**3GPP TSG RAN WG1 #106-e R1-210xxxx**

**e-Meeting, August 16 – 27, 2021**

**Agenda Item: 8.11**

**Source: Moderator (ZTE)**

**Title: Moderator Summary of Email Discussion [106-e-NR-R17-Sidelink-03] Reply LS to R1-2100021**

**Document for: Discussion and Decision**

# Introduction

The reply LS to R1-2100021 was discussed during three previous RAN1 meetings. The reply is closely related to whether UE is allowed to perform sensing operations including PSCCH monitoring and RSRP measurement during its SL DRX inactive time. During RAN1#105-e, extensive debate was done in the email discussion with respect to the two alternatives below where Alt 1 was majority view. The opponents to Alt 1 emphasized the simulation results from some source can demonstrate the performance degradation is limited restricting UE sensing related operation to DRX active time under a given setting. This document synthesizes the related contribution under AI 5 as well as those under 8.11.1.1 aiming to make a convergence on this topic, based on which the reply LS can finally be done.

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| Alt 1 A UE can perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time.  **FFS: Whether when such reception is performed is subject to specification, or is up to UE implementation**  **FFS: Other details**  Alt 2 A UE cannot perform sensing out of the DRX active time |

# Discussions

## Round 1 discussion

Proposed possible agreement

A UE shall perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX active time, for UE behavior during its SL DRX inactive time, down-select in RAN1#106-e from the following two alternatives:

Alt 1 A UE can perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time.

FFS: Whether when such reception is performed is subject to specification, or is up to UE implementation

FFS: Other details

Alt 2 A UE cannot perform sensing out of the DRX active time

The above possible proposed agreement is consolidated based on the discussion so far, with the intention to facilitate further convergence. Please companies share your views on whether you support the proposed possible agreement or not. If not, please indicate the change you would like to make and the underlying reason in a constructive manner.

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| **Company** | **View** |
| OPPO | Support. |
| Xiaomi | We are generally supportive to FL proposal.  However, if a UE does not perform any data transmission, it does not need to do sensing. Therefore, we suggest to clarify by revising the 1st sentence as :  “For partial sensing based resource (re)selection, a UE shall perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX active time.” |
| Lenovo/Motorola | Support. |
| Ericsson | We can be supportive for the sake of progress, but the situation is quite clear in our opinion. Besides this, we have not read any argument as to why the specification should prohibit some UE behavior in this case. In our opinion, there is no reason for that. |
| InterDigital | Support |
| Sharp | Support |
| Panasonic | We generally support FL’s proposal with some comments.  As Uu DRX has timers to extend the active time, we think SL may apply the similar extension mechanisms. Then we need to distinguish the semi-static active time and the extended active time, if such timer is used.  Therefore, we propose to add “semi-static” for both alt 1 and alt 2 to avoid confusions, as following:  A UE shall perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX semi-static active time, for UE behavior during its SL DRX semi-static inactive time, down-select in RAN1#106-e from the following two alternatives:  Alt 1 A UE can perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX semi-static inactive time.  FFS: Whether when such reception is performed is subject to specification, or is up to UE implementation  FFS: Other details  Alt 2 A UE cannot perform sensing out of the DRX semi-static active time |
| NTT DOCOMO | OK  We have similar view with Xiaomi. This proposal would intend UE with some sensing mechanism like partial sensing, random selection with re-evaluation/pre-emption check, etc. This aspect should clearly be mentioned. |
| Qualcomm | Fine with the proposal. We also support the addition proposed by Xiaomi. |
| Apple | We share the similar view as Xiaomi. |
| Samsung | O.K for down-selection.  In our understanding, SL DRX is not only for partial sensing but also full sensing.  Xiaomi have suggested the proposal only for partial sensing. Is it a common understanding? We should make clear about this.  In addition, we agree with Panasonic’s comment. We also need to make it clear whether SL DRX duration means for semi-static time or actual time after down-selection.  The only difference between Alt 1 and Alt 2 should be “can” or “cannot”. Also, Alt 2 also has FFS point. So, we suggest the following modification.  Alt 1 A UE can perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time.  FFS: Whether when such reception is performed is subject to specification, or is up to UE implementation  FFS: Other details  Alt 2 A UE cannot ~~perform sensing out of the DRX active time~~ perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time.  FFS: Whether to perform sensing or not for partially overlapped time between sensing slot(s) and SL DRX inactive time. |
| Futurewei | Support |
| CATT, GOHIGH | Support |
| vivo | We are OK to list the alternatives, but the wording, especially the “can” and “cannot”, is not acceptable to us. For Alt.1, using “can” implies UE is required to do something in DRX inactive time, while for Alt.2, using “cannot” is meaningless from specification perspective. Thus, we suggest the following updates as a compromise:  Alt 1 A UE is possible to ~~can~~ perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time.  FFS: Whether when such reception is performed is subject to specification, or is up to UE implementation  FFS: Other details  Alt 2 A UE does not ~~cannot~~ perform sensing out of the DRX active time |
| Huawei, HiSilicon | Support, but we think that Alt. 1 should be agreed at the first checkpoint, and this meeting’s main work be on advancing the FFS points within Alt 1.  For the addition proposed by Xiaomi, we do not think it is an appropriate direction to limit the scenario for reception and sensing in active time to partial sensing based resource selection only. On the contrary, they can be applied to the resource selection based on full sensing as well, and re-evaluation/preemption checking can also take them into account. On the other hand, based on the RAN2 agreement copied as below, RAN2 does not limit the reception behavior for any particular cases (resource selection, re-evaluation/pre-emption, etc.). Therefore, RAN1 should define the UE behavior but not need to apply them to very limited case. The addition proposed by Xiaomi is not supported.  *4: If a UE is in SL active time, UE should monitor PSCCH. FFS on PSSCH. FFS for sensing impacts.*  *7: Working assumption: SL DRX should take PSCCH monitoring also for sensing (in addition to data reception) into account if SL DRX is used.* |
| Fujitsu | Support |
| Spreadtrum | Support. |
| Intel | Support |
| Sony | Support |
| ZTE,Sanechips | Support. |
| LG Electronics | We have a strong concern on the following part marked with cyan. This is because if a slot in the active time of SL DRX does not belong to a sensing occasion required for Partial/Full Sensing, it is not desirable to force a UE to perform the sensing operation on the slot. So, our suggestion is to change it as “**A UE performs SL reception of PSCCH and RSRP measurement for required sensing occasion(s) belonging to its SL DRX active time**”.  Proposed possible agreement   * A UE shall perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX active time, for UE behavior during its SL DRX inactive time, down-select in RAN1#106-e from the following two alternatives: * Alt 1 A UE can perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time. * FFS: Whether when such reception is performed is subject to specification, or is up to UE implementation * FFS: Other details * Alt 2 A UE cannot perform sensing out of the DRX active time |
| Fraunhofer | Support. |
| Convida Wireless | We are fine with the proposal. We are ok for a UE can perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time. We are open to discuss further whether SL reception of PSCCH and RSRP is subject to specification or is up to UE implementation. |
| Nokia, NSB | Support |
| MediaTek | We support the proposal. We prefer to include the suggested clarification by Xiaomi. |

The initial assessment on companies' preferences are made below,

Preference covered by Alt 1(13 companies): Huawei, HiSilicon[R1-2106477, R1-2108186], Nokia[R1-2106531, R1-2108178,R1-2108179],CATT[R1-2106942],Fujitsu[R1-2107037],FUTUREWEI[R1-2107091], Qualcomm[R1-2107367],CMCC[R1-2107422], LG[R1-2107528], Intel[R1-2107609], APPLE[R1-2107760, R1-2107705], DOCOMO[R1-2107879], ZTE[R1-2108085, R1-2108078, R1-2108079], Ericsson[R1-2108136, R1-2108128,R1-2108133], InterDigital [R1-2108035]

Preference covered by Alt 2(4 companies): vivo[R1-2106620, R1-2107958], Spreadtrum[R1-2106714], Panasonic[R1-2107021], Samsung(R1-2106909)

The moderator would like to further check companies’ views to Alt 1& Alt 2 in the possible agreement. Respecting both the instructions below from RAN1 chair as well as the past discussion history of this topic, it’s encouraged that companies could be more constructive so that collective RAN1 consensus could be established.

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| Couple of things that I would like to request/announce as we start the meeting:  3.To everyone: RAN1#106-e will be a critical meeting in completing Rel-17. I hope we can work together constructively towards completing what we had set out to do 18 months ago. |

Please indicate whether you support Alt 1 or Alt 2 in the possible proposed agreement and necessary justification.

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| **Company** | **View** |
| OPPO | Alt.1 is preferred.  From our simulation results (R1-2107223), it shows PRR performance gain in both periodic-based partial sensing and contiguous partial sensing if sensing is performed within DRX inactive time with marginal power consumption increasing compared to no sensing within DRX inactive time. Therefore, we think it is reasonable to perform sensing within DRX inactive time. |
| Xiaomi | Alt 1 is preferred.  We agree that the data transmission and reception of a UE may be decoupled. For alt 2, the partial sensing requirement may not be always satisfied, and thus the system performance would be degraded due to lack of sensing results. |
| Lenovo/Motorola | Alt 1 is preferred.  The impact of SL DRX setting on PSCCH/PSSCH reception should be avoided as much as possible by using elaborate selection of DRX on-duration period with respect to resource reservation periods/partial sensing config. Hence from power saving perspectives, we propose that partial sensing configuration and DRX on-duration for UE must be as much aligned as possible so that the UE maximizes the capturing as much reservation periods configured in a resource pool. |
| Ericsson | Alt.1  Besides the comments made in the reply above, note the following:  In our view, the main aim/target of having SL-DRX and partial sensing operation is to save power during the resource allocation procedure, i.e., trying to reduce as much as possible the sensing time. However, the shorter the sensing time the higher likelihood of collision by the UEs due to a lower resource pool knowledge.  Following the Active Time in the SL DRX is essential to ensure correct TX/RX communication. Sensing outside the Active Time, while not being required, may be helpful in reducing the collision probability. Thus, our proposal is to leave that possibility up to UE implementation: |
| InterDigital | Support Alt-1 with a UE behavior is specified (not up to UE implementation).  Just to clarify the Alt-1, is it correct understanding that a UE is required to receive SCI-1 only during inactive time for sensing purposes?  We added our company name and tdoc number on the list of companies supporting Alt-1 in red. |
| Sharp | Alt-1 |
| Panasonic | As we commented above, we are not clear the active/inactive time referred by FL is semi-static (configured by upper layers) or including extended by timers (if applied).  If the active/inactive time in the proposal is including possible extensions, we’d like to support Alt 2 that no sensing allowed in inactive time.  If the active/inactive time in the proposal is only the semi-static configuration from upper layers, we support Alt 1. |
| NTT DOCOMO | Alt 1  ‘No sensing within DRX inactive time’ means that there are many resource collisions between V-UE and P-UE for example. Alt 2 is not acceptable for us. |
| Qualcomm | We support Option 1 with the decision left to the UE implementation. Requiring a UE to always perform sensing outside of the DRX active time negates the power saving benefits of the SL DRX. Instead, if a UE is communicating with, e.g., an-always ON UE, and it has an urgent packet to transmit, which cannot wait until the next sensing occasion, the UE can choose to perform sensing and transmission.  We also agree with Lenovo/Motorola that for the purpose of power saving, the DRX ON duration and sensing occasions should be aligned to the extent possible to realize the power saving gains. |
| Apple | Whether a UE performs sensing during sidelink DRX inactive time is a tradeoff between power saving gain and resource selection reliability.  Consider a UE is configured with sidelink DRX. To balance the power saving gain and resource selection reliability, we propose that the UE does not perform sensing before its sidelink data arrival, if the sensing occasion is in its sidelink DRX inactive time. This is aimed to save the sensing power for the UE, which is unnecessary when there is no sidelink data for transmission. On the other hand, the UE performs sensing after its sidelink data arrival, even if the sensing occasion is in its sidelink DRX inactive time. This is aimed to achieve a reliable resource selection when there are sidelink data for transmission. |
| Samsung | Alt 2  Based on the previous discussion, it is clear that there is trade-off between power saving and reliability. We think that DRX is configured in a case where power saving is more important. If system performance is more important, DRX would not be configured. We understand that Alt 1 is majority. Let’s make a conclusion in this meeting anyway. |
| Futurewei | We support Alt 1.  Performing partial sensing during the DRX inactive period improves the PRR performance significantly. We prefer that the sensing during inactive period is based on configuration instead of leaving to UE’s implementation so that better tradeoff between performance improvement and power efficiency can be achieved, but are OK to discuss more as in the FFS. In any case, we should not disallow the better UE implementation as in Alt 2. |
| CATT, GOHIGH | We support Alt 1.  As provided in our updated paper [R1-2108238.zip](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_106-e/Inbox/R1-2108238.zip), performing partial sensing only within SL DRX active time will decrease the PRR performance of P2V traffic with the following system-level simulation results.  cid:image001.png@01D78F8D.7C7B8730  For power consumption, the simulation results show that whether partial sensing is performed only within SL DRX active time or not, considerable power saving effects can be achieved compared with full sensing.  cid:image002.png@01D78F8D.7C7B8730  In our view, there is no need to sacrifice the PRR performance to achieve slightly lower power consumption. Thus, Alt 1 is the better choice. |
| vivo | Our simulation results show that the PRR degradation is neglectable, while the power saving gain is significant. I am quite surprised to see that the power consumption levels are almost the same with or without sensing in DRX inactive time in some companies’ results. For those companies declaring that the power saving gain is minor, **would you please clarify how you model the micro/light/deep sleep in your simulation? How long the UE stay in each sleep state in different schemes? What is the power consumption of each component (i.e., sensing, decoding, sleep, etc.) for different schemes?**  For compromise we can accept Alt-1 with our modification in the previous question (copied below):  Alt 1 A UE is possible to ~~can~~ perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time.  FFS: Whether when such reception is performed is subject to specification, or is up to UE implementation  FFS: Other details  [OPPO]: To quick respond to vivo’s above question, as least our simulation setting follows the agreed simulation settings, including the sleep mode and different sleep mode transition.  Among the 4 contributions with simulation results, three contributions (R1-2107223, R1-2108238, R1-2108085) show PRR degradation if not performing sensing within DRX inactive, and only one contribution (R1-2106620) shows no degradation. And the first 2 contributions also show that the difference for power consumption with/wo sensing within DRX inactive time is very little.  On the other hand, we think every company’s results should be respected. Otherwise, that is not constructive ways of working. If not, we are also very confused for the results showing NO PRR performance difference with/wo sensing within DRX inactive time. Does that mean sensing have no benefit? That conflicts the basic logic of sensing even from R14 LTE SL. |
| Huawei, HiSilicon | We can support Alt.1 for progress but think we should use this meeting to progress the FFS points within it. prefer with specified rules  SL DRX is configured for saving power, but the QoS requirements for the service shall be guaranteed as well. If a UE is not allowed to perform sensing during DRX inactive time, the sensing results may be insufficient to exclude others’ reservation completely and resource collision probability will increase especially for congested channel, thus the QoS requirement, such as reliability, cannot be guaranteed. Therefore, it should allow UE to perform sensing during SL DRX inactive time, especially, or at least, for the high QoS transmission, to fulfill these requirements. Maybe Alt. 2 proponents can consider compromises of this type.  However, if the operation is purely up to UE implementation, it will leave the system uncontrolled on sensing behavior, which will impact UEs which perform sensing in the RP, also this may violate RP level configuration for RA, e.g. RP allow partial-sensing or full-sensing, but a UE choose not to perform sensing at all during inactive time (assuming, e.g. all CPS slots are within inactive timer no PBPS is performed), this means UE performs random selection that is not allowed in this RP. To unify UE behavior and guarantee the system performance, some conditions as to minimum amounts of sensing need to be specified. |
| Fujitsu | Alt 1 is preferred.  In our view, limiting sensing operation within the SL DRX active time may degrade the sensing accuracy and system performance in some cases.  For example, for a UE performing PBPS, if both of the most recent two sensing occasions for a given periodicity do not overlap with SL DRX active occasion, whether the resource exclusion should be done only according to the sensing result of the third recent occasion if it is overlaps with SL DRX active duration? The answer is “No” from our perspective since this may lead PRR degradation. In this case we think sensing should still be done in the most recent one or two occasions to obtain the more reliable results even if they overlap with inactive duration. |
| Spreadtrum | In contribution R1-2106620 and R1-2107223, we can find different simulation results. In contribution R1-2106620, the power consumption is reduced without notable PRR performance loss. But in contribution R1-2107223, performing sensing within DRX ON duration only provides marginal power consumption gain. Simulation results in the two contributions are somewhat controversial.  From the perspective of power saving, we prefer Alt 2. But if majority companies support Alt 1, we are OK with up to UE implementation to make progress. |
| Intel | Prefer Alt.1 with expectation that the following FFS will be resolved during the meeting week: FFS Whether when such reception is performed is subject to specification, or is up to UE implementation |
| Sony | We support Alt-1.  We agree with companies above that DRX on-duration should be aligned with the partial sensing configuration as much as possible in order to maximize the power saving gains. |
| ZTE,Sanechips | Alt-1. The simulation results from R1-2108085 as below can reflect the performance degradation due to restricting sensing to UE's SL DRX on duration. The underlying reason is that If a Tx UE only performs sensing within ON duration depending on the DRX configuration of its own direction to its Rx UE, it is likely that failure to identify the resource reserved by other Tx UEs and consequent collision would happen.  C:\Users\10217598\AppData\Local\Temp\ksohtml10040\wps1.png  : Performance evaluation for the impact of SL DRX on sensing(Scenario 1)  C:\Users\10217598\AppData\Local\Temp\ksohtml10040\wps2.png |
| LG Electronics | As already commented by other companies, simply prohibiting the sensing operation in SL DRX inactive time is not good from the perspective of performance. So, our preference is Alt 1. |
| Fraunhofer | We support Alt 1.  We agree with other companies that the partial sensing occasions should be aligned with the SL DRX active period in order to maximize the power saving gains. |
| Convida Wireless | We are ok with the Alt 1. We are fine for that a UE can perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time. We are open to discuss further whether SL reception of PSCCH and RSRP measurement is subject to specification or is left up to UE implementation. |
| Nokia, NSB | Alt 1. And we further support: “It is up to UE implementation to perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time.” |
| MediaTek | We support Alt. 1. |

Moderator Summary for Round 1 input

For the proposed possible agreement, the following point was raised:

1) Limit the scenario to periodic based partial sensing.

2)Clarify the active/inactive time as semi static

3) Update the wording of Alt 2 to be aligned with that of Alt 1 as well as an FFS

*Alt 2 A UE cannot perform sensing out of the DRX active time perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time.*

*FFS: Whether to perform sensing or not for partially overlapped time between sensing slot(s) and SL DRX inactive time.*

4) Update the wording of Alt 1

Alt 1 A UE is possible to can perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time.

FFS: Whether when such reception is performed is subject to specification, or is up to UE implementation

FFS: Other details

5) Progress should be made on the FFS part for this meeting

For the first change, it's moderator and some company's understanding that it seems the question in RAN2 is pretty generic and if there is no technical issue with having this agreement for different sensing type, we can keep the original version to better address RAN2 question

For the second point, it's moderator's understanding that not only the semi-static timer but the reTx related timer e.g. HARQ RTT timer should be considered, thus the change is not needed. Please let me know in case of any mis-understanding.

For the third point, the wording change for the main bullet can be done if there is no concern from other companies, but I am not sure of the intention of the added FFS.

For the fourth point, my understanding is that the previous wording 'can' is able to deliver a neutral message that whether the UE behavior is subject to specification and implementation shall be further discussed. I am not sure whether the proposed change shall be acceptable to all.

For the fifth point, the moderator further proposed Alt 1as possible agreement 2. In case the possible agreement 2 can be achieved for this meeting, we can discussed further for further progress.

*Proposed possible agreement 1*

A UE shall perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX active time, for UE behavior during its SL DRX inactive time, down-select in RAN1#106-e from the following two alternatives:

Alt 1 A UE can perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time.

FFS: Whether when such reception is performed is subject to specification, or is up to UE implementation

FFS: Other details

Alt 2 A UE cannot perform sensing out of the DRX active time

*Proposed possible agreement 2*

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

FFS: Whether when such reception is performed is subject to specification, or is up to UE implementation

FFS: Other details

## Round 2 discussion

The following has been approved by email as outcome of round 1 discussion.

*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*

In the previous round, some companies explicitly expressed their preference on progressing on the FFS for this meeting. For this round, the moderator would like to collect companies' views on the potential way forward via the following questions.

*Question 2.1*

*Please indicate whether you prefer to further progress on the FFS for this meeting.*

*If yes, do you prefer to specify the UE behavior of SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time or leave it to implementation. If the preference is up to specification, please indicate the specific rules.*

*If no, please go to question 2.2*

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| *Company* | *View* |
| OPPO | We don’t think it can be left to UE implementation. If so, some UE will not perform sensing within DRX inactive time and that will cause interference to other UEs and degrade PRR performance.  In our view, the same behavior of PSCCH reception and RSRP measurement within DRX inactive time as DRX active time is preferred. No necessary to introduce specific/different sensing procedure for that. |
| vivo | It would be better if RAN1 can have further progress and inform RAN2, which should be very helpful for RAN2 considering that RAN2 has only one meeting in the next quarter.  In our view the UE behavior should be left to UE implementation, because whether/when to perform the reception and/or measurement in DRX inactive time is highly depending on the UE implementation, such as the triggering/condition of light/deep sleep, etc. Given that these procedures are currently not specified (and up to UE internal design), how can the spec define a suitable UE behavior that is harmonized with different UEs? Noted that in Uu case, whether/when to perform measurement in DRX inactive is also up to UE implementation, it is reasonable also to be applied in SL.  Regarding the system performance, we don’t think there would be significant degradation. It should be a reasonable assumption that a power saving UE would not have a large volume of traffic, then even if there might be some conflicts due to insufficient sensing, the impact should be limited and can be recovered by HARQ. It is worth noting that the power saving UE is also motived to avoid any potential conflict, because a large number of retransmissions are also not desirable from power saving perspective. |
| Sharp | “*The UE behavior of SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time*” should not be left to UE implementation. The UE behavior should be the same regardless of whether the UE is in or not in SL DRX inactive time, i.e. no special handling is introduced in the spec on this aspect for SL DRX inactive time. |
| LG Electronics | First of all, we would like to emphasize that the **SL DRX operation** is related to the **reception of SL data**. This means that the application of SL DRX operation would be different depending on whether a UE performs SL data reception or not. With this understanding, it is **NOT** desirable for the UE’s sensing operation form/rule to be changed depending on whether the SL data receptions is performed by it or not. For the ease of explanation, let’s take one example scenario where in the same resource pool, Type-A UEs do not perform SL data reception but perform sensing-based resource selection to transmit packets, and Type-B UEs perform SL DRX operation to receive SL data. In this case, we are not technically convinced why Type-B UEs should be allowed to perform different sensing operation (compared to those of Type-A UEs) just because it performs SL DRX operation/SL data reception. Rather, such an exception will negatively affect the performance of SL communication in the resource pool.  In summary, we **oppose** that whether or not the UE performs the sensing operation within the SL DRX inactive time and, if so, in what form it is performed are left to the UE’s implementation. Furthermore, we think that even during the SL DRX inactive time, the UE should perform **the same sensing operation according to the partial sensing form/rule currently defined in RAN1**. |
| Ericsson | RAN1 should try to converge to an agreement without FFS in this meeting.  In our view, the UE behavior where a UE can perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time is **up to UE implementation.**  A UE that is performing SL-DRX is in a power saving mode, and therefore, it is reasonable to have a trade-off between power saving and potential detection of collisions. If additional rules are introduced to force a UE to perform sensing, then the main goal of SL-DRX, i.e., power saving, will be diminished. |
| NTT DOCOMO | For the main question, YES. FFS should be solved.  Then, for the subsequent question, **Sensing based on rule is needed.** “up to UE implementation” means that no UE may monitor any slots of DRX inactive time. Whether or not is unclear from regulators perspective, so they shall assume the lowest level for achievable communication performance.  I think companies discuss from different perspectives as follows. There is trade-off definitely, so compromised option would be needed...   * Sensing based on rule   + Pros: Better communication performance from system level (total optimization)   + Pros: Regulator can assume the communication performance level with sensing behavior   + Cons: More power consumption from each UE perspective * Up to UE implementation   + Pros: Less power consumption at each UE   + Pros: Each UE can do behavior to avoid using other UE’s reserved resource (local optimization?)   + Cons: Worse communication performance from system level   + Cons: Regulator shall assume the situation that no any UE does not perform sensing |
| Intel | We prefer to resolve FFS at this meeting if it is possible.  We do not foresee a big spec impact except that partial sensing procedure for sidelink transmissions should be respected. We are open to discuss if partial sensing behavior in SL-DRX inactive time need to be somehow relaxed to provide reliability power saving tradeoffs |
| Panasonic | We prefer to resolve the FFS before drafting LS to RAN2.  Moreover, we think the UE sensing behavior should be specified instead of implementation. |
| Lenovo/Motorola | We prefer to **specify the UE behavior**. Specifically, we propose that the SL DRX active time and partial sensing occasions should be aligned to the extent possible to achieve the tradeoff between power saving gains and system performance.  Both the partial sensing and SL DRX operations are proposed for the purpose of power saving. However, if the *UE behavior of SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time* is left up to implementation, it is hard to guarantee a proper sensing time for UE. Consequently, longer sensing time results in more power consumption for UE, while shorter sensing time leading to higher possibility of resource collision. To this end, we propose that partial sensing configuration and DRX on-duration for UE should be as much aligned as possible so that the UE maximizes the capturing as much reservation periods configured in a resource pool. |
| Fraunhofer | We prefer to resolve the FFS in this meeting, if possible.  We **support the specification** of UE behavior regarding when it is able to perform reception in the SL DRX inactive time. Based on the pros/cons list provided by DCM, we prefer the alignment between partial sensing occasions and SL DRX cycles, resulting in better performance at a system level. |
| CATT, GOHIGH | Yes, we prefer to resolve the FFS, and support to specify the UE behavior. |
| Convida Wireless | We are open for discussions and whether progress on the FFS for this meeting. |
| Xiaomi | We prefer to resolve the FFS in this meeting, but we are also fine if further progress cannot be made, and the send the current agreement to RAN2.  We agree to specifying UE sensing behavior. If full sensing based resource selection is performed by UE, it may need to be specified that UE should keep sensing in DRx-inactive duration. However, if partial sensing based resource selection is performed, whether to allow some sensing behavior up to UE implementation needs to be further investigated. For example, we have agreed that it is up to UE implementation to select Y candidate slots in the selection window for PBPS, and thus the selection of sensing occasions would be more or less up to UE implementation. From our opinion, the same rules can be used for UE determining sensing occasions in DRX-inactive duration. |
| Futurewei | We are ok to continue the discussions on the FFS for this meeting. We prefer to specify the UE behavior of SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time instead of leaving it to UE implementation. The basic rule for specification is to align the partial sensing with DRX active time period as much as possible. We may first decide to adopt which option in first FFS bullet before coming to the details. |
| InterDigital | Yes, it would be good if we can resolve FFS in this meeting.  The UE behavior has to be specified to make the system more stable. If it leaves to the UE implementation, lots of UEs may not perform sensing during inactive period for its own benefit (e.g., battery saving) which results in lower system performance. Therefore, it is important to mandate all UEs perform the same UE behavior to be fair. |
| Apple | We prefer to solve the FFS in this meeting.  From reliable system perspective, it is preferrable to specify UE’s sensing behavior on sensing during SL DRX inactive time. Also, we should strive to align the partial sensing occasions with SL DRX active time to achieve large power saving gain. |
| Fujitsu | Yes, we prefer to resolve the FFS, and it should be **subject to specification**.  We do not prefer to leave the sensing operation during the SL DRX inactive time to implementation. Because from the system point of view, this will result in inability to control the balance between PRR performance and power saving. For instance, some mechanism can be considered and specified, to obtain the power saving benefits as much as possible without significantly degrading the PRR performance. |

*Question 2.2*

*Please share your comments on the reply below for the RAN2 LS,*

|  |  |
| --- | --- |
| RAN1 would like to thank RAN2 on the announcement of their agreement and working assumption on sidelink DRX.  Regarding the below working assumption   |  | | --- | | Working assumption:  SL DRX should take PSCCH monitoring also for sensing (in addition to data reception) into account if SL DRX is used. |   It's RAN1's understanding that UE can perform PSCCH monitoring and RSRP measurement for sensing during SL DRX inactive time with the agreement made in RAN1#106-e. Thus RAN1 has concern on the WA which may imply that the PSCCH monitoring for sensing should take SL DRX into account and is not allowed during DRX inactive time.  *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* |

|  |  |
| --- | --- |
| *Company* | *View* |
| OPPO | We don’t think it is necessary to discuss this question at current stage. How to response the LS depends on the outcome of question 1. We suggest to focus on question 1 to see whether RAN1 can converge on it, then we can discuss how to reply the LS. |
| vivo | Our preference is we try to make more progresses in this meeting, and to provide more details and helpful information to RAN2. |
| Sharp | If the FFS as discussed in Question 2.1 can be resolved in this meeting, the corresponding RAN1 agreement should be captured in the reply LS. Otherwise it is also OK to simply inform RAN2 of the above RAN1 agreement. |
| Ericsson | If RAN1 is able to reach an agreement about the answer in Q2.1 then we should provide it to RAN2. In case there is no possible agreement, it is OK to send the agreement in Q2.2 to RAN2. |
| NTT DOCOMO | Let’s try to conclude Q2.1 first. |
| Intel | If there is no additional progress in RAN1 then it automatically becomes the default option and then issue is to be handled by RAN2. |
| Panasonic | We also prefer to conclude question 2.1 first. |
| Lenovo/Motorola | We prefer to make more progress in this meeting. If there is no possible agreement, it is ok to send the outcome of round 1 discussion to RAN2. |
| Fraunhofer | We also prefer to attempt to make more progress in this meeting, based on Q2.1. If not possible, we can send this text in Q2.2. |
| CATT, GOHIGH | It would be better to reply LS based on the question 2.1. Otherwise, we prefer to only provide main-bullet to RAN2. |
| Convida Wireless | We are ok with the proposal of reply for RAN2 LS. |
| Xiaomi | We are fine to reply the current agreement if no further progress is made. |
| Futurewei | If we do not have any agreement on any FFS part in this meeting, we prefer to send current agreement to RAN2 to avoid further delay. |
| InterDigital | We can try to make further progress in Q2.1 but if we don’t make any additional agreement, it is still much better to send a reply LS with existing agreement. |
| Apple | We are fine with the current reply if there is no further agreement made in the meeting. |
| Fujitsu | We also think it is better to conclude question 2.1 first. |

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# Appendix

*R1-2106922*

***Proposal 1: It is not preferred that sensing operation is only allowed in its own SL DRX active duration.***

***Proposal 2: Sensing operation is allowed in SL DRX inactive duration without the restriction of its own SL DRX configuration***

***Proposal 3: Reply LS to RAN2,***

* ***From RAN1’s perspective, sensing operation is allowed in SL DRX inaction duration without the restriction of its own SL DRX configuration. And RAN1 respectfully asks RAN2 to take the information into account.***

*R1-2107705*

***Observation 1:*** *Sensing during sidelink DRX off duration significantly reduces the power-saving benefits of sidelink DRX.*

***Observation 2:*** *No sensing during sidelink DRX off duration leads to a higher resource selection collision possibility.*

***Proposal 1:*** *When a UE is configured with sidelink DRX,*

* *the UE performs sensing after its sidelink data arrival, even if the sensing occasion is in its sidelink DRX off duration.*
* *the UE does not perform sensing before its sidelink data arrival, if the sensing occasion is in its sidelink DRX off duration.*

*R1-2107958*

RAN1 thanks RAN2 for the LS informing the working assumption and agreements on sidelink DRX design. RAN1 would like to confirm RAN2’s understanding, i.e., if SL DRX is used, the impact of DRX on sensing (as well as resource allocation) should be considered in addition to data reception. More specifically, a UE is not required to perform sensing out of the DRX active time. RAN1 will consider the DRX impact in RAN1’s design, and respectfully asks RAN2 to provide any updates of DRX design that may have potential impacts on sensing and resource allocation.

*R1-2108078, R1-2108079*

[Observation 1: The granularity of SL DRX operation could be per a pair of source/destination, or per cast type, or per L2 destination ID.](#_Toc79167941)

[Observation 2: The SL DRX configurations can be obtained from pre-configuration,SIB ,dedicated-RRC or PC5-RRC.](#_Toc79167942)

[Observation 3: For one UE, more than one SL DRX configurations would be configured.](#_Toc79167943)

[Observation 4: For unicast, the SL DRX for both Tx UE and RX UE can be acquired by one UE.](#_Toc79167944)

Proposal 1: A UE can perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time.

Proposal 2: For data reception, all configured SL DRX should be applied .

Proposal 3: The reception that can be known in advance needs to be monitored even if in off-duration, e.g. SPS transmissions.

RAN1 would like to thank RAN2 on the announcement of their agreement and working assumption on sidelink DRX.

Regarding the below working assumption

|  |
| --- |
| Working assumption:  SL DRX should take PSCCH monitoring also for sensing (in addition to data reception) into account if SL DRX is used. |

It's RAN1's understanding that UE can perform PSCCH monitoring for sensing during SL DRX inactive time. Thus RAN1 has concern on the WA which may imply that the PSCCH monitoring for sensing should take SL DRX into account and is not allowed during DRX inactive time.

*R1-2108128,R1-2108133*

**Reply to RAN2 LS:** From RAN1 perspective, there are no objections to the working assumptions and agreements reached by RAN2. Nevertheless, it is important to clarify whether a UE is allowed to perform sensing operations including PSCCH monitoring and RSRP measurement during SL-DRX *Inactive Time*.

From RAN1 perspective, a UE shall perform sensing during its SL-DRX *Active Time.* It is up to UE implementation to perform SL reception of PSCCH and RSRP measurement for sensing during its SL-DRX *Inactive Time*.

Observation 1 The main objective of SL-DRX and partial sensing operation is to reduce the power consumption during the resource allocation procedure.

[Proposal 1 A UE shall perform sensing during its SL-DRX Active Time. It is up to UE implementation to perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time.](#_Toc79153246)

*R1-2108178,R1-2108179*

RAN1 would like to confirm RAN2’s working assumption: SL DRX should take PSCCH monitoring also for sensing into account if SL DRX is used.

Through RAN1 discussion, RAN1 reached this agreement:

[It is up to UE implementation to perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time.]

**Proposal 1: It is up to UE implementation to perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time.**

*R1-2108186*

***Proposal 1: Reply to RAN2 as follows:***

* + - ***When a sensing UE has a SL DRX configuration, a UE can perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time, at least according to specified conditions.***

*R1-2106714*

***Proposal 8: SL reception of PSCCH and RSRP measurement for sensing should not be supported during SL DRX inactive time.***

*R1-2106724*

***Proposal 5: The Y candidate slots and the associated periodic sensing occasions should be within the SL-DRX ON duration.***

*R1-2106818*

Proposal 11: For resource selection, UE should exclude resources which it has not monitored during the OFF state of sidelink DRX operation in a resource sensing window.

Proposal 12: A UE based on partial sensing RA scheme should determine a partial sensing window considering an ON state of DRX operation.

*R1-2106909*

**Proposal 12: For UE with enabled SL DRX, sensing window is adjusted into DRX active time with configured sensing window.**

* **Sensing is not performed (e.g. using random selection instead) if no sensing slot is within active time.**

**Proposal 13: The same principle can be applied both for partial sensing and full sensing when SL DRX is performed.**

**Proposal 14: When TX UE performs resource selection for RX UE with SL DRX enabled, the resource selection window is adjusted (within remaining PDB) according to SL-DRX active time of RX UE.**

* **Exceptional resource pool is used if there is no available slot for resource selection**

**Proposal 15: SCI is used to align SL DRX wake-up time between TX UE and RX UE(s).**

*R1-2107021*

*Proposal 1: The SL DRX active time is consisting of the semi-static active time and extended active time similar to Uu active time.*

*Proposal 2: No SL operation should be mandated outside the DRX active time for power saving consideration*

*Proposal 3: For SL operation allocated within DRX semi-static inactive time, a SL UE is mandated to extend its DRX active time or up to UE implementation*

*Proposal 4: A SL DRX semi-static active time could be backward extended for sensing purpose when a SL transmission triggering slot is near to the beginning of semi-static active time. The extension could be same size as the sensing window, truncated or extended by a fixed value*

*Proposal 5: A SL DRX semi-static active time could be forward extended for a SL UE to complete its transmission, reception, decoding, etc*

*Proposal 6: The extension of SL DRX semi-static active time could be triggered by previous SL or DL signalling*

*Proposal 7: 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”*

*Proposal 8: 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.*

*R1-2107022*

**Proposal 4: We propose that the partial sensing occasions are aligned with the SL DRX active period in order to maximize the power saving gains.**

**Proposal 5: In the case of Mode 2, we propose that 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.**

**Proposal 6: In the case of inadequate sensing results, we propose that the UE uses assistance information messages in order to obtain the required sensing information for carrying out reliable resource selection.**

*R1-2107037*

Sensing can be performed during SL DRX inactive time as well as active time.

For periodic-based partial sensing, it may be beneficial to refine the determination rule of “k” for a given periodicity when SL DRX is configured, from power saving perspective.

For contiguous partial sensing, when SL DRX is configured, the corresponding slots can be monitored regardless of whether they overlap with SL DRX active time or not.

*R1-2107091*

***Proposal 14:*** ***Allow UE to perform sensing during the DRX inactive period.***

***Proposal 15:*** ***Different settings can be configured for periodic partial sensing in DRX active and inactive periods, e.g., maximum number of sensing occasions.***

***Proposal 16:*** ***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.***

*R1-2107151*

Proposal 8: Study the above potential solutions to reduce impact of sidelink DRX.

*R1-2107163*

**Proposal 4: Consider the potential impacts on RAN1 when DRX is introduced. For example, scheduling time gap and resource selection/re-evaluation.**

**Proposal 5: RAN1 further discuss the issue of DRX on-duration alignment problem arising due to contiguous partial sensing with negative TA negative value.**

**Proposal 6: Additional DRX configuration can be configured for Tx UE performing periodic partial sensing considering multiple resource reservation periods.**

**Proposal 7: RAN1 study on the transmission of assistance indication like go-to-sleep to aid Rx UE(s) enter early DRX sleep state.**

*R1-2107223*

**Observation 3: If sensing is performed within DRX active time only, that will affect sensing accuracy and re-evaluation/pre-emption are not applicable in some cases.**

**Observation 4: If sensing is performed within both DRX active time and DRX inactive time, more accurate sensing results can be obtained and re-evaluation/pre-emption are applicable.**

**Proposal 14: Performing partial sensing within both DRX active time and DRX inactive time is supported.**

**Proposal 15: If SL DRX is configured, the selected resource for initial transmission should be within DRX ON duration of RX UE.**

**Proposal 16: If SL DRX is configured, some enhancements of mode 2 resource selection procedure should be further studied.**

**Observation 5: If RX UE miss transmission from TX UE, it will not start related SL DRX timer, that will cause error in following transmissions.**

*R1-2107367*

Observation 5: Partially overlapping DRX configurations increase collisions among power saving UEs' transmissions.

Proposal 12: 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.

**Proposal 13: 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.**

Proposal 14: It should be left to the UE’s implementation to decide whether sensing is limited to its DRX ON duration or not.

*R1-2107422*

***Observation 1: If partial sensing is only performed within SL DRX active time, the available sensing occasions may not enough to acquire accurate sensing results***

***Proposal 3: A UE performs SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time.***

[*R1-2107481*](file:///C:\Users\10217598\Desktop\Docs\R1-2107481.zip)

***Proposal 9: Study potential impacts of SL DRX on sensing operation.***

[*R1-2107528*](file:///C:\Users\10217598\Desktop\Docs\R1-2107528.zip)

***Observation 4: Resource selection procedure based on partial sensing uses a separate procedure from that for SL DRX operation. As a result, partial sensing and SL DRX operation are specified separately in Rel.17.***

***Proposal 33:*** *For partial sensing UE, sensing results obtained by SL DRX operation in active time are used for resource (re)selection, resource re-evaluation/pre-emption checking, in addition to the partial sensing results.*

***Proposal 34:*** *If RX UE performs SL DRX operation, TX UE selects at least the resources for the initial transmission and a (pre-)configured number of retransmissions in RX UE’s SL DRX ON duration or active time. The remaining retransmission resources can be selected in OFF duration, which is expected to be an active time extended based on the reception during active time.*

***Proposal 35:*** *When RX UE performs SL DRX operation, if TX UE detects DTX of a certain transmission and the next retransmission is expected outside the RX UE’s SL DRX active time, TX UE triggers resource reselection for the next transmission resource so that the reselected resource is within the active time.*

***Proposal 36:*** *TX UE performs random resource selection when resource (re)selection is triggered within a range of a threshold from the start of RX UE’s SL DRX ON duration.*

***Proposal 37:*** *If RX UE performs SL DRX operation, the target resource ratios are separately configured for RX UE SL DRX ON and OFF duration in TX UE’s resource allocation for periodic transmission.*

***Proposal 38:*** *If RX UE performs SL DRX operation, the RSRP threshold is separately adjusted until each target resource ratio is achieved in RX UE SL DRX ON and OFF duration in TX UE’s resource allocation for periodic transmission.*

***Proposal 39:*** *Two options can be considered for channel sensing duration in SL DRX mode-2 resource allocation.*

*Opt 1. Sensing is allowed only during the active time.*

*Opt 2. Sensing is allowed during the inactive time as well as the active time.*

***Proposal 40:*** *If RX UE performs SL DRX operation, in resource allocation procedure, TX UE deprioritizes or excludes resources that are affected by the interference caused by RF On and Off operations due to Uu link DRX operation. Details are FFS.*

[*R1-2107609*](file:///C:\Users\10217598\Desktop\Docs\R1-2107609.zip)

***The design of SL DRX cycle needs to ensure that UE partial sensing behavior 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)***

***Defined partial sensing procedure (periodic and contiguous) need to be fulfilled irrespective of the SL DRX status***

***Sensing in the SL DRX inactive time is up to UE implementation***

***If information about the SL DRX active time of one or more of the recipients of a transmission is known, this should be considered when selecting the candidate resources***

[*R1-2107879*](file:///C:\Users\10217598\Desktop\Docs\R1-2107879.zip)

**Observation 9:**

* *For a resource pool (pre-)configured with full/partial sensing, it would be a valid situation that at least full sensing UE can transmit on any time resource in the resource pool. If power saving UE does not perform sensing during its SL DRX inactive time, many resource collisions would happen.*

**Proposal 14:**

* *Support Alt 1, i.e.*
  + *A UE can perform SL reception of PSCCH and RSRP measurement for sensing during its SL DRX inactive time.*

**Proposal 15:**

* *For sensing during its SL DRX inactive time, either option is supported.*
  + *Option 1: UE shall perform sensing during its SL DRX inactive time.*
  + *Option 2: UE performs sensing during its SL DRX inactive time, based on specified rule(s). FFS the rule(s)*

[*R1-2107899*](file:///C:\Users\10217598\Desktop\Docs\R1-2107899.zip)

**Proposal 12: Support the Tx UE to preclude resources that are not within the time slots of Rx UE DRX on duration.**

**Proposal 13: When SL DRX is configured and partial sensing RA scheme is performed, UE should keep sensing during SL active duration.**

[*R1-2108035*](file:///C:\Users\10217598\Desktop\Docs\R1-2108035.zip)

**Proposal 21: The UE in SL DRX can perform either sensing-based resource selection or random resource selection.**

**Proposal 22: The Rx UE in its SL DRX active time shall decode both the first and second SCI.**

**Proposal 23: For partial sensing purposes, monitoring PSCCH is not affected by SL DRX configuration.**

**Proposal 24: In the slots outside of DRX active time where the UE performs sensing, the UE decodes the first SCI only.**

**Proposal 25: Consider congestion control enhancement for DRX operation.**