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Agenda Item: 6.8.2.5

Source: Huawei, HiSilicon

Title: Summary for MAC proposals under 6.8.2.5

Document for: Discussion, Decision

# Introduction

This is the summary for the tdocs submitted for agenda item 6.8.2.5 for the impacts to MAC spec for positioning. The summary mainly focus on the following aspects:

* DRX and positioning SRS
* eLCID and SP Positioning SRS Activation/Deactivation MAC CE
* Miscellaneous Issues

The Tdocs under this summary are as follows:

[R2-2003135](file:///C:\Users\mtk16923\Documents\3GPP%20Meetings\202004%20-%20RAN2_109bis-e,%20Online\Extracts\R2-2003135%20MAC%20CE.docx) Change LCID to eLCID for SP Positioning SRS Activation/Deactivation MAC CE Ericsson CR Rel-16 38.321 16.0.0 0720 - F NR\_pos-Core

[R2-2003062](file:///C:\Users\mtk16923\Documents\3GPP%20Meetings\202004%20-%20RAN2_109bis-e,%20Online\Extracts\R2-2003062%20Correction%20to%20SP-SRS%20(de-)activation%20MAC%20CE.docx) Correction to SP SRS actication deactivation MAC CE Huawei, HiSilicon draftCR Rel-16 38.321 16.0.0 NR\_pos-Core

[R2-2002618](file:///C:\Users\mtk16923\Documents\3GPP%20Meetings\202004%20-%20RAN2_109bis-e,%20Online\Extracts\R2-2002618%20Discussion%20on%20the%20impact%20of%20DRX%20on%20SRS%20for%20NR%20positioning.docx) Discussion on the impact of DRX on SRS for NR positioning vivo discussion Rel-16 NR\_pos-Core

[R2-2003768](file:///C:\Users\mtk16923\Documents\3GPP%20Meetings\202004%20-%20RAN2_109bis-e,%20Online\Extracts\R2-2003768%20Runnnig%20CR%20to%20MAC%20spec%20for%20R16%20Positioning.docx) Running CR to MAC spec for R16 Positioning Huawei, HiSilicon draftCR Rel-16 38.321 16.0.0 NR\_pos-Core

# Discussions

## eLCID and SP Positioning SRS activation/deactivation MAC CE

In RAN2#109-e, the following agreements have been made on eLCID in the MAC spec

|  |
| --- |
| Agreements [AT109e][012][R16]   * LCID spaces for both DL and UL MAC CEs are extended from Rel-16. * To extend LCID spaces for MAC CEs, a new MAC subheader with one-byte eLCID field is introduced. Tentatively LCID value 34 is used for both DL and UL for the new MAC subheader. * When the new MAC subheader with one-byte eLCID field is used, eLCID values 0 to 255 indicates LCID values 64 to 319, accordingly. * The LCID range in IAB running CR (i.e. 64 to (216 – 65)) is updated to '320 to (216 + 319). It is FFS whether to keep reserved LCID values in IAB running CR. * For the selection of set1 (below 64) or set2 (above 64), the general principle is that less frequent and low priority MAC CEs should be assigned to set2, and more frequent and high priority MAC CEs (which also requires low overhead) can be assigned to set1 based on consensus. With this principle, the final decision is made by each WI discussion. * No restriction (e.g. always to have L field) is needed to assign MAC CE to set2. |

RAN2 has introduced the eLCID table to address the problem of depletion of LCID values. To determine whether a MAC CE should be assigned an LCID or eLCID value, RAN2 has agreed the general principle that less frequent and low priority MAC CEs should be assigned an eLCID value, and more frequent and high priority MAC CEs (which also requires low overhead) can be assigned an LCID value.

As discused by Huawei and Ericsson, both companies think while the SP Positioning SRS Activation/deactiation MAC CE is desgined only for positioning, the possible application scenarios for this MAC CE may not be quite wide. Hence, both companies propose to categorize it as a set2 MAC CE, with LCID range beyond 64

***Question1: Does company think the LCID/eLCID of SP Positioning SRS Activation/deactiation MAC CE should be above 64?***

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Ericsson | Yes |  |
| Huawei,HiSilicon | Yes |  |
| vivo | Yes |  |
| Intel | Yes |  |
| OPPO | Yes | We prefer to used eLCID for SP Positioning SRS Activation/deactiation MAC CE since it is transmitted with less frequent. |
| Qualcomm | Yes |  |
| CATT | Yes |  |
| Nokia | Yes |  |

## DRX and positioning SRS

In the current MAC spec, the relationship between DRX and SRS (aperiodic, semi-persistent, periodic) is captured as follows:

|  |
| --- |
| *TS38.321-v16.0.0*  5.7 Discontinuous Reception (DRX)  < [irrelevant](javascript:;)  parts are omitted >  When DRX is configured, the MAC entity shall:  < [irrelevant](javascript:;)  parts are omitted >   1. in current symbol n, if the MAC entity would not be in Active Time considering grants/assignments/DRX Command MAC CE/Long DRX Command MAC CE received and Scheduling Request sent until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in this clause:   2> not transmit periodic SRS and semi-persistent SRS defined in TS 38.214 [7];  2> not report CSI on PUCCH and semi-persistent CSI configured on PUSCH.   1. if CSI masking (*csi-Mask*) is setup by upper layers:   2> in current symbol n, if *drx-onDurationTimer* would not be running considering grants/assignments/DRX Command MAC CE/Long DRX Command MAC CE received until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in this clause:  3> not report CSI on PUCCH.  NOTE: If a UE multiplexes a CSI configured on PUCCH with other overlapping UCI(s) according to the procedure specified in TS 38.213 [6] subclause 9.2.5 and this CSI multiplexed with other UCI(s) would be reported on a PUCCH resource outside DRX Active Time, it is up to UE implementation whether to report this CSI multiplexed with other UCI(s).  Regardless of whether the MAC entity is monitoring PDCCH or not, the MAC entity transmits HARQ feedback, aperiodic CSI on PUSCH, and aperiodic SRS defined in TS 38.214 [7] when such is expected.  < [irrelevant](javascript:;)  parts are omitted > |

Based on the above text, we can make the following two observations:

* Periodic SRS and semi-persistent SRS is not transmitted during DRX inactive time
* Aperiodic SRS is transmitted regardless of the active/inactive time for DRX

While proposed by vivo in R2-2002618, it is proposed that RAN2 should clarify whether transmitting SRS for positioning is allowed when the UE is not in Active Time.

First, we should consider for SP positioning SRS and Periodic SRS and discuss whether they should be transmitted when the MAC entity is not in Active Time. In [R2-2002618], it was proposed to follow the ehaviour of SRS-Resource transmission, periodic or semi-persistent SRS for positioning is not transmitted when the UE is not in Active Time.

***Question2: Does company think that SP and Periodic Positioning SRS should be transmitted during MAC entity not in Active time?***

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Ericsson | No | It is good to have same as legacy behaviour. |
| Huawei, HiSilicon | Yes | From our view, there is no such need, the reason is that for SP and P SRS, it is muted is because, during DRX inactive, there will be no PDCCH monitoring and hence no scheduling from network. The network does not to estimate the channel condition with SRS. While for positioning SRS, things are different. The purpose of Positioning SRS is that the serving/neighbouring cells can estimate the time of arrival and angle of arrival. Transmission of positioning SRS has no relation to PDCCH monitoring and hence, no relationship with DRX.  From the network perspective, it is not quite feasible to support this. If this is supported, the network (both serving cell and neighbouring cells) need to know the active time of the UE. While, the active time, according to the definition in MAC spec, is quite dynamic that it can change with the dynamic scheduling from the network. We don’t think we can send this information to the LMF, then, from the LMF to the neighbouring cells. |
| Vivo | No | We slightly prefer “SRS for positioning should be not transmitted during MAC entity not in Active time”  In response to Huawei，we have the same understanding about why SRS not transmitted during MAC entity not in Active time. But during the MAC entity not in Active time, we also doubt whether it is necessary for the UE to send SRS with the same time domain density (e.g. with the same period) as in Active time. In other words, we want to make sure that transmitting SRS for positioning has no impact on DRX or UE power saving . |
| Intel | No | It should be solved by network, i.e. configure SP,P SRS properly with DRX. |
| OPPO | No | We can follow the legacy behavior. |
| Qualcomm | No | This seems not a RAN2 issue per se. RAN4 currently defines requirements under the side condition of no DRX only. Any additional requirements should be discussed in RAN4. Since the gNB configures the SRS for positioning, it can also change the UE DRX configuration, if needed. I cannot see why it should be different compared to “normal” SRS. |
| CATT | Yes | We share the same view as Huawei. Transmission of positioning SRS has no relation to PDCCH monitoring and hence, no relationship with DRX. The usage of PoS SRS is different from SRS and no need to follow the legacy behaviour. |
| Nokia | No | As aperiodic SRS is allowed to be transmitted in inactive time anyway, we do not see the necessity to allow SP-SRS and P-SRS at this stage. In particular, we may not have time to evaluate the impacts of chnaging such behavior considering we are approaching the end of the WI. |

Second, for aperiodic positioning SRS, in RAN2#109bis-e, the following agreement has been made:

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| * Send an LS to RAN3, indicating that the RAN2 signalling can currently configure aperiodic SRS for positioning, but we need to know if it the specification effort is feasible to complete from RAN3 perspective. Intel think this could be done in a reply to the previous RAN1 LS. (R2-1914310) |

Hence, currently, the status of support for aperiodic positioning SRS is still pending to the decision in RAN3. If aperiodic positioning SRS is supported, we need to discuss whether it can be transmitted during inactive time.

***Question3: Does company think that Aperiodic Positioning SRS should be transmitted during MAC entity not in Active time, if aperiodic positioning SRS is supported?***

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Ericsson | Yes | It is good to have same as legacy behaviour. |
| Huawei,HiSilicon | Yes | It should be tranmitted since it is under network control. |
| vivo | Yes | In response to Intel, the aperiodic SRS need be transmitted when not in Active time for some low latency services. |
| Intel | No | For Aperiodic POS SRS, the network can trigger the transmission upon the UE is in Active time. |
| OPPO | Yes | We can follow the legacy behavior. |
| Qualcomm | Yes | Also here, I cannot see why it should be different compared to “normal” SRS. |
| CATT | Yes | It can be transmitted when network triggers. |
| Nokia | Yes | Transmitting A-SRS is already supported in Rel-15, it is hence natural to have the same behaviour in Rel-16. |

## Misc Issues

In the current MAC spec, the description for the field within the MAC CE is captured as follows:

|  |
| --- |
| - DL-PRS ID: This field contains an identity for DL-PRS resource *dl-PRS-ID* as defined in TS 37.355 [23]. The length of the field is 8 bits; |

While, Huawei thinks this is not correct since this DL-PRS ID is defined by RAN1 to uniquely identify the PRS resource within a TRP. Hence it is more of an identity associated with a TRP. In [R2-2003768], the following change is proposed.

|  |
| --- |
| - DL-PRS ID: This field contains an identity accociated with a certain TRP, which is the field *dl-PRS-ID* as defined in TS 37.355 [23]. The length of the field is 8 bits; |

***Question4: Do company agree with the above change?***

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Ericsson |  | This is related to other discussion that we have also in LPP. We can discuss this as well as part of that or it will be covered. |
| Huawei,HiSilicon | Yes | For the discussion mentioned by E//, the discussion is mainly on the definition of TRP id. We think it is not related to the PRS ID here. |
| vivo |  | Agree with E//, we should leave it to LPP discussion. |
| Intel |  | Same view as Ericsson. |
| OPPO |  | Agree with Ericsson. |
| Qualcomm |  | I think the "DL PRS" should not be deleted. I.e,  "This field contains an identity for DL-PRS accociated with a certain TRP…"  Alternatively, a reference to 37.355 should also be sufficient:  "This field contains *dl-PRS-ID* as defined in TS 37.355 [23]. The length of the field is 8 bits;" |
| CATT |  | There is definition of DL-PRS-ID in 37.355 which can be referred directly.  The definition in 37.355: “This field is used along with a DL PRS Resource Set ID and a DL PRS Resources ID to uniquely identify a DL PRS Resource. This ID can be associated with multiple DL PRS Resource Sets associated with a single TRP.”  We can clarify the definition of TRP-ID during the online meeting. |
| Nokia |  | Agree that the current description of DL-PRS-ID in MAC CR is not correct and that the Huawei proposed change is in-principle OK but we need to resolve the TRP-ID discussion first since structure changes for the TRP-ID is being discussed there. Based on the outcome of that discussion we can decide on a appropriate text proposal for the definition of DL-PRS-ID in MAC CR. |

There are also some editorial changes within [R2-2003768]

|  |
| --- |
| - C: This field indicates whether the octets containing Resource Serving Cell ID field(s) and Resource BWP ID field(s) withn the field Spatial Relation for Resource ID I are present, except for Spatial Relation Resource IDi with DL-PRS or SSB. When A/D is set to 1, if this field is set to 1, the octets containing Resource Serving Cell ID field(s) and Resource BWP ID field(s) in the field Spatial Relation for Resource IDi are present, otherwise if this field is set to 0, they are not present. When A/D is set to 0, this field is always set to 0 that they are not present;  ===omitted==  - DL-PRS Resource ID: This field contains an index for DL-PRS resource *nr-DL-PRS-ResourceId* as defined in TS 37.355 [23]. The length of the field is 6 bits; |

**Question5: *Do company agree with the above editorial change?***

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Ericsson | Yes | Looks ok. |
| Huawei, HiSilicon | Yes | Looks good |
| vivo | Yes | Ok. |
| Intel | Yes |  |
| OPPO | Yes |  |
| Qualcomm |  | In principle O.K., but the (existing) description for this field is already rather confusing. |
| CATT | Yes |  |
| Nokia | Yes |  |

## Others

In this section, companies are welcomed to provide other questions on the current MAC spec.

### Questions from Ericsson

SUL for positioning has not been discussed. It is good to omit it for now. Otherwise some signaling would be needed to indicate in NRPPa where SUL or NUL has been used?

***Question6.1 :Do companies agree with the above issue?***

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Huawei, HiSilicon | No | We think SUL/NUL is a feature that is designed in R15. Hence , it is a common feature that all R16 WI needs to take into the assumption in R16 design. Hence, no need to discuss whether SUL is supported for positionig or not. |
| E// | Yes |  |
| vivo | No | Agree with HW,we should support it by default. |
| Intel | Yes | It depends on whether additioanl efforts are needed to support SUL for POS. I assume yes, then it should be discussed in Rel-17. But it should be stage 2 issue instead of MAC issue. |
| OPPO |  | We can first discuss whether to support SUL in R16 positioning. |
| Qualcomm | No | Agree with vivo/Huawei. Its anyhow decided by NW. I haven’t seen this topic in any contribution for this meeting. |
| Ericsson |  | We need to have general dicussion on SUL. As this has also impacts for MSG1 based on demand SI for positioning.  SUL as such has been introduced for coverage extention (Dual conenctivity carrier aggregation). Even if it is decided by NW, not sure if we have full support for this over NRPPa and LMF handling. NW may switch SRS transmission between SUL/NUL. |
| CATT | Yes | If the impact for MSG1 based on demand SI in idle/inactive, this topic should be discussed in main session because not only posSIB but also common SIBx will be impacted. Even if someone wants the enhancement of SRS scheduling, this topic should be moved to Rel-17 to study at first. |
| Nokia | Yes | Don’t recollect discussing impacts of SUL for positioning before. This is coming in at a late stage now to analyze if there are any signalling impacts to RAN2/RAN3. If possible, it should be postponed to next release or should be discussed based on a discussion paper for next meeting. |

Spatial Relation should be optional or not needed for example for FR1. When MAC CE is provided, there should be explicit indication whether spatial relation is present or absent.

***Question6.2 :Do companies agree with the above issue?***

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Huawei,HiSilicon | Not sure | This is a good point. Indeed, the indication of spatial relation is not necessry for FR1.  While, it should be noted that, for the R15 spec, in the MAC CE for activation/deactivation of SP SRS, the bit fields for spatial relation indication are always present. For FR1, the UE behavior is that, when receiving the MAC CE, the UE shall ignore the fields for spatial relation indication.  While the current spec has not supported optinality of spatial relation, we wonder whether we always indiate this, like in release15, or we can optimize it and make it optional present. We have a neutral view on this and would like to see the views from the other companies. |
| E// | Yes |  |
| vivo | Yes | Considering the number and the bit length of spatial relationship, we perfer using 1 bit to indicate that the MAC CE doesn’t have the indication of spatial relation. |
| Intel | Not sure | Agree with Huawei. If spatial relation is not used for FR1, then the UE can Know this based on the freq. |
| OPPO | No | We see no need to introduce explict indication, and UE can ignore the spatial relation for FR1 as in R15. |
| Qualcomm |  | Needs further discussion. I haven’t seen this topic in any contribution for this meeting. |
| CATT | Yes | Yes. The indication field of Spatial Relation info in MAC CE should be optional. It is present for FR2 and absent for FR1. This can save the signalling overhead. |
| Nokia |  | No strong view, but it is better to have the same behaviour as in Rel-15 to reduce specification complexity. |

UE may support multiple BWP; should NW send spatial relation per BWP? Same relation can be applicable for all BWP. Thus no need to repeat spatial relation for every BWP. An indication can be used if spatial relation is applicable for all BWP.

***Question6.3 :Do companies agree with the above issue?***

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Huawei, HiSilicon | No | Currently, the activation/deactivation is per SRS resource set and the indication of spatial relation is per SRS resource. I am not sure what needs to be changed. |
| E// | Yes |  |
| vivo | No | Agree with Huawei. And the SRS PosResource are defined in the active BWP. Only in the SUL and CA, there are multilple BWP, we don’t think the spatial relation is always the same. |
| Intel | No | Agee with Huawei. |
| OPPO | No | Agree with Huawei. |
| Qualcomm | No | Same view as Huawei. |
| CATT | No | Same view as Huawei |
| Nokia | No | We think it is possible to apply different spatial relation across different BWPs. |

DL PRS Resource ID is optional for spatial relation as UE can identify based upon TRP ID and Resource set. This Optionality should be indicated in MAC CE design.

***Question6.4: Do companies agree with the above issue?***

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Huawei, HiSilicon | No | We currently agree that the spatial relation should be a specific resource, based on existing RRC configuration for P-SRS and AP-SRS. Unless RRC configuration support optionality of resource ID, we do not think MAC should support omit resource ID. |
| E// | Yes |  |
| vivo | Yes | We agree that this IE is optional, and we think both RRC and MAC should support. |
| Intel |  | Try to understand whether the UE can always identify the spatial relation based on TRP ID and resource set ID> |
| Qualcomm | No | I can’t follow the Ericsson statement and I made a similar comment already during RRC drafting. I.e., in current RRC, the DL-PRS-Resource ID in *DL-PRS-Info* is conditional present on pathloss. I don’t think this should be the case. Not sure how the UE can obtain the Resource ID based on TRP ID and Resource Set ID. Maybe Ericsson can clarify. |
| Ericsson2 |  | We should not put a mandatory requirement on NW to signal spatial relation up to resourceID level. In fact, the NW knows what resourceID to signal based upon the information that comes from the UE in ECID or DL PRS RSRP measurement report from DL-AoD etc. indicating the resource ID.  If UE has moved within a resourceSet; UE may identify a new resourceID.  For RRC configuration; however for scenario where pathloss and spatial relations are both provided in RRC; it is optimum to provide the resource ID. For scenario where only spatial relation is configured either in RRC or MAC; our view is that it should be Optional. |
| Nokia |  | Not sure how UE can infer the unique DL PRS resource ID from TRP ID and Resource Set. |



# Conclusion

Based on the above summary, we make the following proposals that we think can be discussed during the online session in RAN2#109bis-e:

***Proposal1:***