**3GPP TSG RAN WG1 #106bis-e R1-2110478**

**e-Meeting, October 11 –19, 2021**

**Source: Moderator (OPPO)**

**Title: FL summary for AI 8.11.1.1 – resource allocation for power saving (before 2nd GTW)**

**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#106bis-e

Agreements reached during October 14th GTW session for R17 NR eSL

**Agreement**

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

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| *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.

Topics for email discussion

[106bis-e-NR-R17-Sidelink-01] Email discussion on resource allocation for power saving– Kevin (OPPO)

* 1st check point: October 14
* Final check point: October 19

## Topic #1: Remaining issues in PBPS (resolving FFS items)

**Background**: The working assumption (WA) from RAN1#105-e on the (pre-)configuration of periodic sensing occasions for k and the subsequent FFS items should be finalized in this meeting for the RRC parameter list. From reviewing contributions submitted to this meeting (in Section 4), the majority of companies (11) see no technical issue or enhancement needed to include more *k* values on top of the most recent two periodic sensing occasions per *Preserve* in the existing WA. On the other hand, 5 companies propose to include more k values / PSOs to provide more flexibility. However, it was argued that such flexibility is not needed as the most recent two PSOs will provide the most updated/relevant reservation information, more power consumption will be needed to monitor more PSOs, and it is not in line with R14 partial sensing where only the most recent PSO is monitored per reservation period.

Moreover, it is brough up that the product of the resource reservation periodicity *Preserve* and its corresponding *k* value is upper bounded by a (pre)configured threshold.

For the set of (pre-)configured *P*reserve values, there is still an open FFS on whether UE is mandated to monitor PSOs corresponding to *PRSVP\_Tx* when it is not part of the (pre-)configured set. Based on reviewing the contributions, 8 companies think it is unnecessary while 4 think it should be mandated.

### Questions before 1st GTW session

**Question: For UE monitoring periodic sensing occasions (PSOs) In periodic-based partial sensing (PBPS),**

* **Question 1-1:** Is it agreeable that when (pre-)configured, only the two most recent PSOs (before the first slot of *Y* candidate slots subject to processing time restriction) per reservation periodicity can be monitored by the UE according to the WA made for *k* value in RAN1#105-e?
  + If yes, the following two FFS items can be closed, besides the details of the (pre-)configuration can be handled as part of RRC parameter list discussion.
    - 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.
  + If no, which other values / PSOs should be included for the flexibility enhancement and whether a value denotes a specific occasion to monitor or the earliest occasion to start the monitoring.

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| **Company** | **Yes/No** | **Comments** |
| Xiaomi | Yes | From our point of view, the current working assumption can work and there is no need to further optimize on this case. |
| Ericsson | Yes | We propose to confirm the WA from RAN1#105-e where the two most recent sensing occasions are monitored if they are (pre-)configured. |
| Fraunhofer | No | We prefer to maintain flexibility with regards to the UE monitoring the number of PSOs depending on the priority of the transmission. For example, k could indicate the last 4 PSOs and UEs could use the two most recent PSOs for low priority transmissions, three for medium and 4 for high priority transmissions. This can be a trade-off between reduced power consumption and enhanced performance. |
| Qualcomm | Please see comment | The proposal needs to be clarified as whether the additional monitoring is enabled for all periodicities jointly or independently. We support jointly enabling/disabling of the additional monitoring for all periodicities. |
| Futurewei | No | We propose to have more sensing occasions and only specify a maximum number of sensing occasions for every periodicity and leave the (pre-)configurations for each periodicity to the implementation. Since there are many overlaps on the sensing slots between the third most recent sensing occasion and the two most recent sensing occasions for different periodicities and different slots in the Y candidate slots, the additional slots for UE to monitor are not many, compared with the slots in two most recent sensing occasions. Moreover, by specify a maximum number of sensing occasions. We do not need to specify additional restriction as in Question 1-2.  We are ok to have maximum number of sensing occasion being 3.  The value in the (pre)configuration denotes a specific occasion to monitor. |
| Apple | No | We think the largest k value for each periodicity P\_reserve could be configured. Probably, the configuration of largest k value is related to T\_0 in Question 1-2. |
| LGE | Yes | We prefer (pre-)configuration for full flexibility of the network. But for making progress, if majority prefer most two recent PSOs, we’re ok for it with one clarification. The PSO is (pre-)configured per periodicity, which includes possibility of (pre-)configuring PSO separately for each periodicity. |
| Convida Wireless | Yes | We are ok to confirm the WA when (pre-)configured only the two most recent PSOs (before the first slot of *Y* candidate slots subject to processing time restriction) per reservation periodicity can be monitored by the UE according to the WA made for *k* value in RAN1#105-e. |
| OPPO | Yes | This is a trade-off between power saving and reliability. Current WA can work and there is no necessary to perform additional optimization at current stage. |
| Samsung | Yes with comments | We’re fine two remove the two FFS bullets, but have concern on confirming the WA as the wording is ambiguous with the phrase “Possible values”.  One point from the RRC parameter discussion is whether to configure the monitoring of using a single value for all monitored periodicities or to have a value configured for each periodicity. This point should be discussed in this meeting and we prefer the latter solution. |
| NTT DOCOMO | Yes | We do not see benefit from high flexible configurations of k value. Two most recent sensing occasions are sufficient. |
| Spreadtrum | Yes | We support to confirm the WA in RAN1#105-e that the two most recent PSOs per reservation periodicity are monitored when (pre-)configured. |
| Huawei, HiSilicon | Yes | The point in the question is already settled by the working assumption, unless and until the working assumption is cancelled. It does not need to be re-addressed here, if at all time-consuming. We are fine to confirm the working assumption, but otherwise suggest not spending time trying to do so.  Agree that the two FFS can be closed. |
| Fujitsu | No | We agree FutureWei and Apple to have more sensing occasions and only specify a maximum number of sensing occasions to bring more flexibilities. |
| vivo | No | The values that can be included can be any value that does not exceed a certain limit. For example, it can be specified that the earliest occasion that the UE can monitor for a TB is the 10th most recent occasion before the resource set, then any value corresponding to an occasion that is not earlier than that occasion can be configured, e.g., if 10 corresponds to the 10th most recent occasion, then a value <=10 can be configured. |
| CATT | Yes | We are ok to close the FFS |
| Lenovo&MotM | Yes | To consider the progress, we share the same view with Xiaomi, further optimization is not needed. |
| Panasonic | Yes | We agree to confirm the WA. |
| ZTE, Sanechips | No | Similar view as vivo |
| Nokia, NSB | Yes | This WA was agreed two meetings ago. We shall close this by confirming the WA. |

* **Question 1-2:** Is it agreeable to restrict UE monitoring of PSOs not earlier than *T0*, the (pre-)configured sensing window for the Tx resource pool (*sl-SensingWindow*)?

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| **Company** | **Yes/No** | **Comments** |
| Xiaomi | Yes | First of all, it should be PSOs not earlier than n-T0, where T0 is defined the same as in sensing window of Rel-16 V2x.  We support the proposal. Even for full sensing based resource selection, the sensing results before n-T0 is not considered in resource (re)selection. The sensing results before n-T0 could be too early so it may provide inaccurate or even wrong information, e.g. a set of periodic reservations have already stopped. Therefore, we do not see the need to consider sensing results before n-T0 in partial sensing. |
| Ericsson | See comment | In our view, the specification mandates that a UE using PBPS must have monitored all PSOs in [n-T0, n-Tproc,0] and uses the corresponding sensing results to determine the status of the resources in the RSW. There is no need to specify or even discuss what happens earlier than T0. |
| Fraunhofer | Yes | We do not see the need for UEs to consider the monitoring of PSOs earlier than *T0*. |
| Qualcomm | Please see comment | Is the proposal that the UE doesn’t monitor PSOs prior to T0? If yes, we support the proposal but would like the wording to be clarified  The UE does not monitor PSOs earlier than n – T0, where T0 is the (pre-)configured sensing window parameter for the Tx resource pool (*sl-SensingWindow*) |
| Futurewei | Comments | We do think that a restriction on UE monitoring of PSOs is necessary. However, we think that defining a maximum number of sensing occasions for all periodicities should be sufficient. |
| Apple | Yes | In Rel-16 V2X with full sensing, the sensing window is limited. This is because the earlier sensing results may not be valid. We should have the similar constraints for partial sensing UEs. Considering the power saving requirements, we think T\_0 could be smaller for partial sensing UEs than that for full sensing UEs. This T\_0 could also restrict the largest value of k in Question 1-1. |
| LGE | Yes | All SOs need to be limited within a (pre-)configured range to avoid unnecessary outdated monitoring for a long periodicity. |
| Convida Wireless | Yes | We are ok with the proposal. |
| OPPO | Yes | The motivation of T0 is to determine the starting position of sensing window. We don’t think it is reasonable to perform sensing before n-T0. |
| Samsung | Please see comment | At first we think “not earlier than *T0*” should be modified as “not earlier than n-*T0*”. In addition, we would like to clarify whether question 1-1 and 1-2 works together, e.g. even if UE is (pre-)configured to monitor two most recent PSOs, UE still may monitor single most recent PSO if the second most recent PSO is before n-*T0*. |
| NTT DOCOMO | Yes | Monitoring slots earlier than slot n-T0 is unnecessary as Rel-16. |
| Spreadtrum | Yes | We support the proposal. |
| Huawei, HiSilicon | No | In LTE-V, there is no sensing window defined for partial sensing procedure, and so far, the agreements are for partial sensing occasions are only based on PBPS occasions and CPS window. There is no need to define sensing window (which is used for full-sensing) to restrict partial sensing occasions for partial sensing. |
| Fujitsu | See comment | We agree with Ericsson’s view that we only need to specify how to define the PSOs, and there is no need to discuss what happens earlier than T0. |
| vivo | Comments | This proposal seems to be aimed at invalidating several configured sensing occasions. If T0 is =1100ms, with the proposal, then UE is not allowed to monitor the second most recent sensing occasion for Preserve=1000ms as that occasion is earlier than 1100ms. However, this case is due to a misconfiguration and can be avoided by proper configuration. |
| CATT | Yes | We are ok with the proposal |
| Lenovo&MotM | Yes |  |
| Panasonic | Yes | We support the proposal. |
| ZTE, Sanechips | Comment | Similar view as Ericsson. No need to discuss this. |
| Nokia, NSB | Yes | Not sure why we need to discuss about this. |

* **Question 1-3:** Is it agreeable not mandating UE to monitor PSOs corresponding to *PRSVP\_Tx* when it is not part of the (pre-)configured set of *Preserve* values? That is, the UE may additionally monitor occasions corresponding to *PRSVP\_Tx* based on its implementation.

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| **Company** | **Yes/No** | **Comments** |
| Xiaomi | No | It is important for a UE to sense the sensing occasions corresponding to the same periodicity of its data for transmission, otherwise consistent collision may happen which can severely degrade the performance. Note that other UEs which does not transmit data of this periodicity does not need to sense sensing occasions corresponding to the periodicity if this periodicity is not included in the (pre)configured set of Preserve values. |
| Ericsson | See comment | We do not think that we should be discussing whether to not mandate a behaviour or not.  Given the discussions in earlier meetings, we think the existing agreement from RAN1#105-e stating that “the UE may additionally monitor occasions corresponding to P\_RSVP\_Tx” is all we need at this point. |
| Qualcomm | No | Our evaluations in Rel-16 showed that PRSVP\_Tx is the most important period value to monitor. |
| Futurewei | Yes | It is NOT necessary to mandate UE to monitor PSOs corresponding to *PRSVP\_Tx* when it is not part of the (pre-)configured set of *Preserve* values. |
| Apple | No | To avoid contiguous (periodic) resource collision, we prefer that Tx UE mandatory monitors *PRSVP\_Tx*, **at least for resource re-evaluation and pre-emption (if configured)**. |
| LGE | Yes | If the network does not force it by no configuration, it should be totally up to UE implementation. |
| Convida Wireless | See comment | We don’t think it is necessary to mandate UE to monitor PSOs corresponding to *PRSVP\_Tx* when it is not part of the (pre-)configured set of *Preserve* values. The UE may additionally monitor occasions corresponding to *PRSVP\_Tx* based on its implementation and this may be sufficient. |
| OPPO | No | Sensing based on *PRSVP\_Tx* is very important to avoid consistent transmission collision. That is one of the motivation/benefit for inter-UE coordination topic. It is not a good way to drop a simple method (perform sensing based on *PRSVP\_Tx* ) while to pursue a complex method (inter-UE coordination, which has more open issues till now) |
| Samsung | Yes | We think it’s unnecessary to mandate monitoring of PRSVP\_Tx, since it was already supported by UE implementation as agreed in previous meetings, and we would like not to spend time discussing it. |
| NTT DOCOMO | Yes | We think the existing agreement is sufficient. Also if regulator prefers to mandate UE to monitor it, possible P\_RSVP\_TX can be pre-configured in P\_reserve. |
| Spreadtrum | Yes | We prefer to leave implementation. It is not necessary to mandate UE to monitor PSOs corresponding to *PRSVP\_Tx* when it is not part of the (pre-)configured set of *Preserve* values. |
| Huawei, HiSilicon | Yes | Unless mandated behaviour is agreed, there is no such behaviour defined and hence none specified. RAN1 may not need to spend much time on such issues. In this case, it results in a workable solution, because if the configuration does not provide particular periodicity values, it means network assumes the resulting performance is acceptable. Network can always configure all (or any) values if there is reliability concern. |
| Fujitsu | Yes | UE can monitor the PSOs corresponding to *PRSVP\_Tx* by its implementation. |
| vivo | Yes | It can be up to UE implementation. |
| CATT | Yes | We prefer to leave implementation |
| Lenovo&MotM | No | Mandate UE to monitor PSOs corresponding to *PRSVP\_Tx* is necessary. It can help to avoid potential collision. |
| Panasonic | Yes | We prefer not to mandate it and UE implementation should be sufficient. |
| ZTE, Sanechips | Yes | Up to implementation |
| Nokia, NSB | Yes | Not to mandate in the specs when the PSO is not part of the (pre-)configured set of *Preserve* values. But UE can still monitor based on its implementation. |

### Proposals before 2nd GTW session

FL observations and comments based on inputs received in Sec. 3.1.1:

* On Question 1-1 (number of PSOs that can be (pre-)configured), 17 companies think the most recent two PSOs are sufficient for PBPS and would like to confirm the WA, while 7 companies prefer to have more (e.g., 3, 4 or 10) for the flexibility in (pre-)configuration signalling. It should be noted that the reason why only the two most recent PSOs are chosen in the WA was due to its performance can achieve almost the same as R16 full sensing. Given the current situation and there is an urgent need to finalize its corresponding RRC parameter in this meeting for RAN2, it is recommended to confirm the WA and close the subsequent two FFS items.

Regarding the question brought up by Qualcomm and Samsung on “whether the additional monitoring is enabled for all periodicities jointly or independently”, let’s further discuss this in this meeting.

* On Question 1-2 (restricting UE monitoring of PSOs not earlier than *n-T0*), this was treated during the first online GTW session on Tuesday (1st week). This is generally seen as an optimization and not entirely essential. Therefore, this issue will not be pursued any further.
* On Question 1-3, 17 companies think it is not necessary to mandate the UE to monitor PSOs corresponding to *PRSVP\_Tx* when it is not part of the (pre-)configured set of *Preserve* values, while 6 companies preferred it is mandated. Since it is already agreed that the UE may additionally monitor occasions corresponding to *PRSVP\_Tx*, it is recommended to close this FFS item from RAN1#105-e without any agreement.

**Proposal 1-1 (I):** The following working assumption from RAN1#105-e is confirmed and the two subsequent related FFS bullets are closed without any agreement.

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| *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* |

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| **Company** | **Comments** |
| NTT DOCOMO | Support. |
| Sharp | The first subsequent FFS includes the details of configuration, thus, it needs to be pursued.  [FL] If the WA is confirmed and there is no other PSOs other than the most recent two, then it is just one additional PSO on top of the default one. I think the signalling details can be discussed as part of RRC parameter list. |
| LGE | Support with the comment below.  We think the answer to Question 1-1 should be answered for clarification on Proposal 1-1.  [FL] Based on the responses received for Question 1-1 (II) below, it seems like this next level details should be further discussed after confirming the WA. |
| Fujitsu | We can accept this proposal to make the progress forward, although we slightly prefer to give more flexibility on PSO determination for PBPS. |
| OPPO | We support the proposal. |
| Spreadtrum | Support. |
| Sony | Support. |
| CMCC | Support. |
| NEC | Support |
| vivo | Not support.  This issue is related to RRC parameter which is also impacted by Issue #5, **so we suggest discussing the WA and DRX case together, rather than confirming the WA for the non-DRX case only.**  Specifically, if proposal 5-1(I) is approved and option 2 is allowed, when the nearest PSO and the PSO before the nearest PSO are located at DRX inactive times, they may not be monitored, so the UE will not have any sensing results. In this case, it should allow the UE to monitor earlier PSOs located at active times. However, this would require a separate RRC parameter to configure additional PSOs if this WA is confirmed for no-DRX case.  Although this WA is originally intended to handle the case without DRX, given that we need to stabilize the RRC as soon as possible, and DRX case also has an impact on the RRC parameter related to PSO monitoring, we need to discuss this proposal together with the DRX case to ensure a unified RRC parameter for both DRX case and no-DRX case.  [FL] The concerning situation when both PSOs are located within the DRX inactive time can be further discussed as part of Topic #5. For example, as part of Option 2, when both PSOs of a given reservation periodicity are located within the DRX inactive time can be one of the conditions in which the UE shall monitor the most recent one during the DRX inactive time. In general, two these topics can be handled separately. |
| Xiaomi | Support |
| Panasonic | Support |
| Intel | OK to confirm but prefer to avoid discussing it during GTW call if WA is not challenged |
| Samsung | OK with intention to confirm WA (i.e. monitor the two most recent sensing occasion for each periodicity), but we consider the wording can be improved to avoid ambiguous, and suggest the following update:   * + - *(Working assumption) ~~Possible values correspond to~~ the second 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, in addition to ~~and~~ ~~the last periodic sensing occasion prior to~~ the most recent one for the given reservation periodicity are included.* |
| Huawei, HiSilicon | Agree.  As we commented in the first round, working assumption is reverted only when it is problematic. Introducing more than two occasions is kind of optimization which is not preferred at this stage. In general, we think this issue is not urgent. |
| ZTE, Sanechips | OK for progress |
| Ericsson | We are supportive of this proposal. |
| Fraunhofer | We can accept the proposal for the sake of progress. |
| MediaTek | Support |
| Lenovo&MotM | Support |
| Apple | We can accept the proposal to make progress, even though we still prefer most flexible design. |
| CATT,GOHIGH | OK in principle. But do we need to make decision on the second FFS, which is not an extension of the WA but a clarification of WA itself ?  [FL] If the WA is confirmed and there is no other PSOs other than the most recent two, the (pre-)configuration simply means the UE should also monitor the last PSO prior to the most recent one (default). This FFS is only applicable for the case when we agree to have more than 2 PSOs. |
| InterDigital | Support |
| Qualcomm | Support |
| NTT DOCOMO | Support. |
| Sharp | The first subsequent FFS includes the details of configuration, thus, it needs to be pursued. |
| LGE | Support with the comment below.  We think the answer to Question 1-1 should be answered for clarification on Proposal 1-1. |
| Fujitsu | We can accept this proposal to make the progress forward, although we slightly prefer to give more flexibility on PSO determination for PBPS. |
| OPPO | We support the proposal. |
| Spreadtrum | Support. |
| Sony | Support. |
| CMCC | Support. |
| NEC | Support |
| vivo | Not support.  This issue is related to RRC parameter which is also impacted by Issue #5, **so we suggest discussing the WA and DRX case together, rather than confirming the WA for the non-DRX case only.**  Specifically, if proposal 5-1(I) is approved and option 2 is allowed, when the nearest PSO and the PSO before the nearest PSO are located at DRX inactive times, they may not be monitored, so the UE will not have any sensing results. In this case, it should allow the UE to monitor earlier PSOs located at active times. However, this would require a separate RRC parameter to configure additional PSOs if this WA is confirmed for no-DRX case.  Although this WA is originally intended to handle the case without DRX, given that we need to stabilize the RRC as soon as possible, and DRX case also has an impact on the RRC parameter related to PSO monitoring, we need to discuss this proposal together with the DRX case to ensure a unified RRC parameter for both DRX case and no-DRX case. |
| Xiaomi | Support |
| Panasonic | Support |
| Intel | OK to confirm but prefer to avoid discussing it during GTW call if WA is not challenged |
| Samsung | OK with intention to confirm WA (i.e. monitor the two most recent sensing occasion for each periodicity), but we consider the wording can be improved to avoid ambiguous, and suggest the following update:   * + - *(Working assumption) ~~Possible values correspond to~~ the second 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, in addition to ~~and~~ ~~the last periodic sensing occasion prior to~~ the most recent one for the given reservation periodicity are included.* |
| Huawei, HiSilicon | Agree.  As we commented in the first round, working assumption is reverted only when it is problematic. Introducing more than two occasions is kind of optimization which is not preferred at this stage. In general, we think this issue is not urgent. |
| ZTE, Sanechips | OK for progress |
| Ericsson | We are supportive of this proposal. |
| Fraunhofer | We can accept the proposal for the sake of progress. |
| MediaTek | Support |
| Lenovo&MotM | Support |
| Apple | We can accept the proposal to make progress, even though we still prefer most flexible design. |
| CATT,GOHIGH | OK in principle. But do we need to make decision on the second FFS, which is not an extension of the WA but a clarification of WA itself ? |
| InterDigital | Support |
| Qualcomm | Support |
| Futurewei | We do not support this proposal. We prefer to simply specify a maximum number of sensing occasions and everything else is configurable to ensure more flexibility on PSO. With independent configuration for each periodicity, a slightly larger number of sensing occasions can be configured for the small periodicities. |
| Nokia, NSB | Support. No need for further discussion. |

**Question 1-1 (II):** When the k value in periodic-based partial sensing for resource (re)selection is (pre-)configured, whether the additional monitoring is enabled for all reservation periodicities jointly or independently?

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| **Company** | **Jointly/Independently** | **Comments** |
| NTT DOCOMO | Independently | k value for two most recent sensing occasions is different among periodicity value. In addition, same configuration between large periodicity and short periodicity would not be good. Therefore Independent (pre-)configuration is preferred. |
| LGE | Independently | One of the reasons for independent configuration is to avoid unnecessary out-dated sensing results. For example, if most two recent PSOs are configured to all periodicities for PBPS, and the periodicity of 1sec is included in the periodicities for PBPS, UE should monitor 2 sec ahead from the candidate slot, which is even beyond Rel.16 UE capability. Therefore, unless maximum duration for PBPS is specified, the k values should be able to be (pre-)configured independently for each periodicity. |
| Fujitsu | Jointly | We think the additional monitoring is enabled for all reservation periodicities jointly is a more straightforward way. |
| Sony | Independently | Independent (pre-)configuration is preferred to keep the most recent sensing occasion before slot n. |
| CMCC |  | We think that independently (pre-)configuration provides more flexibility, but we are basically fine with either option.  In our views, whether the k value is (pre-)configured independently or jointly, also depends on the format of k. If k refers to a specific value, then we believe that it should be per periodicity as for different reservation periodicities, the most two recent sensing occasions refer to different k values. On the other hand, if k refers to the indication such as “most recent sensing occasion”, “last to the most recent sensing occasion”, etc, then jointly for all reservation periodicities could be a simple design. |
| NEC | Jointly | We doesn’t the benefit to configure different periodicity with or without additional monitoring occasion. Jointly configuration is simpler. |
| vivo | See comments, slightly prefer independently | It depends on the signalling structure of the configuration of PSO to be monitored.  If k value is used for the PSO configuration, k values corresponding to the nth most recent PSO may change with the value of reservation periodicity and PDB, in this case, k values must be provided per reservation periodicity.  If {enable, disable} or {monitored, not monitored} is used for the PSO configuration, and each {enable, disable} or {monitored, not monitored} corresponds to a specific PSO, then either per reservation periodicity configuration or per pool configuration (i.e., for all reservation periodicities) is feasible. |
| Xiaomi | Jointly | We slightly prefer to jointly (pre-)configuration due to simpler configuration design. |
| Panasonic | Independently | We share similar view with NTT Docomo. |
| Intel | Independently |  |
| Samsung | Independently | This allows the flexibility to have a single monitoring occasion for long periodicities and two monitoring occasions for short periodicities. |
| Huawei, HiSilicon | Jointly | We prefer “Jointly configured”, which does not further complicate signalling design neither bring extra workload. |
| ZTE, Sanechips | Jointly | Reduced signalling structure/overhead – no benefit for independent indication. |
| Ericsson | Jointly | (Pre-)configuring the reservation periodicities independently incurs in a lot of signalling. |
| MediaTek | Jointly | We don’t see a need to use independent configuration that would justify the increased signalling overhead. |
| Lenovo&MotM | Independently |  |
| Apple | Jointly | The benefit of independent indication is not clear to us. The joint configuration is simpler and save signaling overhead. |
| CATT | Independently | Provide more flexibility. In anyway, the gNB could just choose not to make the configuration to save overhead. |
| InterDigital | Independently | Independent configuration is more flexible. |
| Qualcomm | Jointly | There’s no need to support independent additional monitoring. We have not seen evaluation results in support of it and it complicates design and UE implementation. |
| Futurewei | Independently | The number of most recent sensing occasions can be dependent on the periodicity, e.g., small period uses more, and large period uses the less, e.g., most recent sensing occasions. With such flexibility, the UE may configure the partial sensing to have a better alignment with SL DRX cycles |
| Nokia, NSB | See comments | With different periodicities, there will have different k values. This clearly depends on how the (pre-)configuration signalling is designed. The question asked is “*whether the additional monitoring is enabled for all reservation periodicities jointly or independently* ”. Each periodicity shall have its “independent” k values; however, the (pre-)configuration signalling of all reserved periodicities can be “jointly” determined. |
| Bosch | Jointly | Avoiding signalling overhead |

### Proposals for 2nd GTW session

FL observations and comments based on inputs received in Sec. 3.1.2:

* On Proposal 1-1 (I) (confirming WA on PSOs made in RAN1#105-e),
  + Support/accept (25): DCM, LGE, Fujitsu, OPPO, Spreadtrum, Sony, CMCC, NEC, Xiaomi, Panasonic, Intel (wording update), Huawei, HiSilicon, ZTE, Sanechips, Ericsson, Fraunhofer, MediaTek, Lenovo, MotM, Apple, CATT, GOHIGH, IntelDigital, Qualcomm
  + Not support (2): vivo, Futurewei

Given that the only concern of not confirming the WA and close of the subsequent two FFS bullets can be handled as part of Topic #5, I have largely kept the same Proposal 1-1. The additional part, if agreeable to the group, is the suggestion from Intel to update the WA to be in line with an agreement that the timing reference is now the first slot of *Y* and that the second most recent PSO is in addition to the most recent one (default one).

* On Question 1-1 (II) (confirming WA on PSOs made in RAN1#105-e),
  + Jointly (16): Fujitsu, CMCC, NEC, vivo (if enable/disabled or monitored/not monitored), Xiaomi, OPPO, Huawei, HiSilicon, ZTE, Sanechips, Ericsson, MediaTek, Apple, Qualcomm, Nokia, NSB
  + Independently (13): DCM/vivo/Panasonic (due to different k value per periodicity), LGE/Samsung (due to long periodicity), Sony, Intel, Samsung, Lenovo, MotM, CATT, InterDigital, Futurewei

As commented by some companies, it will be hard to configure the exact value of k =1, 2 or other value to indicate the (second) most recent PSOs, due to different periodicity value, location of the selected Y slots and PDB. Most likely, the enabled/disabled or monitored/not monitored type of signalling as currently described in the RAN1 RRC list, will be the simplest approach. Additionally, given that we have also chosen not to optimize PBPS by restricting the max sensing window to (*n-T0*) in the last GTW session, it is not clear if we need to continue restricting the sensing occasion using a different method. Furthermore, SL DRX is for data reception (which is configured by the network or another UE) and sensing is for data transmission. It is also unclear whether they can be aligned.

Nevertheless, given that there is no clear majority of preference between jointly and independently, let’s further discuss this using the FL summary after the 2nd GTW session.

**Proposal 1-1 (II):** The following working assumption from RAN1#105-e is confirmed and the two subsequent related FFS bullets are closed without any agreement.

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| *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* |

If agreeable to the group, the working assumption can be updated to avoid ambiguity as:

* *(Working assumption) ~~Possible values correspond to~~ the second 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, in addition to ~~and~~ ~~the last periodic sensing occasion prior to~~ the most recent one for the given reservation periodicity are included.*

Support/accept (25): DCM, LGE, Fujitsu, OPPO, Spreadtrum, Sony, CMCC, NEC, Xiaomi, Panasonic, Intel, Huawei, HiSilicon, ZTE, Sanechips, Ericsson, Fraunhofer, MediaTek, Lenovo, MotM, Apple, CATT, GOHIGH, InterDigital, Qualcomm

Not support (2): vivo, Futurewei

### Proposals before 3rd GTW session

During the 2nd GTW session for R17 NR eSL, an updated version of Proposal 1-1 (II) was agreed, which is now captured in Section 2 of this document. As such, we can now resume the discussion on whether the additional monitoring of PSOs (when provided) should be (pre-)configured jointly for all reservation periodicities or independently for each reservation periodicity in the (pre-)configured set of *Preserve* values.

One benefit mentioned to (pre-)configure the additional PSOs independently for each reservation periodicity during the last round is that it will allow the (pre-)configuration to limit the number of PSOs that the UE should monitor especially for large reservation periodicity values (such as higher than 500ms). That is, for these large reservation periodicity values, the (pre-)configuration may include only the most recent sensing occasion so that the UE do not need to monitor PSOs that are more than 1100ms in the past, keep the same sensing window as in R16 to reduce power consumption and memory storage. While for reservation periodicities less than 500ms, the (pre-)configuration may include the most recent two PSOs.

However, as commented in the previous section 3.1.3, we have already rejected the notion of optimizing or trying to limit the PSOs that the UE needs to monitored to be within the R16 sensing window (n-T0), even with the possibility of (pre-)configuring up to k=10. Since it is now agreed that we will have at most 2 PSOs per reservation periodicity (*Preserve* value), the benefit of limiting the PSOs for certain reservation periodicities is even less motivated. To this end, the FL propose the following to be discussed directly using email exchange. In addition, it would be good to finalize necessary design relevant to RAN1 for this RRC parameter in this meeting for RAN2.

**Proposal 1-2 (I):** For the PSO(s) that a UE needs to additionally monitored in PBPS, it should be (pre-)configured jointly for all *Preserve* values.

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| **Company** | **Comments** |
| Fujitsu | We agree this proposal. |
| NTT DOCOMO | Although this is not our preference, we are fine with this proposal since now k definition is only most 2 occasion.  BTW, “PSO” is newly used here for proposal/agreement. “periodic sensing occasion” should be clearly mentioned first. |
| LGE | We do not support the proposal. It cannot be justified that partial sensing range should be beyond the full sensing range. We cannot agree that only two PSOs can be a reason to allow it. As the number of periodicities for PBPS increases, the waste of UE power will also increase. It’s against the purpose of power saving.  In addition, monitoring more than e.g. 1100ms is not only useless but also causing low resource utilization. That is, the outdated sensing results will prevent UE from using the resources that are otherwise available as candidate resources.  Last point, the proposal is deviating the Rel.16 rule. It tries to push UE to monitor more than what is defined in Rel.16. So we support independent (pre-)configuration, which is aligned with Rel.16 rule. |
| vivo | Although we prefer independent (pre-)configuration, we can accept the proposal for sake of progress. |
| ZTE, Sanechips | Support |
| Xiaomi | Support |
| OPPO | support |
| NEC | Support |
| Ericsson | We are supportive of this proposal. Having a joint configuration allows for a simpler design and less signalling. |
| MediaTek | Support |
| Huawei, HiSilicon | Support. Given the WA has been confirmed, only up two sensing occasions are monitored, so the benefits of independent (pre-) configuration is not justified. |
| Samsung | We have similar concern with LGE and not support the proposal. In legacy full sensing procedure a earliest sensing boundary was defined since sensing result from too long ago become invalid, and we don’t understand why this rule change for partial sensing. Independent configuration should be supported to allow partial sensing window not spanning compared with full sensing. |
| Nokia, NSB | Based on the agreement we had in last meeting, one reservation periodicity will have at most 2 sensing occasions, which are the two most recent sensing occasions. For different periodicities values, it is not necessary to have the (pre)-configuration of one or two sensing occasions for each periodicity. Instead, a single (pre)-configuration may be sufficient to apply for all *Preserve* values. Therefore, we support this proposal. |

## Topic #2: Partial sensing details (defining TA, TB and candidate resource set SA)

**Background for Topic 2-1:**

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| **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. |

For the above agreement reached in RAN1#106-e, the slots for which the candidate resource set (*SA*) is initialized are according to the selected *Y* candidate slots of PBPS in the case of periodic transmission. And since the resource (re)selection triggering slot *n* for periodic transmissions is can assume to be predictable (known in advanced), and *TA* and *TB* can be negative values, based on reviewing the submitted contributions to this meeting, most company (if not all) think CPS monitoring can start from 31 slots before the first slot of *Y* candidate slots (which is also *SA*).

According to some companies, due to discussion of aperiodic transmission cases, there may be a need to introduce a minimum number of CPS monitoring window (e.g., *M* slots) to ensure there is a minimum / sufficient amount of CPS results for resource selection, the same minimum number of *M* slots can also be adopted for periodic transmission as well.

Furthermore, considering the amount of specification effort and the complication to describe partial sensing behaviour for different cases (i.e., PBPS+CPS for periodic Tx, PBPS+CPS for aperiodic Tx, CPS-only for aperiodic Tx), it may be desirable to have a unified spec description approach in a manner such that it can be applied to all of these 3 cases. One way of describing this is to simply say it is up to UE implementation to select a set of *Y* candidate slots within the RSW such that the UE is able to obtain sufficient partial sensing results from PBPS and CPS for any in the set of *Y* candidate slots. That is, the UE needs to have monitored all slots that could have a SCI pointing to a slot in the set of *Y* candidate slots before the resource (re)selection / reporting of a subset of resources to the higher layer. And this can include slots that have already monitored/to be monitored by the UE for another resource (re)selection and re-evaluation/pre-emption checking process. As such, all available and applicable sensing results for the same resource pool can be utilized.

**Background for Topic 2-2:**

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| **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 |

For the above agreement reached in RAN1#106-e, there seems to be split of opinion of whether or not a new set of *Y* candidate slots should be selected by the UE. One reason is to obtain additional PBPS results when there are PSOs between the triggering slot *n* and first slot of *Y*. Another reason is to ensure there are also Y candidate slots for the resource (re)selection, to be the same as the case for periodic transmission, even without any potential PSOs between slot *n* and first slot of *Y*. And there is also an opinion that the UE should reuse whatever Y candidate slots from a PBPS that fall / are located within the RSW of the triggered resource (re)selection procedure. In Proposal 2-2, different approaches are listed with their corresponding potential CPS monitoring window definition. In general, the FL lists solutions/schemes that are simple and most straight forward.

If a different approach, alternative or enhancement should be included to overcome shortcoming of the listed ones from the FL, please indicate and describe them in the response.

**Background for Topic 2-3:**

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| **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 |

For the above CPS-only agreement reached in RAN1#106-e, based on contributions submitted to this meeting, there are wide range of opinions on how to define *T1* and the RSW. Again, the FL tried to capture the simplest one and the most straight forward approaches and alternatives for defining *TA*, *TB* and initializing the set of candidate resources (*SA*).

If a different approach, alternative or enhancement should be included to overcome shortcoming of the listed ones from the FL, please indicate and describe them in the response.

### Proposals before 2nd GTW session

**Proposal 2-1 (I):** 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:
  + Alt.1: *n*+*T*A = and *n*+*T*B = , where is the first slot of the selected *Y* candidate slots of PBPS.
  + Alt.2: *n*+*T*A ≥ and *n*+*T*B = , where *T*B should be selected by the UE such that *T*B *– T*A *≥ M* and *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on priority, latency or measured CBR.
  + Alt.3: *T*A and *T*B are determined by the UE to monitor all or at least *M* slots (before the reporting of a subset of resources to higher layer) that could have a SCI indicating a reserved resource in any of the selected set of *Y* candidate slots.

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| **Company** | **Alt.1, 2 or 3** | **Comments** |
| NTT DOCOMO | Alt 1 | For periodic transmission, UE can monitor slots prior to slot n. In this case, there is no reason to skip monitoring some slots corresponding to other UE’s aperiodic reservation. Alt 2 will obtain quite small power saving gain, while lead to significant reliability degradation.  It is unclear for us what is difference between Alt 3 and Alt 1+2. |
| Sharp | Alt.1 | Regarding Alt.3, the reporting moment of a subset of resources to higher layer is not specified. Thus, we do not think it is clear enough. Alt. 1 provides the most reliable sensing results for CPS, compared to Alt.2. |
| LGE | Alt 1,  Alt 3 with modification | The simplest way of description is Alt 1.  For periodic transmission, Alt 3 is equivalent to Alt 1 (except M). In this sense, we also support the Alt 3 with the following modification.   * + Alt.3: *T*A and *T*B are determined by the UE to monitor all ~~or at least~~ *~~M~~*slots (before the reporting of a subset of resources to higher layer) that could have a SCI indicating a reserved resource in any of the selected set of *Y* candidate slots.   We don’t support the adjustment of CPS window as in Alt 2 for periodic transmission, same view as DOCOMO. |
| Fujitsu | Alt.1 or 2 | Maybe we need to discuss whether a minimum number of slots for CPS monitoring window should also be introduced to periodic transmission, first. Then we can decide to choose Alt.1 or Alt.2. We think Alt.3 is not so clear and more clarification is needed. |
| OPPO | Alt 1, or Alt 2 | For Alt.1: for periodic traffic, the slot n is known in advance, alt 1 has the more sensing slots than Alt. 2.  For Alt. 2: a common/unified solution/description can be applied to the following cases: PBPS+CPS for periodic traffic, PBPS+CPS for aperiodic traffic, CPS only for aperiodic traffic. |
| Spreadteum | Alt 1 | Alt.1 can exclude the aperiodic reserved resources of other UEs as much as possible. Considering the reliability of resource selection, we prefer Alt.1. |
| Sony | Alt1 | Alt 1 can provide enough sensing results for CPS |
| CMCC | Alt. 1 | In such a case, the introduction of the CPS is to exclude the dynamic reservations, which is within 31 slots. Alt. 1 is the simplest solution. |
| NEC | Alt.1 with comments | For alt.1, we think *n*+*T*B should be , where and it’s up to UE implementation. Because this aligned with Rel16 procedure and also provide more sensing occasion by extending CPS window.  For alt.3, if the CPS window is determined by any possible SCI indicating a reserved resource, then the PBPS sensing occasions will also be included, which is not aligned with CPS window design. |
| Vivo | Alt1 | For a periodic transmission, the packet arrival time (slot n) is predictable, thus the corresponding CPS window can be determined before slot n, there is no motivation to have some sensing slots skipped. |
| Xiaomi | Alt 1 | For Alt 2 we wonder how to determine the value of M.  We do not fully understand alt 3 on whether the M slots defined in the alt 3 includes sensing occasions of PBPS or not. |
| Intel | Alt.1 with modifications | We propose *n*+*T*A ≥ , where value of *L* is pre-configured. Pre-configuration is needed to have flexible solutions for resource pools with different physical structure (e.g., sparse or dense pools)  (n+TB) *=* tLast, where tLast is the slot of the last retransmission of a TB or received HARQ feedback  We have concern on finishing CPS right before resource selection window since re-evaluation procedure requires sensing operation |
| Samsung | Alt.1 with modifications | We would like to clarify whether the values in the equations are physical or logical with the following modification:   * + Alt.1: *n*+*T*A = in logical slots, and *n*+*T*B <= , where is the first logical slot of the selected *Y* candidate slots of PBPS, and are in units of physical time/slots.   We are unclear in alt.2 why UE needs to monitor slots before , considering any intra-period reservations before will not impact selected candidate slots. Alt.3 give UE too much flexibility and is not preferred. |
| Huawei, HiSilicon | Alt. 1 | We support Alt.1.  Given that any aperiodic reservation can indicate maximum 31 slots away, a smaller window size may result in undetected reservation and unexpected collision. On the other hand, the collision would cause additional retransmission and then more transmission power is consumed for a UE. Thus Alt. 2 is not preferable.  On Alt.3, it is not clear which kind of reservation SCI indicated, dynamic or periodic reservation. Take dynamic reservation within a period as an example, if all slots within the window are monitored, it will be equivalent to Alt.1. To sense at least M slots, it has similar problems with Alt. 2, which are caused by shorter window. Therefore, Alt. 3 is not preferable as well. |
| ZTE,Sanechips | Alt 1 | Sufficient sensing results can be guaranteed using Alt 1. |
| Ericsson | Alt.2 | We are supportive of Alt.2. We would suggest a minor modification to the text provided by FL as follows:   * Alt.2: *n*+*T*A ≥ and *n*+*T*B = , where *T*B should be selected by the UE such that *T*B *– T*A *≥ M* and *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on priority, PDB ~~latency~~ or measured CBR.   In our view, PDB is a better parameter to use when defining the minimum number of slots for CPS monitoring since the PDB is a parameter available during the resource selection procedure. |
| Fraunhofer | Alt 2 or Alt 1 with modifications | We are fine with Alt 2. We are also supportive of the modifications provided by Intel for Alt 1 for *n*+*T*A ≥ , where L can be pre-configured in order to introduce flexibility in the sensing window size. |
| MediaTek | Alt. 1 | Alt. 1 provides adequate monitoring for sensing to detect aperiodic reservations (i.e., within 32 slots). |
| Lenovo&MotM | Alt 1 |  |
| Apple | Alt. 1 | Alt. 1 provides sufficient sensing. |
| CATT,GOHIGH | ALT2 | CPS windows does not need to be always the maximum possible length. We support to have a defined (indicated by higher layer) minimal value for CPS window length.  Therefore we support alt2 modified by Ericsson. |
| InterDigital | Alt. 1 | Alt. 1 is the simplest solution and can obtain the full benefits of CPS to detect reservation for retransmission resources. |
| Qualcomm | Alt 3 | Alt3 allows the UE to align its sensing occasions with its DRX occasions, thereby saving power. Otherwise, a UE has to perform sensing and reception in potentially non-overlapping occasions, which defeats the purpose of the enhancements in this AI. |
| Futurewei | Alt 2 with comments. | Since at , the possible collision that UE detected in only at (only one slot of Y slots) and only when interval of the two resources scheduled by other UE is 31, UE can choose not to monitor this to save power as the probability is very low particularly when the CBR is low.  For n+TB, UE may continue sensing after , as Y may be larger than 31. So it should be up to UE implementation whether or not perform sensing after . We can specify an upper bound on TB, though.  Therefore, we prefer alt. 2 with a minor update   * + Alt.2: *n*+*T*A ≥ and *n*+*T*B ≥ ~~=~~ , where *T*B should be selected by the UE such that *T*B *– T*A *≥ M* and *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on priority, latency or measured CBR. |
| Nokia, NSB | Alt 1 | Alt 2 and Alt 3 mandates a minimum size of the CPS window. As long as there is enough sensing occasions, Alt 1 is the simplest approach. |
| Bosch | Alt.2 | We are also fine to re-interpret latency as PDB |

**Proposal 2-2 (I):** 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 () in slot *n*, *TA* and *TB* for CPS monitoring window and a candidate resource set (*SA*) is initialized according to one of the following approaches.
  + Approach 1: Based on a minimum number of Y candidate slots (*Ymin*)
    - No new set of *Y* candidate slots is selected by the UE
    - When there are at least *Ymin* slots of a set of *Y* candidate slots from a PBPS located within the RSW
      * Candidate resource set (*SA*) is initialized to all the slots of the set of Y candidate slots that are located within the RSW
      * CPS monitoring window:
        + *n*+*T*A =
        + *n*+*T*B =
    - When there are less than *Ymin* slots in the RSW
      * Candidate resource set (*SA*) is initialized to the set of all candidate single-slot resources in the remaining RSW [, ], where *TB* is selected by the UE such that length of remaining RSW ≥ *T2min*.
      * For the CPS monitoring window [*n*+*T*A, *n*+*T*B], *T*A = 1 and *T*B is selected by the UE such that *TB* – *TA* ≥ *M*, or *TA* and *TB* are both selected such that UE has sensing results for at least *M* slots before the start of the remaining RSW () including sensing results already obtained by the UE before slot *n* for another resource (re)selection or re-evaluation/pre-emption process.
        + *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on based on priority, latency or measured CBR.
      * *SA* slots with corresponding PBPS results are prioritized in resource selection.
  + Approach 2: Based on a set of Y candidate slots
    - Candidate resource set (*SA*) is initialized to a set of Y candidate slots within the RSW, where all or some of Y candidate slots may be newly selected or from an existing PBPS
    - CPS monitoring window:
      * Alt.1: *n*+*T*A = and *n*+*T*B = , where is the first slot of the *Y* candidate slots.
      * Alt.2: *n*+*T*A ≥ and *n*+*T*B = , where *T*B should be selected by the UE such that *T*B *– T*A *≥ M* and *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on priority, latency or measured CBR.
      * Alt.3: *T*A and *T*B are determined by the UE to monitor all or at least *M* slots (before the reporting of a subset of resources to higher layer) that could have a SCI indicating a reserved resource in any of the selected set of *Y* candidate slots.

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| **Company** | **Approach 1 or 2 (Alt.1, 2 or 3)** | **Comments** |
| NTT DOCOMO | Approach 2 with Alt 2 | We do not understand the meaning of “No new set of Y candidate slots is selected by the UE” in approach 1. The behaviour is only when the UE has another periodic transmissions and the Y candidate slots are available for the aperiodic TX? Or Y slots concept is not applied?  Approach 2 is simple enough, and Alt 2 is better than Alt 1 to ensure sufficient monitoring. |
| Sharp | Approach 2 (Alt.1) | From our perspective, regarding the following agreements,  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).   Approach 2 seems to better align with the intention of the agreement. |
| LGE | Approach 2, Alt 3 | Support approach 2 as it is simpler one. Among the details, we support Alt 3 as it is the simplest and unified description for both periodic and aperiodic transmission case. But, for aperiodic transmission, there could be restriction in selecting RSW and CPS window if PDB is relatively small. Therefore, 31 slots for CPS window cannot be guaranteed for all cases, so we support to set minimum CPS window size M.  Alt 2 is almost same as Alt 3, but it causes more power consumption than Alt 3 in some cases. For example, if UE has already monitored slots in [n-31, n] for another aperiodic transmission, UE does not have to monitor additional slot after n. In this case, UE can select Y candidate slots starting from slot n+1 without any CPS. Alt 2 mandates the condition of *T*B *– T*A *≥ M* with fixed minimum *T*A =1, so UE should unnecessarily monitor additional slots even in this case. Therefore Alt 3 provides a power gain with full flexibility. |
| Fujitsu | Approach 1 with comment | For approach 1, as we commented in proposal 2-1, we need to discuss whether a minimum number of slots should be considered for CPS first. We propose to the following rewording:  Approach 1: Based on a minimum number of Y candidate slots (*Ymin*)   * + - No new set of *Y* candidate slots is selected by the UE     - When there are at least *Ymin* slots of a set of *Y* candidate slots from a PBPS located within the RSW       * Candidate resource set (*SA*) is initialized to all the slots of the set of Y candidate slots that are located within the RSW       * CPS monitoring window:         + *n*+*T*A =         + *n*+*T*B =     - When there are less than *Ymin* slots in the RSW       * Candidate resource set (*SA*) is initialized to the set of all candidate single-slot resources in the remaining RSW [, ], where *TB* is selected by the UE such that length of remaining RSW ≥ *T2min*.       * ~~For the CPS monitoring window [~~*~~n~~*~~+~~*~~T~~*~~A~~~~,~~ *~~n~~*~~+~~*~~T~~*~~B~~~~],~~ *~~T~~*~~A~~ ~~= 1 and~~ *~~T~~*~~B~~ ~~is selected by the UE such that~~ *~~T~~~~B~~* ~~–~~ *~~T~~~~A~~* ~~≥~~ *~~M~~*~~, or~~ *~~T~~~~A~~* ~~and~~ *~~T~~~~B~~* ~~are both selected such that UE has sensing results for at least~~ *~~M~~* ~~slots before the start of the remaining RSW () including sensing results already obtained by the UE before slot~~ *~~n~~* ~~for another resource (re)selection or re-evaluation/pre-emption process.~~         + *~~M~~* ~~is a (pre-)configured minimum number of slots for CPS monitoring window based on based on priority, latency or measured CBR.~~       * *SA* slots with corresponding PBPS results are prioritized in resource selection.       * FFS whether a minimum number of slots should be considered for the CPS monitoring window       * FFS the minimum number of slots is (pre-)configured based on priority, latency or measured CBR   For approach 2, newly selected slots may contain resources that should be excluded by PBPS, which degrades the reliability performance. |
| OPPO | Approach 1 | For aperiodic traffic, the trigger time is arbitrary. It is hardly to pre-select Y slots in advance and initialize candidate resource set based on Y pre-selected slots. |
| Spreadtrum | Approach 2 (Alt.1) | Approach 2 is more flexible than approach 1, and it may get more new monitoring occasions. For the CPS monitoring window with Alt.1, the reason has already been mentioned in proposal 2-1. |
| Sony | Approach 2 with Alt1 | We think approach 2 is better than the approach1, and Alt 1 can provide enough sensing result, no need to support alt2. |
| CMCC | Approach 2 (Alt 1), with modifications | Our preference is more in line with Approach 2, where the candidate resource set should be based on a set of Y candidate slots. We think that particular rules should be defined for whether the Y candidate slots are from the existing PBPS or newly determined.  To be specific, since the triggering slot n of the aperiodic transmission is unpredictable, and so the remaining PDB, the Y candidate slots determined from the on-going PBPS may be partially covered by the RSW. At least when the Y candidate slots within the RSW is smaller than a pre-defined minimum value, new Y candidate slots should be picked by the UE to meet the minimum Y value. We are also open with other rules.  Regarding the CPS window, we prefer Alt. 1. |
| NEC | Approach 2 (Alt.1) | Approach 2 could contain the part of the existing PBPS candidate slots and also new candidate slots considering resource flexibility and different PDB requirement |
| vivo | Approach2 (need clarification) with modified alt1 or modified Alt2. | Our understanding is the ‘a set of Y candidate slots’ in approach2 is a new Y-slot set determined for the CPS process regardless of if a new PBPS or existing PBPS is considered in the resource (re)selection procedure, is this correct understanding? If yes, then we support approach2.  Regarding the CPS window, we think that *n*+*T*A can be earlier than slot n even for unpredictable packet. For example, although the packet arrival time (slot n) may not be predictable, but there may be some existing sensing slots corresponding to other processes before slot n. Obviously they can be considered when determining a CPS window. As shown in the figure, sensing before the triggering slot n of process 1 has been performed for process2, and part of them are within the range []. These results can be used for process 1. Thus, *n*+*T*A can be left to the UE implementation.     * + - * Modified Alt.1: *n*+*T*A is determined by UE~~≥~~  and *n*+*T*B = , where is the first slot of the *Y* candidate slots.       * Modified Alt.2: *n*+*T*A is determined by UE~~≥~~  and *n*+*T*B = , where *T*B should be selected by the UE such that *T*B *– T*A *≥ M* and *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on priority, latency or measured CBR. |
| Xiaomi | None | In our view, for resource selection triggered by aperiodic traffic, the PBPS is not performed for this resource selection but is performed for other resource selection(s), e.g. triggered by other periodic traffic. Therefore, UE behaviour should be similar as that when only CPS is performed, and any existing sensing results including PBPS sensing results can be used in the resource selection as we have agreed. Therefore, we propose approach 3:  **Approach 3: based on UE behaviour when only CPS is performed.**  The details can depend on the discussion output of proposal 2-3. |
| Intel | Comments | Let’s not over optimize UE behaviour and not over-complicate specification. Our proposal is as follows:   * For aperiodic transmission – follow CPS and corresponding resource selection procedure * For periodic transmission – follow PBPS+CPS and corresponding resource selection procedure * For the case when UE has both CPS and PBPS sensing information, it is up to UE implementation whether PBPS information is used for aperiodic transmission |
| Samsung | Approach 1 with comment | We generally support approach 1, with the following comments:   * Clarification is needed that whether *Ymin* corresponds to size of RSW, or the number of slots with PBPS result in RSW. The current wording looks like former case but we think the intention is latter one. * Even if more than *Ymin* slots with PBPS result exists in RSW, the set still need sufficient CPS result. So the CPS window size restriction should be adopted to both cases (>=*Ymin* slots and < *Ymin* slots in RSW), not only adopted when < *Ymin* slots in RSW. * Slots with (existing rather than new) CPS result in RSW can also be considered as candidate slots. * For last sub-bullet “*SA* slots with corresponding PBPS results are prioritized in resource selection”, we are unclear whether the prioritization should be specified or left for UE implementation. * Whether the values in equations are logical or physical needs to be clarified, similarly as we proposed in P2-1(I) |
| Huawei, HiSilicon | See comments | We are generally fine with Approach 1 with enough candidate slots (i.e. number of candidate slots is larger than *Ymin*), but have different opinions on the case without enough candidate slots.  On Approach 1:  CPS is used to detect aperiodic reservation from other UE regardless of its own traffic type (periodic or aperiodic), thus CPS monitoring window size in this case should be same as the case for (in Proposal 2-1 (I)). Given that a UE anyway performs PBPS and resource selection trigger slot, i.e. slot n, is predicable, a UE needs to monitor PBPS occasions before slot n, it is not necessary to limit CPS window must be later than slot n, thus, it should be n+TA =  When there are less than *Ymin* slots in the RSW, we view this case as exceptional case, i.e. a UE cannot obtain sufficient results to be available to use partial sensing scheme in this resource pool. A simpler solution for exceptional case, is reuse legacy operation in both Rel-14/16 where random selection in exceptional resource pool is performed.  To accelerate the discussion, we suggest to put the case of less than *Ymin* slots in the RSW in FFS (it does not impact which approach is selected in our understanding). Approach selection can be discussed first and then go to FFS point if Approach 1 is agreed.  So we suggest to have following changes on proposal:  **Proposal 2-2 (I):** 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 () in slot *n*, *TA* and *TB* for CPS monitoring window and a candidate resource set (*SA*) is initialized according to one of the following approaches.   + Approach 1: Based on a minimum number of Y candidate slots (*Ymin*)     - No new set of *Y* candidate slots is selected by the UE     - When there are at least *Ymin* slots of a set of *Y* candidate slots from a PBPS located within the RSW       * Candidate resource set (*SA*) is initialized to all the slots of the set of Y candidate slots that are located within the RSW       * CPS monitoring window:         + *n*+*T*A =         + *n*+*T*B =     - FFS: When there are less than *Ymin* slots in the RSW       * ~~Candidate resource set (~~*~~S~~~~A~~*~~) is initialized to the set of all candidate single-slot resources in the remaining RSW [, ], where~~ *~~T~~~~B~~* ~~is selected by the UE such that length of remaining RSW ≥~~ *~~T~~~~2min~~*~~.~~       * ~~For the CPS monitoring window [~~*~~n~~*~~+~~*~~T~~*~~A~~~~,~~ *~~n~~*~~+~~*~~T~~*~~B~~~~],~~ *~~T~~*~~A~~ ~~= 1 and~~ *~~T~~*~~B~~ ~~is selected by the UE such that~~ *~~T~~~~B~~* ~~–~~ *~~T~~~~A~~* ~~≥~~ *~~M~~*~~, or~~ *~~T~~~~A~~* ~~and~~ *~~T~~~~B~~* ~~are both selected such that UE has sensing results for at least~~ *~~M~~* ~~slots before the start of the remaining RSW () including sensing results already obtained by the UE before slot~~ *~~n~~* ~~for another resource (re)selection or re-evaluation/pre-emption process.~~         + *~~M~~* ~~is a (pre-)configured minimum number of slots for CPS monitoring window based on based on priority, latency or measured CBR.~~       * *~~S~~~~A~~* ~~slots with corresponding PBPS results are prioritized in resource selection.~~   ….  On Approach 2:  First of all, a new set of Y slots is not quite helpful neither needed, given that the sensing occasion corresponding to the new candidate slots may locate before slot n and has passed. A new set of Y does not provide new available candidate resources indeed. |
| ZTE, Sanechips | Approach 1 | Approach 1 can simplify the candidate resource determination procedure while approach 2 will lead to further discussion on the candidate resource selection process. |
| Ericsson | Neither Approach 1 nor Approach 2 | In our view, we should have a procedure where the selection window is selected in order to maximize the number of candidate slots which are intersecting with the set Y.  Moreover, the set SA shall contain all the resources which are associated to the periodic-based partial sensing occasions. In case, the slots with corresponding PBPS results are below a certain threshold the remaining slots/resources are taken from the remaining RSW.  Moreover, regarding the procedure to perform contiguous partial sensing, we propose to have a unified mechanism which work under any condition instead of having two sensing window depending on Y.  Therefore, we can use the following:   * For the CPS monitoring window [*n*+*T*A, *n*+*T*B], *T*A = 1 and *T*B is selected by the UE such that *TB* – *TA* ≥ *M*, or *TA* and *TB* are both selected such that UE has sensing results for at least *M* slots before the start of the remaining RSW () including sensing results already obtained by the UE before slot *n* for another resource (re)selection or re-evaluation/pre-emption process.   + *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on based on priority, latency or measured CBR.   Based on the previous comments, we propose to include the following approach:  Approach 3:   * Candidate resource set (*SA*) is initialized to all the slots of the set of Y candidate slots that are located within the remaining RSW. In case the total number of slots is below a certain (pre-)defined threshold X:   + Additional candidate resources are selected to fulfil the threshold X from the set of candidate resources in the remaining RSW * For the CPS monitoring window [*n*+*T*A, *n*+*T*B], *T*A = 1 and *T*B is selected by the UE such that *TB* – *TA* ≥ *M*, or *TA* and *TB* are both selected such that UE has sensing results for at least *M* slots before the start of the remaining   + *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on based on priority, latency or measured CBR. |
| Fraunhofer | Approach 2, Alt 2 | We have the same concerns as DCM for Approach 1. We feel that Approach 2 is simpler and Alt 2 provides flexibility with power saving. |
| MediaTek | See comment | We are generally fine with the first part of Approach 1 when there are sufficient candidate slots only.  Essentially, in our view UE implementation can try to align its n trigger timing for the aperiodic traffic based on its other periodic traffic pattern. This should be valid as long as the aperiodic traffic has sufficient PDB for such alignment. When the aperiodic traffic’s RSW is aligned with the Y candidate slots of another periodic traffic, UE will be able to find sufficient candidate slots, as described in the first part of Approach 1. So, the second part of Approach 1 where UE is unable to find candidate slots seems unlikely to happen.  Regarding Approach 2, we have concerns about not properly detecting some of the periodic reservations in the pool when UE is not expected to align Y candidate slots from its periodic-based sensing with the RSW based on aperiodic traffic’s resource selection trigger. |
| Lenovo&MotM | Approach 1 |  |
| Apple | Approach 1 with comments | Approach 1 could ensure the initial candidate slots are more reliable to start with, since periodic reservations are counted.  For the case of “when there are less than *Ymin* slots in the RSW” in Approach 1, we prefer to keep it FFS. In our view, the handling of this case could be similar to Approach 2. |
| CATT,GOHIGH | Approach 2 with Alt 2 | This alternative solve the issue ( alt1 has) that no enough available resource exists for CPS |
| InterDigital | Approach 2  (Alt. 1 or 2) | Our understanding is the new Y candidate slots is up to UE to select and for the newly selected Y candidate slots, the UE perform PBPS from slot n to . However, the UE is not expected to have PBPS sensing for the set of Y candidate slots before slot n since the set of Y candidate predetermined for other TB may not fall within the RSW of the current TB.  If the above understanding is correct, we support Approach 2. Regarding the CPS window, we support either Alt. 1 or 2 since each alternative can have pros and cons. Alt. 1 allows the UE to reduce the CPS window if the set of Y candidate slots is close to slot n. Alt. 2 guarantees the minimum CPS sensing window, which may help reduce collision with aperiodic reservations.  Alt. 3 is not clear to us. We suggest removing Alt. 3. |
| Qualcomm | Approach 1 | Approach 1 allows the UE to prioritize candidate slots with PBPS results while leaving it possible to still transmit an aperiodic transmission when the selection window happens to be between two periods of Y and doesn’t contain any, or too few, slots with PBPS results. This is preferrable to dropping the packet transmission or sensing all the time. There is minor clarification to the text:   * + Approach 1: Based on a minimum number of Y candidate slots (*Ymin*)     - No new set of *Y* candidate slots is selected by the UE     - When there are at least *Ymin* slots of a set of *Y* candidate slots from a PBPS located within the RSW       * Candidate resource set (*SA*) is initialized to all ~~the slots of~~ single-slot candidates in the set of Y candidate slots that are located within the RSW in Step 4)   We also support the details of when there are fewer than Ymin slots in the RSW as they allow the UE to reusing existing sensing results and avoid delaying the packet by restarting sensing for M slots when not needed.  In all cases, the n+1 start of sensing should be subject to some UE processing delay instead of assuming the immediately following slot. For example, if the trigger arrives at the end of slot n, the UE will not have sufficient time to start the sensing procedure and decode the SCI in slot n + 1. Therefore, we propose to replace all instances of n + 1 with n + X, and the constant X can be discussed later. The same applies for all cases of *T*A = 1, which would become *T*A = X.  Finally, we’d also be ok with discussing this proposal after the CPS only case (Proposal 2-3) is finalized. |
| Futurewei | Approach 1 with modification | We prefer no new Y candidate slots. Since the location of Y slots is not deterministic, given the dynamic nature of aperiodic traffic we prefer to configure CPS independently (following CPS only case) and use PBPS sensing results whenever available in the RSW.  The proposed update of Approach 1 is   * + Approach 1: ~~Based on a minimum number of Y candidate slots (~~*~~Y~~~~min~~*~~)~~     - No new set of *Y* candidate slots is selected by the UE     - ~~When there are at least~~ *~~Y~~~~min~~* ~~slots of a set of~~ *~~Y~~* ~~candidate slots from a PBPS located within the RSW~~       * ~~Candidate resource set (~~*~~S~~~~A~~*~~) is initialized to all the slots of the set of Y candidate slots that are located within the RSW~~       * ~~CPS monitoring window:~~         + *~~n~~*~~+~~*~~T~~*~~A~~ ~~=~~         + *~~n~~*~~+~~*~~T~~*~~B~~ ~~=~~     - ~~When there are less than~~ *~~Y~~~~min~~* ~~slots in the RSW~~       * Candidate resource set (*SA*) is initialized to the set of all candidate single-slot resources in the remaining RSW [, ], where *TB* is selected by the UE such that length of remaining RSW ≥ *T2min*.       * For the CPS monitoring window [*n*+*T*A, *n*+*T*B], *T*A = 1 and *T*B is selected by the UE such that *TB* – *TA* ≥ *M*, or *TA* and *TB* are both selected such that UE has sensing results for at least *M* slots before the start of the remaining RSW () including sensing results already obtained by the UE before slot *n* +*T*Bfor another resource (re)selection or re-evaluation/pre-emption process.         + *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on based on priority, latency or measured CBR.       * *SA* slots with corresponding PBPS results are prioritized in resource selection. |
| Nokia, NSB | Approach 1 | We agree the part when there are enough Y candidate slots in the RSW.  When there are not enough Y slots, we shall use Approach 2-like approach with a newly selected set of candidate slots. |

**Proposal 2-3 (I):** 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* and RSW are defined according to one of the followings:
  + Definition 1: *T1* and RSW are defined according to step 1) of Rel-16 TS 38.214 Sec. 8.1.4.
  + Definition 2: *T1 = TB + +*  and the RSW is .
    - Candidate resource set (*SA*) is initialized to the set of all the candidate single-slot resources within the RSW.
* *TA* and *TB* for CPS monitoring window and a candidate resource set (*SA*) for the above Approach 1 is initialized according to one of the following approaches.
  + Approach 1: Based on a remaining RSW after CPS monitoring
    - If *T1* and RSW are defined as per Rel-16, the candidate resource set (*SA*) is initialized to the set of all candidate single-slot resources in the remaining RSW [, ], where *TB* is selected by the UE such that length of remaining RSW ≥ a minimum selection window size (*T2min, Ymin*, etc).
    - For the CPS monitoring window [*n*+*T*A, *n*+*T*B], *T*A = 1 and *T*B is selected by the UE such that *TB* – *TA* ≥ *M*, or *TA* and *TB* are both selected such that UE has sensing results for at least *M* slots before the start of the remaining RSW () including sensing results already obtained by the UE before slot *n* for another resource (re)selection or re-evaluation/pre-emption process.
      * *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on priority, latency or measured CBR.
  + Approach 2: Based on a set of Y candidate slots
    - If *T1* and RSW are defined as per Rel-16, the candidate resource set (*SA*) is initialized to a set of *Y* candidate slots which is to be selected by the UE within the RSW.
    - CPS monitoring window:
      * Alt.1: *n*+*T*A = and *n*+*T*B = , where is the first slot of the *Y* candidate slots.
      * Alt.2: *n*+*T*A ≥ and *n*+*T*B = , where *T*B should be selected by the UE such that *T*B *– T*A *≥ M* and *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on priority, latency or measured CBR.
      * Alt.3: *T*A and *T*B are determined by the UE to monitor all or at least *M* slots (before the reporting of a subset of resources to higher layer) that could have a SCI indicating a reserved resource in any of the selected set of *Y* candidate slots.

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| **Company** | **Definition 1 or 2,**  **Approach 1 or 2 (Alt.1, 2 or 3)** | **Comments** |
| NTT DOCOMO | Definition 1 + Approach 2 with Alt 2 | Important thing is to ensure monitoring sufficient slots. We think the following directions can achieve this.   * Definition 2 + Approach 1 * Definition 1 + Approach 2 with Alt 2 * Definition 1 + Approach 1   Either is OK for us, but slight preference is Definition 1 + Approach 2 with Alt 2 for commonality with the case when periodic reservation is enabled. |
| Sharp | Definition 2, Approach 2(Alt.1) | We prefer a unified design for the above 3 cases. |
| LGE | Definition 1,  Approach 2,  Alt 3 | We have a same view as DOCOMO. We support to follow Rel.16 rule for RSW definition.  Aiming for a simplest and unified solution, we support Approach 2 with Alt 3, as same as in Proposal 2-2. |
| Fujitsu | Please see comment | It seems both approach 1 and 2 are based on definition 1. More clarification is needed.  As for approach 1 and approach 2, we prefer the latter. Approach 1 is based on the premise that the UE starts CPS after the resource (re)selection is triggered in slot n, which is not always true. A UE transmitting periodic packets can also select resource(s) from the Tx pool with periodic reservation for another TB disabled. In such case, the UE is able to start CPS before slot n since the arrival of next TB can be predicted. |
| OPPO | **Definition 1;**  **Approach 1** | For the definition of T1 and RSW, it can reuse the R16 definition, there is no necessary to introduce new definition.  For *TA* and *TB* and candidate resource set (*SA*), we support Approach 1. There are some typos in Approach1:   * *TA* and *TB* for CPS monitoring window and a candidate resource set (*SA*) ~~for the above Approach 1~~ is initialized according to one of the following approaches.   + Approach 1: Based on a remaining RSW after CPS monitoring     - If *T1* and RSW are defined as per Rel-16, the candidate resource set (*SA*) is initialized to the set of all candidate single-slot resources in the remaining RSW [, ], where *TB* is selected by the UE such that length of remaining RSW ≥ a minimum selection window size (*T2min, ~~Y~~~~min~~*~~,~~ etc).     - For the CPS monitoring window [*n*+*T*A, *n*+*T*B], *T*A = 1 and *T*B is selected by the UE such that *TB* – *TA* ≥ *M*, or *TA* and *TB* are both selected such that UE has sensing results for at least *M* slots before the start of the remaining RSW () including sensing results already obtained by the UE before slot *n* for another resource (re)selection or re-evaluation/pre-emption process.       * *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on priority, latency or measured CBR. |
| Spreadtrum | Definition 2, Approach 2(Alt.1) |  |
| Sony | Definition 1 + Approach 2 with Alt 1 |  |
| CMCC | Definition 1,  Approach 1 | Regarding the definition of T1, we don’t see the strong need to change the way defined in Rel-16. |
| NEC | Definition 1  Approach 2 (Alt.1) | We prefer definition 1 and approach 2 to use R16 as baseline and to define CPS window as Alt.1 to monitoring the possible reservation within 32 slots. |
| vivo | Definition 1 + approach2 with modified alt1 or modified Alt2. | No need to introduce a T1 definition different from the CPS in pool allowing PBPS for CPS only case, prefer to reuse the R16 T1 to have a unified framework for CPS in pools with/without PBPS to minimize the spec efforts.  Regarding the CPS window, we think that *n*+*T*A can be earlier than slot n for the same reasons provided in our comments to **Proposal 2-2 (I):**   * + - * Modified Alt.1: *n*+*T*A is determined by UE~~≥~~  and *n*+*T*B = , where is the first slot of the *Y* candidate slots.       * Modified Alt.2: *n*+*T*A is determined by UE~~≥~~  and *n*+*T*B = , where *T*B should be selected by the UE such that *T*B *– T*A *≥ M* and *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on priority, latency or measured CBR. |
| Xiaomi | Approach 1 with revision | We do not see the benefit or necessity to define a new parameter M. To guarantee all the useful CPS sensing results are achieved, TB-TA should be at least 31. Therefore, we suggest to revise the approach 1 as:   * + Approach 1: Based on a remaining RSW after CPS monitoring     - If *T1* and RSW are defined as per Rel-16, the candidate resource set (*SA*) is initialized to the set of all candidate single-slot resources in the remaining RSW [, ], where *TB* is selected by the UE such that length of remaining RSW ≥ a minimum selection window size (*T2min, Ymin*, etc).     - For the CPS monitoring window [*n*+*T*A, *n*+*T*B], *T*A = 1 and *T*B is selected by the UE such that *TB* – *TA* ≥ 31 *~~M~~*, or *TA* and *TB* are both selected such that UE has sensing results for at least 31 *~~M~~* slots before the start of the remaining RSW () including sensing results already obtained by the UE before slot *n* for another resource (re)selection or re-evaluation/pre-emption process.       * *~~M~~* ~~is a (pre-)configured minimum number of slots for CPS monitoring window based on priority, latency or measured CBR.~~ |
| Intel | Definition 1  Approach 3 (Modified Approach 1) | For RSW, we propose Definition 1.  For monitoring window:   * we propose *T*A = 1 * (n+TB) *=* tLast, where tLast is the slot of the last retransmission of a TB or received HARQ feedback   We have concern on finishing CPS right before resource selection window since re-evaluation procedure requires sensing operation |
| Samsung | Definition 2  Approach 1 with revisions | We are not clear whether “above Approach 1” means Approach 1 in P2-2(I). If so, we prefer to discuss the initialization of candidate resource set by a separate proposal.  For TA/TB values in CPS-only case, it needs to be clarified that whether the two bullets in each approach correspond to definition 1&2, respectively, and whether they will be down-selected. Since some bullets mentioned remaining RSW as shown in definition 1, and different steps are mixed together, we prefer to further discuss after the wording and logical structure being clear enough.  We also suggest to modify the definition of T1 value as: , similarly as in Rel-16 NRSL. |
| Huawei, HiSilicon | Definition 1,  Approach 2 (Alt. 1) | On T1 and RSW  Rel-16 definition is already sufficient for Rel-17 RA schemes, and works well. It has never been demonstrated there are any problems for reusing it, so definition 1 should be adopted which is already agreed for CPS + PBPS case.  On *TA* and *TB* for CPS monitoring window  Main bullet is not clear, which approach is implied by the wording “above approach 1”, we think it can be simply deleted.  We agree the FL’s assessment that giving multiple combinations of PBPS and CPS will complicate the design and cost more TU budget. It is desirable to have a unified framework for cases of PBPS+CPS and CPS only to reduce the specification effort. Thus Approach 2 is preferred, which is aligned with CPS+PBPS case.  On approach 1, the CPS results cannot be utilized if the first selected candidate resource is 31/31+ slots away from the end of CPS window, and whereas in Approach 2 the CPS results will be always useful to determine at least the first candidate slot.  Similarly as in Proposal 2-2 (I), a smaller CPS window can lead to incomplete sensing which may not detect some aperiodic reservation from other UEs. Thus Alt 1 is supported. |
| ZTE, Sanechips | Definition 1+ Approach 2 Alt 1 | The RSW can be set such that CPS window is set according to Rel-16 logic. |
| Ericsson | Definition 1 + Approach 1 | We are supportive of Definition 1 + Approach 1. |
| Fraunhofer | Definition 1, Approach 2, Alt 2 | Regarding T1 and RSW, we are fine with using the Rel-16 definitions.  We support Approach 2 with Alt 2 for commonality with Proposal 2-2. |
| Lenovo&MotM | Definition 1 and  Approach 1 |  |
| Apple | Definition 2, Approach 1 (with modification) | Definition 2 is clear in defining RSW. In Definition 1, not all the resources are usable in the RSW, which is against the definition of RSW.  It is unclear which “the above Approach 1” refers in the second main bullet.  In Approach 1, we do not specify the details of “M” and suggest keeping M as FFS.   * + Approach 1: Based on a remaining RSW after CPS monitoring     - If *T1* and RSW are defined as per Rel-16, the candidate resource set (*SA*) is initialized to the set of all candidate single-slot resources in the remaining RSW [, ], where *TB* is selected by the UE such that length of remaining RSW ≥ a minimum selection window size (*T2min, Ymin*, etc).     - For the CPS monitoring window [*n*+*T*A, *n*+*T*B], *T*A = 1 and *T*B is selected by the UE such that *TB* – *TA* ≥ *M*, FFS on M. ~~or~~ *~~T~~~~A~~* ~~and~~ *~~T~~~~B~~* ~~are both selected such that UE has sensing results for at least~~ *~~M~~* ~~slots before the start of the remaining RSW () including sensing results already obtained by the UE before slot~~ *~~n~~* ~~for another resource (re)selection or re-evaluation/pre-emption process.~~   *~~M~~* ~~is a (pre-)configured minimum number of slots for CPS monitoring window based on priority, latency or measured CBR.~~ |
| CATT,GOHIGH | See comment | *T1* and RSW are defined according to definition 2.  But there is no reason that *TA* and *TB* is based on “Based on a remaining RSW after CPS monitoring” or “Based on a set of Y candidate slots”, it’s misleading and confusing.  You can just list the constraint for *TA* and *TB.* For example (we support )Alt.2: *n*+*T*A ≥ and *n*+*T*B = , where *T*B should be selected by the UE such that *T*B *– T*A *≥ M* and *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on priority, latency or measured CBR. |
| InterDigital | Definition 1 + Approach 1 | We prefer to keep the same definition of the resource selection window as R16. Therefore, we support Definition 1.  Regarding CPS sensing window, in our view, minimum CPS sensing window is essential. Approach 1 requires the UE sensing right after slot n while Approach 2 allows the UE to delay CPS sensing according to the selection of the set of Y candidate slots. We don’t see the motivation to delay the CPS; therefore, we support Approach 1. |
| Qualcomm | Definition 2, Approach 1 | The Rel-16 definition of R1 assumes that UE already has sensing results, which isn’t always the case for Rel-17. If Definition 1 is used, the M\_total should be updated.  We support Approach 1 because it lowers transmission latency and increases the candidate set size when there are existing sensing results.  In all cases, the n+1 start of sensing should be subject to some UE processing delay instead of assuming the immediately following slot. For example, if the trigger arrives at the end of slot n, the UE will not have sufficient time to start the sensing procedure and decode the SCI in slot n + 1. Therefore, we propose to replace all instances of n + 1 with n + X, and the constant X can be discussed later. The same applies for all cases of *T*A = 1, which would become *T*A = X.  Is “Approach 1” a typo in the following?   * *TA* and *TB* for CPS monitoring window and a candidate resource set (*SA*) for the above Approach 1 is initialized according to one of the following approaches. |
| Futurewei | Definition 2,  Approach 1 with some modifications | Approach 1 with definition 1 is a simple and clean approach of CPS for aperiodic traffic. And the approach does not need to tie with any setting for PBPS. Then minimum RSW should not be dependent of Ymin. Since CPS only be effective for the next 31 slots, the minimum number of slots should be equal or smaller than 31 subject to processing time. We prefer . Also UE is allow to continue sensing after n+TB and an upper bound ofTB is needed which is a function of remaining PDB, min RSW, etc, e.g.,  We propose some minor change on approach 1   * + Approach 1: Based on a remaining RSW after CPS monitoring     - If *T1* and RSW are defined as per Rel-16, the candidate resource set (*SA*) is initialized to the set of all candidate single-slot resources in the remaining RSW [, ], where *TB* is selected by the UE such that length of remaining RSW ≥ a minimum selection window size (*T2min, ~~Y~~~~min~~*~~,~~ etc).     - For the CPS monitoring window [*n*+*T*A, *n*+*T*B], *T*A = 1 and *T*B is selected by the UE such that *TB* – *TA* ≥ *M*, or *TA* and *TB* are both selected such that UE has sensing results for at least *M* slots before the start of the remaining RSW () including sensing results already obtained by the UE before slot *n* for another resource (re)selection or re-evaluation/pre-emption process.       * *M where ,* is a (pre-)configured minimum number of slots for CPS monitoring window based on priority, latency or measured CBR.       * Upper bound of TB is PDB-RSWmin- (Tproc,0 +Tproc,1 ). |
| Nokia, NSB | Definition 2, Approach 1 | This is the CPS only case. Generally Rel-16 rule shall be followed to for T1 and RSW. The T1 definition in TS 38.214 Sec 8.1.4 is:  “- selection of is up to UE implementation under , where is defined in slots in Table 8.1.4-2 where is the SCS configuration of the SL BWP;”  This Rel16 definition assumes that UE has full sensing result at n. This is no longer true for CPS. Therefore, a new T1 definition is needed. |

### Proposals for 2nd GTW session

FL observations and comments based on inputs received in Sec. 3.2.1:

* On Proposal 2-1 (I) (the case of PBPS+CPS for periodic transmission),
  + Alt.1 (CPS monitoring window = 32 slots): DCM, Sharp, LGE, Fujitsu, OPPO, Spreadtrum, Sony, CMCC, NEC (*T1* instead), vivo, Xiaomi, Intel/Fraunhofer (start is configurable and ends at last re-Tx/HARQ), Samsung (logical slot update), Huawei, HiSilicon, ZTE, Sanechips, MediaTek, Lenovo, MotM, Apple, InterDigital, Nokia, NSB
  + Alt.2 (M ≤ CPS monitoring window ≤ 32 slots): Fujitsu, OPPO, Ericsson/CATT/GOHIGH (PDB), Fraunhofer, Futurewei (*n*+*T*B ≥ )
  + Alt.3 (sensing all or *M* slots to detect dynamic reservations in SCI): LGE (small update), Qualcomm

Since the majority’s preference is Alt.1 due to full sensing results can be obtained by the UE, an updated proposal is provided below taking into account of suggestion from Samsung on logical/physical slot and whether we should use *T1* instead of .

* On Proposal 2-2 (I) (the case of PBPS+CPS for aperiodic transmission),
  + Approach 1: Fujitsu (FFS CPS window), OPPO, Samsung (min CPS, prioritization and logical/physical), Huawei/HiSilicon/MediaTek/Apple (FFS for less than *Ymin* in RSW), ZTE, Sanechips, Lenovo, MotM, Qualcomm, Nokia, NSB
  + Approach 2
    - Alt.1: Sharp, Spreadtrum, Sony, CMCC, NEC, vivo (earlier results), InterDigital
    - Alt.2: DCM, vivo (earlier results), Fraunhofer, CATT, GOHIGH, InterDigital
    - Alt.3: LGE
  + Approach 3 (only CPS is considered): Xiaomi, Intel, Futurewei
* On Proposal 2-3 (I) (the case of CPS-only for aperiodic transmission),
  + Definition 1 (17): DCM, LGE, OPPO, Sony, CMCC, NEC, vivo, Intel, Huawei, HiSilicon, ZTE, Sanechips, Ericsson, Fraunhofer, Lenovo, MotM, InterDigital
  + Definition 2 (8): Sharp, Spreadtrum, Samsung, Apple, CATT, GOHIGH, Qualcomm, Futurewei, Nokia, NSB
  + Approach 1 (12): OPPO, CMCC, Xiaomi (no minimum *M*), Intel (sensing till last re-Tx), Samsung, Ericsson, Lenovo, MotM, Apple, InterDigital, Qualcomm, Futurewei, Nokia, NSB
  + Approach 2 (15)
    - Alt.1: Sharp, Spreadtrum, Sony, NEC, vivo, Huawei, HiSilicon, ZTE, Sanechips,
    - Alt.2: DCM, vivo, Fraunhofer, CATT, GOHIGH
    - Alt.3: LGE

**Proposal 2-1 (II):** 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:
  + Alt.1: *n*+*T*A = in logical slots, and *n*+*T*B = , where is the first slot of the selected *Y* candidate slots of PBPS, and , are in units of physical time/slots.
    - FFS whethershould be changed to *T1.*
  + ~~Alt.2:~~ *~~n~~*~~+~~*~~T~~*~~A~~ ~~≥ and~~ *~~n~~*~~+~~*~~T~~*~~B~~ ~~= , where~~ *~~T~~*~~B~~ ~~should be selected by the UE such that~~ *~~T~~*~~B~~ *~~– T~~*~~A~~ *~~≥ M~~* ~~and~~ *~~M~~* ~~is a (pre-)configured minimum number of slots for CPS monitoring window based on priority, latency or measured CBR.~~
  + ~~Alt.3:~~ *~~T~~*~~A~~ ~~and~~ *~~T~~*~~B~~ ~~are determined by the UE to monitor all or at least~~ *~~M~~* ~~slots (before the reporting of a subset of resources to higher layer) that could have a SCI indicating a reserved resource in any of the selected set of~~ *~~Y~~* ~~candidate slots.~~

### Proposals before 3rd GTW session

During the 2nd GTW session for R17 NR eSL, an updated version of Proposal 2-1 (II) was agreed, which is now captured in Section 2 of this document. Let’s continue the discussion for the remaining P2-2 (PBPS+CPS) and P2-3 (CPS-only), both for resource (re)selection procedure triggered by aperiodic transmission.

One thing that I think is worth considering when making a selection of an approach or alternative in each proposal is that it is highly desirable that we can have a common approach and same/similar CPS and candidate resource set (*SA*) initialization design in both cases for simpler specification. But of course, if it is technically well justified that we should have different designs for the two cases, then we can live with that.

FL comment for P2-2, I have not removed any approach and alternatives in the new proposal (Proposal 2-2 (II)), in fact, Ericsson’s proposal is included as Approach 3 and the scheme from Xiaomi/Intel/Futurewei is in Approach 4. This proposal will not be discussed during the 2nd GTW session but to be continued over the FL summary to collect more views since new approaches are now added.

**Proposal 2-2 (II):** 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 () in slot *n*, *TA* and *TB* for CPS monitoring window and a candidate resource set (*SA*) is initialized according to one of the following approaches.
  + Approach 1: Based on a minimum number of Y candidate slots (*Ymin*)
    - No new set of *Y* candidate slots is selected by the UE
    - When ~~there are~~ at least *Ymin* slots of a set of *Y* candidate slots from a PBPS are located within the RSW
      * Candidate resource set (*SA*) is initialized to all ~~the slots of~~ single-slot candidates in of the set of Y candidate slots that are located within the RSW in Step 4)
      * CPS monitoring window:
        + *n*+*T*A is determined by UE, , , or a minimum CPS monitoring window should be ensured

FFS on X

* + - * + *n*+*T*B = , where , are in units of physical time/slots.
    - FFS: When there are less than *Ymin* slots in the RSW, including a minimum selection window, minimum CPS monitoring window and reusing all existing sensing results.
  + Approach 2: Based on a set of Y candidate slots
    - Candidate resource set (*SA*) is initialized to a set of Y candidate slots within the RSW, where all or some of Y candidate slots may be newly selected or from an existing PBPS
    - CPS monitoring window:
      * Alt.1: *n*+*T*A = and *n*+*T*B = , where is the first slot of the *Y* candidate slots.
        + FFS on X
      * Alt.2: *n*+*T*A ≥ and *n*+*T*B = , where *T*B should be selected by the UE such that *T*B *– T*A *≥ M* and *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on priority, latency or measured CBR.
        + FFS on X
      * Alt.3: *T*A and *T*B are determined by the UE to monitor all or at least *M* slots (before the reporting of a subset of resources to higher layer) that could have a SCI indicating a reserved resource in any of the selected set of *Y* candidate slots.
  + Approach 3: Merger between Approach 1 and 2
    - Candidate resource set (*SA*) is initialized to all the slots of the set of Y candidate slots that are located within the remaining RSW. In case the total number of slots is below a certain (pre-)defined threshold X:
      * Additional candidate resources are selected to fulfil the threshold X from the set of candidate resources in the remaining RSW
    - For the CPS monitoring window [*n*+*T*A, *n*+*T*B], *T*A = 1 and *T*B is selected by the UE such that *TB* – *TA* ≥ *M*, or *TA* and *TB* are both selected such that UE has sensing results for at least *M* slots before the start of the remaining
      * *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on based on priority, latency or measured CBR.
  + Approach 4: Based on CPS-only + all available sensing results including PBPS
    - Candidate resource set (*SA*) is initialized to the set of all candidate single-slot resources in the remaining RSW [, ], where *TB* is selected by the UE such that length of remaining RSW ≥ *T2min*.
    - For the CPS monitoring window [*n*+*T*A, *n*+*T*B], *T*A = 1 and *T*B is selected by the UE such that *TB* – *TA* ≥ *M*, or *TA* and *TB* are both selected such that UE has sensing results for at least *M* slots before the start of the remaining RSW () including sensing results already obtained by the UE before slot *n*+*T*Bfor another resource (re)selection or re-evaluation/pre-emption process.
      * *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on based on priority, latency or measured CBR.
    - *SA* slots with corresponding PBPS results are prioritized in resource selection.

|  |  |  |
| --- | --- | --- |
| **Company** | **Which approach or alternative** | **Comments** |
| Fujitsu | Approach 1 | It is the simplest approach and can provide more reliable performance compare with the other three approaches. |
| NTT DOCOMO | Approach 2 with Alt 2 | In my understanding, Approach 1 tries to use existing PBPS results as many as possible first but it will be a bit complicated to ensure minimum CPS window size as having big FFS. Meanwhile, approach 2 tries to ensure minimum CPS window size first and existing PBPS results are used only if available.  Approach 2 will be easier, so we prefer approach 2.  Regarding alt, alt 1 means that the UE shall wait monitoring completion of many slots for transmission. It is not good for some traffic e.g. with severe latency requirement with high priority. Changeable window will be better. |
| LGE | Approach 2  Alt 4 | We support FL’s direction that we should aim for a common solution for various cases. We have the following procedure in summary for PBPS+CPS for periodic transmission.   1. RSW selection (same as Rel.16) 2. Candidate slots selection (>Ymin) 3. Required partial sensing (PBPS+CPS) prior to ty0 4. Resource exclusion and reporting S\_A   We prefer the same procedure to be used for PBPS+CPS and CPS only for aperiodic transmission as follows   1. RSW selection (same as Rel.16) 2. Candidate slots selection (>Ymin) 3. Required partial sensing (CPS) prior to ty0 4. Resource exclusion and reporting S\_A   UE can choose any location of candidate slots within RSW in periodic transmission. But in aperiodic transmission, UE should choose candidate slots considering the required partial sensing including CPS. This is the only difference, and we don’t have to force UE to perform PBPS for aperiodic transmission. UE can always consider any PBPS results available, and it’s already enough.  Based on the above approach, and we’re aiming for unified approach, we suggest to add the following Alt 4 using the agreed text for periodic transmission case.   * + Alt 4: *n*+*T*A is at least 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 for CPS, and , are in units of physical time/slots.   + M(<32) is (pre-)configured.   We support Alt 4, and it should be same as the CPS-only case. Optimization for using any available PBPS sensing results or Y candidate slots for PBPS should be handled by UE implementation. We don’t need to discuss such optimization issues at this stage.  The last comment on the main bullet. The condition described in the proposal is not general case representing aperiodic transmission, but a special case where the RSWs for periodic and aperiodic transmission overlaps to some extent. We prefer more generalized condition rather than this kind of special one, to avoid unnecessary steering for optimization as in approach 1 ☺  Whether or not performing PBPS cannot be a condition for aperiodic transmission. We suggest to remove the relevant part. For this reason, CPS operation should be same regardless of configurability of periodic transmission in a resource pool.  **Proposal 2-2 (II):** 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, |
| vivo | Modified approach2+alt1/2/3 or modified approch3 | This issue is related to Proposal 2-3, we should avoid introducing different procedure for the CPS process in a pool with enabled/disabled PBPS. For example, if a set of Y candidate slot is determined for the CPS only case in pool with disabled PBPS as discussed in Proposal 2-3 to guarantee sufficient candidate resources, then for CPS in CPS+ existing/triggered PBPS case discussed in this proposal, we also need to consider a separate set of candidate slot for the CPS process. As we support approach2 in Proposal 2-3, we also prefer approach2 in this proposal to have a unified design for CPS.  For the starting point of CPS, as we mentioned before, if there are existing resources available before slot n, there is no reason not to consider them when determining the CPS window, so the *n*+*T*A can be set to .  If a new Y candidate slot is determined for CPS, it is possible that there is no overlapping between the remaining selection window and the set f Y candidate slot of any existing PBPS. Thus we have the approach2 modified as below   * Approach 2: Based on a set of Y candidate slots   + Candidate resource set (*SA*) is initialized to a set of Y candidate slots within the RSW, where all or some or none of Y candidate slots may be newly selected or from an existing PBPS   + CPS monitoring window:     - Alt.1: *n*+*T*A is determined by UE, , or and *n*+*T*B = , where is the first slot of the *Y* candidate slots.       * FFS on X     - Alt.2: *n*+*T*A is determined by UE, , or ≥ and *n*+*T*B = , where *T*B should be selected by the UE such that *T*B *– T*A *≥ M* and *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on priority, latency or measured CBR.       * FFS on X     - Alt.3: *T*A and *T*B are determined by the UE to monitor all or at least *M* slots (before the reporting of a subset of resources to higher layer) that could have a SCI indicating a reserved resource in any of the selected set of *Y* candidate slots.   Having said that, if it is hard to do down selection between approach1 and approach2, we can focus on the common issues discussed in both Approach 1 and Approach 2, i.e., whether to introduce a minimum size limit M for CPS window and a minimum size limit for the set of candidate slot **(To distinguish from the Y candidate slot of PBPS, the minimum size for the set of candidate slot in the proposal is denoted by Zmin, the size of the set of candidate slot is denoted by Z)**. How to determine the set of candidate slot, whether the set of candidate slot should be determined based on status of the Y candidate slot of any PBPS, whether Zmin is exactly as Ymin for PBPS, can be FFS in the following meeting. So we modified approach3 as following   * Approach 3: Merger between Approach 1 and 2   + Candidate resource set (*SA*) is initialized to all the slots of the set of Z~~Y~~ candidate slots that are located within the remaining RSW. In case the total number of slots is below a certain (pre-)defined threshold Zmin~~X~~:     - FFS：whether the set of Z candidate slots should be set to the overlapping slots between the remaining RSW and the Y slot of PBPS       * FFS the case when Z<Zmin     - FFS whether all or some of the set of Z candidate slots are the slots are newly determined     - Additional candidate resources are selected to fulfil the threshold Zmin~~X~~ from the set of candidate resources in the remaining RSW   + For the CPS monitoring window [*n*+*T*A, *n*+*T*B], *~~T~~*~~A~~ ~~= 1~~ *n*+*T*A is determined by UE, , or and *T*B is selected by the UE such that *TB* – *TA* ≥ *M*, or *TA* and *TB* are both selected such that UE has sensing results for at least *M* slots before the start of the remaining     - *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on based on priority, latency or measured CBR. |
| ZTE,Sanechips | Approach 1 | 1: In both Approach 1 and 2, slot n is a physical slot, but T^SL\_y0 is a logical slot, so the formula and the equality sign should be replaced as the wording in the agreement for Proposal 2-1 (II).  2: It should be acknowledged that both PBPS and CPS are triggered by MAC layer and is performed for current transmission, based the parameters provided by MAC layer such as the resource pool from which the resources are to be reported; L1 priority; the remaining packet delay budget; the number of sub-channels to be used for the PSSCH/PSCCH transmission in a slot ;optionally, the resource reservation interval.  Accordingly, the candidate resource set (*SA*) should sensed via both PBPS and CPS, i.e. the candidate resource set (*SA*) should be the same for both PBPS and CPS. |
| Xiaomi | Approach 4 | From our understanding, for aperiodic traffic it cannot guarantee that there always exist more than Ymin candidate slots of PBPS.  - Approach 1 consider the case as FFS, and thus we do not think it is a complete solution;  - In current Approach 2, it is not clear whether there is a lower bound on the number of candidate slots Y like PBPS. In addition, it is not clear how many slots in Y candidate slots should be from PBPS, since it said “All or some of Y candidate slots may be newly selected or from an existing PBPS”. If arbitrary number of slots in Y candidate slots can be from PBPS, we do not see much difference from approach 2 and approach 4. The only issue we need to discuss is on how to decide CPS monitoring window and CPS SA.  - In Approach 3, if the number of candidate slots from PBPS in remaining RSW is less than X, additional candidate resources will be fulfilled. However it is still not clear on how to fulfill the resources. A simple solution to fulfill the resource is to include all the single slot candidate resource in the remaining RSW window, which can thus be very similar to Approach 4.  - In our view Alt 4 can also include all the candidate slots from existing PBPS which is located in the remaining RSW. In addition, it is rather simple and clear. |
| OPPO | Approach 1 | Add a note as below to clarify that is not the first slot of Y which is selected for PBPS for periodic traffic.  Note: is slot of the set of Y candidate slots that are located within the RSW in Step 4) |
| NEC | Approach 2 and Alt.1 | Still our preference is same as first round. Approach 2 could contain the part of the existing PBPS candidate slots and also new candidate slots considering resource flexibility and different PDB requirement |
| Ericsson | Approach 3 | We are supportive of Approach 3 since it includes a procedure where the selection window is selected in order to maximize the number of candidate slots which are intersecting with the set Y.  Additionally, based on the agreement reached during last GTW related to P2-1, Approach 3 creates a CPS which is aligned with the agreements reached in this meeting. We have a similar view as FL that we should strive to have a unified procedure for the CPS as much as possible. |
| Fraunhofer | Approach 2, Alt 4 (from LG) | We prefer to support LG’s Alt 4 for the CPS monitoring window since it is a common solution to the agreement made for PBPS+CPS for periodic transmissions. The value of M can be based on priority, latency or measured CBR.   * + Alt 4: *n*+*T*A is at least 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 for CPS, and , are in units of physical time/slots.   + M(<32) is (pre-)configured based on priority, latency or measured CBR. |
| MediaTek | Approach 1 | This is the simpler approach, and it ensures common set of Y candidate slots between PBPS and CPS. |
| Huawei, HiSilicon | Approach 1 with modification | We support Approach 1 in general and suggest to have some modifications.  Approach 1 is aligned with agreement for case that , and is reasonable because sensing is to detect other UE’s reservation to avoid collision with its own, regardless of its own traffic type being periodic or aperiodic, i.e. there is just one set of Y slots, and UE checks PBPS and CPS to determine available resources. In addition, PBPS already allows UE performing sensing before slot n, the max(.) operation is not needed to set the starting of the monitoring window, because a UE can always monitor most recent 31 slots prior to the t\_y0 (subject to processing time).   * Approach 1: Based on a minimum number of Y candidate slots (*Ymin*)   + No new set of *Y* candidate slots is selected by the UE   + When ~~there are~~ at least *Ymin* slots of a set of *Y* candidate slots from a PBPS are located within the RSW     - Candidate resource set (*SA*) is initialized to all ~~the slots of~~ single-slot candidates in of the set of Y candidate slots that are located within the RSW in Step 4)     - CPS monitoring window:       * *~~n~~*~~+~~*~~T~~*~~A~~ ~~is determined by UE, , , or a minimum CPS monitoring window should be ensured~~         + ~~FFS on X~~       * *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.       * *n*+*T*B = , where , are in units of physical time/slots.   + FFS: When there are less than *Ymin* slots in the RSW, including a minimum selection window, minimum CPS monitoring window and reusing all existing sensing results.   Approach 2, new selected slots does not help the UE to detect periodic reservation made by other UEs before slot n, thus results in higher collisions if they are used.  Approach 3, those additional candidate resources added to fulfil the threshold X, which does not belong to the Y candidate slots, have not been monitored before t\_y0, and likely result in more collisions if used. In addition, the purpose of CPS is to detect aperiodic reservation on top of periodic reservation which is detected by PBPS. Thus CPS window should be set based on t\_y0 for initial resource selection, otherwise without considering the set of Y slots, CPS window would be far from the t\_y0, e,g, more than 31 slots, and does not help to detect aperiodic reservation. The CPS results would be less useful.  Approach 4, similar comment for Approach 3, the initialized candidate resource sets contains slots beyond a set of Y slots, which are not sensed before t\_y0 accordingly. It will be problematic to use such slots since more collision may occur. On the other hand, it does not make sense either what the “another resource (re)selection or re-evaluation/pre-emption process” refer to, neither know the relationship with the initial candidate resource determination. We have concerns on this approach. |
| Samsung | Approach 1 as 1st preference,  Approach 4 as second preference | We have concern on the latency impact of initiating new PBPS for aperiodic transmissions, thus Approach 2 is not acceptable for us.  Approach 1 is preferred because of its higher reliability and lower transmission delay and no additional power consumption, especially for the case of Ymin slots with PBPS result existed in the RSW. We suggest the following modifications to avoid ambiguity and align the wording with another agreement we made in GTW:   * Approach 1: Based on a minimum number of Y candidate slots (*Ymin*) * No new set of *Y* candidate slots is selected by the UE * When ~~there are~~ at least *Ymin* slots of a set of *Y* candidate slots from ~~a~~ PBPS(s) are located within the RSW   + Candidate resource set (*SA*) is initialized to all ~~the slots of~~ single-slot candidates in of the set of Y candidate slots that are located within the RSW in Step 4)   + CPS monitoring window:     - *n*+*T*A is no earlier than the latest of M logical slots before slot , and is no earlier than next X logical slot after n, or a minimum CPS monitoring window should be ensured       * By default, M is 31 unless (pre-)configured with another value.       * FFS on X     - *n*+*T*B ~~=~~ , is slots earlier than , where is the first slot of the selected *Y* candidate slots of PBPS and ~~, where~~ , are in units of physical time/slots. * FFS: When there are less than *Ymin* slots from PBPS(s) located in the RSW, including a minimum selection window, minimum CPS monitoring window and reusing all existing sensing results or using Approach 4.   Considering the consistency between different traffic type and sensing schemes, we can accept approach 4 as a compromise, and would like to further discuss under what condition approach 4 is used. In our understanding, one typical scenario is when there are insufficient PBPS sensing result within RSW, therefore we added using approach 4 in the FFS bullet above.  For approach 4 we also suggest some minor modifications:   * + For the CPS monitoring window [*n*+*T*A, *n*+*T*B], *~~T~~*~~A~~ ~~= 1~~ n+*T*A is the next logical slot after slot n, and n+*T*B is at least M logical slots after slot n. *T*B is selected by the UE such that *TB* – *TA* ≥ *M*, or *TA* and *TB* are both selected such that UE has sensing results for at least *M* slots before the start of the remaining RSW (the next logical slot after n+*T*B, subject to ) including sensing results already obtained by the UE before slot *n*+*T*Bfor another resource (re)selection or re-evaluation/pre-emption process. |
| Nokia, NSB | Approach 1 or Approach 2 Alt.1 | This is the case for aperiodic transmission with both PBPS and CPS enabled. Approach 1 prioritize PBPS sensing results, which is desirable when possible aperiodic traffic may happen between periodic transmission.  Approach 2 allows a newly selected Y candidate slots. We would be okay with Alt 1 on the CPS.  Approach 3 uses CPS sensing window, which will result in independent sensing for periodic traffic and aperiodic traffic (PBPS for periodic, and CPS for aperiodic). This is not necessary.  Approach 4 is similar to Approach 3 in CPS window, while the RSW is defined after n+T\_B. Not sure whether there will be enough slots in RSW when the aperiodic traffic size is relatively large. |

FL comments for Proposal 2-3: I believe all comments have been reflected in the updated Proposal 2-3 (II) below. For Definition 2, from the input comments in the last round, technically I have not identified a reason why T1 should be defined differently from the other two cases (PBPS+CPS for periodic and aperiodic transmissions). On the other hand, in Approach 2, since the candidate resource set (*SA*) should always be initialized to a set of selected Y slots (for which the UE should be able to select anywhere within the RSW) it is not well compatible with Definition 2. Furthermore, the *T1* and RSW definitions for PBPS+CPS cases are already aligned with those in R16, it seems simpler for the specification and provides a more aligned RSW design with other cases. Alt.3 is removed due to limited support.

Therefore, I invite further comments on the following Proposal 2-3 (II) using the FL summary. Since there is no new approach or alternative is provided in this round, rather than simply saying Approach x or Alternative y is preferred, I would like everyone to consider essential / killer reason(s) why we should go with Approach 1 or one of the alternatives in Approach 2.

**Proposal 2-3 (II):** 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* and RSW are defined according to one of the followings:
  + Definition 1: *T1* and RSW are defined according to step 1) of Rel-16 TS 38.214 Sec. 8.1.4.
  + ~~Definition 2:~~ *~~T~~~~1~~ ~~= T~~~~B~~ ~~+ +~~*  ~~or , and the RSW is .~~
    - ~~Candidate resource set (~~*~~S~~~~A~~*~~) is initialized to the set of all the candidate single-slot resources within the RSW.~~
* *TA* and *TB* for CPS monitoring window and a candidate resource set (*SA*) ~~for the above Approach 1~~ is initialized according to one of the following approaches.
  + Approach 1: Based on a remaining RSW after CPS monitoring
    - If *T1* and RSW are defined as per Rel-16 (Definition 1), the candidate resource set (*SA*) is initialized to the set of all candidate single-slot resources in the remaining RSW [, ], where *TB* is selected by the UE such that length of remaining RSW ≥ a minimum selection window size (*T2min~~, Y~~~~min~~*~~, etc~~).
    - For the CPS monitoring window [*n*+*T*A, *n*+*T*B], *T*A = 1 or X and *T*B is selected by the UE such that *TB* – *TA* ≥ *M*, 31 or tLast, or *TA* and *TB* are both selected such that UE has sensing results for at least *M* or 31 slots before the start of the remaining RSW () including sensing results already obtained by the UE before slot *n*+*T*Bfor another resource (re)selection or re-evaluation/pre-emption process.
      * *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on priority, ~~latency~~ PDB or measured CBR.
      * tLast is the slot of the last retransmission of a *TB* or received HARQ feedback
      * FFS on the value for *X* and *M*, and whether *TB* should be upper bounded
  + Approach 2: Based on a set of Y candidate slots
    - *T1* and RSW are defined as per Rel-16 (Definition 1), the candidate resource set (*SA*) is initialized to a set of *Y* candidate slots which is to be selected by the UE within the remaining RSW [, ], where *TB* is selected by the UE such that length of remaining RSW ≥ a minimum selection window size (*T2min* or *Ymin*).
    - CPS monitoring window:
      * Alt.1: *n*+*T*A is determined by UE or and *n*+*T*B = , where is the first slot of the *Y* candidate slots.
        + FFS on X
      * Alt.2: *n*+*T*A is determined by UE or ≥ and *n*+*T*B = , where *T*B should be selected by the UE such that *T*B *– T*A *≥ M* and *M* is a (pre-)configured minimum number of slots for CPS monitoring window based on priority, latency or measured CBR.
        + FFS on X
      * ~~Alt.3:~~ *~~T~~*~~A~~ ~~and~~ *~~T~~*~~B~~ ~~are determined by the UE to monitor all or at least~~ *~~M~~* ~~slots (before the reporting of a subset of resources to higher layer) that could have a SCI indicating a reserved resource in any of the selected set of~~ *~~Y~~* ~~candidate slots.~~

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| **Company** | **Which approach or alternative** | **Comments** |
| Fujitsu | Approach 2,  Alt 1 | Approach 2 provides a unified framework.  For Alt.2, with a shorter CPS monitoring window, some aperiodic reservation information will be missed, which leads to higher collision probability. |
| NTT DOCOMO | Approach 1 or  Approach 2 with Alt 2 | Approach 2 with alt 1 means that the UE shall wait monitoring completion of many slots for transmission. It is not good for some traffic e.g. with severe latency requirement with high priority. Changeable window will be better. |
| LGE | Approach 2,  Alt 1 with modification | Based on the current situation, we prefer Approach 2 with Alt 1 with some modification. The same requirement on the minimum sensing window should also be added on Alt 1.   * + Alt.1: *n*+*T*A is determined by UE or and *n*+*T*B = , where is the first slot of the *Y* candidate slots, and *T*B should satisfy *T*B *– T*A *≥ M* for a (pre-)configured *M*.     - FFS on X   Alt 2 allows shortened CPS window by UE implementation, which is quite critical in performance degradation for CPS-only case as there is no PBPS as in periodic transmission.  As for Approach 1, it’s not a unified approach in selecting the candidate resource sets, differently from the cases where periodic transmission is allowed in a resource pool. As we’re aiming for a common solution, we don’t prefer this approach. |
| Vivo | Approach2, alt1 or alt2 | In approach1, UE should first determine a CPS window, then determine the remaining selection window and the corresponding *SA*. while in the PBPS+CPS, UE determines *SA* based on PBPS first and derive the CPS window. so approach1 will require a procedure different from the case of CPS with PBPS and more significant spec efforts. We prefer to have a unified procedure for a CPS process with/without PBPS.  In addition, when T2 is set to >=T2min and T2min-TB>31 slots, there will be some slots in the remaining selection window without CPS results from the CPS window. Since no collision can be sensed for these resources, these resources will be reported directly to the MAC layer. It turns out that UE actually prioritizes these resources which has higher risk of collision during the resource reporting.  For approach2, as it is up to UE to determine the new Y-slot set for CPS, UE can select a Y-slot set with at least one CPS result. |
| Xiaomi | Approach 1 | In our view one of the major difference between approach 1 and approach 2 is on how candidate resource set (*SA*) is constructed. In approach 1 the resource set is constructed from time-domain continuous slots, while in approach 2 the resource set can be constructed from time-domain distributed slots. We do not see the necessity to built SA from distributed time slots, which may only increase the latency performance. Therefore, we prefer to approach 1. |
| OPPO | Approach 1 |  |
| NEC | Approach 2 and Alt.1 | Same reason as first round |
| Ericsson | Approach 1 | In our view, the following are advantages of Approach 1:   * The contiguous sensing procedure for aperiodic transmissions is different than in Rel-16 since the sensing procedure is triggered after the arrival of packet in the buffer (i.e., triggering slot n) which consumes part of the PDB of the packet. Approach 1 proposes to have a minimum selection window size which avoids the effects of having a reduced selection window (e.g., unavailability of enough resources). * Moreover, for the contiguous sensing window using a similar reasoning, it is important to have a (pre-)configured minimum sensing window in order to avoid packet collisions.   + Sensing is more important in loaded scenarios or for high priority transmissions. Therefore, we propose to base this parameter in priority or CBR. * Additionally, based on the agreements reached during GTW session for power saving, Approach 1 provides a unified scheme for performing contiguous partial sensing which is aligned with the current proposals.   We also have a question for clarification, what is the intention of the parameter: tLast is the slot of the last retransmission of a TB or received HARQ feedback |
| Fraunhofer | Approach 2, Alt 4 | Regarding the CPS monitoring window, we think that the same solution for the previous 2 cases would work here as well, and prefer to maintain a common solution as much as possible. It also provides the option of a configurable sensing window.   * + Alt 4: *n*+*T*A is at least 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 for CPS, and , are in units of physical time/slots.   + M(<32) is (pre-)configured based on priority, latency or measured CBR. |
| MediaTek | Approach 2, Alt 1 | Approach 2 is preferred to have consistency of Y candidate slots between different cases. |
| Huawei, HiSilicon | Approach 2 with modifications | We support the spirit of Approach 2 that initialize the resources based on set of resource Y, which unifies the frame for PBPS + CPS (), PBPS + CPS () and CPS-only. However, the current Approach 2 seems self-contradicted. If the Y is selected within the remaining RSW, which implies the sensing window is fixed at the beginning of the RSW, but the following bullet is discussing how to set the monitoring window, which is based on t\_y0. It does not make sense what the sensing window proposed here. As we explained for Proposal 2-2 (II), fix the sensing window at the beginning of RSW is not reasonable. Thus, we suggest to remove the limitation within remaining RSW for Approach 2. On the monitoring window determination, in order to have more progress, we also suggest to merge Alt.1 and Alt. 2 which is already agreed for PBPS + CPS ().  In summary, we suggest to have following changes on Approach 2:   * + Approach 2: Based on a set of Y candidate slots     - *T1* and RSW are defined as per Rel-16 (Definition 1), the candidate resource set (*SA*) is initialized to a set of *Y* candidate slots which is to be selected by the UE within the ~~remaining~~ RSW ~~[, ], where~~ *~~T~~~~B~~* ~~is selected by the UE such that length of remaining RSW ≥ a minimum selection window size (~~*~~T~~~~2min~~*~~or~~ *~~Y~~~~min~~*~~).~~     - CPS monitoring window:       * ~~Alt.1:~~ *~~n~~*~~+~~*~~T~~*~~A~~ ~~is determined by UE or~~ ~~and~~ *~~n~~*~~+~~*~~T~~*~~B~~ ~~= , where is the first slot of the~~ *~~Y~~* ~~candidate slots.~~         + ~~FFS on X~~       * ~~Alt.2:~~ *~~n~~*~~+~~*~~T~~*~~A~~ ~~is determined by UE or ≥ and~~ *~~n~~*~~+~~*~~T~~*~~B~~ ~~= , where~~ *~~T~~*~~B~~ ~~should be selected by the UE such that~~ *~~T~~*~~B~~ *~~– T~~*~~A~~ *~~≥ M~~* ~~and~~ *~~M~~* ~~is a (pre-)configured minimum number of slots for CPS monitoring window based on priority, latency or measured CBR.~~         + ~~FFS on X~~       * *n*+*T*A = max (M logical slots earlier than slot , n) 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. |
| Samsung | Approach 1 with comments | We prefer approach 1 that all slots within RSW are initialized to SA rather than selecting a set of candidate slots.  For the definition of sensing window, we also would like to clarify whether values in formula are logical/physical, e.g. *n*+*T*Ais next logical slot after n, and *n*+*T*B = M logical slots after n. The exact wording can be similar as in other proposals.  Regarding RSW starting point, we still think all slots in RSW should be considered for selection of candidate resource, rather than introducing the definition remaining RSW and re-interpret legacy rule. We want to keep Definition 2 in previous proposal that n+T1 is determined by the next logical slot after *n*+*T*B subject to .  In approach1, since *T*B can be selected by UE, and the starting of (remaining)RSW is dependent of *T*B, the minimum size of (remaining)RSW is not denoted by *T2min* itself. We suggest the following change:   * …such that length of remaining RSW ≥ a minimum selection window size (*T2min-T1~~, Y~~~~min~~*~~, etc~~).   In addition, regarding CPS window size, in our understanding tLast is a slot index according to actual reception status, so we are unclear of the motivation of introducing tLast and prefer to remove it. |
| Nokia, NSB | Approach 1 | We are okay with the T1 definition as long as is initialized in the remaining RSW defined after n+T\_B.  This is CPS only case. RSW shall follow CPS monitoring. |

## Topic #3: Random resource selection (resolving remaining issues / FFS items)

**Background**: In RAN1#106-e, we agreed on the following possible options to resolve the issue of non-sensing capable UEs performing random resource selection for low priority transmission in a resource pool with mixed RA schemes (e.g., random selection with full/partial sensing). Based on reviewing contributions submitted to this meeting, please refer to Section 4 for identified issues and amount of support in each option, it is clear that we should try to agree on Option 1 for simplicity and backward compatibility.

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| **Agreement** (RAN1#106-e):  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 |

Additionally, there is still an FFS item on “whether/how re-evaluation and pre-emption can be supported by Ues performing random resource selection that do perform sensing” from RAN1#104-e meeting. Based on reviewing the contributions in this meeting, there is a majority to support this for Type D Ues (7 vs. 2).

### Proposals before 1st GTW session

**Proposal 3-1 (I):** For random resource selection in a resource pool (pre-)configured with full/partial sensing and random resource selection, 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
* FFS remaining details for the RRC parameter (e.g., possible priority threshold values or the range of priority values)

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| **Company** | **Comments** |
| Xiaomi | Support.  We also think the priority threshold value /range of priority level can be CBR based (pre)configured. We hope this can be reflected in the proposal. |
| Ericsson | We are not supportive of this proposal and we have the following comments on the background information about Option 1 from FL:   * We do not think that Option 1 is simpler that Option 2 or Option 7. We have the field for reserved bits in SCI 1st stage which can be used to accommodate the information that the UE is performing random resource selection so other Ues can know this information. * Moreover, the addition of this information in SCI 1st stage does not make the procedure non-backward compatible.   + Rel-16 Ues will simply ignore this new information. Rel-16 Ues will be able to receive the SCI 1st stage from Rel-17 Ues performing random resource selection in a shared resource pool.   Therefore, we propose to modify Option 2 as follows in order to have a simpler implementation:  **Proposal 3-1 (II):**  Option 2’: Include a 1-bit field in the 1st stage SCI that indicates that the UE is performing random resource selection. |
| Fraunhofer | We are supportive of the FL’s proposal.  Regarding the first FFS, if only high priority transmissions can be transmitted in a mixed pool, we need to discuss where Ues that carry out random resource selection for low priority transmissions can transmit – whether it be in a separate resource pool configured for only random resource selection or any other solution. |
| Qualcomm | We don’t support the proposal.  We prefer to not introduce any special handling for this case based on our evaluation results that showed no impact on full-sensing Ues’ performance when random selection Ues are introduced to the pool. |
| Futurewei | We prefer option 2 as it will also benefit to legacy Rel-16 UE. It will not impact the re-evaluation/pre-emption process for legacy UE as the increased priority level (lower value) is sent on the priority field in 1st stage SCI. So backward compatibility won’t be an issue for option 2. Therefore, we suggest keep option 2 for initial online discussion. Since the third FFS covers the first two FFS’s, we can rephrase the 3rd FFS to simplify the proposal.  We do not think option 1 is a simple solution. There are some issues if the resource partitioning is not introduced. First, the low-priority random selection may not get its data transmitted in time if its priority is lower (larger value) than the configured priority threshold. Second, there may be some overlap between the resource pool from rel 16 and resource pool from Rel 17, or between two Rel-17 resource pools with different thresholds. Some specification or rules need to be specified for the resource pool overlap. Therefore, for option 1, resource partitioning is necessary and different priority thresholds can be applied for resource partitions. Therefore, we propose  **Proposal 3-1 (I):** 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 r~~Resource pool partitioning can be ~~additionally~~ applied   + FFS remaining details for the RRC parameter (e.g., possible priority threshold values or the range of priority values) * 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 mapping to the original priority value associated with QoS requirement or that the UE performs random resource selection. |
| Apple | Not support.  This is not efficient in resource usage. If there is no resource pool (pre)configured to dedicatedly support random resource selection, then a UE with random resource selection is unable to transmit any sidelink data with low priority. |
| LGE | We prefer option 12 that no consideration is needed. But as a compromise for progress, we’re ok with option 1 as proposed. But we have objection on any further optimization by leaving FFS.  Support with removing FFS. |
| Convida Wireless | We are ok with the proposal.  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. |
| OPPO | Not support  If a UE (e.g. UE1) with priority P1 which is higher than the priority threshold can use random resource selection in a RP, that will affect the performance of other Ues which has higher priority than P1 since other UE cannot perform resource reselection based on re-evaluation/pre-emption checking to avoid collision with UE1. Only Ues with lower priority than P1 can avoid collision with UE1. That means UE1 (with priority P1) will only collides with other Ues who have higher priority than UE1. That is not reasonable. In our view, the UE with higher priority, its performance should be protected.  For option 2, we also don’t think it should be supported. Increasing the priority in SCI of random resource selection is not acceptable. The priority in SCI not only reflects the priority of corresponding data packet, some other physical procedure are also based on priority, such as TX/TX or TX/RX collision handling. Increasing the priority in SCI will affect other procedures.  For option 7, that is not backward compatibility.  In our view, some simple solution can be used, such as the resource pool partitioning (the first FFS in the proposal). On the other hand, option 12 is acceptable to us. |
| Samsung | Support.  For the 1st FFS bullet, we prefer that the priority value is provided for a subset of resources of the resource pool, rather than the entire resource pool, otherwise for some random resource selection transmissions, the UE will not be able to transmit anything. |
| NTT DOCOMO | Support. Option 1 is simple one and gets benefit since Ues performing sensing can avoid collisions by re-evaluation/pre-emption check. Option 1 does not need any further agreements other than RRC parameter discussion. We do not think discussions pointed out by FW are unnecessary since current option 1 without any additional enhancement can work. Option 2 needs much more discussions as we see “FFS”s, so not preferable. |
| Spreadtrum | We support the proposal and the first FFS that resource pool partitioning should be removed. |
| Huawei, HiSilicon | Agree.  This issue has been identified by many companies, in their simulation results. The issue is due to that Rel-17 support mixed types of RA in the same resource pool, which is not the case in LTE-V.  Option 1 controls the population of random selection UE in a mixed RA resource pool via priority threshold which is similar to pre-emption threshold in Rel-16 to control the pre-emption operation. It will only allow the random selection UE with enough high priority operation in the mixture resource pool to have less impact on full sensing UE. Furthermore, option 1 has no additional design on SCI field and is backward compatible for Rel-16 UE. |
| Fujitsu | We don’t support this proposal as option 1 is not an efficient way of resource usage.  We prefer option 2 considering backward compatibility and suggest keeping it for initial discussion. |
| Vivo | We prefer Option 2 because it also benefits the R16 UE, while in Option 1, the R16 UE still has a higher risk of collision with the random-selection UE than the R17 sensing UE. |
| CATT | We support the proposal |
| Lenovo&MotM | Not support. |
| Panasonic | We support the proposal |
| ZTE, Sanechips | Support |
| Nokia, NSB | Do not support this proposal.  We’d prefer Option 2 because it can provide backward compatibility for Rel-16 UE.  The resource reservation by a UE with random resource selection can be pre-empted by a UE with sensing. But this UE can’t identify the situation leading to collision. We may consider increasing the priority at PHY for a UE with random selection or adding SCI bits to indicate sensing capability (resource selection scheme).  The above issue also exists in the case that the shared resource pool is also used by Rel-16 sensing Ues. Adding SCI bits to indicate sensing capability doesn’t work since Rel-16 Ues can’t identify newly added SCI bits. On the contrary, increasing PHY priority for a UE with random selection is a feasible choice for backward compatibility with Rel-16 sensing Ues. We may use the increased priority value in the priority field in the 1st-stage SCI. This can increase the capability of a Rel-17 UE with random resource selection to protect itself from being pre-empted by Rel-16 Ues. Accordingly, to retain proper operations between Rel-17 Ues with different resource selection schemes, an extra priority field containing the original priority value associated with QoS requirements can be added to the SCI. |
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**Proposal 3-2 (I):** Re-evaluation and pre-emption checking (when *sl-PreemptionEnable* is (pre-)configured) are applicable for sensing capable (Type-D) Ues performing random resource selection.

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| **Company** | **Comments** |
| Xiaomi | From our understanding UE applies random resource selection to minimize the power consumption by cancelling the sensing behaviour. If re-evaluation and pre-emption are still performed, UE is actually preforming sensing; and this should be discussed as special case for partial sensing based RA, for example, some special case in CPS. In addition, if re-evaluation/pre-emption is supported for random RA, and if the reselection is triggered, whether the sensing results in re-evaluation/pre-emption should be used in the re-selection? If so, this is in CPS scope. Therefore, we suggest to discuss this issue after the relationship between random RA and CPS based RA is clarified. |
| Ericsson | We are supportive of the direction of this proposal. Nevertheless, in order to make the proposal clearer, we propose the following rewording:  **Proposal 3-2 (II):**  Re-evaluation and pre-emption checking (when *sl-PreemptionEnable* is (pre-)configured) are applied by sensing capable (Type-D) Ues performing random resource selection |
| Qualcomm | We support with a minor text change.  Re-evaluation and pre-emption checking (when *sl-PreemptionEnable* is (pre-)configured) are applicable for sensing capable ~~(Type-D)~~ Ues performing random resource selection.  We showed that random selection + re-evaluation brings the performance close to full-sensing performance. This approach is also more suitable for small PDB packets because CPS after selection trigger would reduce the selection window size, which would impact the performance of those small PDB packets. |
| Futurewei | We do not support this proposal. Type D UE chooses performing random resource selection to save power. Re-evaluation and pre-emption require sensing, which is against the original intention for type-D UE performing random resource selection. For periodic transmission, the periodic partial sensing occasions before the Y candidate slots, if initiated, mostly passed when performing re-evaluation and pre-emption. |
| Apple | Support.  In our view, Type-D UE could perform random resource selection for the purpose of power saving. A Type-D UE with sensing capability can perform sensing between the resource selection time and the resource re-evaluation/pre-emption checking time. These sensing results can be used in resource re-evaluation and pre-emption checking to reduce the resource collision chance of a randomly selected resource. Hence, resource re-evaluation and pre-emption checking should be supported for a UE performing random resource selection while having sensing capability. |
| LGE | By some reason such as insufficient sensing, UE can select random resource selection. But after that, if possible, UE should be able to perform re-evaluation and pre-emption checking to avoid resource collision as much as possible. |
| Convida Wireless | We are ok with the proposal.  Re-evaluation and pre-emption checking (when *sl-PreemptionEnable* is (pre-)configured) are applicable for sensing capable (Type-D) Ues performing random resource selection. |
| OPPO | Support.  There maybe several reasons for type-D UE to perform random resource selection. For example, the PDB is very small and there is no time to perform CPS for resource selection. In this case, UE can perform random resource selection and based on re-evaluation/pre-emption to avoid potential collision. Our simulation result also shows the performance of this case. |
| Samsung | We’re OK with the proposal |
| NTT DOCOMO | Support. Even if UE performs random selection, collision can be avoided by re-evaluation/pre-emption check. This means, power saving gain can be obtained at resource selection procedure while reliability is ensured by the re-evaluation/pre-emption check. One good balance becomes possible. |
| Huawei, HiSilicon | No  Whenever a packet arrives, the UE can always do some CPS before ty0. This questions the relationship between “random + re-evaluation/pre-emption” and “CPS”.  Random resource selection is used to minimize the power consumption, with revaluation/pre-emption checking for random resource selection, it will significantly increase the power consumption. If reliability is concerned, for type-D UE, it can also use partial sensing, either PBPS + CPS, or CPS only, with revaluation/pre-emption checking. Thus we don’t see the necessity to have this.  In summary, we suggest to discuss CPS first, which may already cover “random + re-evaluation/pre-emption”, so that RAN1 can avoid specifying duplicate functions for the same purpose. |
| Fujitsu | We do not support this proposal.  If random selection is selected, the purpose is obviously to save power as much as possible, so do re-evaluation/pre-emption will contradict with this original purpose of random selection. |
| Vivo | We are ok with the proposal. UE could decide to perform random selection to save power, but it should be allowed to re-evaluate and perform pre-emption checks to improve reliability, and we see no strong motivation to prohibit such behaviour. |
| CATT | No.  We think these UE should not perform re-evaluation and pre-emption. For random selection ,there is no benefit of further re-evaluation and pre-emption, while the ue power consumption will go up. |
| Lenovo&MotM | Support. |
| Panasonic | We don’t support the proposal. Performing re-evaluation/pre-emption for random selection defeats the purpose of power saving. |
| ZTE, Sanechips | Support |
| Nokia, NSB | The question is whether a type-D UE (w/ sensing capability) is allowed to perform re-evaluation/pre-emption while random selection is used for resource allocation. There is no clear advantage for a type-D UE because the UE has its sensing capability anyway. Not support this. |

### Proposals before 2nd GTW session

FL observations and comments based on inputs received in Sec. 3.3.1:

* On Proposal 3-1 (random resource selection in a resource pool with mixed RA schemes),
  + Supportive of the proposal (based on Option 1 in RAN1#106-e): Xiaomi, Fraunhofer, LGE (remove FFS), Convida, Samsung, DCM (remove FFS), Spreadtrum (remove FFS), Huawei, HiSilicon, CATT, Panasonic, ZTE, Sanechips
  + Not support of the proposal (without mentioning other preference): Apple, Lenovo&MotM
  + Preferred Option 2 or a modified version: Ericsson (option 2’), Futurewei, Fujitsu, vivo, Nokia, NSB
  + Preferred Option 12: Qualcomm, LGE, OPPO

It is observed the original Option 1 has the majority support of 13 companies, while Option 2 has 5 supporting companies and Option 12 has 3. It is recommended that we try to move forward with Option 1 without the FFS bullet to keep the solution as simple as possible. For low priority transmissions, they can always be transmitted using the exceptional pools.

* On Question 3-2 (re-evaluation and pre-emption checking for random selection),
  + Support (13): Ericsson, Qualcomm, Apple, LGE, Convida, OPPO, Samsung, DCM, vivo, Lenovo&MotM, ZTE, Sanechips
  + Questions: Xiaomi,
  + Not support (8): Futurewei, HW, HiSi, Fujitsu, CATT, Panasonic, Nokia, NSB

It was clarified by some companies that some of the motivations / reasons why a sensing capable UE would perform random resource selection could be due to insufficient sensing, short PDB, and power saving for the resource selection but improving reliability from re-evaluation and pre-emption checking. At the same time, there was also a suggestion that we can revisit this proposal after the discussion for CPS. Since this issue does not have impact to other designs, let’s revisit at a later stage.

**Proposal 3-1 (II):** For random resource selection in a resource pool (pre-)configured with full/partial sensing and random resource selection,

* 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 remaining details for the RRC parameter (e.g., possible priority threshold values or the range of priority values)

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| **Company** | **Comments** |
| NTT DOCOMO | Support. |
| LGE | Support |
| Fujitsu | As what we have replied in the 1st round, Option 1 is not an efficient way of resource usage.  However, to move forward, we are OK if both Option 1 and Option 2 are supported. |
| OPPO | We don’t support this proposal.  If a random RS UE with priority P1 which is higher than priority threshold can use the mix RP, it will affect ONLY the full sensing Ues with higher priority than P1 since full sensing UE with higher priority will not perform resource selection based on re-evaluation/pre-emption checking. Full sensing UE with lower priority can avoid collision with the UE with RS. That is not acceptable since the performance of full sensing UE with higher priority should be protected. That is main motivation to introduce re-evluation/pre-emption mechanism in R16. This proposal will break the principle and degrade the performance of UE with higher priority |
| Spreadtrum | Support. |
| Sony | Support |
| CMCC | Support. |
| NEC | Support |
| vivo | **Disagree.**  **First of all, this proposal is incomplete,** it is still unclear how the transmission with low priority from random-selection UE is handled, is it dropped or transmitted in another pool? Second, if we follow the way commented by FL, i.e., low-priority packets are transmitted in the exception pool, **then the PRR of the VUE will significantly decrease according to our evaluation in [R1-2108998]**. In our contribution, we have compared the following options.  Baseline: All Ues sharing the same resource pool, where VUEs perform full sensing while PUEs perform random selection.  Opt 1-3: Two resource pools are configured (i.e., resource pool partitioning is applied). The first pool is shared between VUE performing full sensing and PUE performing random selection for packets with priority values lower than the threshold (e.g. 4). The second pool is dedicated for packet with random selection only. (which means the low priority packects can only be transmitted in the second pool)  Opt 2: All Ues sharing the same resource pool and VUEs perform full sensing. The priority is increased (e.g. 2) for the transmissions based on random selection.  It can be observed that the VUE PRR of options 1-3 significantly decreases, i.e., by around 7% comparing with that of optin2 and Baseline.  Overall, Option 2 achieves the best trade-off, i.e., having about 2% PRR performance gain of PUE without notable loss of VUE PRR performance or power consumption.   |  |  | | --- | --- | | Simulation results of random selection:    Figure 8: Average PRR of VUE in unicast | Figure 10: Power consumption of different schemes | |
| Xiaomi | The probability of random resource selection to collide with sensing based high priority transmissions would be different when the congestion status is different, therefore the value of the threshold or the range of priority levels could be different when the congestion status is different. This is also aligned with Rel-16 congestion control principles.  Therefore, we suggest to revise the FFS bullet as “FFS remaining details for the RRC parameter (e.g., possible priority threshold values or the range of priority values, including different priority threshold value or range of priority level based on different measured CBR)” |
| Panasonic | Support |
| Intel | Support |
| Samsung | We have concern on that proposal as it stands preventing low priority traffic from being transmitted in a resource pool when random resource selection is used. We are not convinced by using of exceptional pool, since all low priority traffic using random selection will be prevented and that is not negligible traffic load. The following update is suggested:   * Option 1: a priority threshold value or a range of priority levels is (pre-)configured for a subset of resources in the resource pool, below or within which random resource selection is allowed in these resources.   + Note, lower value means higher priority   + FFS remaining details for the RRC parameter (e.g., possible priority threshold values or the range of priority values) |
| Huawei, HiSilicon | We support the proposal.    To alleviate some companies’ concerns, Option 1 does not bring difficulties/latency on transmission of random selection UE with priority. Network can configure more than one normal resource pools for transmission with different priority thresholds, random selection UE can select a resource pool based on its priority. On the other hand, at least UE could perform random selection in exceptional pool which is the typical operation in Rel-16. |
| ZTE, Sanechips | Support |
| Ericsson | We are not supportive of this proposal. If we follow the option included in the proposal, only transmission which have high priority can be transmitted using random resource selection in a shared resource pool. We do not think this limitation is reasonable.  We propose to use Option 2’ which was included in our previous reply.  Option 2’: Include a 1-bit field in the 1st stage SCI that indicates that the UE is performing random resource selection. |
| Fraunhofer | We are supportive of the FL’s proposal, but feel that it is incomplete. We still have a concern with how transmissions with lower priority values are going to be handled. The proposal does not address this case and agree with Vivo’s option 1-3 for handling this. |
| MediaTek | We are not supportive of this proposal.  We have concerns on inefficient resource usage. We prefer Option 2 for its simplicity. |
| Apple | As mentioned in the first round, we think Option 1 is not efficient in resource usage. If there is no resource pool (pre)configured to dedicatedly support random resource selection, then a UE with random resource selection is unable to transmit any sidelink data with low priority. The use of exceptional resource pool does not seem to a good way forward in our view.  We think Option 7 is simple and efficient in resource usage. It also could prevent full sensing UE from collision from random resource selection UE. |
| CATT,GOHIGH | Support. |
| InterDigital | Support |
| Qualcomm | We still prefer to not introduce any special handling for this case based on our evaluation results that showed no impact on full-sensing Ues’ performance when random selection Ues are introduced to the pool.  Further, the option with a range as presented in the proposal has not been evaluated to the best of our knowledge. What was simulated by other companies was a single priority threshold. |
| Futurewei | Although we prefer option 2, we are ok with option 1 but provided that the issues we commented before are resolved. There are two major issues if the resource partitioning is not introduced.  First, the low-priority random selection may not get its data transmitted in time if its priority is lower (larger value) than the configured priority threshold. Some low priority data may have long delay. It is better to allow some low priority transmissions in each pool.  Second, there may be some overlap between the resource pool from rel 16 and resource pool from Rel 17, or between two Rel-17 resource pools with different thresholds. Some specification or rules are needed when there is a resource pool overlap.  Therefore, for option 1, resource partitioning is necessary and different priority thresholds can be applied for resource partitions. We propose the following update on option 1   * Option 1: a priority threshold value or a range of priority levels is (pre-)configured for a subset of the resource pool, below or within which random resource selection is allowed.   + Multiple subsets are supported with independent configuration of the priority threshold or a range of priority level.   + FFS: whether must have a subset of resource pool without priority restriction.   + Note, lower value means higher priority   + FFS remaining details for the RRC parameter (e.g., possible priority threshold values or the range of priority values) |
| Convida Wireless | We support the proposal. |
| Nokia, NSB | We do not support this proposal. |
| Bosch | We support Option 1; however, we still prefer to keep the FFS. We don’t believe that using the exceptional pool will be a solution nor a good idea. Exceptional pools are used by all Ues (with/without sensing) for some radio-link failure and other sensing special cases. Therefore, it is very important not to make it busy or not reliable. |

### Proposals before 2nd GTW session

FL observations and comments based on inputs received in Sec. 3.3.2:

* On Proposal 3-1 (II),
  + Supportive/acceptable (20): DCM, LGE, Spreadtrum, Sony, CMCC, NEC, Xiaomi, Panasonic, Intel, Samsung/Futurewei (resource subset), Huawei, HiSilicon, ZTE, Sanechips, Fraunhofer, CATT, GOHIGH, InterDigital, Convida
  + Not support of the proposal (prefer either option 2, 2’ or 7) (9): Fujitsu, OPPO, vivo, Ericsson, MediaTek, Apple, Qualcomm, Nokia, NSB

Given there is strong majority of supporting the proposal of (pre-)configuring a priority threshold, I will propose the following updated version to be treated in the 2nd GTW session for SL.

**Proposal 3-1 (III):** For random resource selection in a resource pool (pre-)configured with full/partial sensing and random resource selection,

* Option 1: a priority threshold value ~~or a range of priority levels~~ is (pre-)configured for the resource pool or a subset of resources, below ~~or within~~ which random resource selection is allowed.
  + Note, lower value means higher priority
  + FFS remaining details for the RRC parameter (e.g., possible priority threshold values ~~or the range of priority values~~, including priority threshold values based on different measured CBR)

## Topic #4: Re-evaluation and pre-emption checking (next level details)

**Background**: In R16 NR sidelink, UE performs re-evaluation and pre-emption checking (when *sl-PreemptionEnable* is (pre-)configured) for every pre-selected / reserved resource and all TBs in every period (for periodic transmissions). For R17 power saving Ues, we should aim adopt a mechanism to achieve a good balance between PRR / reliability performance and power saving gain. This includes the actual sensing mechanism and how often the re-evaluation and pre-emption checking should be performed by the UE.

From reviewing the contributions submitted to this meeting, there are two issues we can try to have some initial discussions.

First issue: Transmission period / TB for re-evaluation and pre-emption checking

* Option 1: UE performs re-evaluation and pre-emption checking (when *sl-PreemptionEnable* is (pre-)configured) ONLY during the initial resource (re)selection period for both periodic and aperiodic transmission cases.
* Option 2: UE performs re-evaluation and pre-emption checking (when *sl-PreemptionEnable* is (pre-)configured) for every TB / transmission period, in case of periodic transmission.
* Option 3: (Pre-)configurable between Option 1 and Option 2 for the case of periodic transmission.
* Option 4: (Pre-)configured to perform re-evaluation based on the priority of the TB; Skip pre-emption for certain reservation periods and the number of skip periods is (pre-)configured per priority.

Second issue: Candidate resources for partial sensing in re-evaluation and pre-emption checking

* Option 1: UE performs partial sensing only for the pre-selected resources and/or reserved resources .
* Option 2: UE performs partial sensing according to the remaining candidate resources set (*SA*) from the initial resource (re)selection procedure.
* Option 3: UE performs partial sensing beyond the remaining candidate resources set (*SA*) from the initial resource (re)selection procedure (e.g., covering also some or all of the remaining RSW)

### Proposals before 1st GTW session

**Question 4-1:** Should the UE perform re-evaluation and pre-emption checking only in the initial resource (re)selection period or in every transmission period / TB?

* Option 1: ONLY during the initial resource (re)selection period for both periodic and aperiodic transmission cases.
* Option 2: For every TB / transmission period, in case of periodic transmission.
* Option 3: (Pre-)configurable between Option 1 and Option 2 for the case of periodic transmission.
* Option 4: (Pre-)configured to perform re-evaluation based on the priority of the TB; Skip pre-emption for certain reservation periods and the number of skip periods is (pre-)configured per priority.
* Option 5: other, please elaborate

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| **Company** | **Option** | **Comments** |
| Xiaomi | Option 2 | All other options may have issue that the pre-emption from higher priority transmission would be ignored, this would degrade the reliability of high priority data transmission. Therefore, option 2 should be supported. |
| Ericsson | Option 5 | For every TB / transmission period, for both periodic and aperiodic transmission cases. |
| Qualcomm | Option 2 | Checking every TB transmission period increases the probability of detecting other Ues’ reservations and reduces collision likelihood by providing the UE with more opportunities to change its selected or reserved resources. |
| Futurewei | Option 2 | Same rule in Rel-16 V2X on re-evaluation and pre-emption checking can be applied. Power consumption is already reduced a lot by periodic based partial sensing. Addition power saving over partial sensing by skipping re-evaluation and pre-emption is very limited. For additional power saving, UE can consider the random resource selection. |
| Apple | Option 2 | To achieve the reliable resource selection, we prefer Option 2 to ensure the resource re-evaluation or pre-emption checking is performed at each period. |
| LGE | 2 | We support option 2 for resource collision avoidance. The sensing results for initial resource selection cannot guarantee no collision on the TBs of the following periodic transmissions. |
| Convida Wireless | Option 2 | The UE should perform re-evaluation and pre-emption checking in every transmission period or TB. |
| OPPO | Option 2 with comment | Support the proposal in general. Perform re-evaluation and pre-emption checking for each TB can achieve higher reliability. Our simulation compares the PRR performance between option 1 and option 2, and the results show that option 2 has better performance.  We agree with Ericsson’s comment. This should apply to both periodic and aperiodic transmission. |
| Samsung | Option 2 | Neighbour Ues may enter the communication range recently e.g. after TX UE’s transmission in last period, thus resource reservation in last period may not work, especially in high mobility scenarios. Therefore Pre-emption/re-evaluation for every TB/transmission period is needed. |
| NTT DOCOMO | Option 5 | Same view as Ericsson. |
| Spreadtrum | Option2 | Considering the reliability of resource selection, we prefer option 2. |
| Huawei, HiSilicon | With comments | We prefer to reuse the re-evaluation and pre-emption checking procedure in Rel-16 as much as possible. For both initial transmission and retransmission in each period, at least slot m-T3 is checked, where slot m refers to any resources selected by MAC layer, i.e. a resource belongs to  **or .**  The current question 4-1 is not clear whether the retransmission is included or not and whether option 2 is same as Rel-16 or not.  On top of the re-evaluation and pre-emption checking issues, we think the “sensing mechanism” summarized in section 4.5 is essential and can be prioritized to discuss as well. So we suggest to have one (or more) question(s)/proposal(s) on the sensing mechanism design, such as which slots are monitored for re-evaluation and pre-emption checking, etc. |
| Fujitsu | Option 1 or Option 4 | We think such methods can be considered to obtain more power saving gain, which is aligned with the objective of this topic. For instance, different from resource selection, additional sensing for re-evaluation and pre-emption may be useless if the collision is not detected. So, we think we can consider some trade-off methods like Option 1 and 4. |
| Vivo | Option 2 | We share similar view with LGE. If only the initial period is checked, there is no guarantee that collisions in subsequent periods can be avoided. |
| CATT | Option 5 | Re-evaluation checking should be performed during the initial resource (re)selection period for both periodic and aperiodic transmission cases.  Note: In Release 16, for resource(s) pre-selected and to be first time ehaviour, re-evaluation checking is mandatory. But for the non-resource selection TB/transmission period(s), resource(s) has been already ehaviour, and there is no need to perform re-evaluation checking. Same rule in Rel-16 V2X on re-evaluation checking should be applied.  Pre-emption checking should be performed for every TB / transmission period, in case of periodic transmission, when *sl-PreemptionEnable* is (pre-)configured |
| Lenovo&MotM | Option 2 |  |
| Panasonic | Option 5 | We agree with Ericsson’s comments to apply for both periodic and aperiodic TBs. |
| ZTE, Sanechips | Comments | The triggering of re-evaluation/pre-emption is up to MAC. It’s better to use ‘can’ instead of ‘should’. Moreover, both initial and retransmissions for every aperiodic/periodic TB can be subject to reevaluation/pre-emption. |
| LGE(2) | Comments on FL proposal | We need clarification on Proposal 4-1 by FL. We understand Option 2 as a same rule as in Rel.16 NR V2X. There are some notes in Section 5.22.1.2a in 38.321 regarding the case of periodic transmission.  NOTE 6: For the selected sidelink grant corresponds to transmissions of multiple MAC PDU, 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.  Further clarification needs to be added as below to follow the Rel.16 rule.  **Proposal 4-1 (I):** It is supported that UE performs re-evaluation and pre-emption checking for the initial transmission and retransmissions of a TB in each transmission period based on Rel.16 rule, for both periodic and aperiodic transmission case. |
| Nokia, NSB | Option 2 |  |

**Question 4-2:** How to determine candidate resources for partial sensing in re-evaluation and pre-emption checking?

* Option 1: UE performs partial sensing only for the pre-selected resources and/or reserved resources .
* Option 2: UE performs partial sensing according to the remaining candidate resources set (*SA*) from the initial resource (re)selection procedure.
* Option 3: UE performs partial sensing beyond the remaining candidate resources set (*SA*) from the initial resource (re)selection procedure (e.g., covering also some or all of the remaining RSW)

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| **Company** | **Option** | **Comments** |
| Xiaomi | Option1 or option 2 | We think UE should reuse the existing sensing results as much as possible, and thus option 1 or option 2 is preferred. |
| Ericsson |  | For this question, we would like to get clarification on it. In our view, the options in the questions are either the legacy behaviour of a UE performing re-evaluation and pre-emption checking or the procedure has been already agreed in previous meetings.  What is the intention of this proposal and which parts of the procedure would be changed? |
| Qualcomm | Option 1 | We don’t see the need to depart from Rel-16 procedure for this case. |
| Futurewei | Comments | Since the initial set SA for aperiodic transmission with CPS or PBPS+CPS is not yet specified yet, we suggest considering this after discussions of initial set, sensing windows, resource selection window for aperiodic traffic with CPS and PBPS+CPS.  In general, for re-evaluation and pre-emption, we propose to follow the procedures in Rel-16 as much as possible, i.e., UE continues the sensing and performs resource exclusions before m-T3. Therefore, for partial sensing, we can follow the same procedure. Since periodic partial sensing slots are specified based on most recent sensing occasion before the first slot of Y candidate slot, no additional sensing is performed within Y slots. Contiguous sensing can be specified within Y candidate slots (for periodic traffic) and within RSW (for aperiodic), UE shall perform CPS beyond remaining candidate resources set (*SA*). One other issue is that remaining candidate resource set is formed based on a procedure with RSRP threshold change. With new sensing results, some resource that was excluded may appear in the remaining set. Therefore, generally, option 3 is preferable. But we are open to option 2 depending on outcome from other discussions as aforementioned. |
| Apple | Option 1 or Option 2 with comments | We may need to discuss periodic based partial sensing and contiguous partial sensing separately.  For periodic based partial sensing, we support Option 2. In case a selected/reserved resource is unavailable, then UE could select a replacement resource from candidate resource set.  For contiguous partial sensing, we support Option 1 since there is no clear candidate resource set defined. |
| LGE | 2 | We support option 2 as it preserves the resources for reselection if collision is detected based on re-evaluation and pre-emption checking. |
| Convida Wireless | Option 1 or Option 2 | We prefer the option 1 and option 2 for UE performs partial sensing only for the pre-selected resources and/or reserved resources or UE performs partial sensing according to the remaining candidate resources set (*SA*) from the initial resource (re)selection procedure |
| Samsung | Option 1 with comments | We prefer option 1 to reuse existing sensing result and follow legacy structure as much as possible. In addition, we suggestion the following modification:  Option 1: UE performs partial sensing only for the ~~pre-selected~~ higher-layer selected resources subject to re-evaluation and/or ~~reserved~~ higher-layer selected resources subject to pre-emption . |
| NTT DOCOMO | Option 1 or Option 2 | Additional monitoring slots of PBPS for re-evaluation/pre-emption check should be avoided. Option 1/2 can achieve this, but Option 3 cannot. |
| Huawei, HiSilicon | Discuss sensing mechanism first. | We prefer to reuse Rel-16 mode 2 procedure as much as possible, for those resources selected by higher layer resource (i.e.  **or**), a UE performs re-evaluation and pre-emption checking. On the other hand, we want some clarifications from FL that whether option 1 is same as Rel-16 re-evaluation and pre-emption checking or not?  Similar to Question 4-1, we suggest to discuss the sensing mechanism first. |
| Fujitsu | Comments | We think this issue including two aspects, maybe we can discuss them separately:   1. Defining PSOs for re-evaluation/pre-emption checking for the pre-selected resources and/or reserved resources . 2. Defining PSOs for resource reselection candidate resource set triggered by re-evaluation/pre-emption checking   For 1), we think specify the PSOs for option 1 is enough; For 2), we prefer option 3 because the remaining candidate resources set (SA) may be not enough (i.e., less than Ymin), so additional resources beyond the remaining candidate resources set can be selected during the resource reselection. |
| Vivo | Option1 | According to the agreement highlighted below, our understanding is that option1 is the only way to go. We also see no motivation to depart from the R16 procedure to introduce more candidate resources in addition to the indicated set.  **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. |
| CATT | Option 2 | UE should reuse the existing sensing results as much as possible. |
| Panasonic | Option 1 or 2 | We prefer to reuse existing resources. |
| ZTE, Sanechips | Comments | Similar view as Fijitsu. |
| Nokia, NSB | Comments | We’d like to defer this discussion after the resource selection of partial sensing for both CPS and CPS+PBPS. Besides, we shall reuse Rel-16 as much as possible. |

### Proposals before 2nd GTW session

FL observations and comments based on inputs received in Sec. 3.4.1:

* On Proposal 4-1 (re-evaluation and pre-emption checking in every transmission period), this was briefing discussed during the first GTW session for sidelink on Tuesday (1st week). Based on the comments received and raised during the first round of discussion, the proposal is updated below.
* On Question 4-2 (candidate resources for partial sensing in re-evaluation and pre-emption checking),
  + Option 1: Xiaomi, QC, Apple, Convida, Samsung, DCM, vivo, Panasonic
  + Option 2: Xiaomi, Apple, LGE, Convida, DCM, CATT, Panasonic
  + Comments:
    - Ericsson: In our view, the options in the questions are either the legacy behaviour of a UE performing re-evaluation and pre-emption checking or the procedure has been already agreed in previous meetings.
    - Futurewei/HW/HiSi/Nokia/NSB: defer this discussion after the resource selection of partial sensing for both CPS and CPS+PBPS
    - Fujitsu/ZTE/Sanechips:
      * Defining PSOs for re-evaluation/pre-emption checking for the pre-selected resources (r\_0,r\_1,r\_2,…) and/or reserved resources (r\_0^’,r\_1^’,r\_2^’,…).
      * Defining PSOs for resource reselection candidate resource set triggered by re-evaluation/pre-emption checking

Since there is a somewhat strong desire to finalize the sensing mechanism for both CPS and PBPS+CPS, we can revisit this later (maybe in the next meeting).

**Proposal 4-1 (II):**

When UE is configured with partial sensing by its higher layer, the UE performs re-evaluation and pre-emption checking (when *sl-PreemptionEnable* is (pre-)configured) for the initial transmission and retransmissions of a TB in each transmission period as per Rel-16 behaviour, for both periodic and aperiodic transmission cases.

* Note, in Rel-16, it is up to UE implementation to perform re-evaluation after the initial resource (re)selection period.

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| **Company** | **Comments** |
| NTT DOCOMO | Supportive but clarification.  Now we are talking about “when” UE performs re-evaluation and pre-emption checking, right? “How” UE performs is separate issue (Question 4-2).  The reason of this clarification is that “as per Rel-16 behaviour” can be understood “How” is also included. This point should be clearly mentioned in this proposal. |
| Sharp | In our understanding, resources in the initial period are not for pre-emption check, since it is designed for reserved (already indicated) resources. Thus, we prefer to remove “in each transmission period” and accordingly, the note is not necessary. |
| LGE | Support with modification.  Thanks for capturing our comment aiming for not deviating from Rel.16 rule. One comment is that it’s not wholly up to UE implementation whether or not to perform re-evaluation for non-initial transmission – it depends on the conditions. To be clear on this point, we suggest to replace the sub-bullet with the relevant Rel.16 text (terminology was changed to be friendly with RAN1).  **Proposal 4-1 (II):**  When UE is configured with partial sensing by its higher layer, the UE performs re-evaluation and pre-emption checking (when *sl-PreemptionEnable* is (pre-)configured) for the initial transmission and retransmissions of a TB in each transmission period as per Rel-16 behaviour (below), for both periodic and aperiodic transmission cases.   * For periodic transmission, 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. * ~~Note, in Rel-16, it is up to UE implementation to perform re-evaluation after the initial resource (re)selection period.~~ |
| Fujitsu | We still think skipping the pre-emption check for all or certain reservation periods can be considered as a trade-off b/w power saving and reliability. As a compromise, we can accept Option 3 which make the pre-emption check for not initial periods configurable. |
| OPPO | Support.  While the note in the sub-bullet does not reflect R16 agreement correctly and we suggest to remove it.  According to following description in 38.321, there is some conditions that it is up to UE implement to perform re-evaluation |
| Sony | We are basically ok with this proposal |
| NEC | Support |
| vivo | Support |
| Xiaomi | Agree |
| Panasonic | Support |
| Intel | Agree |
| Huawei, HiSilicon | We can support this proposal, although we think this issue it not essential.  Rel-16 procedure is reused naturally unless problem is found, RAN1 does not need to confirm the operation which has specified in previous release. Generally, we think this issue is not urgent. |
| ZTE, Sanechips | Considering AP case, modify to a TB ~~in each transmission period~~  [FL] In case of aperiodic Tx, there is only one period. The sentence is still OK 😊 |
| Ericsson | We are supportive of the proposal as it is, but we have a comment/question regarding the Note included by FL in the proposal. In our view, it is not up to UE implementation to perform re-evaluation after the initial resource reselection period based on the following agreements from Rel-16. In our view, except for some rare cases, pre-emption is applicable rather than re-evaluation. Could you please clarify the note included in the proposal?  **Agreements:**   * For re-evaluation of a pre-selected resource contained in a slot ‘k’ to be first time signaled in a slot ‘m’, where k ≥ m,   + Step 1 of the resource (re-)selection procedure is performed at least at the moment ‘m-T3’, and if the pre-selected resource is not in the identified candidate resource set, Step 2 is triggered for reselection of the resource     - Re-evaluations before the moment ‘m-T3’ or after ‘m-T3’ but before ‘m’ are not precluded and are up to UE implementation       * FFS whether to mandate a UE to perform Step 1 checking every slot before ‘m-T3’     - FFS whether evaluation of Step 2 has to ensure any introduced timing restrictions between pre-selected and re-selected resources when re-evaluation is triggered, and whether it is allowed to change the pre-selected but not reserved resources which are still in the candidate resource set in order to ensure the timing restrictions * FFS whether for the case of enabled periodic reservation, already reserved resources in upcoming periods can be re-evaluated   Agreements:   * If periodic reservation is in use by a UE, the UE performs re-evaluation check for resources provided by MAC layer to L1, according to specified procedures   + L1 expects that MAC layer provides resources intended for transmission of one TB, which can fit to resource selection window of current TB of the UE, and for which the relevant priority is available   + Re-evaluation check is not applied to the resources that have been signalled in current period or previous periods as per agreements, except that it is up to UE implementation whether to apply re-evaluation check to the resource in non-initial reservation period that have ~~not~~ been signalled neither in the immediate last nor in the current period   + If a resource is indicated for re-evaluation, a re-selection for the resource is performed according to the specified step 2 procedure   NOTE: re-evaluation for the purpose of SPS period signalling in non-initial reservation period is neither supported nor precluded by this agreement  [FL] The note is now updated to use the wording from the MAC spec. |
| MediaTek | Support |
| Lenovo&MotM | Support |
| Apple | We support this proposal in general. Also, the note is not needed in our view. |
| CATT,GOHIGH | OK |
| InterDigital | Need further discussion.  We should first discuss how the UE performs sensing for resource re-evaluation and pre-emption checking. Assuming PBPS and CPS are both used in the resource pool, the UE has to perform CPS in each period (if we follow the same mechanism for resource allocation), which will result in contiguous sensing in every slot for periodic reservation with short interval. Therefore, the UE may not save any power even though we use partial sensing for resource allocation.  [FL] Even if PBPS and CPS are performed in every transmission period, the among of power saving gain is still more than 90% compared to full sensing, shown in some simulation results submitted to this meeting. |
| Qualcomm | We propose to remove the reference to Rel-16 as was discussed on the GTW call since it excludes partial sensing and would require full sensing.  To address concerns raised during GTW, the note can be changed to be part of the agreement as proposed by LGE.  When UE is configured with partial sensing by its higher layer, the UE performs re-evaluation and pre-emption checking (when *sl-PreemptionEnable* is (pre-)configured) for the initial transmission and retransmissions of a TB in each transmission period ~~as per Rel-16 behaviour~~, for both periodic and aperiodic transmission cases.   * As in Rel-16, for periodic transmission, 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 |
| Futurewei | We are ok with the proposal. |
| Convida Wireless | We are fine with the proposal. |
| Nokia, NSB | Support company’s view on the Rel-16 reference. Following Rel-16 UE ehaviour, at least the partial sensing UE shall be allowed to perform re-evaluation/pre-emption checking for the initial transmission. For retransmission, and also following Rel-16 UE, the partial sensing UE shall be allowed NOT to perform re-evaluation/pre-emption checking (up to UE implementation), at least for periodic traffic. The Rel-17 partial sensing is a power saving feature. The UE shall be allowed to save power by skipping re-evalution/pre-emption checking for retransmission. |
| Bosch | Support: we also have the same view as QC, Rel-16 is not relevant for the PS Ues. |

FL observations and comments based on inputs received in Sec. 3.4.2:

* On Proposal 4-1 (II),
  + Support/acceptable: DCM, [Sharp], LGE, OPPO, Sony, NEC, vivo, Xiaomi, Panasonic, Intel, Huawei, HiSilicon, ZTE, Sanechips, Ericsson, MediaTek, Lenovo, MotM, Apple, CATT, GOHIGH, Qualcomm, Futurewei, Convida, Nokia, NSB
  + Not support: Fujitsu

**Proposal 4-1 (III):**

When UE is configured with partial sensing by its higher layer, the UE performs re-evaluation and pre-emption checking (when *sl-PreemptionEnable* is (pre-)configured) for the initial transmission and retransmissions of a TB in each transmission period ~~as per Rel-16 behaviour~~, for both periodic and aperiodic transmission cases.

* As in Rel-16, for periodic transmission, 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.

### Proposals before 3rd GTW session

During the 2nd GTW session for R17 NR eSL, Proposal 4-1 (III) was discussed, mainly on the red texted sub-bullet. Some confusions were raised on what was the intended / specified behaviour for resource re-evaluation in R16 in an non-initial reservation period. FL believes further time for checking is needed for some companies, otherwise the intention of the proposal is quite stable. Therefore, I propose to continue discussing this proposal using the email reflector. An updated version from the Chair’s notes at the end of the GTW session is provided in the following.

**Proposal 4-1 (IV):**

When UE is configured with partial sensing by its higher layer, the UE performs re-evaluation and/or pre-emption checking for the initial transmission and retransmissions of every TB.

* Same as in Rel-16, for periodic transmission, 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.

## Topic #5: Sidelink DRX

**Background**: For the issue (LS from RAN2) on UE performing sensing operation and its relationship with SL DRX (when configured), RAN1 reached the following agreement during the last RAN1#106-e meeting.

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| **Agreement**  A UE can perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time.   * FFS: When such reception and measurement is performed, whether it is subject to specification, or is up to UE implementation * FFS: Other details |

From reviewing the contributions submitted to this meeting, for the first FFT item, it is observed that different proposals can be categorised in into the following 3 options.

* Option 1: UE performing PSCCH reception and RSRP measurement for sensing based on defined rules / processes in the specification regardless of SL DRX active and inactive time of the UE.
* Option 2: UE performing PSCCH reception and RSRP measurement for sensing during its SL DRX inactive time according to one or more specified rules / conditions (e.g., total number of sensing slots in DRX inactive time is greater than a threshold, using different set of (pre-)configured settings for sensing during SL DRX inactive time, only the most recent PSO is monitored, only after resource (re)selection trigger, etc.)
* Option 3: Up to UE implementation

### Proposals before 1st GTW session

**Question 5-1:** Which one of the following options is preferred for UE performing PSCCH reception and RSRP measurement for sensing during its SL DRX inactive time? Please elaborate the reason(s) why for the preference and/or why others are not preferred.

* Option 1: UE performing PSCCH reception and RSRP measurement for sensing based on defined rules / processes in the specification regardless of SL DRX active and inactive time of the UE.
* Option 2: UE performing PSCCH reception and RSRP measurement for sensing during its SL DRX inactive time according to one or more specified rules / conditions (e.g., total number of sensing slots in DRX inactive time is greater than a threshold, using different set of (pre-)configured settings for sensing during SL DRX inactive time, only the most recent PSO is monitored, only after resource (re)selection trigger, etc.)
* Option 3: Up to UE implementation

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| **Company** | **Option** | **Comments** |
| Xiaomi | Option 1 | For a given UE the data transmitting and reception can be two independent processes. To reduce the standardization effort, the same rules can be applied regardless of SL DRX status. |
| Ericsson |  | We propose to have as general behaviour that it is up to UE implementation to perform PSCCH reception and RSRP measurement for sensing outside the Active Time. If a UE gets a packet for transmission during its inactive time, it has two options:   * Wait until active time, and then sense and select resources as soon as it has enough sensing results according to the rules for the sensing procedure it is using. * Start sensing during inactive time, until it has enough sensing results according to the rules for the sensing procedure it is using.   That is:   * The sensing procedure used by the UE determines how much sensing it must perform (number of slots, etc.) * The UE decides whether it wants to start sensing immediately or wait.   Option 1: UE performing PSCCH reception and RSRP measurement for sensing based on defined rules / processes in the specification, e.g., the minimum contiguous sensing window is not fulfilled, regardless of SL DRX active and inactive time of the UE. |
| Fraunhofer | Option 2 | Since the UE can already perform PSCCH reception and RSRP measurement within the SL DRX active time, we need to define only the time period when the UE carries out sensing within the inactive time. |
| Qualcomm | Option 3 | If Option 1 is introduced, it will largely negate the power saving benefits of DRX since the UE would be prevented from going to sleep in many cases. The simplest option in our view is to leaving sensing outside of active time up to UE implementation rather than try to define a rule for every case and scenario. |
| Apple | Option 2 | We think UE does not have to perform PSCCH reception and RSRP measurement during its SL DRX inactive time, except it has data to transmit. Hence, it could perform sensing in SL DRX inactive time only after resource (re)selection trigger. |
| Futurewei | Option 2 | One or more specified rules/conditions, e.g., minimum sensing requirements, need to be specified for sensing during SL DRX inactive time. |
| LGE | 1 | We support option 1 as it guarantees reliable sensing results in SL DRX as same as in no SL DRX operation. |
| Convida Wireless |  | We are open for the options 1 and 2. UE performing PSCCH reception and RSRP measurement for sensing based on defined rules in the specification regardless of SL DRX active and inactive time of the UE. UE performing PSCCH reception and RSRP measurement for sensing during its SL DRX inactive time may be according to one or more specified rules or conditions. |
| OPPO | Option 1 | Considering time limit (only 2 meeting left for R17), there is many other important issue to be discussed. For this topic/issue, there is no necessary to pursue additional optimization for the sensing behaviour. |
| Samsung | Option 1 | For Option 2, since Rel-17 UE sensing behaviour was not completed yet, it is difficult to justify the benefit of Option 2 compared with Option 1. We think that Option2 is for optimization.  Option 3 will cause system performance degradation since some UE may not perform sensing within DRX inactive time by UE implementation and that can cause interference to other Ues. |
| NTT DOCOMO | Option 1 (or 2) | Firstly Option 3 is not OK for us. Completely up to UE implementation means that many reservations would be missed and so many collisions are assumed. Option 1 (or Option 2 as compromise) should be agreed. Note that even in option 1 or option 2, if the UE does not have any transmit data, then the UE can sleep and achieve power saving gain. The UE needs to do sensing ONLY when the UE has transmit data.  One possible compromise would be configurability of which option 1/2 or option 3 is applied for a resource pool. |
| Spreadtrum | Option 3 | Whether supporting sensing during SL DRX inactive time is a tradeoff between power saving and resource selection reliability. From the perspective of power saving, we don’t support option 1. And considering the progress, we prefer some simply solution. So, we support option 3 that SL reception of PSCCH and RSRP measurement for sensing during SL DRX inactive time is up to UE implementation. |
| Huawei, HiSilicon | Option 2 | Option 2 is preferred to balance the power saving gain and performance. So conditions should be defined and UE performs sensing during SL-DRX inactive only when conditions are met.  Option 3 leaves uncontrolled the impacts on system performance where up to UE implementation to decide whether or not performing sensing during inactive time.  Option 1 undermines the power saving gain of SL-DRX. |
| Fujitsu | Option 2 | We think different set of (pre-)configured settings for sensing during SL DRX inactive time can be considered, for example, for PBPS, if all the corresponding PSOs are overlapped with SL DRX inactive time, only the most recent PSO is monitored. |
| CATT | Option 2 | Option 2 is more flexible to achieve power saving gain and avoid collision. |
| Lenovo&MotM | Option 2 |  |
| Panasonic | Option 2 | If option 1 applies, it will lose the power saving benefit of DRX.  We prefer option 2 to have (configurable) trade-offs between performance and power saving with rules. |
| ZTE, Sanechips | Option 1 |  |
| Nokia, NSB | Option 3 | If Option 2 is applied, the open issues would be the specification and/or signalling of these “rules” and “conditions”. Better leave this for UE implementation. |
| Vivo | Option2 | Option 2 is preferred as it can balance reliability and power saving gain. Some more conditions can be further included. For example, when the number of sensing slots in the inactive time is small and requires no significant power consumption, or when the CBR/CR is high or the priority of the TB to be transmitted is high, UE can perform sensing in the inactive time.   * Option 2: UE performing PSCCH reception and RSRP measurement for sensing during its SL DRX inactive time according to one or more specified rules / conditions (e.g., total number of sensing slots in DRX inactive time is greater than a threshold, using different set of (pre-)configured settings for sensing during SL DRX inactive time, only the most recent PSO is monitored, only after resource (re)selection trigger, total number of sensing slots in DRX inactive time is smaller than a threshold, CBR/CR is higher than a threshold, priority of the TB to be transmitted is higher than a threshold, etc.)   In addition, some restrictions on the inactive slots which are/are not used for sensing can be considered as well   * + The slots during its SL DRX inactive time on which PSCCH reception and RSRP measurement for sensing is performed should be no larger than a (pre-)configured value   The slots during its SL DRX inactive time on which PSCCH reception and RSRP measurement for sensing is not performed should be no smaller than a (pre-)configured value |

### Proposals before 2nd GTW session

FL observations and comments based on inputs received in Sec. 3.5.1:

* On Question 5-1 (UE sensing during SL DRX inactive time),
  + Option 1 (8): Xiaomi, LGE, Convida, OPPO, Samsung, DCM, ZTE, Sanechips
  + Option 2 (13): Fraunhofer, Apple, Futurewei, Convida, DCM, HW, HiSi, Fujitsu, CATT, Lenovo&MotM, Panasonic, vivo
  + Option 3 (5): Ericsson, QC, Spreadtrum, Nokia, NSB

**Proposal 5-1 (I):** It is (pre-)configurable between the following options:

* Option 1: UE performing PSCCH reception and RSRP measurement for sensing based on defined rules / processes in the specification regardless of SL DRX active and inactive time of the UE.
* Option 2: UE performing PSCCH reception and RSRP measurement for sensing during its SL DRX inactive time according to one or more specified rules / conditions.
  + FFS the rules / conditions (e.g., total number of sensing slots in DRX inactive time is greater than a threshold, using different set of (pre-)configured settings for sensing during SL DRX inactive time, only the most recent PSO is monitored, only after resource (re)selection trigger, etc.)
* Option 3: Up to UE implementation

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| **Company** | **Comments** |
| NTT DOCOMO | Not best way, but we are fine with (pre-)configurability for compromise.  Regulator can select what is more important, reliability performance in the resource pool or power saving performance for each power saving UE. |
| LGE | We do not support the proposal.  Partial sensing is already the solution for power saving at the cost of sensing performance. Further sacrificing the sensing performance for power saving gain cannot be justified as it causes severe collision problem. So we support option 1.  Regarding option 2, it requires additional works to define the rules and conditions to resolve the FFS point Furthermore, even if we made the rules and conditions, we still need to define operations for resource selection if the partial sensing is not allowed in an inactive time. Does UE perform random selection, or resource selection based on partial sensing results on the previous ON duration, or delay RSW to make CPS after slot n? We’re not sure whether all these issues can be agreed within the targeted timeline.  Regarding option 3, if it is up to UE implementation, there will be server unfairness between Ues in generating interference. For example, SL-DRX UE can decide not to perform inactive-time partial sensing, while TX-only UE should perform the required partial sensing even though those two Ues are related to the same service. In this case, TX-only UE consumes more power for sensing than SL-DRX UE that causes more interferences to the other Ues. From system point of view, these operations are not desirable.  As a conclusion, we don’t see the benefit and justification of option 2 and option 3, so oppose to the configurability. We only support option 1. |
| Fujitsu | We think that (pre-)configurable between option 1 and option 2 is feasible to make the progress forward.  However, option 3 should be precluded because this option may lead to unpredictable reliability degradation from the system perspective. |
| OPPO | If it is hardly to converge, we are OK to make it configurable. While considering large impact effect, we suggest not to define the conditions. It is configured either perform sensing or not within DRX inactive time.  We propose the followings:  **Proposal 5-1 (I):** It is (pre-)configurable between the following options:   * Option 1: UE performing PSCCH reception and RSRP measurement for sensing based on defined rules / processes in the specification regardless of SL DRX active and inactive time of the UE. * ~~Option 2: UE performing PSCCH reception and RSRP measurement for sensing during its SL DRX inactive time according to one or more specified rules / conditions.~~   + ~~FFS the rules / conditions (e.g., total number of sensing slots in DRX inactive time is greater than a threshold, using different set of (pre-)configured settings for sensing during SL DRX inactive time, only the most recent PSO is monitored, only after resource (re)selection trigger, etc.)~~ * Option 3: ~~Up to UE implementation~~ UE NOT performing PSCCH reception and RSRP measurement for sensing within DRX inactive time of the UE |
| Spreadtrum | From the perspective of power saving, we prefer option 3. Considering the progress, we are ok with the proposal for compromise. |
| NEC | Support for comprise. Our preference is option 2 |
| vivo | We object to option1 because DRX with option1 cannot provide much power savings gain, which is contrary to the objective of power-saving.  Regarding the companies’ concerns on the efforts on conditions/rules for option2, we believe that some simple rules such as a limit on the maximum number of sensing slots during inactive time would be sufficient and feasible to achieve a balance between flexibility and power saving. We can accept the configurability of option2 and option3. For example, if option2 is not configured or if the condition/rule is not satisfied, option3 is used and whether to perform sensing during inactive time is up to UE implementation  Furthermore, we have proposed some more specific conditions but they are not reflected in the updated proposal. For example, when the number of sensing slots in the inactive time is small and requires no significant power consumption, there is no harm to do some additional sensing. Or when the CBR/CR or the priority of the TB to be transmitted is high, UE can perform sensing in the inactive time to ensure reliability, so we would like to revise the wording as follows  **Proposal 5-1 (I):**It is (pre-)configurable between the following options:   * ~~Option 1: UE performing PSCCH reception and RSRP measurement for sensing based on defined rules / processes in the specification regardless of SL DRX active and inactive time of the UE.~~ * Option 2: UE performing PSCCH reception and RSRP measurement for sensing during its SL DRX inactive time according to one or more specified rules / conditions.   + FFS the rules / conditions (e.g., total number of sensing slots in DRX inactive time is greater than a threshold, using different set of (pre-)configured settings for sensing during SL DRX inactive time, only the most recent PSO is monitored, only after resource (re)selection trigger, total number of sensing slots in DRX inactive time is smaller than a threshold, CBR/CR is higher than a threshold, the priority of the TB to be transmitted is higher than a threshold, etc.) * Option 3: Up to UE implementation |
| Xiaomi | One of the main motivation for us to choose option 1 is to reduce the standardization effort considering the stringent timeline. There will be much standardization effort for option 2, as we need to discuss the details of rules and conditions which is different for UE in DRX-active. If all the three options are pre-configurable, the standardization complexity is still there and our purpose to choose option 1 cannot be achieved.  Therefore, we do not support to make the options (pre)configurable. |
| Panasonic | We are ok with the compromise. |
| Intel | Option 1. We can accept Option 2 or 3 if UE ehaviour on how to deal with the case of insufficient sensing information is clearly defined. |
| Samsung | Option 1 to reduce work load and ensure the overall progress. |
| Huawei, HiSilicon | We do not support option 3, and think option 1 can be merged to option 2.  The option for configuration between option 1 and option 2 could be OK for the sake of progress. It can be viewed as having a configuration of how much of the inactive state is monitored, with ‘all’ being an extreme case of the configuration with the highest power consumption, and other configurations which save more power if the network is comfortable with the further reduction in sensing. In that sense option 1 and option 2 could be merged, if it helps progress.  Option 1 is a special case of option 2, e.g. when the condition is set to be “minus infinite”, all Ues can meet conditions to perform sensing at sensing occasions regardless of SL DRX active and inactive time. Thus we think option 1 can be included in the option 2 and can be discuss in further how to set/design the rules/conditions.  Option 3 is without control of the network to guarantee overall sensing performance in a sensing-based system given that SL-DRX may not be configured by the network, thus it is doubtful the feasibility and necessity on configuration of this option. |
| ZTE, Sanechips | Option 1 |
| Ericsson | First of all, we would like to clarify that we supported Option 1 in our previous reply and that our position has been wrongly captured. We should be included in Option 1.  We support Option 1 and we would like to add clarification on the defined rules that should be included in the specification.   * A minimum sensing window should always be fulfilled regardless of whether the UE is in DRX Active or Inactive Time   So far as this requirement is satisfied, it is up to UE implementation to decide when to start sensing based on PDB, etc...  [FL] I think fulfilling a minimum sensing window length would better to be discussed as part of partial sensing discussion, since Option 1 is UE always perform partial sensing regardless of DRX active/inactive time. |
| Fraunhofer | We support Option 2, but are fine with having configurability between Option 1 and 2 for the sake of progress. We are also fine with the way forward suggested by Huawei. We do not support Option 3. |
| Mediatek | We prefer not to have such pre-configurability by including all three options.  We originally prefer Option-2, but we can also accept pre-configurability between Option1 and Option2.  We have concern on Option-3 when the SL-DRX inactive time fully overlaps with the sensing window. It’s not clear what that would mean for UE behaviour. Would the UE be allowed to perform partial sensing without any sensing measurements. |
| Apple | We still prefer Option 2. We think the power saving gain is largely reduced in Option 1. We could do better than Option 1 in terms of power saving. |
| CATT,GOHIGH | We support alt2, but we want to clarify that even for alt1, there is still a need to FFS for “on defined rules / processes”.  For Alt2, the rule can be simple , for example there could be two configuration of sensing, one for in active state and one for active state.  [FL]: Regarding “based on defined rules / processes in the specification”, this is intended to mean the rules and processes that we are going to captured in the specification for partial sensing. So, there is no additional spec work / FFS for this part. For the two sets of configurations, one for DRX active time and another one for DRX inactive time, I assume this means different configuration for *Preserve* and PSOs of PBPS in the DRX inactive time, right? |
| InterDigital | We prefer Option 2.  However, to make progress, we are ok to make it configurable between Option 1 and Option 2. |
| Qualcomm | We support Option 3.  Option 1 defeats the purpose of DRX and prevents the UE from realizing the full power savings potential associated with DRX. |
| Futurewei | We prefer Option 2. Option 2 provide better trade-off between power saving and performance. Some simple rules or configurations can be specified, such as minimum sensing requirements during SL DRX inactive time. |
| Nokia, NSB | Support Option 3.  Agree with QC that Option 1 defeats the purpose of DRX. |
| Bosch | We support Option 2; however, it is also fine to pre-configure it between Option 2 and 3 (e.g., if rules/ conditions are not specified). |

### Proposals before 3rd GTW session

FL observations and comments based on inputs received in Sec. 3.5.2:

* On Proposal 5-1 (I) summary of inputs are captured below.
  + Only Option 1 (no pre-configurability at all): LGE, Xiaomi, Intel, Samsung, ZTE, Sanechips, Ericsson (min sensing window) (7)
  + Only Option 2 (no pre-configurability at all): Huawei/HiSilicon/Fraunhofer (merged Option 1), vivo, MediaTek, Apple, CATT, GOHIGH, InterDigital, Futurewei (10)
  + Only Option 3 (no pre-configurability at all): Qualcomm, Nokia, NSB (3)
  + (Pre-)configurable between Option 1, 2 and 3 (acceptable as a compromise): DCM, Spreadtrum, NEC, Panasonic (4)
  + (Pre-)configurable between Option 1 and 2: Fujitsu, Fraunhofer, MediaTek, InterDigital (4)
  + (Pre-)configurable between Option 1 and 3: OPPO
  + (Pre-)configurable between Option 2 and 3: vivo

As can be seen, (pre-)configuration between options is not so favourable and most companies prefer to support only one option of either Option 1 or Option 2. At the same time, there are also opinions that Option 1 is not acceptable to some companies, Option 2 is not acceptable to another group of companies and of course Option 3 is also not acceptable to others.

If looking from different perspective, it can be summarized as:

* + - From specification effort friendly perspective: Option 1 and 3
    - From power saving perspective: Option 2 and 3
    - From reliability / performance perspective: Option 1 and 2

So, overall, there is no good solution that can satisfy everything at the same time.

One more approach we could try is by supporting a simple configuration / threshold solution in Option 2 as suggested by vivo and Huawei/HiSilicon. That is, when the total number of sensing slots in DRX inactive time for a resource (re)selection or re-evaluation / pre-emption checking trigger is greater than a (pre-)configured threshold, the UE performs sensing during its DRX inactive time. Otherwise, when the total number of sensing slots in DRX inactive time is less than the threshold, the UE does not perform sensing during its DRX inactive time. Then by setting this threshold to a large number (e.g., infinity) means the UE does not perform sensing during DRX inactive time. On the opposite, when this threshold is set to a very small number (e.g., minus infinity) means Option 1.

**Proposal 5-1 (II):** Is the following rule/condition acceptable as a simple solution for Option 2 and as our final solution resolving the remaining FFS items for this topic?

* When the total number of sensing slots in DRX inactive time for a resource (re)selection or re-evaluation / pre-emption checking trigger is greater than a (pre-)configured threshold, the UE performs sensing during its DRX inactive time. Otherwise, when the total number of sensing slots in DRX inactive time is less than the threshold, the UE does not perform sensing during its DRX inactive time.

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| **Company** | **Yes/No** | **Comments** |
| Fujitsu | No | Although we support option 2, we think that in addition to the solution in sub-bullet, other solutions can also be considered.  For example, in PBPS, if both of the two most recent sensing occasions are overlapped with SL DRX inactive time, only the most recent one shall be monitored, or earlier occasions which are overlapped with SL DRX active time should be monitored instead, as what has bee commented by Vivo during the 2nd GTW session. We think this is also a simple solution and can provide better trade-off between power saving and performance for PBPS. |
| NTT DOCOMO | Yes (compromise) | This is a kind of (pre-)configurability between option 1 and option 3. Key direction is not so different from the previous proposal.  Our preference order is option 1 only > (pre-)configurability among options > this proposal, but we are fine with this for progress. |
| LGE | No | We object the proposal.  As commented in the previous round, applying a rule of not sensing only to SL-DRX UE is not fair operation from the system point of view. TX-only UE, for example, will not get the benefit of the same power saving even though it is involved in the same service as SL-DRX UE. We don’t support the proposal and still prefer option 1. |
| Vivo | See comments | We are fine with threshold-based condition, but we think when the total number of sensing slots in DRX inactive time is more than a threshold, UE should not do sensing for better power saving, if the total number of sensing slots is smaller than a threshold, UE can do sensing in the inactive time.  We understand that companies have different preferences on the options/conditions for sensing, so we suggest to have a more general proposal, as follows, to merge option 1 into option 2. Note that the location of the sensing slots during inactive time includes the most recent PSO and the sensing slots after triggering  **Proposal 5-1 (II):** ~~Is the following rule/condition acceptable as a simple solution for Option 2 and as our final solution resolving the remaining FFS items for this topic?~~ UE determine whether to perform PSCCH reception and RSRP measurement for sensing during its SL DRX inactive time as follows:   * If a specific condition based on the location or total number of the sensing slots during inactive time is satisfied, UE does not perform PSCCH reception and RSRP measurement for sensing during its SL DRX inactive time * If the specific condition is not satisfied, or by (pre-configuration), UE perform PSCCH reception and RSRP measurement for sensing during its SL DRX inactive time according to the partial sensing configuration   + FFS if the partial sensing configuration provides a different set of (pre-)configured settings for sensing during SL DRX inactive time |
| ZTE, Sanechips | No | In case there is no converged view on DRX, according to the agreement below, Option 1(UE performing PSCCH reception and RSRP measurement for sensing based on defined rules / processes in the specification regardless of SL DRX active and inactive time of the UE.) should be a, otherwise, the agreement should be reverted/modified accordingly.  Even in above proposals Proposal 2-2 (II), Proposal 2-3 (II), we don’t see the inactive time of SL DRX is taken account into the restriction on the number of sensing slots. Given the remaining time on this topic, overall the DRX impact on sensing should be minimized.  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 |
| Xiaomi | No | I see diverse opinion on whether sensing should be performed or not if the total number of sensing slots in DRX inactive time is beyond a (pre-)configured threshold. In our view the rationale to use the number of sensing slots in DRX inactive time to decide whether sensing should be performed is strange. On one hand, more sensing slots in DRX\_inactive time means more power consumption; on the other hand, more sensing slots in DRX\_inactive time implies more performance loss if sensing is not performed. Therefore, we do not think this is a good criteria to decide whether sensing in DRX\_inactive time should be performed. |
| OPPO | No | Some companies have concern about the power saving gain for sensing within inactive time. While our simulation results shows that the power increasing for sensing within inactive time is marginal, while the PRR performance can be improved by 3%. When we discuss number of k values for PBPS, one of the key argument for agreeing more than 1 values of k is better PRR performance can achieved. Following the same logic/reason, we also think that performing sensing in inactive time should be supported considering the power increasing is marginal. |
| NEC | No | We think this option 2-like and should FFS other conditions.  Secondly the logical seem not right in the sub bullet. i.e., the sensing slots in inactive time is greater than a threshold means it will take a lot of power assumption to sensing within inactive time, then UE should NOT perform sensing during inactive time. |
| Ericsson | No | We propose to have a mechanism that aims to avoid having insufficient sensing results, i.e., the UE will perform at least sensing for a certain number of slots. If the UE is not able to fulfill this minimum required sensing during its Active Time then the UE performs at least the remaining sensing during its SL-DRX Inactive Time.  Proposal:   * A UE must do the required sensing, i.e., minimum sensing window   + If a minimum sensing window cannot be fulfilled during its DRX Active Time, a UE performs sensing during its Inactive time to fulfil the minimum sensing window * It is up to UE implementation when to start sensing, e.g., based on PDB, etc...   In our view this mechanism is a simple way to address the issue of sensing during Inactive time and avoids the issue of not obtaining enough sensing results due to SL-DRX Inactive Time configuration. |
| Fraunhofer | Yes with comments | We prefer Option 2, but can accept this proposal as a compromise. |
| MediaTek | No | We don’t think that such threshold is good design. One reason is the following. If UE cannot take sensing measurements for some other reason besides DRX inactive time (e.g., half-duplex problem), UE had better take sensing measurement on its DRX inactive time even if the proposed threshold indicates “no need of sensing during DRX inactive time“.  For another reason, consider the case where UE’s partial sensing is pre-configured with k=1,2 and P\_reserve with multiple values. It would be better for the UE to perform sensing on at least one of k=1 or k=2 for every Preserve value. By following such threshold based solution, there is no distinction between the case where UE does not sense at k=1 or k=2 for the same Preserve value and the case where UE misses only one of k=1 and k=2 for two different Preserve values. The first case is more likely to cause performance degradation than the second case. |
| Huawei, HiSilicon | Yes | We support the proposal. It is reasonable that only when there are not enough sensing results due to sensing occasions are within SL-DRX inactive time, a UE need to perform sensing to obtain reliable results to avoid resources collisions. Otherwise, a UE can skip sensing during SL-DRX inactive time to save power. In addition, we also see benefits that conditions includes priority/CBR which reflects QoS of the traffic, e.g. only when channel is congested, sensing during SL-DRX inactive is needed to obtain complete sensing results to avoid collision. These conditions could be the FFS for this proposal. |
| Samsung | No | In our understanding this is not a compromise between previous options, and it introduces more uncertainty on UE behaviour that every sensing procedure depends on actual resource status and may be modified. We don’t think this is an essential UE behaviour and doubt how much its gain could be. |
| Nokia, NSB | NO | This thresholding operation: “When the total number of sensing slots in DRX inactive time for a resource (re)selection or re-evaluation / pre-emption checking trigger is greater than a (pre-)configured threshold” is a new design, not in the previous Option 2. This provides much uncertainty on the UE’s sensing behaviour. This proposal is not agreeable. |

Contribution summary for power saving RA

## Periodic-based partial sensing (remaining issues)

* Value for k
  + Confirm the working assumption made in #105-e (i.e., k = the most recent two occasions)
    - Yes: [1/HW, HiSi], [3/Nokia, NSB], [7/OPPO], [12/Xiaomi], [16/MTK], [32/E///]
    - Modify/clarify the working assumption to include only the last periodic sensing occasion prior to the most recent one: [1/HW, HiSi], [10/CMCC], [18/DCM], [25/Sharp]
    - Simulation results:
      * [1/HW, HiSi]: We observed k = most recent two outperforms k = most recent one with an increase of 20m in communication range at PRR = 99%
  + Maximum or additional values for k
    - More than 2 (pre-configured): [2/Futurewei] – the last 3 occasions, [5/vivo], [13/ Fraunhofer], [17/Intel] – 4 values, [22/ETRI]
  + RRC (pre-)configuration signalling:
    - The RRC parameter set *additionalPeriodicSensingOccasion* lists the additional sensing occasions for each periodicity in *sl-ResourceReservePeriodList* or its subset if configured. [2/Futurewei]
    - Whether the k value is (pre-)configured per P\_reserve depends on the format of the k, and details can be up to RAN2 [10/CMCC]
    - The additional sensing IE additionalPeriodicSensingOccasion, if configured, applies to all the periodicity. [20/ZTE, SC]
    - Adopt a bitmap for (pre-)configuration of k and (pre-)configuration of k values in PBPS applies for all the reservation periodicities. [25/Sharp], [30/ITL]
  + Others
    - [26/Apple]: when more than the most recent sensing occasion for a given resource reservation periodicity *Preserve* needs to be monitored, the product of the resource reservation periodicity *Preserve* and its corresponding *k* value is upper bounded by a (pre)configured threshold.
* Identification of Y candidate slots (within resource selection window)
  + Minimum number of candidate slots Y (*Ymin*) is determined based on
    - Transmission packet priority, [21/Sony], [6/Fujitsu], [8/NEC], [7/OPPO], [17/Intel] (1..32), [24/IDC]
    - congestion/interference level, [21/Sony], [6/Fujitsu], [9/CATT, GH]
    - number of PSCCH/PSSCH resources to be selected [26/Apple]
  + When PSFCH is configured, HARQ RTT related timing restriction should be considered when UE determines the “Y” candidate slots. [6/Fujitsu]
* Others (e.g., how to handle insufficient sensing results / Y candidate slots within RSW, resource exclusion process, and partial sensing for set of periodically occurring/partitioning resources, etc)
  + Insufficient PBPS results may be due to
    - number of candidate slots for which periodic-based partial sensing is performed is less than the (pre-)configured minimum number of *Y* candidate slots (*Ymin*)
    - *N*⸱*PTX* > *Preserve\_threshold* where
      * *N* is number of TBs transmitted without semi-persistent reservation configured for given PTX
      * *PTX* is the reservation period for transmission
      * *Preserve\_threshold* is a pre-configured threshold from one of the *Preserve* values
  + When PBPS result is insufficient, possible solutions are:
    - Random resource selection in a normal resource pool configured with random resource selection (if priority is higher than a configured threshold) or in an exceptional pool [1/HW, HiSi], [7/OPPO], [23/LGE]
    - Resource selection only based on contiguous partial sensing [7/OPPO], [14/Samsung], [17/Intel], [23/LGE]
      * Plus, all applicable periodic-based partial sensing results (e.g. there may still be some Y candidate slots within the RSW) [7/OPPO], [14/Samsung]
      * UE is not allowed to use semi-persistent reservation [17/Intel]
    - PBPS candidate slots should be prioritized in resource selection [3/Nokia, NSB]
    - UE uses assistance information messages in order to obtain the required sensing information for carrying out reliable resource selection. [13/Fraunhofer]
  + For periodic-based partial sensing, with semi-persistent transmissions enabled per resource pool and multiple sensing occasions configured for *Preserve* [17/Intel]
    - A slot is excluded if all of the *k* sensing occasions for each *Preserve* were not monitored for this slot
    - Each sensing occasions is treated independently for the SL-RSRP based candidate resource exclusion – following the step 6) and 7) of Rel-16 TS 38.214 Sec. 8.1.4 [23/LGE]
  + When determining the sensing occasions for resource re-selection, RAN1 may need to further discuss whether the definition rule of partial sensing occasions for initial resource selection should be completely reused. [6/Fujitsu]
  + For sidelink partial sensing, make sure that the slots hypothetically reserved by non-monitored slots due to SL transmissions are excluded from Y candidate slots. [8/NEC]
  + It is suggested to clarify whether the resource pool is shared between Mode1 and Mode2, and whether periodic resource reservation is supported for Mode1 in the shared resource pool, when to configure k. [11/CAICT]
  + The determination of the Y slots should be pre-defined patterns instead of up to UE implementation. The pattern timing could be with reference to t=n or absolute slot number. [19/Panasonic]
  + Periodic sensing occasions that a UE monitors should be within a sensing gap [20/ZTE, SC]
  + [28/ASUSTeK]:
    - UE shall handle not-monitored slot case, at least for periodic sensing occasions between triggering slot n and the first slot of the selected Y candidate slots subject to processing time restriction.
    - UE shall handle not-monitored slot case for sensing slots within contiguous partial sensing region.
  + [29/QC]:



* + - For supporting mode 2 resource allocation with partial sensing, define a set of periodic partial sensing resource sets partitioning a resource pool.
    - A UE can perform partial sensing over a single or multiple resource sets.
    - The reservation of a resource in a given set can only be signalled from another slot associated with the same resource set.
    - For a UE performing partial sensing, if the resource selection procedure is triggered in slot , the resource selection window consists of the slots associated with a given partial sensing window that lie within .
    - For identifying the availability of resources in a selection window associated with a given partial sensing set in a resource pool with periodic reservation disabled, the sensing information from the past 32 slots that are within the intersection of the sensing window and the same partial sensing set is sufficient.
    - For identifying the availability of a slot associated with a given partial sensing set in a resource pool with periodic reservation enabled, in addition to the sensing information for aperiodic reservations as proposed in Proposal 6, the sensing information from , , is required if belongs to the same partial sensing set.
    - A partial sensing UE performs reception over the set of periodic resources assigned for sensing/transmission.
    - Other UEs should know when a partial sensing UE can receive in order to communicate with it.
  + Mandating UE monitoring of occasions corresponding to *PRSVP\_Tx*
    - If a single set of *Preserve* values can be (pre-)configured, monitoring corresponding to *PRSVP\_Tx* not part of the set is NOT mandated. [5/vivo], [9/CATT, GH], [10/CMCC], [16/MTK], [18/DCM], [22/ETRI], [32/E///]
    - It should be mandated: [12/Xiaomi], [21/Sony], [26/Apple], [29/QC]
  + Enhancements on periodic reservations [9/CATT, GH]
    - In PBPS, when (pre-)configuring additional *k* value(s), for a decoded SCI in slot *m* indicating , UE can assume the associated resources in slot , … , are reserved.

## PBPS + CPS (RP with periodic reservation enabled)

* Condition(s) to perform periodic-based partial sensing + contiguous partial sensing
  + When a resource pool is enabled with periodic reservation and UE is triggered to perform resource (re)selection based on partial sensing,
    - PBPS+CPS shall be always performed [1/HW, HiSi], [5/vivo], [7/OPPO], [10/CMCC], [16/MTK], [17/Intel], [18/DCM], [21/Sony], [23/LGE], [24/IDC]
  + Send an LS to RAN2 to check whether to report periodic-based partial sensing results only is allowed [20/ZTE, SC]
* Determination of CPS monitoring window [n+*TA*, n+*TB*]
  + For periodic transmissions,
    - [1/HW, HiSi], [8/NEC]: *n*+*T*A = and *n*+*T*B =  (regardless of periodic or aperiodic transmission)
    - [2/Futurewei]: CPS starting slot is ty0-31 or later based on a pre-defined range or list. The ending slot is between [TB,min and TB,max]
    - [4/Spreadtrum]: CPS can be performed before slot n, and *TB* - *TA* should be 31 slots.
    - [5/vivo]: *n*+*T*A = and *n*+*T*B =
    - [7/OPPO]: *n*+*T*A ≥ and *n*+*T*B = , where *T*B *– T*A *> M*.
    - [10/CMCC]: [n + TA, n + TB] should be [ty0 - 31, ty0 – Tproc,0 – Tproc,1]
    - [12/Xiaomi]:
      * If *y0 – 31 ≥ 0*; then *TA = y0- 31*, and *TB = y0– Tproc1 – Tproc0*
      * Elseif *y0 – Tproc1 – Tproc0 ≥ 0*; then *TA* is determined by UE implementation with *TA ≤0; TB = y0 - Tproc1 - Tproc0*
      * Else, *TA= TB = 0*
    - [16/MTK]: *n*+*T*A ≥ and *n*+*T*B ≥ , where is the last Y candidate slot
    - [6/Fujitsu]:
    - [17/Intel]:
      * Two alternatives for TA:
        + TA within a range: –max(*tn-M*, resource selection window size) ≤ TA ≤ 1 slot, where tn-N is the distance in physical slots to the slot that is *M* logical slots before the slot with physical index n
        + TA within a range: –max((∆A + tn-*M*), resource selection window size) ≤ TA ≤ 1 slot, where tn-N is the distance in physical slots to the slot that is *M* logical slots before the slot with physical index n, the value of ∆A depends on the maximum time required for switching from sleep state to the monitoring/sensing state
      * TB = ∆B – T3 ≤ PDB, where the value ∆B is determined by slot corresponding to the last retransmission of a given TB or HARQ feedback, T3 is processing delay in slots
    - [26/Apple]: and, where is the time gap between the resource selection trigger and the first candidate resource slot based on periodic-based partial sensing.
    - [14/Samsung]: and
    - [23/LGE]: and *,* where *WCPS* isnot smaller than a (pre-)configured *WCPSmin*
    - [18/DCM], [24/IDC]: and *n+TB = − −*
    - [20/ZTE, SC]: *n*+*T*A should be later than and *n*+*T*B is the slot y1 - .
  + For aperiodic transmissions,
    - [1/HW, HiSi]: *n*+*T*A = and *n*+*T*B = (regardless of periodic or aperiodic transmission)
    - [2/Futurewei]: TB is upper bounded by PDB-WRSW,min - (Tproc,0 +Tproc,1 ) and a minimum CPS monitoring window is smaller than 32- (*Tproc,0* +*Tproc,1*).
    - [4/Spreadtrum]: CPS should perform after resource (re-)selection trigger slot n.
    - [5/vivo]: CPS window corresponding to the Y slots
    - [14/Samsung]: and , where is the slot index of earliest candidate resource. *T*B or its lower/upper bound can be configured according to priority and remaining PDB. If there exists no sufficient resource satisfying any of conditions above, consider further reducing *T*B value or not perform partial sensing.
    - [16/MTK]: *n*+*T*A ≥ and *n*+*T*B ≥ , where is the last Y candidate slot
    - [6/Fujitsu]: andare positive integers and
    - [7/OPPO]: *T*A = 0 or 1, M ≤ TB-TA ≤ 31, T2-TB ≥ Ymin, where M is min CPS window
    - [12/Xiaomi]: TA and TB are determined using the same method as that for CPS only.
    - [26/Apple]: and, where is the time gap between the resource selection trigger and the first candidate resource slot based on periodic-based partial sensing.
    - [23/LGE]: , , where  is the timing of the first candidate slot, *WCPS* is not smaller than a (pre-)configured *WCPSmin*
    - [17/Intel]:
      * TA = 1 slot or TA ≤ ∆A, where ∆A is the max time for UE to switch from a sleeping state to monitoring state needs to be considered. ∆A = 1 meaning that the monitoring window starts at slot ‘n+1’
      * TB = ∆B – T3 ≤ PDB, where the value ∆B is determined by slot corresponding to the last retransmission of a given TB or HARQ feedback, T3 is processing delay in slots
    - [18/DCM]: and *n+TB = − −*
    - [24/IDC]:
      * If there are Y ≥ Ymin candidate slots within the RSW:
        + UE determines the CPS window according to the first slot of *Y* candidate slots and resource (re)selection trigger slot *n*.
      * If there are no Y ≥ Ymin candidate slots within the RSW:
        + *TA = 1*, minimum value of *TB* is (pre-)configured per priority. The set of candidate resources (Set A) is initialized in the window [*n+ TB + Tproc, n+**T2*]
* Whether a new set of Y candidate slots is selected within the RSW for aperiodic transmission
  + Yes
    - If there are corresponding periodic sensing occasions between slot n and first slot of Y. [3/Nokia, NSB], [5/vivo] (up to UE implementation)
    - Y candidate slots for CPS can be separately configured from existing candidate slot for PBPS [9/CATT, GH]
    - When the set of Y candidate slots within the RSW is smaller than a configured parameter *Ymin,p*, a new set of *Y* candidate slots can be determined by the UE to monitor corresponding periodic sensing occasions. [10/CMCC], [24/IDC]
  + No
    - No new set of Y candidate slots, reuse existing Y candidate slots only [1/HW, HiSi], [2/Futurewei], [7/OPPO], [14/Samsung], [17/Intel], [18/DCM], [23/LGE], [25/Sharp]
* Initialization of candidate resource set (SA)
  + For aperiodic transmission,
    - One candidate resource set (*SA*) per resource (re)selection trigger is initialized to the set of all candidate single-slot resources within a selected Y candidate slots in PBPS.
      * It is up to UE implementation to select the set of Y candidate slots within the RSW (e.g. reusing an existing set of Y slots and/or select a new set of Y slots when existing Y candidate slots does not match with RSW)
      * [1/HW, HiSi], [5/vivo], [18/DCM], [23/LGE], [26/Apple]
    - When there is an existing set of Y candidate slots and at least *Ymin* slots of them are located within the RSW, [7/OPPO]
      * a candidate resource set (*SA*) per resource (re)selection trigger is initialized to the set of all candidate single-slot resources from those slots that are located within the RSW. [24/IDC]
      * Otherwise, a candidate resource set (*SA*) per resource (re)selection trigger is initialized to the set of all candidate single-slot resources within the remaining RSW after a CPS monitoring window.
    - PBPS candidate slots should be prioritized in resource selection [3/Nokia, NSB], [7/OPPO]
    - Results from the k PBPS sensing occasions and the CPS are combined to define the candidate set of resources [32/E///]
  + When a resource (re)selection procedure is in a mode 2 Tx pool with reservation for another TB enabled, if UE is configured with both periodic-based and contiguous partial sensing for the resource (re)selection procedure, the sensing results of the two schemes corresponding to different traffic should be applied to the different resource selection windows. [9/CATT, GH]

## CPS only (RP with periodic reservation disabled)

* Definition of *T1* and resource selection window (RSW)
  + *T1* and RSW are defined as per R16
    - [1/HW, HiSi], [7/OPPO], [23/LGE], [24/IDC], [25/Sharp]
    - [7/OPPO]: After CPS, the remaining RSW should overlap with at least *N* slots of SL-DRX ON duration of Rx-UE.
  + New definition of *T1*:
    - [9/CATT, GH]: 
      * No. of candidate slots in RSW should not exceed 32 logical slots to avoid selecting resource with no corresponding sensing results
    - [14/Samsung]: Selection of *T*1 is up to UE implementation under
    - [12/Xiaomi] (minimum RSW is prioritized / guaranteed over CPS window):
      * If T2 – MIN\_RSW – 31 ≥ 0
        + *T1 = n +TA + 31*
      * *Elseif T2- MIN\_RSW– 31<0*, and *T2- MIN\_RSW – Tproc1 – Tproc0 > 0*
        + *T1 =T2- MIN\_RSW*
      * *Else: T1 = Tproc1*
    - [18/DCM]: *n+T1 = n+TB + +*
  + [14/Samsung]:
    - Reuse the definition of *T*2 in legacy full sensing procedure, except that *T*2min is determined according to a minimum threshold of *T*2 – *T*1, and the minimum threshold of *T*2 – *T*1 is configured per priority.
    - The resource selection window of TX UE can be confined within slots corresponding to current or future DRX active time of RX UE(s).
  + A minimum RSW or remaining RSW is defined by
    - Ymin': [5/vivo] (Ymin'= Ymin if PBPS is also performed)
    - *T2min*: [7/OPPO], [32/E///]
    - **Ymin,c: [10/CMCC]**
    - **MIN\_RSW: [12/Xiaomi]**
    - 31- (*Tproc,0 +Tproc,1*) or smaller: [2/Futurewei]
* Determination of CPS monitoring window [n+*TA*, n+*TB*]
  + A minimum CPS monitoring window (*TB – TA*) size *M* is (pre-)configured.
    - Support:
      * [5/vivo], [18/DCM]
      * [2/Futurewei] (smaller than 32- (*Tproc,0* +*Tproc,1*))
      * [7/OPPO], [24/IDC] (according to L1 priority)
      * [9/CATT, GH], [13/ Fraunhofer] (priority and latency)
      * [32/E///] (according to measured CBR)
    - Not required: [20/ZTE, SC]
  + *TA* and *TB* values are dependent on:
    - TB is upper bounded by the remaining PDB minus the minimum RSW size and the processing time from sensing to transmission [2/Futurewei], [3/Nokia, NSB]
      * PDB-WRSW,min - (Tproc,0 +Tproc,1 )
    - TB -TA, depends on the remaining value of the PDB, the minimum RSW for a specific transmission, and CBR/CR metrics [32/E///]
    - The upper bound of the sensing window i.e., *TB*, is defined with respect to the minimum RSW (*T2min*). [32/E///]
      * If PDB < *M + T2min*,
        + The min sensing window size constraint can be neglected [2/Futurewei]
        + UE performs random resource selection [32/E///]
      * If PDB > *M + T2min*, UE performs sensing up to *n+TB*
  + [1/HW, HiSi]: *n*+*T*A = and *n*+*T*B =
  + [5/vivo]: CPS monitoring window takes into consideration of existing sensing slots from other procedure(s).
    - If min number of candidate slots (*Ymin*) and min *M* CPS slots criteria cannot be both met, the *Ymin* candidate slots should be fulfilled over the *M* CPS slots.
  + [7/OPPO]:
    - A minimum time criteria-based approach (min *M* CPS slots, and min *N* slots for DRX), or
    - and , where is selected by UE implementation and *M* is the minimum number of consecutive logical slots for the CPS monitoring window.
  + [8/NEC]: The end time of CPS windowcould be min [y0 – T1 – Tproc,0, y0 – Prev]. The start time of CPS window could be as early as possible, e.g., slot n.
  + [10/CMCC]: [n + TA, n + TB] should be [n+1, min{31, T2 - Ymin,c-Tproc,0 -Tproc,1 }]
  + [12/Xiaomi]:

1) If *T2- MIN\_RSW – 31≥ 0*,

- *TA* is determined by UE implementation within *[0, T2- MIN\_RSW – 31]*;

- *TB = TA + 31 – Tproc0 – Tproc1*;

- *T1 = n +TA + 31*;

2) else if *T2- MIN\_RSW– 31<0*, and *T2- MIN\_RSW – Tproc1 – Tproc0 > 0*，

- *TA* is determined by UE implementation with *TA ≤0*;

- *TB = T2- MIN\_RSW – Tproc1 – Tproc0*;

- *T1 =T2- MIN\_RSW;*

3) else

- *TA = TB = 0;*

- *T1 = Tproc1*;

* + [14/Samsung]: [*n*+*T*A, *n*+*T*B), where *T*A=1, and *T*B is up to 32
    - The value of *T*B or a lower/upper bound of *T*B is configured per priority or according to remaining PDB
  + [26/Apple]:
    - and , if the triggering slot *n* is not predictable
    - and if the triggering slot n is predictable
* Initialization of candidate resource set (*SA*)
  + *Y* candidate slots are selected within a RSW and *SA* is initialised for the selected *Y*.
    - [1/HW, HiSi], [8/NEC], [20/ZTE, SC]
  + Candidate resource set (*SA*) is initialized to the set of all candidate single-slot resources in the remaining RSW (after CPS) as [*n+TB+Tproc,0+Tproc,1*, *n+T2*]
    - [7/OPPO], [24/IDC], [25/Sharp],
  + Candidate resource set (*SA*) is initialized to the set of all candidate single-slot resources in the RSW as [*n+T1*, *n+T2*]
    - [14/Samsung], [18/DCM]
* Resource selection (RAN2)
  + UE prioritizes selection of the resources within Y = 31 slots from the CPS window. [24/IDC]

## Random resource selection (including mixed full/partial sensing with random selection in a same pool)

* Conditions in which random resource selection is applied
  + [9/CATT, GH]
    - UE capability, requirement on power saving, resource pool configuration, congestion condition (as indicated by CBR etc.) and (pre-)configured minimum contiguous partial sensing duration can be the criteria for random resource selection.
  + [12/Xiaomi]
    - A CR limit can be (pre)configured for resource usage of random resource selection for a UE, below which the UE can perform random resource selection. The CR limitation can be CBR dependent as in Rel-16.
  + [17/Intel]
    - UE does not decode PSCCH and measure RSRP (i.e., Type A and Type B UE)
    - UE is configured to operate in power saving resource allocation mode
* Identified issue 1: Randomly selected transmission by UE with no sensing capability and no re-evaluation and pre-emption checking in a resource pool configured with mixed RA schemes.
  + Observations from simulations
    - [1/HW, HiSi]: 1~4% PRR degradation to full sensing UEs
  + Solutions
    - 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.
      * Identified issues: how to handle packets with lower priority than the threshold,
        + UEs carrying out random resource selection and transmitting low priority transmissions should use a resource pool that is configured with random resource selection only. [13/Fraunhofer]
      * Option 1 with resource partitioning: [1/HW, HiSi], [14/Samsung]
        + Identified issues: non-backward compatible, reduced resource efficiency
        + Not support: [30/ITL]
      * Support (20): [1/HW, HiSi], [4/Spreadtrum], [7/OPPO], [8/NEC], [9/CATT, GH], [10/CMCC], [11/CAICT], [12/Xiaomi], [13/Fraunhofer], [14/Samsung], [17/Intel], [18/DCM], [19/Panasonic], [21/Sony], [24/IDC], [27/Convida], [30/ITL], [31/Bosch]
    - 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.
      * Identified issues: questionable performance gain and impact to full sensing UEs, misleading priority value for R16 UEs for QoS management (non-backward compatible), unfair penalty to sensing-based traffic
      * Possible enhancements:
        + An extra 2-bit field is added in SCI for indicating the original priority value associated with QoS requirement based on a mapping function/table.
        + Partition the resource pool into several resource sub-pools. UE selects a sub-pool based on a (pre-)configured priority threshold value or a range of priority levels.
      * Support (7): [2/Futurewei], [3/Nokia, NSB], [5/vivo], [8/NEC], [16/MTK], [19/Panasonic]
    - 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.
      * Identified issues: non-backward compatible, unfair penalty to sensing-based traffic
      * Support (3): [18/DCM], [22/ETRI], [26/Apple]
    - Option 12: No special consideration
      * Support (5): [7/OPPO], [10/CMCC], [12/Xiaomi], [21/Sony], [29/QC]
      * Not support: [2/Futurewei]
    - Other options:
      * Random selection UE with high priority can reserve the resource by sending reservation indication before its data transmission. [20/ZTE, SC]
      * UE shall select/reserve resources for consecutive transmissions with a separation/gap large enough so that the sensing UE can react accordingly if a collision happens. [32/E///]
* Identified issue 2: Persistent collision between a random resource selecting UE with other UEs due to same reservation period [1/HW, HiSi], [3/Nokia, NSB]
  + Due to contiguous NACK for multiple TBs across consecutive periods, when using random selection, reception of NACK across multiple periods of a periodic reservation is a condition for (re-)selecting resources by using exclusion (to turn on sensing). FFS how many periods are required to trigger (re-)selection. [1/HW, HiSi], [3/Nokia, NSB]
  + UE with reception capability of PSFCH can reselect the resource according to the HARQ feedback information to reduce periodically collision occasions. [9/CATT, GH]
  + UEs with different reception capabilities, they are configured with different priorities for the reserved resources by random selection. [9/CATT, GH]
* Others
  + UE should reserve resources for multiple TBs if partial sensing is allowed in the pool and *sl-MultiReserveResource* is configured with {enable}. [8/NEC]
  + Resource pools with random resource selection enabled are configured with PSFCH disabled. [13/Fraunhofer]
  + For UEs carrying out random resource selection and are not capable of PSFCH reception, we propose to restrict the maximum number of blind retransmissions to be carried out based on the priority of the transmission. [13/Fraunhofer]
  + Should a random resource selection procedure be described in PHY spec?
    - Support priority-based resource set report and resource selection. [8/NEC]
    - The resource selection window [*T1*, *T2*] is determined in the same way as in R16 NR-V2X according to step 1 [TS 38.214 Sec. 8.1.4]. [23/LGE]
    - When UE randomly selected a resource for periodic transmission, the resource is reselected based on the NR-V2X SPS resource reservation procedure for the following periodic transmissions, similar to LTE-V2X operation, within the number of periods (*Cresel*). [23/LGE]
  + For random resource selection, the starting subchannel indices for the reserved resources are pseudo-randomly changed based on Source ID. [22/ETRI]

## Re-evaluation and pre-emption checking

* Re-evaluation and pre-emption checking for periodic transmission
  + Option 1: For pre-selected and reserved resources ONLY during initial resource (re)selection period
  + Option 2: For pre-selected and reserved resources in every TB / transmission period
    - [7/OPPO] – sim results, [9/CATT, GH], [31/Bosch]
  + Option 3: (Pre-)configurable between Option 1 and Option 2.
    - [17/Intel]
  + Option 4: (Pre-)configured to perform re-evaluation based on the priority of the TB; Skip pre-emption for certain reservation periods and the number of skip periods is (pre-)configured per priority.
    - [24/IDC]
* Re-evaluation and pre-emption checks for UE performing random resource selection
  + Yes (for Type D UEs): [5/vivo], [7/OPPO], [29/QC], [26/Apple], [18/DCM], [27/Convida], [32/E///]
  + No: [1/HW, HiSi], [9/CATT, GH]
* Sensing mechanisms:
  + Scheme 0: No new PBPS or CPS only for re-evaluation and pre-emption checking [2/Futurewei]
  + Scheme 1: CPS sensing only in every slot after UE reporting a subset of resources for resource (re)selection until at least the last pre-selected/reserved resource for the TB. [32/E///], [22/ETRI]
  + Scheme 2 (e.g. for periodic transmission only): Re-evaluation and pre-emption checking procedures for partial sensing RA should reuse that defined in Rel-16 full sensing RA as much as possible with following changes: [1/HW, HiSi], [7/OPPO], [29/QC]
    - After,
      * Sensing occasions corresponding to are monitored for re-evaluation and pre-emption checking to detect periodic reservations
        + For PBPS, the same process should be followed as per resource (re)selection (including *Preserve* and k values) [7/OPPO], [18/DCM], [29/QC]
        + UE performs periodic-based partial sensing before each selected resources by monitoring the most recent sensing occasion (k=1) as   
          , where is the timing of the *i*-th selected resource. [23/LGE], [11/CAICT]
      * A maximum 31 slots prior to are monitored for re-evaluation and pre-emption checking to detect aperiodic reservations [1/HW, HiSi], [7/OPPO]
      * CPS resource selection window starts immediately after *SA* is reported to MAC and ends at the end of the initial RSW. The sensing time ends at (*m-T3*) – same as R16. [9/CATT, GH]
      * CPS starts from slot m-32 [11/CAICT]
      * Sensing slots for CPS includes additionally slots within, where *m* is a slot index that re-evaluation/pre-emption check is triggered. [18/DCM]
      * UE performs contiguous partial sensing over the window [*,* ], whereis the timing of the *i*-th selected resource, and [23/LGE]
        + for periodic transmission, for aperiodic transmission, and .
      * CPS is performed over [], where *n* is the slot of resource selection and *m* is the slot of a selected resource.
      * Ifis included in the set of *Y* candidate slots and at least a resource subject to pre-emption check is in slot, the UE monitors slots of periodic sensing occasionsexcept for the slot of a prior SCI which indicates the resource. [25/Sharp]
        + Replace *n* with index of the *Y candidate slots, set TA* assubject to the processing time and *TB* as 31 resource pool slots later than *TA*, where is the minimum of values*.*
      * UE monitors slots in for a transmission in slot . [29/QC]
  + Scheme 3: For a pre-selected/reserved resource in slot m, UE monitors slots [m-31, m-*T*3-*T*proc,0), where *T*3 and *T*proc,0 are defined as the same value in Rel-16 NR V2X. [14/Samsung]
    - FFS PBPS-based sensing
  + Scheme 4: CPS should extend to Mmax-T3-Tproc,0 to increase the candidate resource set for resource re-selection. [21/Sony]
* Others
* When HARQ-feedback is enabled, detection of a number of NACKs on PSFCH occasions corresponding to a UE’s own PSSCH transmissions can be used to trigger re-evaluation and pre-emption for partial sensing RA.
  + [1/HW, HiSi]
* Partial sensing should be enhanced by either priority adjustment or signalling, to support re-evaluation / pre-emption checking while maintaining the power saving performance [6/Fujitsu]
* Y candidate resource slots should at least contain and/or a set of resources for re-evaluation and/or pre-emption checking, respectively. [8/NEC]
* In order to achieve power saving gain, when performing re-evaluation/pre-emption after contiguous partial sensing resource selection, the end of RSW for re-evaluation/pre-emption checking should not exceed the ending time of the initial RSW. [9/CATT, GH]
* At least for resource(s) selected by period-based partial sensing, when performing re-evaluation or pre-emption, [12/Xiaomi]
  + Option 1: reuse the set of candidate slots in resource (re)selection
  + Option 2: the set of candidate slots only includes the slots of transmission resource for re-evaluation or pre-emption
* Re-evaluation with power saving mode(s) can be enabled/disabled by resource pool (pre-) configuration. [14/Samsung]
* UE pre-emption behaviour in terms of resource yielding and re-selection is reused from NR-V2X R16 for each partial sensing time interval, determined from partial sensing windows [17/Intel]
* Maximum distance shorter than 32 slots between any two resources indicated by a single SCI is supported for power reduction in resource re-evaluation or pre-emption checking. Details of parameters are FFS. [23/LGE]
* Agreements/conclusions reached for resource selection in partial sensing apply for re-evaluation/pre-emption check. [25/Sharp]
* The candidate resource set for resource re-evaluation and/or pre-emption checking is based on the candidate resource set from the resource selection. [26/Apple]

## Congestion control for power saving RA

* Decisions related to congestion control for partial sensing UEs are discussed when design of partial sensing mechanism is completed (at least enough details are defined) [17/Intel]
  + FFS how to support congestion control in case of random resource selection if no SL reception is supported by UE
* CBR related
  + CBR measurement for partial sensing is performed at least on every Kth slot of the Rel-16 CBR measurement window, where K is (pre-)configured per resource pool. [1/HW, HiSi]
  + CBR is calculated based on *N* measurable slots, where N is (pre-)configured. [7/OPPO]
  + UE is not mandated to perform measurement for CBR/CR outside the DRX active time. [5/vivo]
  + Enhancements for CBR: [5/vivo]
    - Alt.1 CBR measurement window is defined only based on the number of active slots in the resource pool during [n-a, n-1].
    - Alt.2 CBR measurement window is defined in the same way as R16, CBR measurement performed in the active time and inactive time are scaled by the corresponding factor(s) to derive the CBR measurement results.
  + RSSI measurement should be adjusted based on PSCCH/PSSCH reception types. [8/NEC]
  + CBR measure occasion should be adjusted based on monitoring occasions. [8/NEC]
  + If UE performs periodic-based partial sensing, CBR in slot n can be measured by UE in *M* periodic partial sensing occasions before slot *n*, *M* periodic partial sensing occasions could be a subset of the configured partial sensing occasions. [9/CATT, GH]
  + Support enhancements to reduce the number of slots to be sensed for CBR measurements. [12/Xiaomi]
  + Relation between CBR measurement window and active period of a DRX cycle should be discussed and detection of congestion for each active period shall be defined. [15/Lenovo, MotM]
  + Restriction of transmission parameter based on the CBR measurement is performed per active period of a DRX cycle. [15/Lenovo, MM]
    - Restriction of transmission parameter based on the CBR measurement is performed per active period of a DRX cycle
  + If P-UE has no PSCCH/PSSCH reception capability, a (pre-)configured CBR value is used for PHY parameter selection, as in LTE-V2X operation. [23/LGE]
  + If P-UE has PSCCH/PSSCH reception capability, the following CBR value is used for PHY parameter selection: [23/LGE]
    - CBR measured in the partial sensing slots if the number of decoded PSCCH/PSSCH slots is above a threshold
    - a (pre-)configured CBR value, otherwise
  + Measured CBR in slot n is the ratio of sub-channels whose SL RSSI exceed a (pre-)configured threshold to all the sub-channels in the partial sensing slots within a window [n-a, n-1], where a is (pre-)configured. [23/LGE]
* CR related
  + Enhancements for CR: [5/vivo]
    - Alt.1 CR past/future window are defined as the number of active slots in the resource pool during [n-a, n-1] and [n-a, n+b]
    - Alt.2 Reuse the CR window definition in R16, portions of used/granted subchannels in the active time and inactive time are scaled by the corresponding factor(s) to derive the CR measurement results.
  + CBR/CR window should be adjusted considering DRX configuration. [8/NEC]
  + The evaluation of CR and the definition of for power saving resource allocation schemes reuse the design for full sensing resource allocation schemes. [26/Apple]

## Sidelink DRX

* Sensing related
  + UE performing partial sensing in SL-DRX inactive time according to
    - Specification:
      * One or more of the following conditions [1/HW, HiSi]:
        + Condition 1: A ratio of the number of partial sensing slots overlapped with SL-DRX inactive time over the number of total partial sensing slots, is above a (pre-)configured T% threshold
        + Condition 2: Measured CBR is above a (pre-)configured CBR threshold
        + Condition 3: The priority value of to-be-transmitted PSSCH is below a (pre-)configured priority threshold
      * One of the following alternatives [2/Futurewei]:
        + Alt.1 Different settings can be configured for partial sensing in DRX active and inactive durations
        + Alt.2 In DRX inactive time, the UE performs sensing only in the most recent sensing occasion for a given periodicity [5/vivo]
      * The inactive sensing occasions is defined. A SL UE is only required to perform sensing in the inactive sensing occasions in DRX inactive time. [19/Pana]
        + An inactive sensing occasion should be defined as backward extended from a DRX active time when a SL transmission triggering slot is near to the beginning of active time. The period of inactive sensing occasions can be FFS among same size as the sensing window, truncated size of the sensing window or the sensing window extended by a fixed value (e.g., 32 slots).
      * UE performs sensing during DRX inactive time only after its sidelink data arrival. [26/Apple]
      * The same set of sensing occasions / window specified for the case when SL-DRX is not (pre-)configured [6/Fujitsu] (for CPS), [7/OPPO], [9/CATT, GH], [14/Samsung], [17/Intel], [23/LGE], [24/IDC], [31/Bosch]
    - Up to UE implementation: [4/Spreadtrum], [17/Intel], [29/QC], [32/E/// (min CPS window size *M* is mandatory)]
    - (Pre-)configurability between mandating / not mandating sensing during SL DRX inactive time: [18/DCM]
    - Introduce a UE capability of whether sensing during its SL DRX inactive time can be performed as mandatory or not. [18/DCM]
    - Different settings can be configured for periodic partial sensing in DRX active and inactive periods, e.g., maximum number of sensing occasions, different k value. [2/Futurewei], [6/Fujitsu]
* Transmission related
  + For periodic traffic, the transmitting UE can signal the time when the receiving UE expects the next transmission so that the receiving UE can align the DRX with the data reception for better power saving. [2/Futurewei]
  + RSW, set of Y slots, or candidate resource set (*SA*) should overlap with SL-DRX ON duration or active time of Rx-UE as much as possible or at least *N* slots. [5/vivo], [6/Fujitsu], [7/OPPO], [9/CATT, GH]
  + RAN1 can be responsible for determining the candidate resources corresponding to the DRX active time of the RX UE(s) by reporting two candidate resource sets, which correspond to the candidate resources within the DRX active time of the Rx UE(s) and all candidate resources (i.e. *SA*) within the resource selection window respectively. Or RAN2 can be responsible for determining the candidate resources corresponding to the DRX active time of the RX UE(s) based on the candidate resource set (i.e. *SA*) and the adjusted start time of the resource selection window reported by PHY. [9/CATT, GH]
  + When the Rx UE is DRX enabled, Tx UE should ensure that at least the initial transmission can be made during DRX on-duration of the Rx UE to achieve a trade-off between Packet Reception Ratio (PRR) and power consumption. [9/CATT, GH], [6/Fujitsu]
  + Tx UE excludes resources that are not within the time slots of Rx UE DRX on duration. [12/Xiaomi]
  + Resource selection with DRX should be done by RAN2 instead of RAN1. [20/ZTE, SC]
  + In partial sensing based or random selection under SL-DRX operation, the resource selection window [*T1, T2*] is determined in the same way as in R16 NR-V2X according to step 1 [TS 38.214 Sec. 8.1.4]. [23/LGE]
    - UE can select the candidate slots within ON duration or the active time of the SL-DRX cycle, depending on the RAN2 decision.
    - TX UE selects at least resources for the initial transmission and a (pre-)configured number of retransmissions in RX UE’s SL DRX ON duration or active time.
  + High layer provides a restricted set of slots based on Rx-UE’s sidelink DRX inactive time. This restricted set of slots is not to be included in the resource selection window determined at the physical layer. [26/Apple]
  + SL DRX active time of intended RX UE is considered for candidate resources identification of mode 2 resource selection. [28/ASUSTek]
  + In order to keep the collision probability manageable, RAN1 should discuss the conditions for scheduling a (re-)transmission outside of the DRX ON duration of the RX UE. [29/QC]
  + For unicast and groupcast, the Tx UE retransmits on the resources outside of the Rx UE's ON duration only if it receives a NAK in response to the (re)transmission inside the ON duration indicating reservations. [29/QC]
  + Selection of resources at the TX UE is restricted to fall within the Active Time of the RX UE(s) and implemented in RAN1. [32/E///]
* Others
  + Dropping or re-selection of resource(s) at the TX UE is triggered if dropping or re-selection of a resource results in that another resource is not within the active time of the RX UE anymore. [6/Fujitsu]
  + For cases where there is some uncertainty in the timing of a retransmission for a HARQ process (e.g. due to no retransmission resource indicated in the SCI, or possible reselection by the Tx UE), the Rx UE uses a configured SL HARQ RTT timer. [9/CATT, GH]
  + The Tx UE can take the predictable *drx-RetransmissionTimer* running duration of the Rx UE into consideration for determining the allowable transmission time, in order to ensure that the transmission resources selected by the Tx UE can be within Rx UE’s DRX active time. [9/CATT, GH]
  + Partial sensing occasions are aligned with the SL DRX active period in order to maximize the power saving gains. [13/Fraunhofer], [15/Lenovo, MotM]
    - The RX UE aligns its partial sensing occasions according to the received SL DRX configurations, either from the TX UE in the case of unicast, or from pre-configuration in the case of groupcast or broadcast transmissions.
  + Additional DRX configuration can be configured for Tx UE performing periodic partial sensing considering multiple resource reservation periods. [15/Lenovo, MotM]
  + RAN1 study on the transmission of assistance indication like go-to-sleep to aid Rx UE(s) enter early DRX sleep state. [15/Lenovo, MotM]
  + The design of SL DRX cycle needs to ensure that UE partial sensing behaviour is respected (i.e., UE wake up time intervals for the purpose of partial sensing need to be aligned with ON duration intervals, as well as traffic characteristics) [17/Intel]
  + [19/Panasonic]:
    - The SL DRX active time is consisting of the semi-static active time and extended active time similar to Uu active time.
    - A SL DRX semi-static active time could be extended for a SL UE to complete its transmission, reception, decoding, etc.
    - he inactive sensing occasion and extension of SL DRX semi-static active time could be triggered by previous SL or DL signalling.
    - Uu DRX function is independent indication from sidelink sensing/resource allocation timing. On the other hand, a sidelink UE's actual "off" is when both Uu and sidelink operation (sensing/resource allocation timing and SL transmission) are “off”.
  + UE in SL DRX can perform either sensing-based resource selection or random resource selection. [24/IDC]
  + The Rx UE in its SL DRX active time shall decode both the first and second SCI. [24/IDC]
  + Consider congestion control enhancement for DRX operation. [24/IDC]

## Others

* Switching between RA schemes (full sensing, partial sensing, random selection)
  + In a resource pool configured with more than one resource allocation scheme, possible conditions / criteria should be studied for switching between RA schemes (full/partial sensing, random selection) [5/vivo], [8/NEC], [12/Xiaomi], [16/MTK], [19/Panasonic], [23/LGE], [27/Convida]
    - E.g., UE battery/power status, available resource ratio, CR, a timer or counter, higher layer configuration, priority, remaining PDB, based on UE implementation, CBR, sensing results, DRX configuration, HARQ error rate, etc
* During a coordination window for inter-UE coordination operation, a UE does not sense for resources selection to reduce power consumption whilst uses resources indicated from its coordinating UEs for transmission to improve reliability. [1/HW, HiSi]
* Specify a new list of X for partial sensing or set new rules for partial sensing on X with the existing list sl-TxPercentageList for termination criterion in the resource exclusion procedure. [2/Futurewei]
* For public safety use case, to reduce UE power consumption, consider a receiving UE monitor a partial region of a period (similar as control region specified for Rel-12 sidelink) to determine whether to turn on in the rest of the period. [3/Nokia, NSB]
  + To inherit Rel-16 PSCCH/PSSCH channel structure, consider limiting the first transmission of a TB (transport block) in this partial region.
* Assistant information can be provided via sidelink signalling to the UEs performing random selection. [4/Spreadtrum]
* Longer PSFCH period or enhancement of conducting resource selection should be studied. [8/NEC]
* [13/Fraunhofer]:
  + Tx-UE utilizes assistance information from assistance entities, providing a set of resources that power saving UEs can use for increased reliability in their resource selection procedure. [27/Convida]
  + Since power saving UEs are required to be active based on their location, we propose to enable these UEs to wake up and carry out transmissions only when they are in a pre-configured region.
  + Power saving UEs should support bandwidth adaptation by operating over shortened frequency regions or by carrying out partial sensing over a smaller bandwidth. [27/Convida]
* [15/Lenovo, MotM]:
  + RAN1 study the cross-slot scheduling enhancement with a time gap specified between data (+2nd SCI) and 1st SCI, 1st SCI contains information whether the intended recipient is a pedestrian or Vehicular UEs for power saving purposes.
  + Design additional resource reservation indication/signalling for collision avoidance.
  + Support SL Tx/Rx performed in a power saving manner by configuring a resource pool partition for resource alignment among multiple UEs.
    - A resource pool partition is configured by a set of disjoint resource patterns.
    - Each resource pattern can be configured with features about controlling selection opportunities for different type of services and thus facilitating resource avoidance.
    - For a resource pool selected for use, a UE can further (re-)select resource pattern(s) based on sensing results.
    - Resource alignment can be performed by indicating identity of resource pattern among UEs.
  + Mechanism of sensing result sharing by RSU or other UE can be considered for VRU to achieve power saving.
* Study wake-up signal in sidelink to enhance power saving from Rx-UE’s perspective. [16/MTK]
* [17/Intel]:
  + To reduce time for transmission of a TB and improve power saving, randomly pick one out of N first in time candidate resources, where the value of N is pre-configured.
  + Partial sensing can be enabled / disabled per transmission priority level and QoS requirements.
  + For power saving, UE can skip PSSCH demodulation depending on transmission priority level.
  + For UE sidelink power saving, NR supports adaptation of sidelink power saving resource allocation schemes (i.e. b/w random, partial, or full sensing-based resource selection).
  + UEs using partial sensing or random resource selection for transmissions with enabled HARQ feedback are required to monitor the associated PSFCH resources.
* In resource selection after resource identification, UE selects preferentially resource at earlier time in the identified resource set. [18/DCM]
* [19/Panasonic]:
  + The sidelink UE can take sidelink information (including the sensing/resource allocation timing) into account for the UE assistance information for network to inform the gNB for a better coordination with Uu at the network.
  + The decision that SL reception type B or D capable UE is operated as SL reception type A should be by the network when UE is under network coverage. The SL reception type B or D capable UE could either: 1) inform the network its recommended reception type and ask for confirmation, or 2) inform its SL requirements and power reduction capability to the network and let the network to determine the suitable reception type.
  + The reception type D can have a sub reception type that a UE Support SL signals only for PSCCH sensing and not receive PSSCH.
  + No SL transmission is allowed if a UE is in Type A and without a valid synchronization.
  + A dedicated resource pool should be allowed for partial sensing UEs that the Tx pool not overlap with full sensing UEs’ Tx pool and within full sensing UEs’ Rx pool; while the Rx pool is known to full-sensing UEs for partial-sensing UE targeted SL messages.
* Additional enhancements besides random resource selection and partial sensing for power saving should be also discussed. [22/ETRI]
* Prioritization is applied for selection of resource allocation schemes in case the UE is capable of multiple resource allocation schemes configured to enable in a resource pool. And full sensing is always allowed in a resource pool. [25/Sharp]

References

1. [R1-2108763](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2108763.zip) Sidelink resource allocation to reduce power consumption Huawei, HiSilicon
2. [R1-2108800](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2108800.zip) Power consumption reduction for sidelink resource allocation FUTUREWEI
3. [R1-2108818](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2108818.zip) Resource allocation for power saving Nokia, Nokia Shanghai Bell
4. [R1-2108924](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2108924.zip) Discussion on sidelink resource allocation for power saving Spreadtrum Communications
5. [R1-2108998](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2108998.zip) Resource allocation for sidelink power saving vivo
6. [R1-2109036](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2109036.zip) Considerations on partial sensing and DRX in NR Sidelink Fujitsu
7. [R1-2109059](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2109059.zip) Discussion on power saving in NR sidelink communication OPPO
8. [R1-2109129](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2109129.zip) Discussion on resource allocation for power saving NEC
9. [R1-2109191](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2109191.zip) Further discussion on sidelink resource allocation enhancements for power saving CATT, GOHIGH
10. [R1-2109300](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2109300.zip) Discussion on resource allocation for power saving CMCC
11. [R1-2109348](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2109348.zip) Considerations on partial sensing mechanism of NR V2X CAICT
12. [R1-2109384](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2109384.zip) Discussion on sidelink resource allocation enhancement for power saving Xiaomi
13. [R1-2109430](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2109430.zip) NR Sidelink Resource Allocation for UE Power Saving Fraunhofer HHI, Fraunhofer IIS
14. [R1-2109512](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2109512.zip) On Resource Allocation for Power Saving Samsung
15. [R1-2109541](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2109541.zip) Sidelink resource allocation for power saving Lenovo, Motorola Mobility
16. [R1-2109564](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2109564.zip) Remaining issues on sidelink power saving MediaTek Inc.
17. [R1-2109631](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2109631.zip) Sidelink Resource Allocation Schemes for UE Power Saving Intel Corporation
18. [R1-2109699](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2109699.zip) Discussion on sidelink resource allocation for power saving NTT DOCOMO, INC.
19. [R1-2109731](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2109731.zip) Discussion on Sidelink Resource Allocation for Power Saving Panasonic Corporation
20. [R1-2109732](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2109732.zip) Discussion on resource allocation for power saving ZTE, Sanechips
21. [R1-2109800](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2109800.zip) Discussion on sidelink resource allocation for power saving Sony
22. [R1-2109818](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2109818.zip) Discussion on resource allocation for power saving ETRI
23. [R1-2109860](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2109860.zip) Discussion on resource allocation for power saving LG Electronics
24. [R1-2109883](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2109883.zip) Sidelink resource allocation for power saving InterDigital, Inc.
25. [R1-2110005](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2110005.zip) Discussion on resource allocation for power saving Sharp
26. [R1-2110053](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2110053.zip) On Sidelink Resource Allocation for Power Saving Apple
27. [R1-2110116](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2110116.zip) Discussion on NR SL Resource Allocation for Power Saving Convida Wireless
28. [R1-2110131](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2110131.zip) Discussion on partial sensing and SL DRX impact ASUSTeK
29. [R1-2110208](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2110208.zip) Power Savings for Sidelink Qualcomm Incorporated
30. [R1-2110305](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2110305.zip) Resource allocation for power saving in NR sidelink enhancement ITL
31. [R1-2110307](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2110307.zip) Further discussion on power saving for sidelink resource allocation ROBERT BOSCH GmbH
32. [R1-2110339](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2110339.zip) Resource allocation procedures for power saving Ericsson

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

**Agreement**

Regarding RAN2’s question in R1-2106413, in RAN1’s opinion it is feasible, other than in the following exceptional cases:

* SL transmission dropping due to prioritization or congestion control
* Due to re-evaluation, a re-selected resource is earlier than a reserved resource by UE implementation in Mode 2
* If (pre-)configured with many-to-one mapping between Tx and Rx resource pools in some cases *(e.g., when PSFCH is not configured)*

**Agreement**

A UE can perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time.

* FFS: When such reception and measurement is performed, whether it is subject to specification, or is up to UE implementation
* FFS: Other details