**3GPP TSG-RAN WG2 Meeting #124** **R2-231**

**Chicago, UAS, 13th – 17th November, 2023**

**Title: Email discussion on the MAC open issue list**

**Source: Huawei, HiSilicon**

**Agenda item: 8.2.2**

**Document for: Discussion and Decision**

# Background

The following post meeting email discussion has been planned during RAN2#123bis:

**[Post123bis][409][POS] Rel-18 positioning MAC CRs (Huawei)**

Scope: Review the running CRs and develop open issue lists.

Intended outcome: Draft CRs and open issue list for next meeting

Deadline: Medium (2 weeks)

NOTE that we have the following guidelines from the chair on the running CR email discussions

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| Guidance for all post-meeting discussions on running CRs/open issues (also applicable to AI 7.9.1):   * Update the running CR with agreements from the meeting * Rapporteur to propose resolutions for straightforward open issues which can already be included in the running CR * Get input on stage-3 issues that require further input from companies to make a decision: * Focus on stage-3 issues which are better handled via offline, e.g. signaling details, parameter values/ranges, NOT functionality discussion * For these issues, the discussion rapporteur submits a report with proposals to the next meeting, and input via company Tdocs should be avoided * Identify the remaining open issues that need to be solved for WI completion in the next meeting * Company Tdocs for the next meeting should focus on these issues |

This contribution intends to list the remaining functional open issues for the completion of the WI. Companies are invited to take this open issue list as a refence for their submission of tdocs for the next RAN2 meeting. Companies are also invited to list the open issues that they think are not included within the current list

# 2 Sidelink positioning open issue list

The open issues related to the functional aspects of the MAC spec for sidelink positioning are listed as follows. Rapp would like to understand if there are other functional open issues that companies think need to address.

***Question: Do companies think that there are other open issues to be addressed for sidelink positioning in MAC spec?***

|  |  |
| --- | --- |
| Companies | Comments |
| ZTE | 1. One SL-PRS Tx UE may be involved in multiple SL positioning sessions at a time, the demand of SL-PRS transmission may be huge. However, one slot is restricted to be only transmit one SL-PRS resource in Rel-18. So RAN2 should discuss how to control the Tx SL-PRS flow to satisfy sidelink positioning service/QoS/session as much as possible. This issue happens both at shared pool and dedicated pool. We can take the SL-data LCP procedure as baseline, i.e., to set rules to prevent SL-PRS with the highest priority/or with a specific session to occupy the radio resource forever.   [Rapp] LCP addresses this by the token bucket mechanism for different logical channels, but it not for SL-PRS. We can consider about it by listing it in the open issue list but I would consider it as an optimization  => Added an editor’s NOTE in LCP but also added “considered as an optimization by the Rapp”   1. Also, MAC should not maintain/allow infinite grant when the demand of SL-PRS transmission is huge. But current MAC spec does not specify this which may lead to bad implementation:  * for SL-data there are total 16 parallel SL process to perform data transmission, in which there are up to 4 can be used in mode 2. we think SL-PRS can take the similar rule to restrict the maximum number of SL processes that allows SL-PRS transmission in shared pool. * for dedicated pool, MAC spec should also restrict the maximum number that the MAC can maintain grant dedicated for SL-PRS transmission.   [Rapp] => added this to the editor’s NOTE |
| Xiaomi | 1. During LCP procedure, it is unclear how MAC decides whether the remaining resource is enough for the transmission of SL-PRS. Whether PHY should provide both TBS including and not including SL-PRS symbols.   [Rapp] This is already clear form the spec 38.214.     1. Whether any other information is needed in SL-PRS resource request MAC CE aside from the agreed destination ID and L1 priority.   [Rapp] => Added in the existing editor’s NOTE   1. LCP: It is unclear whether some criterion is needed to determine whether the SL grant is applicable for the transmission of the SL-PRS.   [Rapp] => Added in the existing editor’s NOTE   1. Mode 2 SL resource selection: it is unclear whether some criterion relating to SL-PRS requirement(e.g. bandwidth) is needed when selecting the resource.   [Rapp] this is related to the following note.  Editor’s NOTE: FFS how the SL-PRS resource ID is determined and its impacts to MAC. |

5.4.2.2 HARQ process

Editor’s NOTE: FFS conditions for uplink transmission prioritizing over sidelink transmission.

5.4.4 Scheduling Request

Editor’s NOTE: FFS the prioritization between SR triggeded by UL-SCH and SL-PRS. FFS the prioritization between SR triggered by SL-SCH and SL-PRS

Editor’s NOTE: FFS additional conditions for SR cancellation.

## 5.8 Transmission and reception without dynamic scheduling

Editor’s NOTE: FFS whether multiple CGs can be configured for SL-PRS transmission; whether the number of maximum SL-PRS transmissions on SL-PRS dedicated resource pool with CG is needed

Editor’s NOTE: Whether the above formula for determining the CG occasion for CG type 1 for SL-SCH can be reused for SL-PRS

#### 5.22.1.1 SL Grant reception and SCI transmission

Editor’s NOTE: FFS whether the MAC layer can determine to select multiple SL-PRS transmission when SL-PRS is triggered either by the peer UE or the UE's own upper layer.

Editor’s NOTE: FFS whether the MAC layer can determine to select single SL-PRS transmission when SL-PRS transmission is triggered by its own upper layer or by peer UE.

Editor’s NOTE: FFS SL-PRS transmission on SL-PRS shared resource pool when the MAC PDU has been positively acked for resource allocation scheme 1 and scheme 2.

Editor’s NOTE: FFS the resource selection on SL-PRS shared resource pool when both data corresponding to logical channel with PDB and SL-PRS with delay budget are transmitted; or when there is no data corresponding to logical channel and there is only SL-PRS delay budget.

Editor’s NOTE: FFS how the MAC entity determines the SL-PRS delay budget.

Editor’s NOTE: FFS minimum time gap requirement on SL-PRS shared resource pool.

Editor's NOTE: FFS how the SL-PRS resource is determined based on the list of RRC configued SL-PRS configurations, priority, PHY sensing and MAC layer random resource selection for resource allocation scheme 2.

Editor’s NOTE: FFS whether SL-PRS occasion on SL-PRS shared resource pool can be cleared when the MAC PDU has been positively acked for resource allocation scheme 2.

Editor’s NOTE: FFS whether SL-PRS occasion on SL-PRS shared resource pool can be cleared when the MAC PDU has been positively acked for resource allocation scheme 1.

Editor’s NOTE: FFS whether SL-PRS priority is determined by priority in the peer UE's UCI or the UE's own higher layer when the trigger comes from the peer UE's SCI.

Editor’s NOTE: FFS how SL-PRS priority is determined when SL-PRS is triggered by the UE's own higher layer.

#### 5.22.1.2a Re-evaluation and Pre-emption

#### 5.22.1.2b Re-selection for using a received resource conflict indication

Editor’s NOTE: The same issue as section 5.22.1.1 for the relationship between remaining PDB and SL-PRS delay budget for resource selection on SL-PRS shared resource pool.

##### 5.22.1.3.1 Sidelink HARQ Entity

Editor's NOTE: FFS the maximum number of SL processes that allow the SL-PRS transmission.

Editor’s NOTE: The cast type indicator is determined as a result of the logical channel prioritization as in section 5.22.1.4 and should not be indicated by upper layer. There might be an issue with the legacy sidelink communication spec and FFS how this can be resolved.

Editor’s NOTE: FFS how the SL-PRS resource ID is determined and its impacts to MAC.

5.22.1.4.1.3 Allocation of sidelink resources

Editor's NOTE: FFS mechanism for preventing high priority PRS occupying all the resources. Rapp considers it as an optimization but could be further discussed.

Editor's NOTE: FFS more detailed procedure for determining whether PRS is transmitted.

5.22.1.5 Scheduling Request

Editor’s NOTE: FFS the other conditions for the cancellation of the MAC CE.

#### 5.22.1.xx SL-PRS transmission on SL-PRS dedicated resource pool

Editor’s NOTE: FFS how to maintain the resource reselection counter for resource selection in SL-PRS dedicated resource pool.

Editor's NOTE: FFS whether the condition that it is prioritized by higher layer is still needed for SL-PRS prioritized over uplink transmission is.

#### 5.22.2.2 Sidelink HARQ operation and SL-PRS reception on SL-PRS shared resource pool

Editor’s NOTE: FFS how the PFSCH is generated when SL-PRS is transmitted on shared resource pool.

#### 6.1.3.xx SL-PRS resource request MAC CE

Editor’s NOTE: FFS whether the tuple of destination ID and priority can be sent by a list of multiple items within the MAC CE.

Editor’s NOTE: FFS the list of destination IDs the UE request for resource in RRC message.

# 3 LPHAP open issue list

The open issues related to the functional aspects of the MAC spec for LPHAP are listed as follows. Rapp would like to understand if there are other functional open issues that companies think need to address.

***Question: Do companies think that there are other open issues to be addressed for LPHAP in MAC spec?***

|  |  |
| --- | --- |
| Companies | Comments |
| Samsung | **Autonomous TA update** - FFS whether the UE restarts the area-specific TAT after it autonomously updates TA for SRS.  [Rapp] Yes, agree.  => Added to the section of TAT maintenance. - FFS how upper layer indicates PHY to perform the autonomous TA update. (For more details, please find our response to the LPHAP part in ‘Email discussion on the proposed WF for MAC CR drafting’)  [Rapp] there is one comment I have made during the meeting. How to adjust the TA is not part of the MAC spec but in RAN1/4 spec |

5.2 Maintenance of Uplink Time Alignment

Editor's NOTE: FFS whether when the UE autonomously adjust the TA when cell reselection happens, the TAT is restarted.

5.26.2 TA validation for SRS transmission in RRC\_INACTIVE

Editor’s NOTE: FFS the pathloss reference threshold condition for positioning SRS transmission when validity area is configured.

Editor's NOTE: FFS the definition of the current RSRP for TA validation based on the LS send to RAN4.

# 4 CA positioning open issue list

The open issues related to the functional aspects of the MAC spec for CA positioning are listed as follows. Rapp would like to understand if there are other functional open issues that companies think need to address.

***Question: Do companies think that there are other open issues to be addressed for CA positioning in MAC spec?***

|  |  |
| --- | --- |
| Companies | Comments |
| Xiaomi | We made the following agreements:  For activation/deactivation of aggregated SRS across two or three carriers, a single MAC CE is used. FFS if it can be a legacy MAC CE or a new one is needed.  The FFS part should be resolved.  [Rapp] => editor’s NOTE added in CA positioning |
| Samsung | **New MAC CE to activate the aggregated SRS-PosResourceSets - RAN1 agreement**   |  | | --- | | For semi-persistent positioning SRS for bandwidth aggregation, a single MAC CE can activate or deactivate:   * SRS resource set(s) in **one or two or three of three** aggregated carriers * SRS resource set(s) in **one or two of two** aggregated carriers.   Note: the **single spatial relation is indicated** by the MAC CE for **each of two or three aggregated SRS resources**. |   According to the RAN1 agreement above, there are two requirements on the MAC CE for activation/deactivation of the aggregated SRS-PosResourceSets as below.  1. The MAC CE should be able to indicate activation/deactivation of **one or two or three** of the aggregated/linked SRS-PosResourceSets. For example, when three SRS-PosResourceSets (e.g., Set X/Y/Z) are linked via RRC signalling, the (de)activation of various combination (e.g., {SetX}, {SetY}, {SetZ}, {SetX&Y}, {SetY&Z}, {SetX&Y&Z}} should be supported by the MAC CE.  2. The MAC CE should be able to indicate the **single spatial relation for each set of aggregated resources**. When there are multiple sets of aggregated SRS-PosResources within the aggregated SRS-PosResourceSets, the spatial relation information for each set of aggregated SRS-PosResources should be indicated by the MAC CE.  Please, find the following figure for the example.    Since the aforementioned requirements can not be supported by the legacy MAC CE (even in the case of using the reserved 1 bit), RAN2 needs to design a new MAC CE. - FFS design of a new MAC CE to support activation/deactivation of the aggregated SRS resource set(s) based on the RAN1 agreement.  [Rapp] Thanks, added for the comments above |
| Lenovo | Agree with Xiaomi that the FFS part should be discussed: whether legacy MAC CE or new MAC CE is used for the SRS bandwidth aggregation activation/deactivation, if legacy MAC CE is used, how to use 1 bit reservation to activate/deactivate the aggregated SRS should be resolved; if new MAC CE is used, then corresponding new MAC CE design should be considered.  [Rapp] Thanks, added for the comments above |

5.26.2 TA validation for SRS transmission in RRC\_INACTIVE

Editor's NOTE: FFS TA validation for positioning SRS transmission in RRC\_INACTIVE with positioning SRS bandwidth aggregation

Editor's NOTE: whether to reuse the current MAC CE or design a new MAC CE for activation/deactivation of SP positioning SRS with multiple carrier indications

# 5 REDCAP positioning open issue list

The open issues related to the functional aspects of the MAC spec for REDCAP positioning are listed as follows. Rapp would like to understand if there are other functional open issues that companies think need to address.

***Question: Do companies think that there are other open issues to be addressed for REDCAP positioning in MAC spec?***

|  |  |
| --- | --- |
| Companies | Comments |
|  |  |

3.1 Definitions

Editor's NOTE: FFS whether this feature of SRS for positioning Tx frequency hopping is only limited to RedCap UE or applicable for the other UE types.

5.15.1 Downlink and Uplink

Editor's NOTE: Whether the separate BWP configuration is inside each existing data BWP or outside any data BWP and its impacts to BWP operation in MAC spec, with the following R1 agreement: For RedCap UEs, support SRS for positioning frequency hopping by Using a configuration separate from the existing BWP configuration

# 6 Carrier phase positioning open issue list

The open issues related to the functional aspects of the MAC spec for carrier phase positioning are listed as follows. Rapp would like to understand if there are other functional open issues that companies think need to address.

***Question: Do companies think that there are other open issues to be addressed for carrier phase positioning in MAC spec?***

|  |  |
| --- | --- |
| Companies | Comments |
|  |  |

Editor's NOTE: FFS For simultaneous transmission of UL SRS from a target UE and a PRU, is there a need for gNB to indicate the time window(s) directly to UE

# 7 Summary

We list the open issues for the current MAC spec as in the following table

|  |  |  |  |
| --- | --- | --- | --- |
| Numbering | Section | Open issue | Editor’s Comment |
| SL#01 | 5.4.2.2 HARQ process | FFS conditions for uplink transmission prioritizing over sidelink transmission. | Needs further discussion |
| SL#02 | 5.4.4 Scheduling Request | FFS the prioritization between SR triggered by UL-SCH and SL-PRS.  FFS the prioritization between SR triggered by SL-SCH and SL-PRS | Needs further discussion |
| SL#03 | 5.4.4 Scheduling Request | FFS additional conditions for SR cancellation. | Needs further discussion |
| SL#04 | 5.8 Transmission and reception without dynamic scheduling | FFS whether multiple CGs can be configured for SL-PRS transmission; whether the number of maximum SL-PRS transmissions on SL-PRS dedicated resource pool with CG is needed | This issue can be revisited after RAN1 parameter list and RRC spec changes |
| SL#05 | 5.8 Transmission and reception without dynamic scheduling | FFS Whether the above formula for determining the CG occasion for CG type 1 for SL-SCH can be reused for SL-PRS | Can be revisited after receiving the RAN1 parameter list and RRC spec changes |
| SL#06 | 5.22.1.1 SL Grant reception and SCI transmission | FFS whether the MAC layer can determine to select multiple SL-PRS transmission when SL-PRS is triggered either by the peer UE or the UE's own upper layer. | The remaining issue here seems to be only that whether the multiple SL-PRS transmission can be triggered by the peer UE’s SCI.  This will also have RAN1 impacts and we can inform RAN1 of our conclusions |
| SL#07 | 5.22.1.1 SL Grant reception and SCI transmission | FFS whether the MAC layer can determine to select single SL-PRS transmission when SL-PRS transmission is triggered by its own upper layer or by peer UE. | Same as above |
| SL#08 | 5.22.1.1 SL Grant reception and SCI transmission | FFS SL-PRS transmission on SL-PRS shared resource pool when the MAC PDU has been positively acked for resource allocation scheme 1 and scheme 2 | This needs further discussion perhaps in both RAN1/2 on what is the condition to set the PSFCH in shared resource pool: is it only based on the successful reception of data as in legacy, or it is based on both data and SL-PRS |
| SL#09 | 5.22.1.1 SL Grant reception and SCI transmission | FFS the resource selection on SL-PRS shared resource pool when both data corresponding to logical channel with PDB and SL-PRS with delay budget are transmitted; or when there is no data corresponding to logical channel and there is only SL-PRS delay budget. | This is similar to the discussion we had on priority when there are both data and SL-PRS. |
| SL#10 | 5.22.1.1 SL Grant reception and SCI transmission | FFS how the MAC entity determines the SL-PRS delay budget. | Needs further discussion. also related to the LS we sent to SA2 on SL-PRS delay budget. Perhaps there should be mapping defined for LCS QoS similarly as PDB in PQI |
| SL#11 | 5.22.1.1 SL Grant reception and SCI transmission | FFS minimum time gap requirement on SL-PRS shared resource pool. | Need further discussion on the selection of resource when there is PFSCH on shared resource pool |
| SL#12 | 5.22.1.1 SL Grant reception and SCI transmission | FFS how the SL-PRS resource is determined based on the list of RRC configured SL-PRS configurations, priority, PHY sensing and MAC layer random resource selection for resource allocation scheme 2. | This might also only be related to the UE’s internal behavior without spec impacts. But can be beneficial to discuss for having a common understanding |
| SL#13 | 5.22.1.1 SL Grant reception and SCI transmission | FFS whether SL-PRS occasion on SL-PRS shared resource pool can be cleared when the MAC PDU has been positively acked for resource allocation scheme 2. | This is also related to issue SL#08. Need further discussion in RAN1/2 |
| SL#14 | 5.22.1.1 SL Grant reception and SCI transmission | FFS whether SL-PRS occasion on SL-PRS shared resource pool can be cleared when the MAC PDU has been positively acked for resource allocation scheme 1. | This is also related to issue SL#08. Need further discussion in RAN1/2 |
| SL#15 | 5.22.1.1 SL Grant reception and SCI transmission | FFS whether SL-PRS priority is determined by priority in the peer UE's UCI or the UE's own higher layer when the trigger comes from the peer UE's SCI. | RAN1’s LS indicates that there is no change in the SCI indicating specific priority for the peer UE to send PRS. Can be further discussed whether the priority can be based on the priority in the triggering SL-PRS  Feedback to RAN1 is also needed when agreement is made. |
| SL#16 | 5.22.1.1 SL Grant reception and SCI transmission | FFS how SL-PRS priority is determined when SL-PRS is triggered by the UE's own higher layer. | This is also related to open issue SL#10. Maybe it can be defined as a mapping from LCS QoS to SL-PRS priority. And maybe there will not be MAC spec impacts. Dependent on SA2 discussions |
| SL#17 | 5.22.1.2a Re-evaluation and Pre-emption  5.22.1.2b Re-selection for using a received resource conflict indication | The same issue as section 5.22.1.1 for the relationship between remaining PDB and SL-PRS delay budget for resource selection on SL-PRS shared resource pool. |  |
| SL#18 | 5.22.1.3.1 Sidelink HARQ Entity | FFS the maximum number of SL processes that allow the SL-PRS transmission. | Legacy spec’s maximum number of SL processes is 16 and it is restricted that the maximum number of SL processes that can run simultaneously is 4. Need to consider whether some restriction is needed as well for SL-PRS and whether RAN1/2 can discuss this |
| SL#19 | 5.22.1.3.1 Sidelink HARQ Entity | The cast type indicator is determined as a result of the logical channel prioritization as in section 5.22.1.4 and should not be indicated by upper layer. There might be an issue with the legacy sidelink communication spec and FFS how this can be resolved. | This might be an issue with the legacy spec on SL communications. It needs to be further discussed how to resolve this after issues discussed in SL communications, since this is related to shared resource pool |
| SL#20 | 5.22.1.3.1 Sidelink HARQ Entity | FFS how the SL-PRS resource ID is determined and its impacts to MAC. | RRC configures a list of PRS configurations and it needs to be studied how MAC determines the SL-PRS transmission. This is perhaps related to the LCS QOS, delay budget and priority, etc. |
| SL#21 | 5.22.1.4.1.3 Allocation of sidelink resources | FFS mechanism for preventing high priority PRS occupying all the resources. | LCP addresses this by the token bucket mechanism for different logical channels, but it not for SL-PRS. We can consider about it by listing it in the open issue list but I would consider it as an optimization |
| SL#22 | 5.22.1.4.1.3 Allocation of sidelink resources | FFS more detailed procedure for determining whether PRS is transmitted. | Can be discussed based on the contributions from individual companies |
| SL#23 | 5.22.1.5 Scheduling Request | FFS the other conditions for the cancellation of the MAC CE. | Can discuss on the conditions for cancellation of the MAC CE |
| SL#24 | 5.22.1.xx SL-PRS transmission on SL-PRS dedicated resource pool | FFS how to maintain the resource reselection counter for resource selection in SL-PRS dedicated resource pool. | Previously the counter is maintained per SL process. Whether some changes needed for SL-PRS dedicated resource pool |
| SL#25 | 5.22.1.xx SL-PRS transmission on SL-PRS dedicated resource pool | FFS whether the condition that it is prioritized by higher layer is still needed for SL-PRS prioritized over uplink transmission is. | Need further discussion |
| SL#26 | 5.22.2.2 Sidelink HARQ operation and SL-PRS reception on SL-PRS shared resource pool | FFS how the PFSCH is generated when SL-PRS is transmitted on shared resource pool. | This is also related to issue SL#08 and SL#13 and SL#14 |
| SL#27 | 6.1.3.xx SL-PRS resource request MAC CE | FFS whether the tuple of destination ID and priority can be sent by a list of multiple items within the MAC CE. FFS the other fields can be possibly included in the MAC CE. | Whether a single request can transmit request for multiple PRSs need to be studied  Other fields in the MAC CE also for further study based on individual contributions |
| SL#28 | 6.1.3.xx SL-PRS resource request MAC CE | FFS the list of destination IDs the UE request for resource in RRC message. | This is more related to RRC discussion but related to MAC for the destination ID index.  Can be further studied |
| LPHAP#01 | 5.2 Maintenance of Uplink Time Alignment | FFS whether when the UE autonomously adjust the TA when cell reselection happens, the TAT is restarted. | Need further discussion |
| LPHAP#02 | 5.26.2 TA validation for SRS transmission in RRC\_INACTIVE | FFS the pathloss reference threshold condition for positioning SRS transmission when validity area is configured. | Can reuse the legacy mechanism that get the difference between current RSRP and stored RSRP and compare the difference with the RSRP threshold. |
| LPHAP#03 | 5.26.2 TA validation for SRS transmission in RRC\_INACTIVE | FFS the definition of the current RSRP for TA validation based on the LS send to RAN4. | Can be revisited when receiving RAN4 reply LS |
| CA#01 | 5.26.2 TA validation for SRS transmission in RRC\_INACTIVE | FFS TA validation for positioning SRS transmission in RRC\_INACTIVE with positioning SRS bandwidth aggregation | Whether the carriers for positioning belong to the same TAG or can belong to different TAGs |
| CA#02 | 5.26.2 TA validation for SRS transmission in RRC\_INACTIVE | FFS whether to reuse the current MAC CE or design a new MAC CE for activation/deactivation of SP positioning SRS with multiple carrier indications | Can wait for RAN1 conclusion |
| REDCAP#01 | 3.1 Definitions | FFS whether this feature of SRS for positioning Tx frequency hopping is only limited to RedCap UE or applicable for the other UE types. | Wait for RAN1 progress |
| REDCAP#02 | 5.15.1 Downlink and Uplink | FFS whether the separate BWP configuration is inside each existing data BWP or outside any data BWP and its impacts to BWP operation in MAC spec, with the following R1 agreement: For RedCap UEs, support SRS for positioning frequency hopping by Using a configuration separate from the existing BWP configuration | Wait for RAN1 progress since an LS has been sent to RAN1 |
| CPP#01 | ffs section | FFS For simultaneous transmission of UL SRS from a target UE and a PRU, is there a need for gNB to indicate the time window(s) directly to UE | Wait for RAN1 progress |
|  |  |  |  |