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RAN1

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3GPP TSG RAN WG1 Meeting #110e-bis R1-2210527

eMeeting, October 10 – 19, 2022

Source: Moderator (Samsung)

Title: Email discussion on incoming RAN2 LS in R1-2208325 on the support of positioning in FR2-2

Agenda Item: 8.5

Document for: Discussion and Decision

1 Introduction

In RAN2 LS [1], the following issue and related question have been sent to RAN1:

In R17, NR operation is extended up to 71 GHz and new numerologies (i.e., 480 kHz SCS, 960 kHz SCS) are introduced in FR2-2 (52.6 GHz–71 GHz) for data and control channels and reference signals. Moreover, FR2-2 is assumed to be applicable to other Rel-17 features unless otherwise specified based on the below agreement from 71GHz WI in RAN2.

Table 1:

From chairman's note in RAN2#117-e meeting, <i>Applicability of FR2-2 to other Rel-17 features</i>

4.3-1: From RAN2 point of view, FR2-2 are assumed to be also applicable to other Rel-17 features, unless otherwise specified (e.g. if the feature is only for FR1). No impact to the specification expected for cases where we don't specify otherwise.
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Companies can bring up cases (e.g. for some WIs where FR2-2 has not been discussed at all) where differentiation is needed by contributions to May meeting.
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On the other hand, in POS WI, there has been no discussion on the support of positioning (especially related to RAT-dependent positioning) in FR2-2 and thus it is unclear whether SRS for positioning/DL-PRS can be used with the new 480/960 kHz SCS in FR2-2 or not.

Based on the above observation, RAN2 would like to ask RAN1 and RAN4 the following question:

Question: Can SRS for positioning/DL-PRS with 480/960 kHz SCS be supported in FR2-2 in R17?

So in this document, RAN1 will discuss the related issue and corresponding answer to RAN2 question.

2 Summary of Company's inputs

Among the contributions submitted in RAN1#110bis_e, there are 10 papers from 7 sources discussed the related issue. And the summary of company's inputs is given below:

Table 2: Summary of company's input

Source	Proposals/Stand
[2][10] VIVO	SRS for positioning/DL-PRS with 480/960 kHz SCS are not supported in FR2-2 in R17
[3] OPPO	SRS for positioning/DL-PRS with 480/960 kHz SCS are not supported in FR2-2 in R17
[4][5]CATT	SRS for positioning/DL-PRS with 480/960 kHz SCS are not supported in FR2-2 in R17
[6][7]ZTE	SRS for positioning/DL-PRS with 480/960 kHz SCS are not supported in FR2-2 in R17
[8] Huawei, HiSilicon	SRS for positioning with 480/960 kHz SCS can be supported in FR2-2 in R17 DL-PRS with 480/960 kHz SCS is not supported in FR2-2 in R17
[9]Qualcomm	SRS for positioning/DL-PRS with 480/960 kHz SCS are not supported in FR2-2 in R17
[11] Nokia, Nokia Shanghai Bell	SRS for positioning/DL-PRS with 480/960 kHz SCS are not supported in FR2-2 in R17

For PRS, all 7 sources propose to not support 480/960 kHz in FR2-2.

For SRS for positioning, 6 out of 7 sources propose to not support 480/960 kHz in FR2-2, while 1 source mentions that such SRS transmission with 480/960 kHz SCS is quite simple and should have no problem to support that.

Reasons to not support:

1. no discussion/evaluation/specification support of positioning using 480/960 kHz in FR2-2 in Rel-16 and Rel-17. It's unclear on the performance with new SCS in current positioning mechanism. [2][10][3][4][5][9][11]
2. unclear RAN1 spec impact on the configuration of PRS resource and positioning physical layer procedures (e.g., handling of more frequent collision with SRS and PUSCH, new values for DL PRS periodicity/offset etc.) [3][4][5]
3. unclear impact on unlicensed band operation (e.g., how to satisfy the requirement of LBT, Occupancy Channel bandwidth (OCB), etc.) [6][7]
4. significant amount of UE capabilities of PRS do not account for the FR2-2 features [8]

In addition, source [7] mentions that positioning for FR2-2 has been proposed in R18 PosEvo but not supported due to lack of interests and scope limitation. And source [9] mentions that FR2-2 positioning can be supported by using 120 kHz in R17.

Reasons to support (SRS for positioning with 480/960 kHz in FR2-2):

1. UE procedure of sending UL SRS is quite simple and even does not require any capability related change [8].

However, source [8] also mentions that RAN3 needs to further check whether NRPPa/F1-AP specification needs to be updated to incorporate the new SCS in the SRS configuration.

2.1 Additional reason if any

If any companies have additional reasoning to support or not support 480/960 kHz for SRS for positioning/DL PRS, the reasons which are listed above need not to be repeated.

Feedback Form 1: New reasoning

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3 Discussion Round 1[Closed]

Given the summary of company’s inputs so far, there is no companies to support DL PRS with 480/960 kHz in FR2-2 and majority companies don’t support SRS for positioning with 480/960 kHz in FR2-2 neither while one company thinks it should be no problem to support such feature.

Thus, during the first round of our discussion, moderator have following proposal and question.

3.1 DL PRS

3.1.1 Proposal 3a

Proposal 3a □

DL-PRS with 480/960 kHz SCS are not supported in FR2-2 in R17

Companies are invited to provide comments on such proposal (support or not support, and additional comment if any)

Feedback Form 2: Comments/Views

1 – vivo Mobile Communication Co. support
2 – HUAWEI TECHNOLOGIES Co. Ltd. support the proposal (i.e. not support the new SCSs for DL-PRS in FR2-2 in Rel-17)
3 – Qualcomm Incorporated Support
4 – ZTE Corporation Support even for Rel-18
5 – CATT Support the proposal
6 – Nokia Poland Support the proposal. In addition, we assume we should discuss the draft CRs submitted by Nokia and vivo (which are almost the same). If we can agree those CRs then in our view this issue is closed from RAN1 point of view. Should we add a proposal for those CRs?

<p>7 – Guangdong OPPO Mobile Telecom.</p> <p>Support the proposal.</p>
<p>8 – Intel Corporation (UK) Ltd</p> <p>We acknowledge that DL-PRS with 480/960 kHz in FR2-2 are <i>currently</i> not supported. However, we don't think that the necessary changes – that are mainly related to discussions underway as part of RAN1 UE features, are limited. We could simply extend the capability reporting for component #3 for FG 27-3-3 and FG 27-6 for 480/960 kHz SCS.</p> <p>The main changes necessary are likely for RAN3 on the signalling aspects to the LMF and thus, the decision could be made by RAN3.</p>
<p>9 – Samsung Research America</p> <p>support</p>

3.2 SRS for positioning

Although there are majority companies based on the contribution input these don't support SRS for positioning with 480/960 kHz SCS in FR2-2 in R17, moderator feels that it may be technically fair to ask the following question before directly going to majority view.

3.2.1 Question 3a

Question 3a □

Is there any problem/concern to support SRS for positioning with 480/960 kHz SCS in FR2-2 in R17 from RAN1 perspective? If yes, what is the problem/concern?

Companies are invited to provide comments/views on Question 3a.

Feedback Form 3: Comments/Views

<p>1 – vivo Mobile Communication Co.</p> <p>For us, at least the impact of unlicensed bands (60GHz) has not been studied for positioning, such as LBT, signal average power limitation, etc. Therefore, it is weird to us that supporting SRS for positioning with 480/960kHz in FR2-2 directly without relevant evaluation and research.</p>
<p>2 – Qualcomm Incorporated</p> <p>From RRC perspective, the SRS for positioning in connected state follows the SCS of the BWP, so from that perspective it seems OK. However, there will be limitations, e.g. the <i>SRS-PeriodicityAndOffset-r16</i>, <i>currently</i>, can go up to 81920 slots with the thinking of maximum SCS of 120 Khz, I think for 480/960 kHz SCS, higher values might be useful. Then, SRS in RRC Inactive seems to have a limitation in the BW based on the 120 KHz SCS. It is also unclear whether indeed RAN3 might need a change in their specification.</p>

Overall, we don't see the urgency to say that 480/960 KHz SCS is supported for SRS for Positioning, and we are worried that more CRs will come later for discussion to fix this issue, if we open the door at this meeting. Therefore, we prefer to say that it is not supported. In FR2-2, 120 KHz SCS can be used.

3 – ZTE Corporation

We have the similar view as vivo and Qualcomm. The details should be carefully checked. We don't see the urgency to support it.

4 – CATT

In our view, the positioning in FR2-2 has not been studied in RAN1 yet. Positioning on FR2-2 should be a new feature, which may have some additional specification impact, including the SRS-Pos resource allocation in unlicensed spectrum, SRS-Pos physical layer procedures and the potential impact on RAN3 specs. It seems to be too urgent to say that SRS-Pos with 480/960 kHz SCS can be supported in FR2-2 in R17. We are open to further study it and the related research on support of positioning in FR2-2 with SRS-Pos or DL-PRS can be carried out in Rel-19.

5 – Nokia Poland

To clarify we did not express a negative view on SRS for positioning at 480/960 kHz in our Tdoc. Can FL update the table?

With that said we are okay with the majority view that this feature may cause further things to break and was not discussed by RAN1 before.

6 – HUAWEI TECHNOLOGIES Co. Ltd.

We disagree with any argument to say something is not supported because there was no discussion then while **the current spec does not preclude** the support by implementation.

As Qualcomm mentioned, they think 120kHz for FR2-2 is supported for positioning SRS as well as PRS, which is continuation of the practice of Rel-16 combination of unlicensed feature and positioning feature.

With regards to the periodicity issue, maybe other values are needed, but we do not expect to optimize it in Rel-17 or Rel-18.

With regards to other specification change, e.g. NRPPa or F1AP, it is up to RAN3 to decide, similar to the practice that we would not discuss enhanced MIMO-SRS feature will be used in positioning.

Another point to note is FR2-2 may also contain licensed spectrum as least from 3GPP perspective, e.g. n264.

If the concern is about more CRs in RAN1, we could make a conclusion that

RAN1 understands positioning SRS with 480kHz and 960kHz SCS can be supported without any RAN1 specification change.

RAN1 does not expect any further change to RAN1 specifications with regards to positioning SRS in FR2-2.

7 – Guangdong OPPO Mobile Telecom.

We also think it is too urgent to support SRS for positioning at 480/960KHz SCS in Rel-17 which is without evaluation and carefully check.

8 – Intel Corporation (UK) Ltd

We share similar views as Huawei on this and do not see any major bottlenecks in supporting SRS for positioning with 480/960 kHz in FR2-2. Some of the issues highlighted, e.g., on periodicity values, etc. could be left unoptimized for the larger SCS values in R17.

The main changes necessary are likely for RAN3 on the signalling aspects to the LMF and thus, the decision could be made by RAN3.

9 – Samsung Research America

We share the view as VIVO, QC and CATT, that the unclear part on supporting SRS for positioning with higher SCS is quite lot, especially it involves the unlicensed band operation. We are not willing to directly say supporting it just because we have not seen any issue without any design consideration. We had experience to rush agree something it looks no issue at that time, but it turns out did not work well eventually. so we hold conservative view on this, and as CATT mentioned, if needed we could carefully design the positioning in FR2-2 in future release.

and to HW's comment, if RAN1 did not study something, it is natural to say we don't support it. Not the way around. For the proposed conclusion to say, "... **be supported without any RAN1 specification change**" and "**RAN1 does not expect any further change to RAN1 specifications**"; these are exactly the necessary conclusion which need much more time to check. We cannot just say it can be done without specification change, and we dont need any further CR. That will be irresponsible to conclude it right now.

3.3 Outcome of Round 1

Based on the input in Round 1, the following can be observed:

- For Proposal 3a (on DL PRS), there is only one company (Intel) commenting it may not be big issue to support that, but as FL has summarized in section 2, there was some concerns raised to support PRS with 480/960 kHz. So moderator feels that the proposal 3a could be considered as stable and it will be proposed to email approval.

Stable Proposal 3a: DL-PRS with 480/960 kHz SCS are not supported in FR2-2 in R17.

- Regarding the Question 3a (on SRS for positioning), 6 companies (Vivo, QC, ZTE, CATT, OPPO, Nokia) prefer to not say support it and 2 companies (HW, Intel) seems supportive to the SRS for positioning with 480/960 kHz.

4 Discussion Round 2[Closed]

Based on the outcome in round 1, let's focus on the follow up operation on PRS part based on proposal 3a and the handling of SRS.

4.1 DL PRS

For stable proposal 3a, there is one question asked from Nokia that the corresponding CR is needed. From moderator perspective, the proposed CR from vivo and Nokia (almost identical) is aligned with the stable proposal 3a, the content in these two CRs are also simple and straightforward, which is pasted here for convenience.

CR from [10][11]:

5.1.6.5 PRS reception procedure	<omitted text>
A positioning frequency layer is configured by <i>NR-DL-PRS-PositioningFrequencyLayer</i> , consists of one or more DL PRS resource sets and it is defined by:	
- <i>dl-PRS-SubcarrierSpacing</i> defines the subcarrier spacing for the DL PRS resource. All DL PRS resources and DL PRS resource sets in the same DL PRS positioning frequency layer have the same value of <i>dl-PRS-SubcarrierSpacing</i> . The supported values of <i>dl-PRS-SubcarrierSpacing</i> are given in Table 4.2-1 of [4, TS38.211], excluding the values of 240kHz, 480 kHz, and 960 kHz.	
	<omitted text>

Figure 1:

4.1.1 Proposal 4a:

Proposal 4a: adopt the CR R1-2208734.

Companies are invited to provide comments/views on proposal 4a.

Feedback Form 4: Comments/Views to proposal 4a.

1 – Nokia Poland Support
2 – CATT OK

3 – HUAWEI TECHNOLOGIES Co. Ltd.

We prefer to list the supported numerologies, i.e. "including the values of 15kHz, 30kHz, 60kHz, and 120kHz" for a Rel-17 CR.

Using "excluding expression" may require additional change every time we introduce a new SCS.

4 – Nokia Poland

We don't prefer the option listed by Huawei. It may be unclear which SCS in the referenced table are supported with that language. And we prefer to align closer to the prior version. We don't feel that SCS will be added frequently enough for it to be a real concern.

5 – ZTE Corporation

Support the CR

4.2 SRS for positioning

There is not yet common conclusion on whether support SR for positioning with 480/960 kHz, although larger number of companies did not prefer to do it, i.e., 6 vs 2. From moderator perspective, the concerns and the hesitation to directly claim the support of SRS for positioning with 480/960 kHz without studying and evaluation are understandable. Especially consider the late stage at Rel-17 CR phase, no urgency of supporting that SRS for positioning higher SCS has been found.

@HW@Intel, I understand the comment from both you claiming that there was no vital issue found to support this feature, but pls also understand that many other companies being cautious and seeing no necessity to declare the support of it.

The updated proposal will be following majority view and taken into account the late stage of maintain phase of Rel17 epos. Let us target to have a more comprehensive study and design for positioning in FR2-2 in future.

4.2.1 Proposal 4b:

Proposal 4b: SRS for positioning with 480/960 kHz SCS are not supported in FR2-2 in R17.

Companies are invited to provide comments/views on proposal 4b.

Feedback Form 5: Comments/Views to proposal 4b.

1 – HUAWEI TECHNOLOGIES Co. Ltd.

We have concern over the proposal.

There is no urgency to conclude "not support", because such a conclusion is actually triggering further changes in RRC as in R2-2208299, which is absolutely unnecessary and a bad precedence.

srs-PosResourceSetToAddModList-r16 SEQUENCE (SIZE(1..maxNrofSRS-PosResourceSets-r16)) OF SRS-PosResourceSet-r16 OPTIONAL, ~~Need N~~ **Cond SCS**

srs-PosResourceToReleaseList-r16 SEQUENCE (SIZE(1..maxNrofSRS-PosResources-r16)) OF SRS-PosResourceId-r16 OPTIONAL, ~~Need N~~ **Cond SCS**

SCS

This field is optionally present, Need N, if the SCS configured for the corresponding BWP is not 480 kHz or 960 kHz; otherwise the field is absent.

2 – Intel Corporation (UK) Ltd

So far, we have observed two concerns raised regarding UL SRS:

- That the range of the periodicity and offset parameter may not be optimal for 480/960 kHz
- Concerns regarding operation in unlicensed bands due to LBT.

For the first one, as it should be clear, nothing is broken without the optimization.

For the second one, our understanding is that we can have operations in FR2-2 without LBT. However, if LBT operations is a reason for concern, then we don't quite see how it would be feasible for 120 kHz SCS in FR2-2.

In such a case, we should conclude that **DL and UL positioning are not supported in R17 for all SCS values (210/480/960 kHz) in FR2-2 and respond accordingly to RAN2.**

3 – ZTE Corporation

We cannot figure out whether it is supported or not within one week. At least more study is needed from our perspective. So we suggest the wording for the reply LS as follows:

From RAN1 perspective, companies have different views on whether SRS for positioning with 480/960 kHz SCS are supported in FR2-2 in R17, and RAN1 will not optimize the specifications for the feature.

4 – CATT

We support the proposal 4b. Or we also can live with suggested wording as ZTE's comments above, if the consensus cannot achieved in the group.

5 – Futurewei Technologies

We would like more time for studying the issues raised by some companies, as we do not see any obvious roadblock for supporting SRS Pos in FR2-2. Therefore, we prefer ZTE's suggestion.

4.3 Outcome of Round 2

For Proposal 4a to adopt the CR on PRS part, the companies who provided comment has shown the support to the CR except one company prefer to use "inclusion" manner other than the "exclusion" manner. But from moderator's perspective, the answer from the Nokia make sense that, the "exclusion" manner has already used in spec and given the fact that it's just matter of choice of wording preference, which did not impact the purpose of capture the stable proposal. So I hope HW could be ok with current draft CR considering the above reasons and the majority preference.

For proposal 4b, it seems the views from companies are even more divergent. in that sense, the direction of ZTE proposed seems correctly reflect the situation we have, moderator will formulate the update proposal based on that.

5 Discussion Round 3[Closed]

Draft LS reply will be provided soon if the following proposal/conclusion could be stable and acceptable to companies.

5.1 DL PRS

Based on the outcome of round 2, moderator hopes that company could consider the situation and explanation on the only matter of wording preference, let's consider the draft CR in R1-2208734 to be acceptable. So moderator put the proposal 5a almost as same as proposal 4a with only adding "draft", in which the draft CR will be processed accordingly later on.

5.1.1 Proposal 5a

Proposal 5a: adopt the draft CR R1-2208734.

Companies are invited to provide further comments/views on proposal 5a **ONLY IF YOU HAVE STRONG CONCERN.**

Feedback Form 6: Companies are invited to provide further comments/views on proposal 5a ONLY IF YOU HAVE STRONG CONCERN.

5.2 SRS for positioning

Consider the divergent views from companies, moderator tends to agree ZTE's suggestion on how to handle the situation. thus, following proposal is provided.

5.2.1 Conclusion 5a

Conclusion 5a:

RAN1 cannot reach consensus on whether or not SRS for positioning with 480/960 kHz SCS are supported in FR2-2 in R17, thus no optimization on this matter will be pursued for Rel17 positioning enhancement from RAN1 perspective.

Companies are invited to provide further comments/views on conclusion 5a **ONLY IF YOU HAVE STRONG CONCERN.**

Feedback Form 7: Companies are invited to provide further comments/views on conclusion 5a ONLY IF YOU HAVE STRONG CONCERN.

1 – HUAWEI TECHNOLOGIES Co. Ltd.

The current specifications do support configuring SRS with 480kHz and 960kHz, which is the default state.

We want to rephrase the wording as

RAN1 cannot reach consensus whether SRS for positioning with 480kHz/960kHz is not supported in FR2-2 in Rel-17, and no RAN1 specification change on this matter will be pursued for the Rel-17 positioning WI from RAN1 perspective.

2 – Nokia Poland

We prefer the suggestion from ZTE from the last round. We have not had much time and it is too fast to say it will not be concluded by RAN1.

3 – vivo Mobile Communication Co.

OK

4 – ZTE Corporation

The new wording of conclusion 5a cause another round debate. If we can use the wording we suggested in the last round discussion as Nokia mentioned, there may be easier to agree.

5.3 Outcome of Round 3

For DL PRS, after the checking with HW in email reflector, the proposal 5a is acceptable to every one, thus let's consider that is stable and moderator will include that in the draft LS reply.

For SRS for positioning, honestly, there is no fundamental difference between the conclusion 5a and the comments from ZTE in round 2, stating no consensus should be the same as stating different companis have different views. However, considering companies show preference on that wording, moderator will list it for

check and also include it in the draft LS reply.

6 Discussion Round 4 [open]

6.1 SRS for positioning

One purpose of conclusion 5a from moderator is that we should prevent reopening the discussion in the future considering the very late CR stage. With that common understanding hopefully, the suggested wording from ZTE is taken to final check, which seems acceptable to more companies, pls comment only you have very very strong concern. The only wording revision is replace the "feature" to exact what it is, this will be convenient or the draft LS reply since moderater will combine the PRS part and SRS for positoning part together.

6.1.1 Conclusion 6a

Conclusion 6a:

From RAN1 perspective, companies have different views on whether SRS for positioning with 480/960 kHz SCS are supported in FR2-2 in R17, and RAN1 will not optimize the specifications for SRS for positioning with 480/960 kHz SCS in FR2-2 in R17.

Feedback Form 8: Companies are invited to provide further comments/views on conclusion 6a ONLY IF YOU HAVE STRONG CONCERN.

7 Draft reply LS check

Based on the progress so far, moderator prepares the following content for replying LS to RAN2, which simply includes our stable conclusion in it, note that the exact wording may be updated if our final endorsed conclusion is upated.

7.1 Draft reply LS content

RAN1 thanks RAN2 for the LS on support of positioning in FR2-2.

For the question from RAN2 on whether SRS for positioning/DL-PRS with 480/960 kHz SCS can be supported in FR2-2 in R17. RAN1 makes some discussion and has following conclusion :

Conclusion:

DL-PRS with 480/960 kHz SCS are not supported in FR2-2 in R17.

From RAN1 perspective, companies have different views on whether SRS for positioning with 480/960 kHz SCS are supported in FR2-2 in R17, and RAN1 will not optimize the specifications for SRS for positioning with 480/960 kHz SCS in FR2-2 in R17.

companies are invited to provide your comment if you have strong concern.

Feedback Form 9: Companies are invited to provide your comment if you have strong concern.

8 Final outcome:

The proposal 3a, 5a, and conclusion 6a are endorsed.

The draft reply LS is accepted.

9 Reference

- [1] R1-2208325 LS on support of positioning in FR2-2 RAN2, Samsung
- [2] R1-2208579 Draft Reply LS on support of positioning in FR2-2 vivo
- [3] R1-2208804 Draft reply LS on support of positioning in FR2-2 OPPO
- [4] R1-2208909 Discussion on support of positioning in FR2-2 CATT
- [5] R1-2208910 Draft reply LS on support of positioning in FR2-2 CATT
- [6] R1-2209206 Draft Reply LS on support of positioning in FR2-2 ZTE
- [7] R1-2209207 Discussion on support of positioning in FR2-2 for Rel-17 ZTE
- [8] R1-2209842 Discussion on support of positioning in FR2-2 Huawei, HiSilicon
- [9] R1-2210237 Draft Reply on support of positioning in FR2-2 Qualcomm Incorporated
- [10] R1-2208604 Correction on SCS for NR DL PRS vivo
- [11] R1-2208734 Correction on DL PRS subcarrier spacings for FR2-2 Nokia, Nokia Shanghai Bell

