is performed at the selected resource

Observation:

* As there is no clear majority on a specific option, RAN1 may provide the options discussed rather than spending time to down-select one of the options in the remaining time.

Moderator’s suggestion for Issue #2:

* RAN1 provides the list of options discussed and indicates that RAN1 will continue to discuss the options to downselect
* RAN1 also indicates that the current active time is assumed for the options and clarifies that it doesn’t mean that RAN1 has a preference on the current active time for the candidate resource selection in PHY layer

**Regarding the Question #3:**

Summary:

* The main intention for the question was whether RAN1 needs to discuss on which active time has to be considered for the restriction to reply the LS.
  + Yes: vivo, OPPO, Fujitsu, CATT, Pana, MTK, LG, Futurewei
  + No: E///, SS, Xiaomi, ZTE, QC, IDCC, Convida, Nokia, Apple, Sharp, HW
* Majority companies think this is out-of-scope of the LS reply

Observation:

* No further discussion seems to be needed to figure out RAN1’s preference on which active time to use for applying restriction for the candidate resource selection

Moderator’s suggestion for Issue #3:

* RAN1 doesn’t provide preference on which active time to use for restriction in PHY layer

**Draft LS reply (v01):**

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| In RAN1’s view, the restriction has to be applied in PHY layer so that all or a subset of candidate resources reported to MAC layer is located within the active time of the RX UE. The following options have been discussed in RAN1 to apply the restriction for the candidate resource selection:   * Option 1: PHY layer selects and reports candidate resources only within active time of the RX UE * Option 2: PHY layer selects and reports candidate resources in which at least a subset of the candidate resources is within active time of the RX UE * Option 3: PHY layer selects and reports an additional candidate resource set which includes candidate resources within active time of the RX UE   Note 1: the restriction applied in PHY layer based on the active time information provided by MAC layer.  Note 2: the active time provided by MAC layer for the Options 1/2/3 is assumed as the current active time but it doesn’t imply that RAN1 has a preference on using the current active time for selecting and reporting the candidate resources.  Note 3: RAN1 will continue to discuss on the Options listed above for down-selection. |

**Question #4: the draft LS reply (v01) suggested by moderator is acceptable? If not, please provide inputs which part needs to be updated/modified.**

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| --- | --- | --- |
| Company | Yes/No | Comments |
| ZTE, Sanechips | No | We are not convinced by the argument mentioned to introduce DRX impact into PHY layer candidate resource set selection. Relying on MAC can work and the we don’t see any way out by following either option listed as direction for PHY specification change. Our suggestion for the reply is to list all the options including putting this to MAC. The revision would look like,  In RAN1’s view, there is no consensus that the restriction has to be applied in PHY or MAC layer so that selected resources are located within the active time of the RX UE. The following options have been discussed in RAN1 to apply the restriction for the candidate resource selection:   * Option 1: PHY layer selects and reports candidate resources only within active time of the RX UE * Option 2: PHY layer selects and reports candidate resources in which at least a subset of the candidate resources is within active time of the RX UE * Option 3: PHY layer selects and reports an additional candidate resource set which includes candidate resources within active time of the RX UE * Option 4: PHY layer does not apply the restriction for the resource selection based on DRX active time of RX UE |
| OPPO | Yes with comment | We support the draft LS in principle, while with some modifications.  For option 3, it needs to clarify that a candidate resource set is reported in addition to a candidate resource set which is determined based on R16 mechanism (i.e. *SA*).  For Note 2, we suggest to remove the sentence “but it doesn’t….” since the active time is used in all above 3 options. it is enough to say current active time is needed at PHY layer, not necessary to say how to use it.  Then we propose following modification:  **Draft LS reply (v01):**   |  | | --- | | In RAN1’s view, the restriction has to be applied in PHY layer so that all or a subset of candidate resources reported to MAC layer is located within the active time of the RX UE. The following options have been discussed in RAN1 to apply the restriction for the candidate resource selection:   * Option 1: PHY layer selects and reports candidate resources only within active time of the RX UE * Option 2: PHY layer selects and reports candidate resources in which at least a subset of the candidate resources is within active time of the RX UE * Option 3: PHY layer selects and reports another ~~an additional~~ candidate resource set which includes candidate resources within active time of the RX UE in addition to a candidate resource set which is determined by R16 mechanism.   Note 1: the restriction applied in PHY layer based on the active time information provided by MAC layer.  Note 2: the active time provided by MAC layer for the Options 1/2/3 is assumed as the current active time ~~but it doesn’t imply that RAN1 has a preference on using the current active time for selecting and reporting the candidate resources~~.  Note 3: RAN1 will continue to discuss on the Options listed above for down-selection. | |
| LG Electronics | See comments | Firstly, in order to remove unnecessary ambiguity about the listed options, we think that it would be better to directly specify the type of active time used by PHY layer in the description of the options. Also in Option 3, as commented by OPPO, it should be clearly described what the two candidate sets that PHY layer reports to MAC layer are.  Secondly, we think that it would be useful to ask RAN2 if there is a concern about the options/assumptions provided by RAN1. For example, a question such as “**RAN1 respectfully asks RAN2 to inform RAN1 if it has a concern about the above options/assumptions**” can be included in the reply LS.  Thirdly, considering that there is only one meeting left until the end of WI, it would be good to try to down-select one of Option 2 and 3 and provide the selected one to RAN2.   |  | | --- | | In RAN1’s view, the restriction can be applied in PHY layer so that all or a subset of candidate resources reported to MAC layer is located within the current active time of the RX UE. The following options have been discussed in RAN1 to apply the restriction for the candidate resource selection:   * Option 1: PHY layer selects and reports candidate resource set only within current active time of the RX UE * Option 2: PHY layer selects and reports candidate resources in which at least a subset of the candidate resources is within current active time of the RX UE * Option 3: PHY layer selects and reports another candidate resource set which includes candidate resources within current active time of the RX UE in addition to a candidate resource set determined by Rel-16 mechanism.   Note 1: In Options 1/2/3, it is assumed that PHY layer is provided with the current active time but not the future active time by MAC layer when selecting candidate resources reported to MAC layer.  Note 2: RAN1 will continue to discuss on the Options listed above for down-selection. | |
| Qualcomm | Yes, with comments | For Option 3, we propose the following:   * Option 3: PHY layer selects and reports an additional candidate resource set ~~which includes~~ of candidate resources within active time of the RX UE |
| Futurewei | Yes with comments | We are ok with including all options in the reply if non consensus can be made. But it would be better to downselect one and have a solution agreed.  We prefer option 2.  Regarding the active time, our understanding is that it can be either the current active time or future active time. If Rx UE is already in inactive time, Rx inactive timer drx-inactivitityTimer is known to Tx UE and Tx UE knows when future active time of Rx starts. Therefore, we may either remove note 2 or modify it as    Note 2: the active time provided by MAC layer for the Options 1/2/3 is assumed as the current active time if Rx UE is currently in active time, or as the future active time if Rx UE is in inactive time and drx-inactivitityTimer is available at Tx UE, but it doesn’t imply that RAN1 has a preference on using the ~~current~~ active time for selecting and reporting the candidate resources. |
| MediaTek | Yes with comments | Firstly we have two editorial comments:   1. As suggested by Oppo and LGE, it’d be better to clearly describe Option-3 regarding the reporting of two candidate resource sets. We are fine with Oppo’s phrasing on this. 2. In the beginning sentence of the draft LS, it’s better to say ”In RAN1’s view, the restriction ~~has to~~ should be applied in ...”   In addition, we prefer to keep Note-2 as a whole, including the “it doesn’t imply that...” part.  Lastly, we agree with the companies in that we should try to down-select one of the options during this meeting, given the limited time we have left to finalize R17. Our preference is Option-1. |
| Ericsson | Changes are needed | We are supportive of having an LS among these lines, but we have some questions and proposed modifications:   * Regarding the first sentence in the LS: “*In RAN1’s view, the restriction has to be applied in PHY layer so that all or a subset of candidate resources reported to MAC layer is located within the active time of the RX UE*” we propose to capture it in an agreement including *FFS details* since RAN1 will later discuss it.   + Moreover, in the agreement we think that the definition of restriction as defined in RAN2 needs to be clearly stated. * Regarding Note 2, a majority of the companies comment that this is out-of-scope, so we propose to delete Note 2 from the LS reply. RAN2 will decide what Active Time to send to PHY without requiring input from RAN1. * Regarding Note 3, since in RAN1 we did not agree to have the down-selection between these options (or even whether we are limited to only these options), we suggest modifying the note 3 to:   + Note 3: RAN1 will continue to discuss how the restriction is performed by the PHY layer.   Regarding the follow-up procedure in RAN1:   * Is the discussion on the options in RAN1 planned for this meeting and in this thread or what is the intention? * Since the majority of companies are supportive of either Option 1 or Option 2, we propose to limit the down-selection discussion to only these options and remove Option 3. |
| Fujitsu | No | We prefer to remove Option 1 and leave only Option 2 and Option 3 for down-selection.  As explained in Note 2, if the “active time” in the proposal is assumed as the “current active time”, and PHY layer selects and reports candidate resources only within the corresponding duration, the DRX active time extension mechanism designed in RAN2 (e.g., Inactivity timer and retransmission timer) will become useless because all the resources are restricted within the current active time and will not appear in the extended active time. So, we think Option 1 is not feasible and should be removed. We are OK to make further discussion on Option 2 and Option 3. |

LS reply to R2-2108997 (R1-2108710) based on outcome of Section 3

Summary of contributions

|  |  |
| --- | --- |
| Company | Observations and Proposals |
| Nokia [2] | **Observation 1: It is possible to apply Rx UE active time information into the L1 resource selection procedure.**  **Observation 2: Tx UE will depend on higher layers to provide the information about Rx UE active time.**  **Proposal 1: Further study the benefit of introducing new information about Rx UE active time into the L1 resource selection procedure.** |
| ZTE, Sanechips [3] | ***Proposal 1: The restriction on resource selection with DRX should be done by RAN2 instead of RAN1.*** |
| LG [4] | ***Observation 1: When discussing the answer to RAN2’s question, RAN1 should consider the following two cases, and if RAN1 can tell RAN2 which one is preferred, it would be helpful for RAN2 to proceed with the related work.***   * ***Case 1: TX UE selects the resources taking into account only the current active time of RX UE*** * ***Case 2: TX UE selects the resources taking into account both the current and future active time of RX UE***   ***Observation 2: If the resource selection of TX UE is performed considering both the current and future active time of RX UE, it would be beneficial in terms of satisfying the service-related QoS requirement (e.g., by reducing the probability of occurrence of packet drop/decoding failure).***  ***Observation 3: The following can be considered as options for specifying RAN2 agreement-related restriction:***   * ***Option 1: Specify the mechanism to support RAN2 agreement-related restriction in both the RAN1 and RAN2 specifications*** * ***Option 2: Specify the restriction related to RAN2 agreement in the RAN2 specification, i.e., from the point of view of PHY layer, the procedure of TX UE for the packet transmission to RX UE that does not perform the SL DRC operation is reused***   ***Observation 4: In case when Case 2 is supported with Option 1, it is expected that the considerable time will be spent discussing the issues that should be addressed/resolved, which is not desirable given the limited time remaining until the end of Rel-17 item.***  ***Proposal 1: The following is adopted as RAN1’s feedback to RAN2’s question in LS [1]:***   * ***From the point of view of RAN1, it is preferred that the mechanism for TX UE to select the resources taking into account both the current and future active time of RX UE is supported and the relevant procedure is specified in the RAN2 specification.*** |
| HW [6] | ***Observation 1: If RAN1 took the restriction from RAN2 for further design, quite a lot standard efforts would be needed on resource selection window determination, Y candidate slots selection, and candidate resource set determination, etc.***  ***Observation 2: Since the SL DRX active time of RX UE is dynamically changing, PHY layer is difficult to adjust selection window and determine candidate resources precisely based on SL DRX active time of RX UE.***  ***Observation 3: It is more appropriate to reflect the restriction in MAC layer since both the trigger moment for resource selection in PHY layer and SL DRX active time of RX UE are known in MAC layer.***  ***Proposal: Reply to RAN2 as follows:***   * ***RAN1 considers that there are a lot of standard efforts and difficulties to reflect the restriction from RAN2 in RAN1 specifications. Considering the limited time budget in RAN1, RAN1 will not take the restriction into account for PHY layer design in Rel-17.*** |
| Vivo [7] | it is RAN1’s understanding that MAC would provide the active time of the RX UE to PHY when it triggers resource selection procedure, so that PHY can select and report suitable candidate resources (i.e., within the active time of the RX UE) to MAC. |
| OPPO [8] | **Observation: If DRX restriction for resource selection is not considered at RAN1, it is possible that the reported candidate resource set does not included any resource located within RX UE’s DRX active duration so that higher layer cannot select resource within it.**  **Proposal: DRX restriction for resource selection should be implemented at both RAN1 and RAN2.** |
| CATT [10] | ***Observation 1: If the resource selection window of the TX UE does not include any candidate resource corresponding to the DRX active time of the RX UE(s), transmission reliability cannot be guaranteed.***  ***Proposal 1:*** ***RAN1 can be responsible for implementing the restriction that TX UE selects the resources taking into account the active time (current or future) of the RX UE(s) by adjusting the resource selection window to at least partially overlap with the DRX active time of the Rx UE(s).***  ***Proposal 2: Reply LS to RAN2.***   * ***From RAN1‘s perspective, RAN1 can be responsible for implementing the restriction that TX UE selects the resources taking into account the active time (current or future) of the RX UE(s)by adjusting the resource selection window to at least partially overlap with the DRX active time of the Rx UE(s).*** * ***Additionally, down-selection can be done between the following two resource selection methods:***   + ***RAN1 is responsible for determining the candidate resources corresponding to the DRX active time of the RX UE(s) by reporting an additional candidate resource set.***   + ***RAN2 is responsible for determining the candidate resources corresponding to the DRX active time of the RX UE(s) based on the information reported by PHY.*** * ***RAN1 respectfully asks RAN2 to take the above information into account*** |
| Samsung [11] | **RAN1 reply on LS:** In order to avoid frequent resource (re-)selection at higher layer based on above RAN2 agreements, RAN1 can implement that the resource selection window of TX UE can be confined within slots corresponding current or future DRX active time of communicating RX UE(s) and specify UE behavior in PHY spec. |
| Qualcomm [13] | RAN1 discussed how the resource selection at the PHY layer should be performed by a Tx UE considering the DRX configuration of the RX UE; RAN1 concluded that the upper layer shall determine the set of slots coinciding with the DRX active time of the RX UE and inform the PHY layer about a set of allowed resources for selection. Consequently, the PHY layer only selects the resources from the intersection of the set of allowed resources indicated by the upper layer and its selection window. The resource selection restriction can be implemented by RAN1, while the signaling mechanism across the layers can be captured in the RAN2 specification. |
| InterDigital [14] | *Observation 1: If the resource (re)selection window [n+T1, n+T2] extends beyond the active time of the Rx UE(s), providing the set of available resources only within the current active time (i.e., DRX ON duration) of the Rx UE(s) is not desirable since retransmission(s) are allowed outside of the current active time due to RAN2 DRX timers.*  *Observation 2: PHY layer needs to know the current active time of the Rx UE(s) in DRX to determine the set of available resources (i.e., Set A) to report to MAC layer.*  *Proposal 1: PHY layer provides a set of available resources (Set A) including at least a minimum number of resources within the current active time (e.g., DRX ON duration) of the Rx UE(s).*  *Proposal 2: Adopt the following answer to reply LS to RAN2:*   * *RAN1 consider that both PHY layer and MAC layer can apply the restriction as the following:*    + *PHY layer:*     - *PHY layer provides a set of available resources (Set A) including at least a minimum number of resources within the current active time of the Rx UE(s).*     - *PHY layer expects to receive the information related to the current active time of the Rx UE(s) from MAC layer to perform this restriction.*   + *MAC layer:*     - *MAC layer selects the resources for at least initial transmission from the resources provided by PHY layer within the current active time.*     - *MAC layer decides how many retransmission(s) can be made within the current active time of the RX UE(s).* |
| Ericsson [15] | [Observation 1 The two options of resource restriction have similar impacts on specifications.](#_Toc83995503)  [Observation 2 Resource restriction performed by PHY layer has a clear advantage in terms of communication performance since irrelevant resources are avoided.](#_Toc83995504)  [Proposal 1 RAN1 supports and implements the following option: PHY layer performs resource restriction based on the information about DRX Active Time received from MAC layer. How to determine the Active Time is up to RAN2.](#_Toc83995532)  [Proposal 2 RAN1 informs RAN2 of RAN1’s intention stated in Proposal 1.](#_Toc83995533)  [Proposal 3 RAN1 considers the suggested text above when implementing the resource restriction.](#_Toc83995534) |

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