**3GPP TSG RAN WG1 #108-e R1-220xxxx**

**e-Meeting, 21 February – 03 March, 2022**

**Source: Moderator (OPPO)**

**Title:** **FL summary #1 for AI 8.11.1.1 – NR sidelink resource allocation for power saving**

**Agenda item: 8.11.1.1**

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

Introduction

In the latest version of Rel-17 [WID](http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_90e/Docs/RP-202846.zip) for NR sidelink enhancement, the objective for enhancing resource allocation (RA) to reduce UE power consumption in mode 2 is captured as followed.

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| 2. Resource allocation enhancement:   * Specify resource allocation to reduce power consumption of the UEs [RAN1, RAN2]   + Baseline is to introduce the principle of Rel-14 LTE sidelink random resource selection and partial sensing to Rel-16 NR sidelink resource allocation mode 2.   + Note: Taking Rel-14 as the baseline does not preclude introducing a new solution to reduce power consumption for the cases where the baseline cannot work properly.   + This work should consider the impact of sidelink DRX, if any. |

This contribution provides a summary of the submitted contributions, email discussion topics and outcomes during RAN1#106bis-e meeting. Note that, all past outcomes including agreements, conclusions and working assumptions reached during this WI are captured in Section 5 (5 Appendix) of this document.

Collection of agreements / conclusion in RAN1#108-e

To be collected once agreement is reached.

Topics for email discussion

[108-e-R17-Sidelink-01] Email discussion on resource allocation for power saving– Kevin (OPPO)

* 1st check point: February 25
* Final check point: March 3

## Topic #1: Finalization of selection/reporting of subset of candidate resources within RX-UE's SL DRX active time

**Background**: In RAN1#107-e, the group made an agreement to proceed with the following Option 2 (*PHY layer selects and reports candidate resources in which at least a subset of the candidate resources is within the indicated active time of the RX UE*) on the issue of restricting candidate resources to be reported to MAC layer when PHY is indicated with sidelink DRX active time of the RX UE.

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| **Agreement**  When SL DRX active time of Rx-UE is provided by the higher layer for candidate resource selection (including resource (re)selection and re-evaluation/pre-emption checking), the following working assumption is confirmed with option 2 as agreement (with modification in RED)  **Working Assumption (RAN1#106bis-e)**  When PHY layer is indicated with an active time of RX UE from MAC layer for candidate resource selection, a restriction is applied in PHY layer so that at least a subset of candidate resources reported to MAC layer is located within the indicated active time of the RX UE. The following options will be further discussed in RAN1 to restrict resources for candidate resource selection taking into account the indicated active time from MAC layer:   * ~~Option 1: PHY layer selects and reports candidate resources only within the indicated 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 the indicated active time of the RX UE   + FFS: Details on when the number of subsets of candidate resource is less than the threshold   + FFS: The subset of candidate resource outside of the active time should consider each inactive time period   + FFS: UE selection of resource selection window to overlap with indicated RX UE active time   + FFS: Whether it is up to UE implementation to report candidate resources only within the indicated active time of the RX UE * ~~Option 3: PHY layer selects and reports an additional candidate resource set of candidate resources within the indicated active time of the RX UE~~ |

During the RAN1#107bis-e meeting, out of all the proposed solutions in the submitted contributions and the discussions held, the following latest version of combined/refined solution was proposed by the FL for agreement. Unfortunately, it was not accepted by the group. Specifically, the main issue was there is no consensus to specify a solution in L1 to realize the above agreed Option 2 as some claimed that it should be achieved by purely UE implementation.

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| **Proposal 2-1 (VII):**  When SL DRX active time of RX UE is provided by the higher layer for candidate resource selection,   |  | | --- | | ·     At least ~~the first~~ *N* slots of *Y* or *Y’* candidate slots are to be selected within the provided SL DRX active time when partial sensing is configured in the UE by higher layer, where *N* is (pre-)configurable from a range of 1 to [10]. |  * + ~~FFS: whether~~ This does not apply to re-evaluation and pre-emption checking (e.g. number of remaining *Y* or *Y’* candidate slots is less than *N*)   + Note (not to be captured in the spec): it is possible that the whole set of *Y* or *Y’* candidate slots are selected within the provided SL DRX active time (e.g., when the provided SL DRX active time covers the entire remaining PDB)  |  | | --- | | ·     *T2* is selected by UE implementation such that at least ~~the first~~ *N* slots of RSW are ~~to be selected~~ within the provided SL DRX active time when full sensing is configured in the UE by higher layer, where *N* is (pre-)configurable from a range of 1 to [10]. |  * + ~~FFS: whether~~ This does not apply to re-evaluation and pre-emption checking   + Note (not to be captured in the spec): it is possible that the whole RSW is within the provided SL DRX active time (e.g., when the provided SL DRX active time covers the entire remaining PDB)  |  | | --- | | ·     The same (pre-)configured *N* parameter applies to both partial sensing and full sensing cases.  ·     The reported subset of the candidate resources within the provided SL DRX active time of RX UE shall satisfy a threshold. |  * + Option 1: The same higher layer parameter (*sl-TxPercentageList*) is reused for the ratio / threshold That is,  number of candidate single-slot resources remaining within the SL DRX active time of the initialized set  in Step 4) is to be met by using the RSRP threshold increment ~~only for the SL DRX active time~~ in Step 7, where the  is the total number of candidate single-slot resources of the set  within the SL DRX active time.     - The UE shall satisfy this new threshold in addition to the remaining minimum  number of candidate single-slot resources threshold for the whole set  in Step 7. |

Based on the submitted contribution in this meeting, a summary of this topic can be found in Section 4.1 of this document, there is an overwhelming preference / view from 19 contributions that there is a need to specify a solution to guarantee a subset of candidate resources is selected and reported by L1 that does not potentially degrade system performance due to high interference.

To this end, the following question is asked to determine whether there is a consensus within the group to specify a L1 solution to guarantee a subset of candidate resources is selected and reported by L1 when SL DRX active time is provided by the higher layer.

**Question 1:**

Should RAN1 make further agreement(s) on how a UE reports a subset of candidate resources that are within the indicated SL DRX active time of RX UE (Yes/No)?

* + - * If Yes, which one of the following options should be adopted to guarantee UE reporting a subset of candidate resources that are within the indicated SL DRX active time of RX UE?
        + Solution 1: Based on the above Proposal 2-1 (VII) from RAN1#107bis-e. That is,

UE selecting *N* number of slots within the DRX active time and ensuring *X · Ntotal* number of candidate resources remaining within the SL DRX active time of the initialized set *SA* by RSRP threshold increment in Step 7, where the *N* number of slots is a higher layer parameter and the value is determined by UE implementation.

* + - * + Solution 2: Same as Solution 1 but without specifying UE selecting *N* number of slots within the DRX active time. That is, only ensuring *X · Ntotal* number of candidate resources remaining within the SL DRX active time of the initialized set *SA* by RSRP increment in Step 7.
        + Solution 3: Similar to Solution 2, replace *X · Ntotal* with *Z* number of candidate resources remaining, where the *Z* number of resources is a higher layer parameter and the value is determined by UE implementation.
      * If No, how to reflect / capture the above existing agreement in the specification (TS38.214) or completely up to the specification editor?
        + For example, “If the number of remaining candidate single-slot resources within the indicated SL DRX active time in the set *SA* after step 7 is less than *N*, the UE based on its implementation selects and includes additional candidate single-slot resources such that the minimum *N* candidate single-slot resources is met, where *N* is a higher layer parameter and the value is determined by UE implementation.”

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| **Company** | | **Yes/No** | **Comments** |
| NTT DOCOMO | | Yes | Solution 1.  In our understanding, “YES” for the question means that RAN1 should consider non-smart UE that does not handle this issue by UE implementation. With this understanding, full UE behavior should be agreed. It seems that solution 2/3 is not aligned with the assumption. |
| ZTE,Sanechips | Comment | | The solution should be complete and avoid RRC impact to the largest extent, alternatively no further agreement needs to be pursued, a sentence as the following to 8.1.4. in TS 38.214 after step 7 as follows should serve well the purpose in case no further agreement is achieved.  The UE shall report set IMG_256 to higher layers wherein a subset includes up to implementation the resources within the SL DRX active time.  Solution 1 can be reformulated and completed in the wording below (from pervious meeting) for better clarity   * Option 1: The same higher layer parameter (sl-TxPercentageList) is reused for the ratio / threshold That is, number of candidate single-slot resources remaining within the SL DRX active time of the initialized set in Step 4) is to be met by using the RSRP threshold increment in Step 7, where the is the total number of candidate single-slot resources of the set within the SL DRX active time.   + - ***The UE shall satisfy this new threshold in addition to the remaining minimum number of candidate single-slot resources threshold for the whole set in Step 7.***     - ***The UE shall ensure the RSRP threshold increment in Step 7 is not larger than a RSRP threshold upper bound or maximum number of increments provided by higher layer***     - ***If***  *or*  ***is less than thresholds provided by higher layer, UE performs random selection in exceptional resource pool.***   We can support the reformulated solution 1 |
| Apple | | Yes | Solution 1 or Solution 4.  Without specifying that UE selecting N number of slots within the DRX active time, we cannot guarantee that the reported candidate resources have overlap in Rx UE’s DRX active time. Note if there is no overlap between candidate slots and Rx UE’s DRX active time, then *Ntotal* is 0, which means Step 7 passes while all the reported candidate resources are not in DRX active time.  We are also fine with Solution 4 as a combination of Solution 3 and Solution 1.  Solution 4: Similar to Solution 1, replace *X · Ntotal* with *Z* number of candidate resources remaining, where the *Z* number of resources is a higher layer parameter and the value is determined by UE implementation. |
| MediaTek | | Comment | First part of Proposal 2-1 (VII) should be agreed without threshold definition.  It should be specified that UE should select at least the first N slots within the active time. This is necessary for alignment with past RAN2 agreement. This should be applicable to both partial-sensing and full-sensing UE. The threshold definition is not necessary and it can be left to UE implementation.  In brief, we support the first half of Proposal 2-1 (VII) without the last main bullet (i.e., without the threshold-related part for Step-7). |
| Futurewei | | Comments | Our view is that we do not agree to define a new RRC parameter N as in solution 1 or the example given for the “No” branch case. We prefer solution 2 by adding *Ntotal* >=1 for clarification or the "No" branch without a new RRC parameter N.  Note that similar to ZTE mentioned, some aspects of solution 1 are not so clear. For example, we are not clear what is the difference between N and Ntotal now as Ntotal definition is missing (also missing in other solutions). Would N be the minimum number of slots within Rx active time? |
| OPPO | | Yes | We support Solution 1.  We don’t think it is acceptable to up to UE implementation to guarantee there is a subset within SL DRX active time in S\_A. in that case, the UE may perform random selection and the interference to other UEs is uncontrollable. |
| Xiaomi | | comments | We have already agreed that by UE implementation to select Y or Y’ number of candidate slots. Therefore, we do not think further agreement to select candidate slots within DRX active duration is necessary. It can be up to UE implementation.  Even if we need to define UE behaviour, additional higher layer parameter N is not needed. We can simply say that “UE selecting at least 1 candidate slot within the DRX active time by its implementation”.  The same comment applies to the number of candidate resources to be reported to MAC layer. To comply with RAN2 agreement, it would be enough to just say that “ensuring *at least 1* candidate resource remaining within the SL DRX active time of the initialized set *SA* by RSRP threshold increment in Step 7”. |

### Proposal for Week 1 Tuesday GTW

TBD, depending on comments/inputs to Question 1.

## Topic #2: Finalization of re-evaluation and pre-emption checking for aperiodic transmission

**Background**: In the last RAN1 meeting (#107bis-e), the group reached an agreement on the solution design for re-evaluation and pre-emption checking in case of aperiodic transmission, which is mainly based on the solution for the periodic transmission case. However, one key difference in the case of aperiodic transmission is that the minimum *M* slots for CPS cannot be guaranteed due to unpredictable traffic arrival timing. It was agreed to further study a solution for this issue until this meeting.

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| **Agreement**  When UE is triggered to perform re-evaluation and pre-emption checking for aperiodic transmission (*P*rsvp\_TX*=*0) in slot *n*,   * The candidate resource set (*SA*) is initialized to the remaining *Y’* candidate slots that starts from slot and ends at the last slot of the *Y’* candidate slots.   + is the first candidate slot after slot *n+T3*. * UE may perform PBPS for periodic sensing occasions after the resource (re)selection when *sl-MultiReserveResource* is enabled for the mode 2 Tx resource pool   + It is up to UE implementation * UE performs CPS starting from at least *M* consecutive logical slots earlier than to  slots earlier than .   + FFS: When the minimum *M* slots for CPS cannot be guaranteed, * All available sensing results not earlier than *n–T0* for the resource pool indicated by higher layer are applied for re-evaluation and pre-emption checking procedures |

Based on discussions and proposals included in the submitted contributions to this meeting (a summary can be found in Section 4.2 in this document), the majority of companies have a view that the UE should sense all available / as much as possible the slots before re-evaluation/pre-emption triggering slot (i.e., until  slots earlier than ). Based on the majority view, the following is proposed from the FL.

**Proposal 2:**

When a UE is triggered to perform re-evaluation and pre-emption checking for aperiodic transmission (*P*rsvp\_TX*=*0) in slot *n* and the minimum *M* slots for CPS cannot be guaranteed,

* UE performs CPS starting from the resource (re)selection trigger slot of the same TB to  slots earlier than .

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| **Company** | **Comments** |
| NTT DOCOMO | Support. |
| ZTE,Sanechips | This solution wold mandate the CPS for aperiodic transmission to be done from the resource selection triggering always, i.e. T\_A =0. We don’t think this solution is good from power saving perspective. We think the proposal below makes better sense from technical perspective.   * When collision of re-evaluation or pre-emption is detected but the minimum M slots for CPS cannot be guaranteed, UE performs random resource selection in an exceptional resource pool |
| Apple | Support. We should try the best to enhance the resource re-evaluation/pre-emption performance. |
| MediaTek | Support. |
| Sharp | Support. |
| Futurewei | Since in the initial selection when the minimum M slots for CPS cannot be guaranteed, RRS is one of options, we may need to specify them separately. If UE performs option A, the proposed CPS is supported. If UE performs option B RRS, UE does not perform re-evaluation and pre-emption. The proposal is updated as  When a UE is triggered to perform re-evaluation and pre-emption checking for aperiodic transmission (*P*rsvp\_TX*=*0) in slot *n* and the minimum *M* slots for CPS cannot be guaranteed,   * If UE performs option A in the initial resource selection, UE performs CPS starting from the resource (re)selection trigger slot of the same TB to  slots earlier than . * If UE performs option B random resource selection in the initial resource selection, UE does not perform re-evaluation/pre-emption at all. |
| OPPO | Support |
| Xiaomi | Generally support. We suggest to revise the wording of sub-bullet as :  UE senses in all available slots starting from the resource (re)selection trigger slot of the same TB to until  slots earlier than  We think “available” is needed here as UE may need to transmit in some slots so it may not be able to do sensing in all the slots. |

### Proposal for Week 1 Tuesday GTW

TBD, depending on comments/inputs to Proposal 2.

## Topic #3: Finalization of (pre-)configured M value range in CPS for periodic transmission

**Background**: For periodic transmissions, it was agreed that when UE performs contiguous partial sensing, the UE monitors *M* logical slots earlier than slot (in case of resource (re)selection) or earlier than slot (in case of re-evaluation and pre-emption checking) based on the following two past agreements. However, the lower bound of the *M* value in the RRC (pre-)configuration has not been settled in RAN1 so far. In the last RAN1 meeting (#107bis-e), the group agreed as a working assumption that the lower bound for the *M* value in the case of aperiodic transmission can be 0 (some see as a way for disabling CPS). The group also attempted to find if there is a way to disable CPS for the case of periodic transmission in the last RAN1#107bis-e meeting, but it was unsuccessful and no conclusion was reached.

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| **Agreement (from RAN1#106bis-e)**  When UE performs periodic-based and contiguous partial sensing schemes in a mode 2 Tx pool with periodic reservation for another TB (*sl-MultiReserveResource*) enabled,   * For a resource (re)selection procedure triggered by periodic transmission () in slot *n*, *TA* and *TB* for the CPS monitoring window is defined according to one of the followings:   + *n*+*T*A is *M* logical slots earlier than slot , and *n*+*T*B is slots earlier than , where is the first slot of the selected *Y* candidate slots of PBPS, and , are in units of physical time/slots.     - By default, *M* is 31 unless (pre-)configured with another value.   **Agreement (from RAN1#107-e)**  When UE is triggered to perform re-evaluation and pre-emption checking for periodic transmission (*P*rsvp\_TX*≠0*) in slot *n*,   * During the *q*th reservation period (*q*=0,1,2,…, *Cresel*-1), candidate resource set (*SA*) is initialized to the remaining *Y* candidate slots starts from slot and ends at the last slot of the *Y* candidate slots, where the slot indices of the remaining *Y* candidate slots are equal to [*q* x *Prsvp\_Tx* + ], where is a slot index of *Y* candidate slots used in the initial resource (re)selection.   + is the first candidate slot after slot *n+T3*.   + FFS whether/how to handle the case when number of the remaining *Y* candidate slots is less than *Ymin*. * Scheme 1:   + UE performs PBPS for the remaining *Y* candidate slots according to, whereis a slot belong to the remaining *Y* candidate slots, and *k* and *Preserve* are the same as resource (re)selection.   + UE performs CPS starts from *M* logical slots earlier than to  slots earlier than .     - By default, *M* is 31 unless (pre-)configured with another value. |

Since this is a critical issue that RAN1 must finalize RRC parameters and corresponding values within the first week of RAN1#108-e (i.e., this meeting), based on contributions submitted to this meeting (a summary is provided in Section 4.3 of this document) the FL propose for the lower bound of M to be a non-zero value (4 or 5).

**Proposal 3:**

The lower bound of *M* value for CPS in the case of periodic transmission (*contiguousSensingWindowPeriodic*) for both resource (re)selection and re-evaluation / pre-emption checking is a non-zero value.

* Choose between 4 or 5 for the lower bound

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| **Company** | **Comments** |
| NTT DOCOMO | OK with 5 (or larger).  Smallest value of is 4, so if the lower bound is 4, it equals 0 (i.e. no CPS). There is no reason to agree 4 rather than 0 if possibility of no-CPS is preferred. |
| ZTE,Sanechips | We believe this can be made the same as WA in the ‘at least CPS case’, lower bound can be 0 |
| Apple | OK with the proposal. |
| MediaTek | Support value 5 or longer. |
| Futurewei | We support 5 (or larger) as we do not have agreement that CPS can be disabled for periodic traffic. |
| OPPO | OK with the proposal. |
| Xiaomi | We are fine with 5. |

### Proposal for Week 1 Tuesday GTW

TBD, depending on comments/inputs to Proposal 3.

## Topic #4: Update of resource exclusion in step 6

**Background**: Different from R14 partial sensing and R16 NR-V2X, the timing reference point for performing the resource exclusion step 6c is changed for the partial sensing scheme in R17 and it is no longer the resource (re)selection triggering slot *n* as agreed for PBPS since the periodic sensing occasions between slot n and the first slot of *Y* candidate slots should be also monitored as part of resource (re)selection. Furthermore, different also from R14 partial sensing, the periodic sensing occasion has also been extended to include the second most recent one when *additionalPeriodicSensingOccasion* is (pre-)configured. That means, candidate resources should be excluded from the set *SA* based on two reservation periods earlier in the detected SCI. This behaviour is also different from the resource exclusion principle in R16. As such, some companies proposed to make the following updates to Step 6c.

* **Update 1: The time reference point for** 
  + Reason for change: The sensing occasions determined in PBPS and CPS may be located after slot *n* and such case doesn’t exist in R16 full sensing. Therefore, the reference point / definition for in step 6c should be updated.
  + Option A: if slot belongs to the set , otherwise, slot ’ is the first slot after slot belonging to the set .
  + Option B: if slot belongs to the set , otherwise, slot ’ is the first slot after slot belonging to the set .
* **Issue 2: Update of** 
  + Reason for change: When slot is determined based on slot rather than slot , should be set to the remaining selection window size.
  + Option C: converted to milliseconds
  + Option D: converted to milliseconds, where slot is the last slot of the *Y* or *Y’* candidate slots.
* **Issue 3: Update of calculation of value** 
  + Reason for change: For a periodic reservation detected in the most recent periodic sensing occasion, the reserved resource will be located within the selected *Y* or *Y’* candidate slots. But when the most recent two PSOs are to be sensed by the UE and a periodic reservation is detected in the second most recent PSO, it’s reserved resource will not fall within the selected *Y* or *Y’* candidate resources according to the existing *Q* formulation. And hence, it should be updated.
  + When *additionalPeriodicSensingOccasion* is (pre-)configured,
    - Option E: if and ; otherwise . is set to 2
    - Option F:  *+1 if* *and , otherwise*

Since this topic has been brought up in the last meeting, FL propose the followings

**Proposal 4:**

In Step 6 c) of TS38.214 Section 8.1.4, when UE is configured with partial sensing by its higher layer, adopt the following changes:

* if slot belongs to the set , otherwise, slot ’ is the first slot after slot belonging to the set .
* converted to milliseconds, where slot is the last slot of the *Y* or *Y’* candidate slots
* When *additionalPeriodicSensingOccasion* is (pre-)configured, *+1* if and *,* otherwise *.*

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| **Company** | **Comments** |
| NTT DOCOMO | We understand the motivation.  Meanwhile, why is included in the updated version? n in Rel-16 is resource selection triggering timing. To align with this, might be correct one rather than the proposal? is the last slot of sensing slot, not the selection triggering timing. (Or Rel-16 full sensing is a bit not good...?) |
| Apple | We support the proposal.  We may add the sentence for first sub-bullet that “ is the first candidate slot of partial sensing.” |
| Sharp | We are fine with 1st sub-bullet.  For 2nd sub-bullet, in R16 NR V2X, it was agreed to use T\_scal as RSW(i.e. T2-T1), although the specs was kept as T2 (discussed in the preparation phase of R16 NR V2X in RAN1#108e). We think it is better to reuse the RSW with necessary change, i.e. end of sensing window is instead of slot n, thus, T\_scal is changed as T2-() as Option C implied.  For 3rd sub-bullet, we do not support the proposal. E.g. 4 periodicities (P1/P2/P3/P4) are configured for the resource pool and only one of them (P1) is configured for and the additional sensing occasion is configured. The periodicity in a received SCI (i.e. ) in the sensing occasion can be P2/P3/P4. In these cases, we fail to see why the condition needs to be multiplexed by ‘2’ for the right side. In our understanding, if the condition is applied, it seems the monitoring UE does not need to perform exclusion procedures for the default sensing occasion any longer, since it is already incorporated by the additional one, i.e. Q is increased by 1 compared to R16. Briefly saying, we don’t see the need to separate the case with or without the additional sensing occasion configured, i.e. change of Q is not needed. |
| Futurewei | We are not convinced that the updates are necessary. The sensing exclusions are for the resources Since there is no update on , updates are just for avoiding unnecessary check. On the other hand, for re-evaluation/pre-emption in R16, the sensing is also after slot n. But no update was needed for re-evaluation in R16. Therefore, we do not think this is essential. The proposal is not needed. |
| OPPO | Support this proposal.  Furthermore, we think this proposal is applicable to both initial resource selection and re-evaluation/pre-emption checking. When applied to re-evaluation or pre-emption, ty0 in the first and second sub-bullet should be replaced by tyi, where tyi is the first candidate slots after the re-evaluation or pre-emption trigger. |
| Xiaomi | We are fine with the 1st sub-bullet.  For the second sub-bullet, we think using option C is more reasonable: converted to milliseconds.  For the last sub-bullet, we do not understand the intention. Even for full sensing UE may monitor multiple occasions in the sensing window for a given period, we are not sure why it needs to be specially treated. |

### Proposal for Week 1 Tuesday GTW

TBD, depending on comments/inputs to Proposal 4.

## Topic #5: Handling of non-monitored slots in step 5

**Background**: In both the last RAN1#107bis-e and this RAN1#108-e meetings, it has been brought up by some companies that the issue of resource exclusion due to non-monitored slots in step 5/5a should be resolved in partial sensing. According to the latest 38.214 R17 specification, Step 5/5a is applied in the case of partial sensing. On the other hand, this is not applied in R14 LTE-V2X for partial sensing.

Back in RAN1#104-e meeting, this issue was already discussed. At that time, it was proposed for UE to avoid selecting *Y* candidate slots that would collide with UL and other SL transmissions. However, this proposal was removed based on comments and understanding that this can be done by UE implementation and there is no need to capture this in the spec as in R14. So, it implies that the issue of non-monitored slots would not exist based on UE careful selection of Y candidate slots. As such, the existing / R16 step 5/5a would not be needed.

In this meeting, it has been proposed by some companies to capture this as an agreement, so that it can be correctly reflected in TS 38.214. To this end, the FL propose the following:

**Proposal 5:**

* For Step 5 and 5a of TS38.214 Section 8.1.4, they are only applied for UE configured with full sensing by its higher layer.

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| **Company** | **Comments** |
| NTT DOCOMO | We are fine with this direction, but in this case, also step 2 needs to be updated, right? Or the sentence in step 2 of “The UE shall monitor slots which belongs to a sidelink resource pool within the sensing window except for those in which its own transmissions occur” is applied to partial sensing as well? The paragraph has a text “when the UE performs full sensing”, so we feel a bit ambiguous. |
| Sharp | We are fine with the proposal. |
| Futurewei | If it is by UE implementation to avoid selecting *Y* candidate slots that would collide with UL and other SL transmissions, the step 5 and 5a are ok for partial sensing too. Therefore, the proposal is not necessary. But removing steps 5 and 5a for partial sensing may have performance impact for UE with bad implementation. So, we do not support this proposal. |
| OPPO | OK with the proposal |
| Xiaomi | When the issue was discussed in RAN1#104-e, it is still unclear whether UE may use sensing results after resource (re)selection is triggered. However later we agreed that UE may use sensing results before Y candidate slots but after slot n when resource (re)selection is triggered. This is different from LTE-V, where all the sensing results are available at slot n and thus UE can select only candidate slots without half-duplex issue. By allowing UE to use sensing results in the future, we can no longer assume that Y or Y’ candidate slots without half-duplex issue can be selected by UE implementation. UE cannot preclude future collisions when it determines the set of Y or Y’ candidate resource at slot n.  Therefore, we do not support this proposal. |

### Proposal for Week 1 Tuesday GTW

TBD, depending on comments/inputs to Proposal 5.

Contribution summary for power saving RA

## Selection/reporting of subset of candidate resources within RX-UE's SL DRX active time

* **Approach 1: Purely based on UE implementation (e.g., up to editor to capture existing agreement in 38.214)**
  + [2/Nokia, NSB]
  + Reasons:
    - Freedom for UE to choose and report candidate resources outside the indicated active time of the Rx UE. UE may have choice to report some candidate resources outside active time or to only report candidate resource inside active time.
* **Approach 2: Specify L1 solution in selecting and reporting of subset of candidate resources**
  + [1/HW, HiSi], [3/Futurewei], [5/OPPO], [7/Panasonic], [8/Fujitsu], [9/DCM], [10/IDC], [11/Spreadtrum], [13/ETRI], [15/Apple], [17/CMCC], [19/Xiaomi], [20/Samsung], [21/ MediaTek], [22/QC], [25/LGE], [26/E///], [28/ZTE, Sanechips], [30/HW, HiSi]
  + Possible mechanisms:
    - Option 0: A minimum *N* number of resources within DRX active time should be satisfied (e.g., higher layer indicates the value *N* ranges from 1 to 10)
    - Option 1: A minimum % threshold of resources within DRX active time should be satisfied (e.g., Proposal 2-1 (VII) from RAN1#107bis-e)
    - Option 2: UE first selects resources within the active time of the Rx UE. In case the number of resources is below a threshold X, it is up to UE implementation to select resources outside of the active time until fulfilling the threshold X.
  + Reasons:
    - Current sensing and resource selection procedures in 38.214 cannot ensure there is a subset of the candidate resources within the indicated active time of the RX UE.
    - Better power saving for the RX UE when more resources are included in the subset of the candidate resources, due to less time the RX UE needs to stay awake to receive retransmissions.

## CPS monitoring window / disabling CPS for periodic Tx

* **Lower bound of *M* value in (pre-)configuration**
  + Lower bound for M
    - Zero: [25/LGE], [29/Samsung], [28/ZTE, Sanechips]
    - Non-zero (4 or 5): [1/HW, HiSi], [2/Nokia, NSB], [3/Futurewei], [5/OPPO], [9/DCM]

## Re-evaluation/pre-emption checking for aperiodic Tx

* **FFS: When the minimum M slots for CPS cannot be guaranteed**
  + Solution 1: UE sensing all available slots between initial resource selection and re-evaluation/pre-emption triggering slot (e.g., UE performs sensing until  slots earlier than  in a best effort way)
    - [5/OPPO], [6/CATT, GH], [9/DCM], [10/IDC], [11/Spreadtrum], [15/Apple], [17/CMCC], [20/Samsung], [21/ MediaTek]
  + Solution 2: Use all available sensing results
    - [2/Nokia, NSB]
  + Solution 3: UE performs PBPS after the resource (re)-selection triggering for resource (re-)evaluation and pre-emption checking
    - [26/E///]
  + Solution 3: UE performs random resource selection in an exceptional resource pool
    - [28/ZTE, Sanechips]

## Update of resource exclusion in step 6

* **Update 1: is to be determined based on slot or .**
  + [4/vivo], [5/OPPO], [15/Apple], [25/LGE]:
  + [23/Sharp]:
  + Reason:
    - The sensing occasions determined in PBPS and CPS may be located after slot *n* and such case doesn’t exist in R16 full sensing. Therefore, the reference point / definition for in step 6c should be updated.
  + No change is needed: [3/Futurewei] (step 6c is also used for re-evaluation and pre-emption where the sensing is performed after resource selection triggering slot n.)
* **Update 2: is updated according to:**
  + [5/OPPO], [20/Samsung]: slotminus slot in milliseconds
  + [4/vivo], [8/Fujitsu], [15/Apple], [25/LGE], [27/ITL]: , where slot is the last slot of the selected Y candidate slots.
  + Reason:
    - When slot is determined based on slot rather than slot , should be set to the remaining selection window size.
  + No change is necessary: [3/Futurewei] (The resource on is limited to the RSW of the sensing UE. Therefore, setting an appropriate Q value is just to find the resource conflict within the RSW for efficient check. With a larger Q, the unnecessary slots are included for resource overlap check but will not affect the outcome as is always within the candidate resources in RSW.)
* **Update 3: in step 6c should be calculated separately if *additionalPeriodicSensingOccasion* is (pre-)configured or not when UE is performing partial sensing.**
  + **When *additionalPeriodicSensingOccasion* is not configured, the possible values ofare same as R16 full sensing (i.e., include 1 and).**
  + **When *additionalPeriodicSensingOccasion* is configured:**
    - [4/vivo]: if and ; otherwise . is set to 2.
    - [5/OPPO], [15/Apple]:  *+1 if* *and , otherwise .*
  + Reason:
    - For a periodic reservation detected in the most recent periodic sensing occasion, the reserved resource will be located within the selected *Y* or *Y’* candidate slots. But when the most recent two PSOs are to be sensed by the UE and a periodic reservation is detected in the second most recent PSO, it’s reserved resource will not fall within the selected *Y* or *Y’* candidate resources according to the existing *Q* formulation. And hence, it should be updated.

## Random resource selection in pools with mixed RA schemes

* **Option 1: A priority threshold value or a range of priority levels is (pre-)configured for the resource pool, below or within which random resource selection is allowed. Note, lower value means higher priority. The (pre-)configured threshold can be any of the 8 priority values (including Option 12).**
  + **FFS whether resource pool partitioning can be additionally applied**
  + No resource partitioning: [1/HW, HiSi], [6/CATT, GH], [9/DCM], [10/IDC], [7/Panasonic], [11/ Spreadtrum], [12/Sony] (including 1-bit field in SCI), [17/CMCC], [27/ ITL]
  + With resource partitioning: [3/Futurewei], [20/Samsung], [7/Panasonic]
  + Reasons:
    - HW/HiSi results showed PRR performance degradation for mixed random selection and full sensing RA schemes in the same pool. By adopting Option 1 (priority threshold=2), PRR performance is close to dedicated RP
    - Samsung results showed as the number of groups that users are partitioned into increases, the randomness within each group is reduced leading to less collision and higher PRR.
* **Option 12: No special handling**
  + [2/Nokia, NSB], [20/Samsung] (if no partitioning in Option 1), [22/QC], [5/OPPO]
  + Reasons:
    - QC simulation result: The performance of full-sensing UEs in the system is not noticeably impacted when a proportion of UEs is replaced with ones that do not perform sensing.
    - Unequal interference to full/partial sensing UEs with different priority levels with Option 1. Higher priority UEs would be more impacted by this than lower priority ones.

## FFS: Full sensing UE performing sensing according to (pre-)configuration enabling/disabling for sensing during its DRX inactive time

* **Handling 1: This open issue does not need to be resolved (close the issue without any agreement)**
  + [2/Nokia, NSB], [4/vivo], [5/OPPO], [6/CATT, GH], [9/DCM], [13/ETRI], [14/Intel], [17/CMCC],
  + Reasons:
    - Unclear motivation why a full sensing UE (vehicle UE with continuous power supply) would only need to performing sensing in limited duration of time since the UE does not need to conserve power.
    - A UE configured with SL DRX for power saving for its own reception is not expected to use full sensing for SL transmission for this link
    - If a full sensing UE follows such (pre-)configuration, assuming the (pre-)configuration is “enabled”, it then behaves like a partial sensing UE and monitors only the most recent PSOs and M slots for CPS. When it is disabled, it does not perform any sensing at all during DRX inactive time. These behaviours are exactly the same as a partial sensing UE. When such (pre-)configuration IE is applied in a resource pool, all UE behaves like a partial sensing UE. There is no ‘true’ full sensing UEs at all in the resource pool.
    - No further optimization is needed for full sensing UE
* **Handling 2: Full sensing follows the same (pre-)configuration signalling for enabling/disabling**
  + [3/Futurewei] (when UE supports partial sensing), [15/Apple], [21/ MediaTek]
  + Reasons:
    - For power saving purpose

## How to handle non-monitored slots in partial sensing (e.g., Step 5)

* **Option 1: Step 5 does not apply to UE performing partial sensing**
  + [4/vivo], [5/OPPO], [23/Sharp]
  + Reasons:
    - When UE selects *Y* or *Y’* candidate slots, based on its implementation, the UE should avoid slots where UL / other SL transmission occurs.
    - Same handling as in R14 LTE-V2X
* **Option 2: A slot is excluded if all of the k sensing occasions for each Preserve were not monitored for this slot**
  + [14/Intel]
* **Option 3: This issue should at least be discussed**
  + [16/ASUSTeK]

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Appendix (outcomes of past meetings)

## RAN1#103-e (26/Oct – 13/Nov 2020)

**Conclusion**

* SL reception Type A and Type D should be used as the reference for evaluation and designing of SL power saving features in R17.
  + Type A: UE is not capable of performing reception of any SL signals and channels, FFS with exception of performing PSFCH and S-SSB reception (aim to conclude in RAN1#104-e)
  + Type D: UE is capable of performing reception of all SL signals and channels defined in R16. It does not preclude UE to perform reception of a subset of SL signals/channels
  + If there are evaluations with assumptions other than the above reference, the detailed assumptions need to be reported
  + Note: the types and the associated capability defined here are not intended to be defined as Rel-17 UE features as is.

Agreements:

* Partial sensing based RA is supported as a power saving RA scheme
  + FFS details
* Random resource selection is supported as a power saving RA scheme
  + FFS any changes or enhancement
  + FFS on conditions to apply random resource selection

Agreements:

* In R17, a SL Mode 2 Tx resource pool can be (pre-)configured to enable full sensing only, partial sensing only, random resource selection only, or any combination(s) thereof
  + FFS details, including usage, potential restrictions, whether/how any enhancement or condition is needed for the coexistence of full sensing and power saving RA scheme(s) in a same resource pool, etc.

Agreements:

* Re-evaluation and pre-emption checking are not supported by UEs that do not perform any sensing (i.e. PSCCH reception)
* Re-evaluation and pre-emption checking are supported by UEs that perform sensing
  + FFS details and any conditions(s) in which re-evaluation and pre-emption can be performed
* FFS whether/how re-evaluation and pre-emption can be supported by UEs performing random resource selection that do perform sensing
* Note: details about sensing in this context, including when it is performed, are not decided yet.

Agreements:

* Further study congestion control based on CBR and CR for power saving RA schemes
  + Identify necessary changes from R16 CBR/CR (if any), including transmission resource selection and transmission parameters that can be adjusted and applicable to power savings RA schemes
  + Note: this is not intended to require all UEs to perform sensing for the purpose of CBR measurement

## RAN1#104-e (25/Jan – 05/Feb 2021)

Agreements**:**

* Random resource selection is applicable to both periodic and aperiodic transmissions
  + FFS conditions for random resource selection

**Conclusion:**

* PSFCH reception is not included for Type A UE
* S-SSB reception is not included for Type A UE
* SL reception Type B is additionally added
  + Type B: Same as Type A with an exception of performing PSFCH and S-SSB reception
* Note: the same conditions as in RAN1#103-e regarding the context of the discussion of Type A and Type D still apply (also applicable to type B)

Agreements**:** In a resource pool (pre-)configured with at least partial sensing, if UE performs periodic-based partial sensing, at least when the reservation for another TB (when carried in SCI) is enabled for the resource pool and resource selection/reselection is triggered at slot n, it is up to UE implementation to determine a set of Y candidate slots within a resource selection window, where

* FFS condition(s) and timing(s) for which periodic-based partial sensing is performed by UE
* The resource selection window is [n+T1, n+T2]
  + As a baseline, T1 and T2 are defined in the same way as in R16 NR-V2X according to step 1 [TS 38.214 Sec. 8.1.4]
  + Further discuss whether or not to introduce a threshold to re-define T1 and T2 such that
    - T1≥ 0 (subject to processing time constraint Tproc, 1), and T2 ≤ remaining PDB
    - T2-T1 *≤* (pre-)configured threshold
* A minimum value for Y is (pre-)configured from a range of values, FFS details
* FFS any restriction to determine Y candidate slots (including its relationship with SL-DRX)
* FFS whether the resource selection window [n+T1, n+T2] should be confined within a set of periodic set of resources and its relationship with SL-DRX
* Note: The terminology “periodic-based partial sensing” is based on the “partial sensing” used in LTE-V and it is intended to be used for the design and discussion of partial sensing in Rel-17.

Agreements**:** In a resource pool (pre-)configured with at least partial sensing, if UE performs periodic-based partial sensing, at least when the reservation for another TB (when carried in SCI) is enabled for the resource pool and resource selection/reselection is triggered at slot n, the UE monitors slots of at least one ~~a set of~~ periodic sensing occasion~~s~~, where a periodic sensing occasion is a set of slots according to 

if tvSL is included in the set of Y candidate slots.

* *P*reserve is a periodicity value from the configured set of possible resource reservation periods allowed in the resource pool (*sl-ResourceReservePeriodList*). Down select to one:
  + Option 1: *P*reserve corresponds to all values from the configured set *sl-ResourceReservePeriodList*
  + Option 2:  *P*reserve corresponds to a subset of values from the configured set *sl-ResourceReservePeriodList*
    - FFS how to determine the subset (e.g., by (pre-)configuration, UE determination)
  + Option 3:  *P*reserve is a common divisor among values in the configured set *sl-ResourceReservePeriodList*
  + Option 4: FFS others
* k ~~equals to~~is selected according to (down select to one)
  + Option 1: Only the most recent sensing occasion ~~within sensing window~~ for a given reservation periodicity before the resource (re)selection trigger or the set of Y candidate slots subject to processing time restriction
  + Option 2: The two most recent sensing occasions ~~within sensing window~~ for a given reservation periodicity before the resource (re)selection trigger or the set of Y candidate slots subject to processing time restriction
  + Option 3: All possible sensing occasions after
  + Option 4: Only one periodic sensing occasion for one reservation period. The k value is up to UE implementation. Max value for k is (pre-)configured.
  + Option 5: k is (pre-)configured, including multiple values
  + Option 6: (pre-)configuration of a bitmap, same as in LTE-V
  + Option 7: FFS others
* FFS relationship between periodic sensing occasions and SL-DRX
* FFS condition(s) and timing(s) for which periodic-based partial sensing is performed by UE
* Note: companies are encouraged to show performance data for the down selections

Agreements:

* In a resource pool (pre-)configured with at least partial sensing, if UE performs contiguous partial sensing and resource (re-)selection is triggered in slot n, support the following option:
  + Option 1: For the purpose of resource (re-)selection, the UE monitors slots between [*n*+*T*A, *n*+*T*B] and performs identification of candidate resources, in or after slot *n*+*T*B, based on all available sensing results, including periodic-based partial sensing results (if applicable).
    - FFS *T*A, *T*B (including the possibility of equal to zero, positive or negative) and remaining details (in particular, whether there should be exclusion of slots, changes in TA/TB values for different purposes, etc.)
    - FFS whether n can be replaced by e.g., index of some of Y candidate slots
  + FFS condition(s) in which contiguous partial sensing is performed by UE
  + FFS interaction with SL-DRX, if any
  + FFS interaction with periodic-based partial sensing, if any
  + Other options are not precluded
  + Note: This option is not to replace random resource selection only without sensing or re-evaluation and pre-emption checking

## RAN1#104b-e (12 – 20 April 2021)

**Conclusion:**

* In periodic-based partial sensing,
  + It is not necessary to further discuss whether or not to introduce a threshold to re-define T1 and T2.

**Agreements:**

* In periodic-based partial sensing,
* For the set of *P*reserve values, down-select to one of the following in RAN1#105-e
  + - Alt.1: *P*reserve corresponds to all values from the configured set *sl-ResourceReservePeriodList*
    - Alt.2: A set of *P*reserve values is (pre-)configured and includes up to the full set of values from the configured set *sl-ResourceReservePeriodList*
      * FFS if support multiple sets of *P*reserve values based on one or more metrics
      * FFS whether/how to restrict the set of values
* For the k value, down-selection to one of the following in RAN1#105-e (further refinement of each of the alternatives is possible)
  + - * + Alt 1: Option 1 as in RAN1#104-e
        + Alt 2: A modified Option 5 as in RAN1#104-e, where the modification is such that it also includes option 1

FFS how to (pre-)configure (e.g. including bitmap), whether a maximum number of k values is needed, and whether it can be up to UE implementation to select a k value based on the (pre-)configuration

* + - * + FFS details, e.g., sensing before the resource (re)selection trigger or the first slot of the set of Y candidate slots subject to processing time restriction, etc.
      * Note: companies are encouraged to provide more evaluations

**Agreement:**

* When periodic-based partial sensing is potentially performed by UE in a mode 2 Tx resource pool provided by higher layer, at least all of the followings are met:
  + Periodic reservation for another TB (sl-MultiReserveResource) is enabled for the resource pool
  + The resource pool is (pre-)configured to enable partial sensing
  + Partial sensing configured by higher layer in the UE

## RAN1#105-e (10 – 27 May 2021)

Agreement:

* For the set of *P*reserve values in periodic-based partial sensing,
  + If no (pre-)configuration (i.e., by default), *P*reserve corresponds to all values from the (pre-)configured set *sl-ResourceReservePeriodList*.
  + Otherwise, a single set of *P*reserve values can be (pre-)configured, where the set of P*reserve* values are restricted to a subset of the (pre-)configured set *sl-ResourceReservePeriodList*
    - This is per mode 2 Tx resource pool (pre-)configuration
    - A UE by implementation may also monitor other *sl-ResourceReservePeriodList* values not part of the restricted subset
      * In particular, the UE may additionally monitor occasions corresponding to P\_RSVP\_Tx
        + FFS whether the monitoring can be mandatory

Agreement:

* In periodic-based partial sensing for resource (re)selection, the UE at least monitors in periodic sensing occasion(s) for a given reservation periodicity before the first slot of the selected Y candidate slots subject to processing time restriction for the identification of candidate resources.

  o   The processing time restriction includes *Tproc,0SL*  and *Tproc,1SL*.

  o   Aspects relating to sensing during SL DRX are to be discussed separately

* Relationship to re-evaluation and pre-emption operation for periodic-based partial sensing to be discussed separately
  + FFS details including whether monitoring of periodic sensing occasions between triggering slot n and the first slot of the selected Y candidate slots subject to processing time restriction is performed as part of resource (re)selection or re-evaluation and pre-emption checking

Agreement:

* For the k value in periodic-based partial sensing for resource (re)selection,
  + By default, the UE monitors the most recent sensing occasion for a given reservation periodicity before the resource (re)selection trigger slot n or the first slot of the set of Y candidate slots subject to processing time restriction.
  + If (pre-)configured, UE additionally monitors periodic sensing occasions that correspond to a set of values which can be (pre-)configured with at least one value
    - (Working assumption) Possible values correspond to the most recent sensing occasion for a given reservation periodicity before the resource (re)selection trigger slot n or the first slot of the set of Y candidate slots, and the last periodic sensing occasion prior to the most recent one for the given reservation periodicity are included.
    - FFS: whether/which other values and details of the (pre-)configuration (e.g. max number of values or sensing occasions)
    - FFS: whether a value denotes a specific occasion to monitor or the earliest occasion to start the monitoring.
  + FFS relationship between periodic-based partial sensing occasions and SL-DRX
  + Note:
    - This is for the case when the resource (re)selection triggering slot n is expected by UE

Agreement:

* For random resource selection,
  + Reuse the maximum distance separation of 32 logical slots for a HARQ retransmission resource reserved by a prior SCI for the same TB, which was defined in R16 for full sensing operation.
  + SL HARQ feedback enabled transmission is supported (FFS applicable conditions if any)
    - The minimum HARQ feedback time gap (Z) shall be respected between any two selected resources of a TB where a HARQ feedback for the first of these resources is expected.
* FFS the impact of resource collision when random resource selection is performed by a UE which does not perform sensing / re-evaluation and pre-emption checking in a resource pool with mixed RA schemes (e.g. for low priority or any priority transmissions).
  + Including study potential solution(s) if the impact is not negligible (e.g. threshold based, raising priority, minimum time gap, pattern based, a priori SCI reserving initial transmissions, resource pool partitioning, and etc.).

Agreement**:** In contiguous partial sensing for resource (re)selection, *TA* and *TB* values can be zero, positive or negative

* *TA* and *TB* values or range depend on different operating scenarios or conditions (e.g., periodic/aperiodic traffic, predictability of triggering slot n, remaining PDB, re-evaluation/pre-emption checking, HARQ feedback, CBR/CR parameter, power saving, etc)
  + FFS details
* FFS: details of how periodic-based partial sensing and contiguous partial sensing are used for re-evaluation and pre-emption checking. Including how to reduce UE’s power consumption (caused by additional sensing operation of re-evaluation/pre-emption) after its resource selection, with the considerations of different operating scenarios or conditions (e.g., pre-emption enabled/disabled, HARQ-ACK enabled/disabled, etc).

## RAN1#106-e (16 – 27 August 2021)

**Agreement**

In periodic-based partial sensing, UE monitoring of periodic sensing occasions between triggering slot n and the first slot of the selected Y candidate slots subject to processing time restriction is performed as part of resource (re)selection.

**Agreement**

Conditions in which contiguous partial sensing is performed by UE, when at least all of the followings are met:

* L1 [is expected to be or] is triggered by higher layer to report resources for resource (re-)selection in a mode 2 Tx pool
  + FFS: When the trigger will be received by L1
* The resource pool is (pre-)configured to enable partial sensing
* Partial sensing is configured by higher layer in the UE

**Agreement**

For a resource pool (pre-)configured with at least partial sensing and UE is configured by its higher layer for partial sensing,

* Periodic-based partial sensing and contiguous partial sensing schemes are supported for resource re-evaluation and pre-emption checking
  + FFS details of partial sensing for re-evaluation and pre-emption checking, including any restrictions / conditions on performing PBPS and CPS, subset of resources, timing, candidate resource set (*SA*) and etc
* Same as in Rel-16, the higher layer indicates a set of resources and/or a set of resources for re-evaluation and/or pre-emption checking, respectively
  + Pre-emption checking is enabled according to the Release-16 interpretation of *sl-PreemptionEnable.*
    - FFS: If additional enhancements are needed for enabling/disabling
* The triggering of re-evaluation and pre-emption checking is as in R16.

**Agreement**

**When UE performs only contiguous partial sensing (CPS) in a mode 2 Tx pool with periodic reservation for another TB (*sl-MultiReserveResource*) disabled, and a resource (re)selection is triggered in slot n,**

* **The resource selection window (RSW) is [**n+T1**,** n+T2**] where** T2 **is defined based on step 1) of Rel-16 TS 38.214 Sec. 8.1.4**
  + FFS whether the resource selection window **[**n+T1**,** n+T2**]** should be confined within a set of periodic set of resources and its relationship with SL-DRX
* **On the sensing window [**n+TA**,** n+TB**] for CPS,**
  + Details of TA and TB values based on the agreements from previous RAN1 meetings
  + FFS whether and how to define a minimum CPS window size, including (pre-)configurability and the case when TB **-** TA **is smaller than the minimum CPS window size**
  + FFS whether and how to define a maximum value / upper bound for TB with respect at least to the minimum RSW size and the remaining PDB, including (pre-)configurability
* **FFS how a set of candidate resource (**SA**) is initialized** considering candidate single-slot resources, including
  + Whether and how to define a minimum size for the RSW (e.g., Rel-16 T2min), including (pre-)configurability
  + Whether the set SA is confined within a set of Y candidate slots within the RSW
* **UE performs resource exclusion from the set** SA **based on at least all available sensing results and based on step 6) and 7) of Rel-16 TS 38.214 Sec. 8.1.4**
* **Note, re-evaluation and pre-emption checking in a resource pool with periodic reservation for another TB (*sl-MultiReserveResource*) disabled is considered separately.**
* **FFS: Details on** T1

**Agreement**

For random resource selection in a resource pool (pre-)configured with full/partial sensing and random resource selection, down-select to one of the followings in RAN1#106bis-e

* Option 1: A priority threshold value or a range of priority levels is (pre-)configured for the resource pool, below or within which random resource selection is allowed
  + Note, lower value means higher priority
  + FFS whether resource pool partitioning can be additionally applied
* Option 2: Increase the priority for the transmission based on random selection and indicate the new priority value in the priority field in the 1st-stage SCI
  + FFS: An extra field is added in SCI for indicating the original priority value associated with QoS requirement,
  + FFS: A 1-bit field in the SCI indicates that the UE is performing random resource selection, or
  + FFS: An extra field is added in SCI for indicating the mapping to the original priority value associated with QoS requirement.
* Option 7: Exclude resources reserved by UE performing random selection without re-evaluation / pre-emption checking, regardless of their priorities. E.g. a 1-bit field in the SCI indicates that the UE is performing random resource selection and not performing re-evaluation and pre-emption checking
* Option 12: No special consideration

**Agreement**

When UE performs periodic-based and contiguous partial sensing schemes in a mode 2 Tx pool with periodic reservation for another TB (sl-MultiReserveResource) enabled,

* For a resource (re)selection procedure triggered by aperiodic transmission (Prsvp\_TX=0) in slot n,
  + The resource selection window (RSW) is [n+T1, n+T2], and T1 and T2 are defined in the same way according to step 1) of Rel-16 TS 38.214 Sec. 8.1.4
    - FFS whether UE determines a new set of Y candidate slots within the RSW and monitors corresponding periodic sensing occasions between slot n and the first slot of the new Y candidate slots subject to processing constraints
    - FFS how to initialize a set of candidate resource (SA) for the triggered resource (re)selection procedure and which partial sensing scheme(s) and results can be used for resource exclusion in the resource (re)selection procedure
    - FFS whether the resource selection window [n+T1, n+T2] should be confined within a set of periodic set of resources and its relationship with SL-DRX
* Note, re-evaluation and pre-emption checking based on periodic-based and contiguous partial sensing schemes is considered separately

**Agreement**

When UE performs periodic-based and contiguous partial sensing schemes in a mode 2 Tx pool with periodic reservation for another TB (sl-MultiReserveResource) enabled,

* For a resource (re)selection procedure triggered by periodic transmission (Prsvp\_TX≠0) in slot n
  + A set of candidate resource (SA) is initialized to the set of selected Y candidate slots of PBPS
    - UE performs contiguous partial sensing in [n+TA, n+TB] for resource exclusion from the initialized candidate resource set (SA)
      * FFS details of TA and TB based on the agreement(s) from previous RAN1 meetings
* Note, re-evaluation and pre-emption checking based on periodic-based and contiguous partial sensing schemes is considered separately

FFS: The condition under which UE performs periodic-based and contiguous partial sensing schemes in a mode 2 Tx pool with periodic reservation for another TB (sl-MultiReserveResource) enabled

## RAN1#106bis-e (11 – 19 October 2021)

**Working Assumption**

When PHY layer is indicated with an active time of RX UE from MAC layer for candidate resource selection, a restriction is applied in PHY layer so that at least a subset of candidate resources reported to MAC layer is located within the indicated active time of the RX UE. The following options will be further discussed in RAN1 to restrict resources for candidate resource selection taking into account the indicated active time from MAC layer:

* Option 1: PHY layer selects and reports candidate resources only within the indicated 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 the indicated active time of the RX UE
* Option 3: PHY layer selects and reports an additional candidate resource set of candidate resources within the indicated active time of the RX UE

**Agreement**

In the agreement from RAN1#105-e, the working assumption is confirmed and the FFS bullet (in RED) is closed without any agreement.

|  |
| --- |
| Agreement from RAN1#105-e:   * For the k value in periodic-based partial sensing for resource (re)selection,   + By default, the UE monitors the most recent sensing occasion for a given reservation periodicity before the resource (re)selection trigger slot n or the first slot of the set of Y candidate slots subject to processing time restriction.   + If (pre-)configured, UE additionally monitors periodic sensing occasions that correspond to a set of values which can be (pre-)configured with at least one value     - (Working assumption) Possible values correspond to the most recent sensing occasion for a given reservation periodicity before the resource (re)selection trigger slot n or the first slot of the set of Y candidate slots, and the last periodic sensing occasion prior to the most recent one for the given reservation periodicity are included.     - FFS: whether/which other values and details of the (pre-)configuration (e.g. max number of values or sensing occasions)     - FFS: whether a value denotes a specific occasion to monitor or the earliest occasion to start the monitoring.   + FFS relationship between periodic-based partial sensing occasions and SL-DRX   + Note:     - This is for the case when the resource (re)selection triggering slot n is expected by UE |

**Agreement**

When UE performs periodic-based and contiguous partial sensing schemes in a mode 2 Tx pool with periodic reservation for another TB (*sl-MultiReserveResource*) enabled,

* For a resource (re)selection procedure triggered by periodic transmission () in slot *n*, *TA* and *TB* for the CPS monitoring window is defined according to one of the followings:
  + *n*+*T*A is *M* logical slots earlier than slot , and *n*+*T*B is slots earlier than , where is the first slot of the selected *Y* candidate slots of PBPS, and , are in units of physical time/slots.
    - By default, *M* is 31 unless (pre-)configured with another value.

**Agreement**

For the periodic sensing occasion(s) (PSO(s)) that a UE needs to additionally monitored in PBPS, it shall be (pre-)configured jointly for all *Preserve* values.

* The UE is not required to monitor PSOs earlier than *n–T0* if the UE is triggered to do resource (re)selection in slot n, where *T0* is (pre-)configured

**Agreement**

When UE performs at least contiguous partial sensing in a mode 2 Tx pool for a resource (re)selection procedure triggered by aperiodic transmission (*P*rsvp\_TX*=0*) in slot *n*, *TA* and *TB* for CPS monitoring window and a candidate resource set (*SA*) is initialized according to potentially one of the following approaches (final decision in RAN1#107-e). Other approaches are not precluded and the details in each approach can still be updated.

* Approach 1: (*SA*is initialized based on at least slots with PBPS and/or CPS results and guarantee a minimum of *M* slots for CPS)
  + The UE selects a set of *Y’* candidate slots with corresponding PBPS and/or CPS results (if available) within the RSW.
    - FFS how to handle the case if the total number of *Y’* candidate slots is less than a (pre-)configured threshold *Y’min* without dropping the aperiodic transmission
    - FFS whether the Y’ candidate slots for aperiodic transmission is the same as the Y candidate slots in PBPS for periodic transmission of another TB(s)
    - FFS whether/how to prioritize/select resources based on partial sensing results.
    - FFS: How to select Y’ in case of CPS only
  + Candidate resource set (*SA*) is initialized to the set of all single-slot candidate resources in the selected *Y’* candidate slots.
  + For the CPS monitoring window [*n*+*T*A, *n*+*T*B]:
    - *TA* and *TB* are both selected such that UE has sensing results for a minimum of *M* consecutive logical slots before *ty0*, where *ty0* is the first slot of the selected *Y’* candidate slots.
      * FFS: By default, *M* is 31 unless (pre-)configured with another value, or M is (pre-)configured based on transmission priority
      * FFS the range of (pre-)configured *M* from a TBD lowest value up to 30
      * FFS: how to handle the case when the minimum *M* slots for CPS cannot be guaranteed
  + FFS: RSW in case of CPS only
* Approach 2: (*SA* is initialized based on all candidate single-slot resources and guarantee a minimum of *M* slots for CPS)
  + Candidate resource set (*SA*) is initialized to the set of all candidate single-slot resources in [*n+TB+Tproc,0+Tproc,1*, *n+T2*], where *TB* is selected by the UE such that length of [*n+TB+Tproc,0+Tproc,1*, *n+T2*] ≥ *T2min*.
    - *Tproc,0*, *Tproc,1* are in units of physical time/slots
    - FFS whether/how to prioritize/select resources based on partial sensing results (if PBPS is performed).
  + For the CPS monitoring window [*n*+*T*A, *n*+*T*B]:
    - *T*A = X
      * FFS value X for *TA* including X=1 and negative value
    - *TB* is selected such that UE has sensing results for a minimum of *M* consecutive logical slots before the start of (*n+TB+Tproc,0+Tproc,1*).
      * FFS: By default, *M* is 31 unless (pre-)configured with another value, or M is (pre-)configured based on transmission priority
      * FFS the range of (pre-) configured *M* from a TBD lowest value up to 30
      * FFS: how to handle the case when the minimum *M* slots for CPS cannot be guaranteed
* Approach 3: (independent approach for different case)
  + When UE additionally performs periodic-based partial sensing in the resource pool, the above Approach 1 applies.
  + When UE does not perform periodic-based partial sensing in a resource pool that does not allow resource reservation for another TB, the above Approach 2 applies.

**Working Assumption**

In a resource pool (pre-)configured to enable partial sensing, when UE is configured with partial sensing by its higher layer, the resources for which the UE performs re-evaluation and/or pre-emption checking are for the initial transmission and retransmissions of every TB according to Rel-16 specification based on partial sensing results.

* Same as in Rel-16, for periodic transmission, re-evaluation check is not applied to the resources that have been signalled in current period or previous periods, except that it is up to UE implementation whether to apply re-evaluation check to the resources in non-initial reservation period that have been signalled neither in the immediate last nor in the current period.
* The resource in the main bullet is the set of resources (*r*0, *r*1, *r*2, …) and/or the set of resources (*r*0', *r*1', *r*2', …)  for re-evaluation and/or pre-emption checking, respectively, which has been agreed in RAN1 #106-e.

## RAN1#107-e (11 – 19 November 2021)

**Agreement**

When UE performs at least contiguous partial sensing in a mode 2 Tx pool for a resource (re)selection procedure triggered by aperiodic transmission (*P*rsvp\_TX*=0*) in slot *n*, the general design framework in Approach 1 from RAN1#106bis-e in below is adopted. Note that, the details can still be updated.

* Approach 1: (*SA*is initialized based on at least slots with PBPS and/or CPS results and guarantee a minimum of *M* slots for CPS)
  + The UE selects a set of *Y’* candidate slots with corresponding PBPS and/or CPS results (if available) within the RSW.
    - FFS how to handle the case if the total number of *Y’* candidate slots is less than a (pre-)configured threshold *Y’min* without dropping the aperiodic transmission
    - FFS whether the Y’ candidate slots for aperiodic transmission is the same as the Y candidate slots in PBPS for periodic transmission of another TB(s)
    - FFS whether/how to prioritize/select resources based on partial sensing results.
    - FFS: How to select Y’ in case of CPS only
  + Candidate resource set (*SA*) is initialized to the set of all single-slot candidate resources in the selected *Y’* candidate slots.
  + For the CPS monitoring window [*n*+*T*A, *n*+*T*B]:
    - *TA* and *TB* are both selected such that UE has sensing results for a minimum of *M* consecutive logical slots before *ty0*, where *ty0* is the first slot of the selected *Y’* candidate slots.
      * FFS: By default, *M* is 31 unless (pre-)configured with another value, or M is (pre-)configured based on transmission priority
      * FFS the range of (pre-)configured *M* from a TBD lowest value up to 30
      * FFS: how to handle the case when the minimum *M* slots for CPS cannot be guaranteed
  + FFS: RSW in case of CPS only

**Agreement**

When SL DRX active time of Rx-UE is provided by the higher layer for candidate resource selection (including resource (re)selection and re-evaluation/pre-emption checking), the following working assumption is confirmed with option 2 as agreement (with modification in RED)

**Working Assumption (RAN1#106bis-e)**

When PHY layer is indicated with an active time of RX UE from MAC layer for candidate resource selection, a restriction is applied in PHY layer so that at least a subset of candidate resources reported to MAC layer is located within the indicated active time of the RX UE. The following options will be further discussed in RAN1 to restrict resources for candidate resource selection taking into account the indicated active time from MAC layer:

* ~~Option 1: PHY layer selects and reports candidate resources only within the indicated 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 the indicated active time of the RX UE
  + FFS: Details on when the number of subsets of candidate resource is less than the threshold
  + FFS: The subset of candidate resource outside of the active time should consider each inactive time period
  + FFS: UE selection of resource selection window to overlap with indicated RX UE active time
  + FFS: Whether it is up to UE implementation to report candidate resources only within the indicated active time of the RX UE
* ~~Option 3: PHY layer selects and reports an additional candidate resource set of candidate resources within the indicated active time of the RX UE~~

**Agreement**

When UE performs at least contiguous partial sensing in a mode 2 Tx pool for a resource (re)selection procedure triggered by aperiodic transmission (*P*rsvp\_TX*=0*) in slot *n*,

* The UE selects a set of *Y’* candidate slots with corresponding PBPS and/or CPS results (if available) within the RSW.
  + If the total number of *Y’* candidate slots is less than a (pre-)configured threshold *Y’min*,
    - How UE includes other candidate slots is up to UE implementation
* Candidate resource set (*SA*) is initialized to the set of all single-slot candidate resources in the selected *Y’* candidate slots.
* For the CPS monitoring window [*n*+*T*A, *n*+*T*B]:
  + *TA* and *TB* are both selected such that UE has sensing results starting at *M* consecutive logical slots before *ty0* and ending at *Tproc,0* + *Tproc,1* slots earlier than *ty0*.
    - FFS: By default, *M* is 31 unless (pre-)configured with another value, ~~or~~ where *M* is (pre-)configured based on transmission priority
    - FFS: The range of (pre-)configured *M* from a TBD lowest value up to 30
    - When the minimum *M* slots for CPS cannot be guaranteed, support both
      * Option A, the UE ensures the *Y’min* criterion is fulfilled
      * Option B: UE performs random resource selection
      * When the UE performs Option A or Option B is up to UE implementation

**Conclusion**

No additional triggering enhancement on top of existing Rel-16 mechanism in re-evaluation and pre-emption checking for partial sensing UEs in Rel-17, including enabling / disabling re-evaluation by (pre-)configuration.

* This does not restrict the triggering of re-evaluation and pre-emption checking due to inter-UE coordination message in scheme 2 (if agreed).

**Agreement**

When UE is triggered to perform re-evaluation and pre-emption checking for periodic transmission (*P*rsvp\_TX*≠0*) in slot *n*,

* During the *q*th reservation period (*q*=0,1,2,…, *Cresel*-1), candidate resource set (*SA*) is initialized to the remaining *Y* candidate slots starts from slot and ends at the last slot of the *Y* candidate slots, where the slot indices of the remaining *Y* candidate slots are equal to [*q* x *Prsvp\_Tx* + ], where is a slot index of *Y* candidate slots used in the initial resource (re)selection.
  + is the first candidate slot after slot *n+T3*.
  + FFS whether/how to handle the case when number of the remaining *Y* candidate slots is less than *Ymin*.
* Scheme 1:
  + UE performs PBPS for the remaining *Y* candidate slots according to, whereis a slot belong to the remaining *Y* candidate slots, and *k* and *Preserve* are the same as resource (re)selection.
  + UE performs CPS starts from *M* logical slots earlier than to  slots earlier than .
    - By default, *M* is 31 unless (pre-)configured with another value.

**Agreement**

When UE performs random resource selection, LTE principle is reused:

* The UE is not required to measure CBR.
* When no SL CBR measurement result is available, a (pre-)configured SL CBR value is used.

**Working assumption**

For UE performs partial sensing or random resource selection, Rel-16 SL CR evaluation is directly reused.

**Agreement**

For SL CBR measurement in partial sensing, select one option in the following:

* Option 1, 2, 3: SL RSSI is measured for slots in which the UE performs partial sensing and PSCCH/PSSCH reception over a SL CBR measurement window defined in Rel-16. The calculation of SL CBR is limited within the slots for which the SL RSSI is measured.
  + If the number of SL RSSI measurement slots is below a (pre-)configured threshold, FFS the following or other options.
* Option 1: a (pre-)configured SL CBR value is used.
* Option 2: the UE additionally measure a set of slots within the SL CBR measurement window to meet the threshold.
* Option 3: the UE measures an additional set of slots which can be extended outside the SL CBR measurement window to meet the threshold.
* FFS whether the set of slots in option 2/3 are (pre-) configured or selected by UE implementation.
  + Option 4: LTE principle is reused:
* The UE is not required to measure CBR.
* When no SL CBR measurement result is available, a (pre-)configured SL CBR value is used

## RAN1#107bis-e (17 – 25 January 2022)

**Agreement**

When UE is configured to perform partial sensing by a UE higher layer (including when SL DRX is configured), SL RSSI is measured in slots where the UE performs partial sensing and PSCCH/PSSCH reception over the SL CBR measurement window defined in Rel-16. The calculation of SL CBR is limited within the slots for which the SL RSSI is measured.

* If the number of SL RSSI measurement slots is below a (pre-)configured threshold, a (pre-)configured SL CBR value is used.

**Agreement**

When UE is triggered to perform re-evaluation and pre-emption checking for aperiodic transmission (*P*rsvp\_TX*=*0) in slot *n*,

* The candidate resource set (*SA*) is initialized to the remaining *Y’* candidate slots that starts from slot and ends at the last slot of the *Y’* candidate slots.
  + is the first candidate slot after slot *n+T3*.
* UE may perform PBPS for periodic sensing occasions after the resource (re)selection when *sl-MultiReserveResource* is enabled for the mode 2 Tx resource pool
  + It is up to UE implementation
* UE performs CPS starting from at least *M* consecutive logical slots earlier than to  slots earlier than .
  + FFS: When the minimum *M* slots for CPS cannot be guaranteed,
* All available sensing results not earlier than *n–T0* for the resource pool indicated by higher layer are applied for re-evaluation and pre-emption checking procedures

**Agreement**

When UE performs at least contiguous partial sensing in a mode 2 Tx pool for a resource (re)selection procedure and re-evaluation/pre-emption checking triggered by aperiodic transmission (*P*rsvp\_TX*=0*) in slot *n*,

* For minimum size M of the CPS monitoring window [*n*+*T*A, *n*+*T*B]:
  + By default, *M* is 31 unless (pre-)configured with another value
  + The range of (pre-)configured *M* is from 0 (working assumption) to 30

**Agreement**

**When UE performs only contiguous partial sensing (CPS) in a mode 2 Tx pool with periodic reservation for another TB (*sl-MultiReserveResource*) disabled, and a resource (re)selection is triggered in slot *n*,**

* T1 **is defined based on step 1) of Rel-16 TS 38.214 Sec. 8.1.4.**
  + No update to specification is necessary due to this agreement
* Note: The selected *Y’* slots do not overlap with the sensing window

**Agreement**

Whether UE performs SL reception of PSCCH and RSRP measurement for partial sensing on slots in SL DRX inactive time is enabled/disabled by (pre-)configuration per resource pool when partial sensing is configured in the UE by a higher layer.

* When it is enabled,
  + When UE performs periodic-based partial sensing for a given *Preserve*, UE monitors only the default periodic sensing occasion.
  + When UE performs contiguous partial sensing, UE monitors a minimum of *M* slots for CPS.
* Note, when it is disabled, the UE is not required to perform SL reception of PSCCH and RSRP measurement in SL DRX inactive time.
* Note: no further optimization on the resource (re)selection procedure with regard to SL DRX operation is specified in Rel.17.
* FFS the case when full sensing is configured in the UE by a higher layer