**3GPP TSG RAN WG1 #104-e  R1-21xxxxx**

**e-Meeting, January 25th – February 5th, 2021**

**Agenda Item: 7.2.8**

**Source: Moderator (Huawei)**

**Title: Summary of [104-e-NR-Pos-03] for the reply LS to R1-2100005**

**Document for: Discussion and decision**

# Introduction

The summary is intended to collect views and provide summary for agreement on the reply LS to R1-2100005 during RAN1#104-e.

[104-e-NR-Pos-03] Email discussion/approval for the reply LS to R1-2100005 until Jan-28 - Su Huang (Huawei)

The plan of the email discussion is as follows.

* Phase 1: Initial collection of views till 00:01 UTC, 27 Jan.
* Phase 2: Final proposal and draft reply LS till 23:59 UTC, 28 Jan.

# Summary of t-doc status

The t-docs submitted are listed below.

[1] R1-2100005 LS on Rel-16 NR Positioning Correction RAN3, Huawei

[2] R1-2100312 Discussion on RAN3 LS on Rel-16 NR Positioning Correction CATT

[3] R1-2100313 Draft Reply LS on Rel-16 NR Positioning Correction CATT

[4] R1-2101153 Draft reply LS on Rel-16 NR Positioning Correction vivo

[5] R1-2101250 Discussion on SRS carrier information Huawei, HiSilicon

[6] R1-2101251 Reply LS on Rel-16 NR Positioning Correction Huawei, HiSilicon

In the incoming LS R1-2100005 [1], RAN3 asked two questions during Rel-16 maintenance, as listed below.

|  |
| --- |
| 1. Correction of NRPPa periodic UL SRS time transmission:

When the LMF requests for periodic UL SRS to be configured, it could recommend a starting time for the periodic SRS transmission to the serving gNB, and aligning it later with the neighbouring nodes, so that the first UE SRS transmission is not missed.**Q1: Does RAN2 see any issues with this functionality?****RAN1 is invited to feedback if needed**1. Inclusion of SRS frequency information Positioning Information Request:

The LMF may request dedicated SRS at particular frequency band for UL positioning. The gNB does not know whether to configure SRS on PCell or SCell without LMF indication.**Q2: Does RAN1 see any issues with this functionality?****RAN2 is invited to feedback if needed** |

RAN1/RAN2 are asked to respond to the questions.

Views from companies based on t-doc submission are summarized below.

|  |  |  |
| --- | --- | --- |
| **Source** | **Q1** | **Q2** |
| R1-2100312 [2], CATTR1-2100313 [3], CATTDraft Reply LS | It seems not critical for the LMF to recommend a starting time for the periodic SRS transmission to the serving gNB. It may also introduce an additional implementation complicity without clear benefit. | It is unclear the motivation and the benefit for LMF to request dedicated SRS at a particular frequency band for UL positioning. Suggest RAN3 proving additional information on the scenarios where LMF should determine the particular frequency band for UL positioning. |
| R1-2101153 [4], vivo Draft Reply LS |  | Regarding the inclusion of SRS frequency band information into Positioning Information Request, RAN1 understands the intention of it. RAN1 is not sure whether this information is really beneficial, as even if this information is contained, the gNB still needs to determine the serving cell for SRS transmission according to its own situation, instead of following the request of the LMF. |
| R1-2101250 [5], Huawei/HiSiliconR1-2101251 [6], Huawei/HiSiliconDraft Reply LS |  | The SRS carrier information should be included in the POSITIONING INFORMATION REQUEST.* It can be the ARFCN of the desired SRS carrier.

It is RAN1’s understanding that SRS can be configured on the PCell and/or the SCell(s), and the inclusion of SRS frequency information, e.g. the carrier ARFCN, is beneficial for a gNB to configure the SRS and provide the SRS configuration for the desired carriers. |

# Discussion

## Q1

Only one source [2] thinks that RAN1 should answer Q1.

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| --- | --- |
| **Source** | **Views from the source** |
| R1-2100312 [2], CATT | They understand that* The generic procedure of LMF requesting SRS configuration to the serving gNB, and the LMF requesting SRS measurement to the neighbouring gNBs, are according to stage-2 specification TS 38.305.
* Depending on the SRS configuration and the message transportation/processing delays, the neighboring gNB could miss the reception of the first UE SRS transmission.
* The approach may be useful, but not critical for several reasons
	+ The number of the transmission for periodic SRS transmission is configurable. The number of the SRS transmission of transmission can be configured to compensate for the potential miss of the 1st SRS transmissions
	+ From the neighboring gNB points of view, period SRS transmission is more often used for the cases when the transmission beam of the target UE and the reception of the neighboring gNBs are not fully aligned, in which case there is a need for multiple repeat transmission of the SRS for beam alignment
	+ LMF may not have the information for proper configuration of the starting time, in which case if the starting time is recommended too early, the 1st SRS will still be missed, and if the starting time is recommended too late, it will introduce additional measurement delay
 |

Companies are encouraged to provide answers regarding Q1.

**Question 1-1: *Do companies think that the reply to Q1 is needed from RAN1 perspective?***

|  |  |  |
| --- | --- | --- |
| **Company name** | **Answer** | **Comments** |
| CATT | yes | Since RAN1 is invited to provide the feedback, it would be helpful for RAN3 to make the decision if RAN1 provides the inputs. |
| vivo | No | Since original Q1 is “Does RAN2 see any issues with this functionality?”. I guess no need for RAN1 to answer for RAN2.  |
| Qualcomm | No | We are OK for RAN1 to not reply.  |
| OPPO | No | It is ok to not reply if RAN1 does not see any issue |
| Huawei/HiSilicon | No | We think the question should better be addressed by RAN2. |
| Apple | No | Better to leave it to RAN2 for now |
| ZTE | No | Leave it to RAN2. |
| Intel | No | Up to RAN2 discussion. |
| LG | No | It would be better to discuss it by RAN2. |
| Nokia/NSB | No | Okay for RAN1 not to reply.  |
| FUTUREWEI | NO | We should let RAN2 answer this question |
| Ericsson | No | Leave the issue to RAN2. |

***Question 1-2: If the reply to Q1 is needed, do companies see any issue with this functionality?***

|  |  |  |
| --- | --- | --- |
| **Company name** | **Answer** | **Comments** |
| CATT | yes | It seems not critical for the LMF to recommend a starting time for the periodic SRS transmission to the serving gNB. It may also introduce an additional implementation complicity without clear benefit. |
| vivo |  | My understanding of CATT’s provided answer above is actually corresponding to “whether RAN1 see any issue with this functionality”. To that, we don’t have strong view and can consider if RAN1 have common understanding/views on this. |
| Qualcomm |  | We see this to be a good optimization that can be revisited if needed in a next release. We see some usefulness to increase efficiency for the periodic SRS for Positioning, but we are OK to not add it in this release |
| OPPO |  | Aligning the start time to neighbor Node does provide the information of when the transmission of SRS for positioning is available.  |
| Apple |  | The benefit of this extra report in the context of Rel-16 is not clear to us. |
| Nokia/NSB |  | Agree with QC above.  |

**Intermediate Summary**

During the email discussion, only one company thinks that replying Q1 is needed from RAN1 perspective, while all the remaining companies think otherwise. Therefore, the moderator has the following proposal. Companies are encouraged to provide comments on whether the proposal is agreeable.

### *Proposal 1:* *RAN1 will not asnwer Q1.*

|  |  |
| --- | --- |
| **Company name** | **Comments** |
| Huawei/HiSilicon | Support. |
| LG | Support |
| Intel | Support |
| vivo | OK |

## Q2

Three sources [2][4][5] think that RAN1 should answer Q2.

|  |  |
| --- | --- |
| **Source** | **Views from the source** |
| R1-2100312 [2], CATT | They understand that* The LMF has the UE SRS capability based on the current CA band combination, and the gNB also has the information on the current CA band combination and the preferred frequency band for the configuration of the SRS for positioning.
* The meaningfulness of the approach depends on
	+ Whether LMF has the information on the supported band/preferred bands of the neighbouring gNB, and
	+ The fact that LMF is in a better position to decide which band should be used
* However, NRPPa does not support the capability reporting of the neighbouring gNBs, and it can be left up to operators and configured by OAM.
* Another reason is that the same carrier should be used positioning throughout a coverage area, which could be the carrier of the PCell or the SCell.
 |
| R1-2101153 [4], vivo | They understand that the gNB still needs to determine the serving cell for SRS configuration according to its own situation, even if it is indicated by the LMF. |
| R1-2101250 [5], Huawei/HiSilicon | The understand that* Current RAN1 assumption, e.g. UE capability signaling, allows SRS transmission on a SCell, which is different from the Rel-17 feature discussed in the SI, and it is beneficial for collocated and non-collocated deployment.
* Positioning SRS is the dedicated SRS for positioning, and gNB cannot take the risk of configuring it on SCell(s) without LMF indication, and the spatial relation/pathloss reference is not always present to imply the SCell information.
* The information should be included, and it can be the carrier ARFCN.
 |

It seems that all interested companies think that the reply to Q2 is needed from RAN1 perspective. Companies are encouraged to provide answers regarding Q2.

***Question 2-1: Do companies see any issue with this functionality?***

|  |  |  |
| --- | --- | --- |
| **Company name** | **Answer** | **Comments** |
| CATT | yes | As discussed in our tdoc (R1-2100312), our view is that gNB should decide the carrier for the transmission of SRS for positioning (either in PCell or SCell).For Huawei’s comments, first we agree SRS transmission on a SCell discussed here is different from the Rel-17 feature discussed in the SI. We also agree it is beneficial for supporting SRS transmission on a SCell. However, it is unclear to us why LMF is in a better position to make the decision on why carrier to make the decision on which carrier should be configured for SRS transmission, and how LMF has more information (e.g., the spatial relation/pathloss reference, the SCell information collocated and non-collocated deployment) than gNB for making the decision. |
| vivo | Yes | As we discussed, this functionality of carrying requested SRS band information from the LMF to the gNB may not be beneficial.After all, the gNB is the one determining the serving cell for SRS configuration according to its own situation, even if it is indicated by the LMF. |
| Qualcomm | No | It is essential LMF to request/sggest/indicate for a specific band to be used for several reasons:1. LMF is the entity that configures DL PRS, and in Rel-16, only same-band PRS/SRS is really supported for M-RTT.
2. The SRS capabilities are reported for the currently configured cells; and they can change across cells. So the LMF has to make a decision related to which cell to be used.

It should be noted that a gNB can always make a different decision, but that should NOT mean that the LMF should not provide a suggestion.  |
| OPPO | Yes | In our view, the gNB determines the configuration of SRS for positioning and then indicates that to the LMF. Do not see clear benefit for LMF requesting the band for SRS.  |
| Qualcomm2 |  | Sorry for replying again, but I really don’t understand the arguments presented above. The gNB decides the final configuration, NOONE argues with that but the LMF **indicates** what is called: “Requested SRS Transmission properties”. Why do we have the LMF requesting the periodicity, the number of SRS resources, whether it should be P, SP, AP, how many transmissions, what is the BW, and not have which band the SRS should be? To those companies that say that the band suggestion from the LMF is not needed:* How will the LMF ensure that the PRS and the SRS are in the same band?
* Why did RAN1 agree to send SRS capabilities per band to the LMF, if the LMF cannot make any recommendation with that information?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number Of Periodic Transmissions | C-ifResourceTypePeriodic |  | INTEGER (0..500,…) | The number of periodic SRS transmissions requested. The value of ‘0’ represents an infinite number of periodic SRS transmissions. |
| Resource Type | M |  | ENUMERATED (periodic, semi-persistent, aperiodic, …) |  |
| CHOICE *Bandwidth* | M |  |  |  |
| >FR1 |  |  | ENUMERATED (5mHz, 10mHz, 20mHz, 40mHz, 50mHz, 80mHz, 100mHz, ...) |  |
| >FR2 |  |  | ENUMERATED (50mHz, 100mHz, 200mHz, 400mHz,…) |  |
| **SRS Resource Set List** |  | *0.. 1* |  |  |
| **>SRS Resource Set Item** |  | *1..<* *maxnoSRS-ResourceSets>* |  |  |
| >>Number of SRS Resources Per Set | O |  | INTEGER (1..16,...) | The number of SRS Resources per resource set for SRS transmission.  |
| **>>Periodicity List** |  | *0.. 1* |  |  |
| **>>>Periodicity List Item** |  | *1..<maxnoSRS-ResourcePerSet>* |  |  |
| >>>>PeriodicitySRS | M |  | ENUMERATED (0.125, 0.25, 0.5, 0.625, 1, 1.25, 2, 2.5, 4, 5, 8, 10, 16, 20, 32, 40, 64, 80, 160, 320, 640, 1280, 2560, 5120, 10240, …) | Milli-seconds |
| >>Spatial Relation Information | O |  | 9.2.34 |  |
| >>Pathloss Reference Information | O |  | 9.2.53 |  |
| SSB Information | O |  | 9.2.54 |  |

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| vivo2 |  | To us, the question to ask: Is this “Requested SRS Transmission band information” from the LMF to the gNB a recommendation for the gNB to refer or an order which the gNB should obey?If the former, then whether to have this information from the LMF to the gNB does not assure the band to which SRS is transmitted. Hence, there’s doubt on the benefit.Unless the understanding of this “Requested SRS Transmission band information” is that it’s the same (in the sense that a gNB should follow regardless) as LMF requesting a gNB on the SRS periodicity, the number of SRS resources, whether it should be P, SP, AP, how many transmissions, what is the BW, etc.Now, a question to the proponent companies, what is the understanding of this band information request?  |
| Qualcomm3 |  | As we said before, a gNB decides the final SRS parameters. Having the LMF recommending (as it is the case for what is shown above) is always helpful. A gNB would try to meet the recommendations if possible; but that is the “best” we could have in current specification. This goes back to the wellknown debate: SRS in LPP or in RRC? Is the gNB/RAN controlling the UL resources or the Core network (LMF)? It is clear that more than a year ago we agreed that SRS is in the RRC, so the serving gNB/RAN makes the decision what to configure to the UE. However, at the same time, we identify that it is important to have some knowledge of what the LMF needs. That is why finally the spec went in the direction shown above; a “middle ground” situation. I don’t think we can reopen this major, rather philosophical debate at this stage; for us it is clear that a gNB makes the decision; even though we were proponents of the other solution. We are just trying to make the system work and have a consistent technical solution. PRS and SRS need to be on the same band in NR Rel-16 (e.g. see RAN4 requirements, or limited capability and reporting signaling for PRS/SRS on different bands; as you may recall, there was a debate on this for a few meetings, and then we agreed to not really specify the feature ; aka leave it up to implementation). Another obvious argument: The UE reports SRS capabilities for the current band configuration to the LMF. Why did we agree to that? To enable the LMF to be able to recommend/suggest/request specific SRS properties. What else could be the reason?  |
| Huawei/HiSilicon | No | To CATT, gNB will make the final call, but the information from LMF based on TRPs selected for UE positioning (further based on QoS, etc.) is beneficial for the gNB to take into account when configuring SRS. Of course, we can do OAM as suggested by CATT in their contribution, but sometimes the TRP frequencies selected for positioning (UL-only/Multi-RTT) can be rather dynamic depending on the use cases and QoS.To OPPO, if we leave it all to gNB, no one can ensure that the configured SRS will be useful from the LMF perspective, and perhaps UE will transmit SRS on a carrier where no TRP is listening.To vivo, we think that any information from LMF to the gNB is the recommendation. Indeed “whether to have this information from the LMF to the gNB does not assure the band to which SRS is transmitted”, but to have this information will assure that gNB does not configure the SRS on the band where no TRP is listening. Please also see the highlighted text in NRPPa. Those characteristics are for gNB’s information, and if gNB cannot do that, it should return the FAILURE message. 8.2.6.2 Successful Operation**Figure 8.2.6.2-1: Positioning Information Exchange procedure, successful operation**The LMF initiates the procedure by sending a POSITIONING INFORMATION REQUEST message to the NG-RAN node.If the *Requested SRS Transmission Characteristics* IE is included in the POSITIONING INFORMATION REQUEST message, the NG-RAN node may take this information into account when configuring SRS transmissions for the UE, and it shall include the *SRS Configuration* IE and the *SFN Initialisation Time* IE in the POSITIONING INFORMATION RESPONSE message.8.2.6.3 Unsuccessful Operation**Figure 8.2.6.3-1: Positioning Information Exchange procedure, unsuccessful operation**If the *Requested SRS Transmission Characteristics* IE is included in the POSITIONING INFORMATION REQUEST message and the NG-RAN node is unable to configure any SRS transmissions for the UE, it shall respond with a POSITIONING INFORMATION FAILURE message. If a handover of the target UE has been triggered, the NG-RAN node shall send a POSITIONING INFORMATION FAILURE message with an appropriate cause value. |
| Apple | No  | In our understanding, similar to QC’s, LMF anyway asks gNB on how SRS(s) are needed/should be configured. Of course, eventually this is gNB who makes the decision the exact SRS configuration parameters. Based on this argument, this extra information can still be “requested” by LMF |
| CATT2 |   | Thanks for the discussion. Based on the discussion, it seems the main issue is that there can be mismatch of the DL carrier for DL PRS configured by the LMF and the UL carrier for SRS transmission configured by the gNB for multi-RTT. If this is the case, although the current proposal may alleviate the problem, it may not totally resolve the problem. It seems additional information may be needed in the request from LMF to gNB to let gNB know whether the gNB needs to follow LMF’s request to avoid the configuration failure. For example, if LMF wants to avoid gNB to assign different carrier for multi-RTT approach, the request from LMF may want to carrier the information so that gNB will take LMF’s request as high-priority to avoid the failure in Multi-RTT positioning. For other cases, e.g., UTDOA, the gNB may still assign a different UL carrier in the response based on the consideration the resource usage or other considerations. |
| Huawei/HiSilicon |  | To CATT, to our knowledge, even for UTDOA(UL-TDOA), if gNB assign a different UL carrier, the TRP layout supporting that different UL carrier may not be best fit for localizing the UE, e.g. due to the GDOP. We understand that there is no TRP capability exchange in NRPPa, but this type of capability can be better handled by OAM instead of SRS frequency.Note that in TS 36.305, there was a procedure of E-SMLC selecting LMUs before sending SRS request to the eNB, which was not shown in TS 38.305 anymore, but we should have a reasonable assumption that LMF should select the neighbouring gNBs before requesting SRS to the serving gNB as well. |
| Qualcomm4 |  | To CATT: The band information would be enough for MRTT, no need of a CC index: having them on the same band is the baseline functionality for MRTT. Either way, PRS is not strictly speaking constraint/associated with a CC, but a band. Also, whether there needs to be additional signaling from LMF to the serving gNB is a separate topic, and from our side, we are all for it, to ensure more seamless operation. However, we are now discussing something very specific, and we are in the CR phase of rel-16. Unfortunately RAN3 did not finalize this part, and had to send an LS to RAN1 whether this minimal functionality would be problematic. I can see many ways that we can be improved in the future. Having said the above, if companies are worried that replying “No” in the RAN3 question, would enable the LMF to control the RAN resources, please rest assured, the spec already says: “the NG-RAN node **may** take this information into account”; RAN3 did not ask whether RAN1 believes LMF requests should be mandatory or optional for the serving gNB; so there is no intention to change the principle that the RAN uses these recommendations/information optionally. |
| ZTE | NO | We support to have SRS frequency indication from LMF. It’s a good feature to assist serving gNB to configure SRS, not only for MRTT method, but also for better listening by gNBs. |
| Intel | No | LMF request with recommended frequency band information is beneficial for the proper SRS for positioning configuration by gNB via RRC.  |
| LG | No | In our understanding, the information transmitted from LMF to gNB is a suggestion/recommendation, and the LMF cannot enforce the gNB to follow the LMF’s suggestion. However, the LMF’s suggestion is useful for gNB to configure SRS.  |
| Nokia/NSB | No | While a bit late in our view for this type of addition to the specs we don’t see a technical concern with the proposal from RAN1 perspective.  |
| FUTUREWEI | No | To our understanding, this type of recommendation can be helpful with proper implementation at the gNB though does not mandate what the gNB may do. We can further discussion detailed reply text to avoid any potential issues or misunderstanding. |
| Ericsson | No | We don’t see a problem with an LMF recommendation, but given the fact that the gnodeB will in the end decide the SRS configuration without an obligation to take into account the recommendation, we are not sure there is a clear gain.  |

**Intermediate Summary**

During the email discussion, three companies (CATT, vivo, OPPO) think that there is an issue. 9 companies (Qualcomm, Huawei/HiSilicon, Apple, ZTE, Intel, LGE, Nokia/NSB, Futurewei, Ericsson) do not see the issue, among which some consider it essential, and some are not sure whether it is a clear gain.

It is not clear whether the opponents changed their minds after a few rounds of opinion exchange, however, as the concerns have more or less been addressed by other companies, and no further concern has been raised, the moderator makes the following tentative proposal. Companies are encouraged to provide comments on whether the proposal is agreeable.

### *Proposal 2:* *RAN1 will answer Q2 with “RAN1 does not see the issue of this functionality”.*

|  |  |
| --- | --- |
| **Company name** | **Comments** |
| CATT | Fine with the answer |
| Huawei/HiSilicon | Support |
| ZTE | Support |
| LG | Support |
| Qualcomm | We prefer a stronger language. This leaves it open to debate again in RAN3 whether to include the functionality or not; which should be avoided. If RAn3 wants to debate whether it should be band-only or carrier, that’s fine; but the usefulness should not be debated again. Example of wording:* “RAN1 does not see the issue of this functionality and considers it to be beneficial in some cases”
 |
| FUTUREWEI | Support. Not sure we can say more than this. |
| Intel | Support |
| vivo | We can accept moderator’s proposal 2. On the wording suggestion of Qualcomm, we don’t believe that’s RAN1 consensus w.r.t. beneficial or not.  |

With regard to the detail of SRS frequency information, it seems that different companies have different views, e.g. band information, carrier information. Due to limited time, the moderator has the following tentative proposal. Companies are encouraged to provide comments on whether the proposal is agreeable.

### *Proposal 3:* *RAN1 will additionally answer Q2 with “The detail of the SRS frequency information is left up to RAN3”.*

|  |  |
| --- | --- |
| **Company name** | **Comments** |
| CATT | Fine with the answer |
| Huawei/HiSilicon | Support |
| ZTE | Support. |
| LG | Support |
| Qualcomm | This is OK |
| FUTUREWEI | Support |
| Intel | Support |
| vivo | Not our preference to answer something not asked in original RAN3’s question to RAN1. For progress, we can accept this proposal 3 if all other companies think necessary to have this sentence in the LS. |

If companies think that other information feedback from RAN1 is needed, e.g. for avoiding any further potential issues or misunderstanding, they are encouraged to comment below.

### *Other information in the reply*

|  |  |
| --- | --- |
| **Company name** | **Other information** |
| Qualcomm | We prefer a stronger language. This leaves it open to debate again in RAN3 whether to include the functionality or not; which should be avoided. If RAN3 wants to debate whether it should be band-only or carrier, that’s fine; but its usefulness in some cases should be clear and not delay even further the corrections of NRPPa specification. Example of wording:“RAN1 does not see the issue of this functionality and considers it to be beneficial in some cases” |
| Moderator | To QC:Based on the feedback from other companies, it may be hard to reach consensus on the inclusion of the benefit analysis even for some cases. To my understanding, RAN3 can figure it out based on the current reply from RAN1. |
|  |  |

## Draft reply LS

Companies are encouraged to check the draft reply LS.

## Others

Companies are encouraged to provide additional comments that are not covered by the above questions.

***Additional Comments***

# Conclusion

TBD