

3GPP TSG-RAN Meeting #98eRP-223531

Electronic, 12 – 16 December 2022

Agenda Item: 9.1.1

Source: Email discussion moderator (Intel)

Title: Email discussion summary for [98e-06-R18-Positioning]

Document for: Discussion and decision

1 Introduction

This document reports on the following email discussion during RAN#98-e:

[98e-06-R18-Positioning]

Input contributions covered: RP-222983, 2984, 2991, 3005, 3007, 3017, 3035, 3042, 3095, 3124, 3134, 3135, 3163, 3225, 3244, 3255, 3278, 3281, 3286, 3336, 3360, 2717, 2726, 2982, 3020, 3025, 3085, 3121, 3251->3425, 3289, 3373

2 Completion of Study Item

RAN has received the following 2 liaison statements:

- RP-222717 LS on Study on expanded and improved NR positioning (R3-226889; to: RAN, RAN1, RAN2, SA2; cc: -; contact: Huawei) from RAN3
- RP-222726 LS on RRM agreements on expanded and improved NR positioning (R4-2220439; to: RAN1, RAN2; cc: RAN; contact: Ericsson) from RAN4

The status report from the rapporteurs is submitted in RP-222982, and the study item technical report TR 38.859v1.0.0 is submitted in RP-223289 for a one step approval.

2.1 Initial Round

The moderator proposes that the 2 liaison statements and the Status Report can be noted, and the TR can be approved. Companies may provide comments on any of these documents and/or the moderator's proposal for these documents

Feedback Form 1: Completion of Study Item - Initial Round

<p>1 – vivo Mobile Communication Co. Support moderator’s proposal.</p>
<p>2 – KT Corp. Support moderator’s proposal</p>
<p>3 – Ericsson LM We support the moderator’s proposal.</p>
<p>4 – Fraunhofer IIS We are okay with the moderator’s proposal.</p>
<p>5 – Sony Europe B.V. Support the moderator’s proposal.</p>
<p>6 – Apple France We are fine with the moderator’s proposal</p>
<p>7 – Erik Sunell Consulting [On behalf of Toyota Info Technology Center] We support the moderator’s proposal.</p>
<p>8 – Classon Consulting [for FUTUREWEI] Support</p>
<p>9 – MediaTek Inc. We support the moderator’s proposal.</p>
<p>10 – AT&T GNS Belgium SPRL We support the moderator’s proposal.</p>
<p>11 – TELECOM ITALIA S.p.A. No specific comment on the moderator’s proposal.however, since there is no other space to provide this comment, we would like to raise the issue of the contents of the proposed work item and overall workload. The draft work item is a monster work item with tens of sub-objectives. This is not acceptable and a clear down-scoping is needed. Based on the outcome of the study (100 MHz required) we think sidelink positioning is not of practical interest and could be completely discarded from the Work tem scope. further downselection is in any case required.</p>

<p>12 – Spreadtrum Communications</p> <p>We support the moderator’s proposal.</p>
<p>13 – Beijing Xiaomi Mobile Software</p> <p>Support the moderator’s proposal.</p>
<p>14 – China Mobile E-Commerce Co.</p> <p>We support moderator’s proposal.</p>
<p>15 – Intel Corporation (UK) Ltd</p> <p>We support the proposal from the moderator.</p> <p>To clarify in response to the comment from Telecom Italia, the recommendation from RAN1 is that up to 100 MHz BW should be supported by the specifications, not that 100 MHz is always required. As the extensive evaluation results reported in the TR indicate, depending on specific use-cases, deployment scenarios, and accuracy requirements, the target positioning/ranging accuracy may be achieved with as small as 20 MHz BW.</p>
<p>16 – SHARP Corporation</p> <p>We support the moderator’s proposal.</p>
<p>17 – OPPO Beijing</p> <p>Support.</p>
<p>18 – ZTE Corporation</p> <p>We would like to clarify that we may have 3 TUs per RAN1 meeting, and 2 TUs per RAN2 meeting. Based on that, much down-scoping may not be needed at all. Except SL positioning, all others do not need much effort from RAN1 perspective. Compared with MIMO, AI/ML which also have 3 RAN1 TUs, the positioning scope here is much smaller.</p>
<p>19 – CATT</p> <p>Support the moderator’s proposal.</p>
<p>20 – NEC Corporation</p> <p>We support the moderator’s proposal.</p>
<p>21 – Nokia France</p> <p>We support the moderator’s proposal.</p>

<p>22 – Motorola Mobility Germany GmbH</p> <p>[Lenovo]</p> <p>We also support the Moderator’s proposal.</p>
<p>23 – LG Electronics Inc.</p> <p>Support the moderator’s proposal.</p>
<p>24 – HUAWEI TECHNOLOGIES Co. Ltd.</p> <p>Support moderator’s proposal <input type="checkbox"/></p> <p>We would also like to echo ZTE’s observations.</p> <p>In general we see that good outcome of the SI and valuable recommendations from different working groups. The number of recommendations from all working group seems not small at a first glance. But according to company contributions, the main impacting working groups of these recommendations spreads, so it leads to rather balanced workload across working groups without overloading a specific working group. So from our view we should value study outcome and carrier all the valuable study outcome to WI.</p>
<p>25 – Philips International B.V.</p> <p>We support the moderator’s proposal.</p>
<p>26 – Tejas Networks Ltd.</p> <p>We support the moderator proposal.</p>
<p>27 – CEWiT</p> <p>We support the proposal</p>
<p>28 – IIT Kanpur</p> <p>We support the moderator proposal.</p>

2.1.1 Summary from Initial Round

Telecom Italia raised general concerns about workload and proposed that the WI can be down-scoped, include sidelink positioning. ZTE and Huawei expressed the view that not much down-scoping may be needed given the TU allocation for this item.

Based on the comments received the following conclusions are made, and no intermediate round discussion is required for this topic:

Conclusions regarding completion of Study Item:

- RP-222717 (LS from RAN3) can be noted
- RP-222726 (LS from RAN4) can be noted
- RP-222982 (Status Report) can be noted

- RP-222982 (38.859v1.0.0) can be approved

3 WI scope

The rapporteurs have provided a draft of the WID in RP-222983. This draft WID has been created with an inclusive approach to provide text for all potential objectives, and with those objectives or parts of objectives likely to require more discussion during this week being shown in blue text and square brackets.

This email discussion is structured with a section on each of the top level objectives from the draft WID. Company proposals associated with each top level objective will be discussed within each section.

3.1 Sidelink positioning (including ranging)

3.1.1 Initial Round

Companies are requested to provide comments on the high level objectives for sidelink positioning (not commenting on the detail wording of the text for which a separate feedback form is provided). Specifically companies are requested to comment on the following (noting that it is not necessary to comment simply to repeat a company position that is already correctly captured in the summary):

1. Inclusion of SL-TDOA positioning method (blue text within the rapporteur's draft WID). Views from the contributions are summarised below:
 - a) Supportive to include: AT&T/Firstnet (3007), Xiaomi (3017), Spreadtrum (3035), CMCC (3042), Qualcomm (3124), CATT(3135), docomo(3163), CEWiT et al (3225), MediaTek(3244), ZTE (3255), OPPO(3020), Samsung (3085), Bosch (3425)
 - b) Not supportive to include to manage workload: Intel(2984), Ericsson (3286)
2. Resource allocation scheme 2 congestion control/inter UE coordination (blue text within the rapporteur's draft WID). This topics was not explicitly commented on within the company contributions.
3. Inclusion of unlicensed spectrum. There is a checkpoint within the SID to discuss this again at RAN#98. Views from the contributions are summarised below:
 - a) Supportive to study and if needed specify: Bosch (3425)
 - b) Not supportive to include: CMCC (3042), vivo (3095), Qualcomm (3124), docomo(3163), ZTE(3255), Futurewei (3336), Lenovo (3360), Samsung (3085), LG(3121), Apple (3373)
4. Inclusion of FR2 spectrum. Views from the contributions are summarised below:
 - a) Supportive to include: Xiaomi (3017)
 - b) Not supportive to include: ZTE (3255), Ericsson (3286), Futurewei (3336), Samsung (3085), LG(3121)
5. Inclusion of SL-AOD. Views from the contributions are summarised below:
 - a) Supportive to include: Huawei(3005, as second prio), AT&T/Firstnet (3007), vivo (3095)

6. Dedicated resource pools should be treated with higher priority than shared resource pools. Proposed by Intel(2984), CATT(3135), docomo(3163).
7. Combined Uu/PC5 position should be treated with a lower priority than PC5 only. Proposed by docomo(3163)
8. Privacy considerations. Apple (3373) proposes that privacy concerns need to be explicitly addressed in the WI, UE based positioning methods should be supported, and transmission of SL-PRS must be optional.
9. Others. Companies may comments on other high level aspects of the objectives for sidelink positioning

Feedback Form 2: Sidelink positioning - Comments to high level objectives - Initial Round

1 – ZTE Corporation

1. In section 5.3.2 of the TR, most companies use SL-TDOA to facilitate absolute positioning. So we support it as we agreed in SI. Further, it does not help too much for workload if SL-TDOA method is postponed. The spec enhancement is only on signaling design. No need evaluation anymore. If down-scope is really needed, we suggest to drop double-side RTT.
2. For the WID, we are fine not to explicitly mention this topic, but we think the further discussion in WI should be allowed.
- 3&4. We suggest to go for majority. FR2 and unlicensed bands should not be included in this release. But we are fine to study it if majority is OK.
5. SL-AOD has been agreed as the second priority. We suggest to keep the wording as RAN1 agreed for WID. Alternatively, we are flexible to go with majority.
- 6&7 We don't think down-scope is needed. Especially for Combined Uu/PC5, we strongly support this scenario. Without this, we don't think positioning accuracy can be guaranteed.
8. Since it was not discussed before, we prefer not to mention it in WID at least in this meeting.

2 – vivo Mobile Communication Co.

- 2: We are okay to consider resource allocation scheme 2 congestion control/inter UE coordination
- 4: Please add vivo as "not supportive"
- 5: Please add vivo as "not supportive"

3 – KT Corp.

1. Support to include SL-TDOA
2. For Scheme 2 we are OK to remove square bracket in WID
3. Inclusion of Unlicensed not necessary considering the workload
4. Not supportive
5. Support to include SL-AOD

4 – Ericsson LM

- 1: We want to clarify that we would be OK including SL-TDOA in scope, if the overall size of the work item allows it.

- 2: Support to be in scope. Our understanding is that congestion control is an integral part of Scheme 2, just like it is a part of mode 2 for SL for communication.
- 3: Do not support to include unlicensed since it is not supported by SL communication.
- 4: Do not support including FR2. The conclusion of the SI was that up to 100MHz of BW was recommended, for which FR1 is enough. Moreover, there is no FR2 specific enhancements for SL for communications (such as beam management).
- 5: Do not support. We prefer following the conclusion of the TR and only include AoA for angle based methods.
- 6: Do not support. We should respect the TR conclusion and treat shared and dedicated resource pools equally. Shared resource pools are critical to a good use of SL resources for operators.
- 7: Do not support. During the study, hybrid positioning has been shown to be providing significant benefit in performance.
- 8: We understand that all of SL positioning in Rel-18 will be up to UE capability(ies).

5 – Fraunhofer IIS

- 1 We are fine with the inclusion of SL-TDOA in the WID.
- 2 We support to consider resource allocation scheme 2 congestion control/inter UE coordination in the WID.
- 3 We agree with the majority to downscope the inclusion of unlicensed spectrum.
- 4 We are generally supportive to include FR2 to support InF use cases
- 5 We are supportive of SL-AOD.
- 6 We agree that dedicated resource pools are of higher priority to achieve identified targets of sidelink positioning.
- 7 Don't support.

6 – Apple France

1. Support SL-TDoA. It is the only scheme in which all the processing can take place at the target UE, enhancing privacy. We should keep the recommendations from the study item phase.
2. We support consideration of Resource allocation scheme 2 congestion control/inter UE coordination.
3. Do NOT support inclusion of sidelink positioning for the unlicensed spectrum
4. Not supportive.
5. Not supportive. Keep the recommendations from the study item phase
6. Open to discussion
7. Do not support
8. Support. TDoA should be supported

7 – ROBERT BOSCH GmbH

3. In our understanding, when drafting the WID, V2X use cases were among the most prominent examples to start the study on SL positioning. The study revealed that the ITS band will not offer sufficient bandwidth to meet the V2X accuracy requirements especially in urban environments. In addition, notable progress in the SL evolution work item considering SL for unlicensed has been made. Hence, we think that

the conditions in the checkpoint are satisfied. At the same time, we also agree that the workload is quite high. Nevertheless, we believe that considering the checkpoint conditions, the bandwidth recommendations, progress in SL evolution and ensuring the relevance of Rel. 18 SL positioning for V2X use cases – studying unlicensed spectrum should be in the scope of the WID.

4. At this point, we feel that FR2 is of least importance and should not be supported in the Rel. 18 WID. However, like unlic. we would be ok to study.

5. Considering, the overall number of positioning methods recommended from RAN1, we don't think SL-AoD should be added at this point as well.

6. We see no need to prioritize dedicated resource pool.

7. In our understanding, Uu/PC5 positioning was extremely important to achieve stringent positioning requirements. We do not support to de-prioritize Uu/PC5, if unlicensed spectrum is also not studied.

8. In our opinion, privacy considerations are important. However, we didn't agree on a common understanding of the term privacy nor how privacy considerations should be considered in RAN1 design. Therefore, we propose not to consider it in the WID.

8 – Erik Sunell Consulting

[On behalf of Toyota Info Technology Center]

1. We support the inclusion of SL-TDOA in the WID.

2. We are fine to consider resource allocation scheme 2 congestion control/inter UE coordination in the WID.

6. Shared and dedicated resource pools were treated equally in the SI. We prefer to treat them equally in the WI as well.

7. We would like to note that at least PC5 positioning needs to be done before specifying combined Uu/PC5 positioning. It seems difficult to proceed the other way around. No strong opinion on the priority. If time permits, both can be done. We also wonder if the combining can be left up to the implementation.

8. No privacy issues surfaced during the SI. If there is a privacy issue, it needs to be defined first before it can be considered in the WI scope.

9 – Classon Consulting

[for FUTUREWEI]

1. support SL-TDOA

2. support

3. do not support unlicensed

4. do not support FR2

5. support SL-AOD

6. prefer same priority

7. prefer same priority

8. do not support

10 – MediaTek Inc.

1. Support the inclusion of SL-TDOA.

2. OK to have this in scope.

3. We have some sympathy for Bosch's comment above, but considering the workload and the difficulty of coordinating between the two Rel-18 WIs, we think it's reasonable to postpone work on SL-U positioning.
4. Same general issue as 3; considering the workload, we are OK not to include FR2.
5. No strong view on SL-AoD.
6. OK with higher priority for dedicated resource pools.
7. We consider the Uu+PC5 case important and do not support down-prioritizing it.
8. The privacy issue is a new topic and seems more suitable for WG discussion.

11 – AT&T GNS Belgium SPRL

1. We support inclusion of SL-TDOA positioning method.
2. We support both Resource allocation scheme 2 congestion control/inter UE coordination.
3. & 4. We are ok to exclude FR2 and unlicensed spectrum support and should focus on ITS/FR1 licensed bands.
5. We are supportive for the inclusion of SL-AOD.
6. No strong view that dedicated resource pools should be treated with higher priority than shared resource pools.
7. No strong views that combined Uu/PC5 positioning should be treated with a lower priority than PC5 only.
8. Privacy considerations are important, but we have not discussed these aspects in the SI phase.

12 – TELECOM ITALIA S.p.A.

The conclusion that 100 MHz licensed spectrum in FR1 is required implies that this feature will likely never be implemented, therefore we have strong concerns in general to with approving the feature.

Assuming companies will anyhow want to approve the Work Item (ignoring the work load), as a minimum unlicensed and FR2 operations should not be supported.

13 – TELECOM ITALIA S.p.A.

After looking to the full discussion, we would like to raise the issue of the contents of the proposed work item and overall workload. The draft work item is a monster work item with tens of sub-objectives. This is not acceptable and a clear down-scoping is needed.

Based on the outcome of the study (100 MHz required) we think sidelink positioning is not of practical interest and could be completely discarded from the Work item scope. further downselection of other objectives is in any case required.

14 – InterDigital

1. We are supportive. However, we agree with Intel and Ericsson that considering workload, RTT-based solutions and AoA should be prioritized. We can work on SL-TDOA, considering inter-UE synchronization, if there are enough TUs.
2. We support to include it. We think it's a necessary feature for scheme 2 (UE autonomous SL-PRS resource allocation)
3. Do not support as it increases workload significantly.

4. Do not support as it increases workload significantly.
5. Do not support as it increases workload significantly.
6. We support to treat dedicated resource pool at higher priority compared to shared resource pool, mainly due to limited amount of TUs.
7. We support the proposal to keep the workload reasonable level
8. It is not clear to us the issue where privacy becomes a concern and which WG should work on the privacy aspect.

15 – NTT DOCOMO INC.

1. we are fine to either include or exclude it. Considering workload, our current preference is to exclude SL-TDOA.
2. OK
3. Not necessary as commented in our contribution.
4. Not necessary as commented in our contribution.
5. Not support. Let's focus on recommended mechanism.
6. OK. Workload should be considered carefully.
7. If majority want to keep both, we can accept that. But workload should be considered carefully.
8. Not support. This topic was not discussed in study phase. Necessity to say this issue in WID is unclear.

16 – Spreadtrum Communications

1. We support SL-TDOA
2. Support to be in scope
3. Do not support to include unlicensed spectrum
4. Do not support to include FR2 spectrum
5. No strong view on SL-AoD
6. Support
7. We prefer the same priority as PC5-only positioning

17 – Beijing Xiaomi Mobile Software

1. SL-TDOA is at least can be used with the RSU scenario for absolute positioning and it recommended by the RAN1, we support it.
2. We think it can be discussed in the work group.
3. Fine to defer the unlicensed spectrum in the later release.
4. We can simply reuse the FR1 function to the FR2 and don't discuss the enhancements on FR2, but we can follow the majority views.
5. Not supportive, we should follow the TR conclusion.
6. Not supportive, we think dedicated resource pools and shared resource pools should be treated with the same priority.
7. No strong view, open to discussion.

8. We think the SL-SRS transmission should be based on UE capability.

18 – China Mobile E-Commerce Co.

1. We support to include SL-TDOA. It was clearly recommended in the TR, and to enable absolute positioning, the resource overhead of SL-TDOA, especially UL-like SL TDOA, is much less than that of RTT.
2. We support to include resource allocation scheme 2 congestion control/inter UE coordination in the WI, and we are fine to explicitly mention it in the WID to avoid further ambiguity.
3. Not consider unlicensed spectrum in this release, the workload is too high.
4. The study on FR2 is limited, and we are OK to deprioritize FR2 for the sake of workload.
5. We are OK to include SL-AoD for FR1 if workload is manageable.
6. Please include CMCC as supporting companies. RAN1's agreement was made with a note saying that unified design of dedicated RP and shared RP is not implied, which we believe that it may double the workload. At least companies are all supportive of dedicated RP, and hence dedicated RP should be prioritized.
7. Both Uu+PC5 and PC5 only should be included, no need to down scope.
8. Such study was not investigated in the SI.

19 – Samsung R&D Institute UK

Thanks for the discussion. Some comments from our side as:

For #1), We support SL-TDOA. We can add the following in the WID if necessary to resolve the concern as:

For SL-TDOA, specify solution(s) to mitigate impact of synchronization error between multiple anchor UEs.

For #2), We are OK to include in WID about scheme 2 congestion control/inter UE coordination.

For #7), Uu/PC5 should not be treated with lower priority than PC5.

20 – Samsung R&D Institute UK

Thanks for the discussion. We suggest the following update (marked in bold) since TR says that the following was studied: “ $N \geq 1$ (where $N=1$ corresponds to full RE mapping pattern)”.

- Specify SL PRS for support of sidelink positioning such that the SL PRS uses a comb-based (**including full RE mapping pattern**) frequency domain structure and a pseudorandom-based sequence where the existing sequence of DL-PRS is used as a starting point [RAN1].

21 – Intel Corporation (UK) Ltd

1. While we are not necessarily against inclusion of SL TDOA, we think the work scoping should focus on elements essential to introduce SL ranging/positioning in this release.

The most promising option from a practical standpoint is RTT-based methods using SL, with SL AoA being a useful for direction estimations. SL TDOA is highly sensitive to synchronization errors between UEs. Without enhancements to enable much tighter synchronization than what is achievable today, specifying SL TDOA may only consume specification efforts with its applicability limited to a very few scenarios, e.g., those with tightly synchronized RSUs. On the other hand, it is rather unlikely to include new studies on improving spec-based solutions for enhancing inter-UE synchronization within Rel-18 timeframe. Thus, at least prioritizing SL RTT and SL AoA for WG efforts would be a more responsible approach in view of the rather large scope of work for SL ranging/positioning.

2. On resource allocation scheme 2 congestion control/inter UE coordination, this was included with blue text since it would need to be a “study and if needed” type of objective as RAN1 did not study these aspects much during the SI. While these features may not be critical for the initial release with SL positioning, we support their inclusion within normative work scope as elements to ensure a future-proof design.

3. We support limiting the work in Rel-18 to licensed bands. Although from the perspective of required BW for SL ranging/positioning accuracy, bandwidths up to 100 MHz (for FR1) are recommended and should be supported by specifications, there are licensed bands supporting up to 100 MHz for SL, e.g., band n79. At the same time, support of SL-U is currently work in progress, and it would not be prudent to introduce support of SL ranging/positioning to unlicensed spectra at this point.

4. We support limiting the work in Rel-18 to FR1 bands. Support of FR2 for SL communications is still not sufficiently mature (still under consideration as part of Rel-18 SL enhancements) and support for SL positioning in FR2 bands can be pursued at least once support of SL communications is in place.

5. RAN1 has not been able to recommend SL AoD considering that typical UE Tx antenna configurations do not lend themselves of much use for accurate SL AoD-based positioning. We prefer to follow the recommendations in the TR in this regard.

6. Dedicated resource pools for SL PRS should be prioritized as they would need to be supported at the minimum. Technically, we see the value of supporting shared resource pools and the concern is purely from workload management perspective as we expect this topic could consume quite some RAN1 time. Hence, we propose to at least prioritize work on dedicated resource pools at the beginning and pick up shared resource pools depending on overall progress.

7. On hybrid Uu+PC5 based positioning, given the promising gains observed during the SI, we are supportive of treating this at same level as PC5-only positioning.

8. While privacy concerns are important and RAN designs should be cognizant of such considerations, we do not see a need for special handling in the WID for this purpose. In any case, most SL positioning capabilities can be expected to be optional, and details can be discussed as part of usual UE capabilities discussions during the WI.

22 – SHARP Corporation

1. OK to include SL-TDoA in the scope.
2. We are fine to consider resource allocation scheme 2 congestion control / inter UE coordination in the WID.
3. Not supportive. R18 SL positioning should focus on what has been supported in R16/R17 SL.
4. Not supportive. R18 SL positioning should focus on what has been supported in R16/R17 SL.
5. Do not support. We prefer to follow the recommendation from the SI phase.
6. Follow the conclusion from the SI. Both shared and dedicated resource pools should be treated equally.
7. We share the views from Toyota that PC5 positioning needs to be done before specifying combined Uu/PC5 positioning, not the other way around.
8. We do not see the need to capture it in the WI scope. It can be discussed as part of UE feature discussions in WGs, if necessary.

23 – NEC Corporation

1. We support to include SL-TDOA in the scope.
2. We support to include resource allocation Scheme 2 congestion control/IUC in the WID.
3. We do not support considering the discussion on unlicensed spectrum utilization is still ongoing in SL Evo.
4. We do not support at this stage due to the workload consideration.
5. We support to include SL-AOD.
6. We support to treat dedicated resource pools with higher priority than shared resource pools.
7. We support to treat PC5 only positioning with a higher priority and consider combined Uu/PC5 positioning subsequently.

24 – CATT

- 1: Okay to include SL-TDOA in scope with the understanding that the further enhancement to overcome issues related to SL-TDOA, such as time synchronization errors, Tx/Rx timing errors can be discussed in a future release.
- 2: Okay to include.
- 3: Not to include unlicensed spectrum.
- 4: No strong view, but it might be better to delay FR2 in a future release.
- 5: Support SL-AOD.
- 6: For R18, our preference is to treat dedicated resource pools with higher priority not support, considering the complexity involved in shared resource pools.
- 7: Okay to support hybrid positioning. The accuracy is expected to be improved the combined Uu/PC5.
- 8: We support UE based SL positioning. Whether UE supports SL-PRS is upto UE capability.

25 – Nokia France

1. We are OK to include SL-TDOA, as the effort involved seems small.
2. We see at least inter-UE coordination being useful for SL positioning.
3. Given that SL-U itself is only just being specified, we would suggest to handle SL-U positioning in a later release.
4. We have not seen strong support for including this.
5. We have not seen strong motivation to support this based on the consideration during the SI.
6. We are OK with the proposal to prioritise dedicated resource pools, but would also be OK to treat dedicated and shared pools with equal priority.
7. Both combined Uu/PC5 and PC5-only solutions need to be included in order to provide an overall solution.
8. Privacy concerns are valid, but this can be driven from SA2/SA3, and RAN can address any requirements set by SA2 and provide support for any SA3 decided solution(s).

26 – Qualcomm CDMA Technologies

2. Congestion control and inter-UE coordination are separate topics, and we propose to discuss them separately. In our view, congestion control is essential for the functioning of the system. Inter-UE coordination is a nice to have feature; however, we would be ok with deprioritizing it.
3. In our view, using unlicensed spectrum for SL PRS is necessary to meet performance requirements for at least V2X and Public Safety due to limited dedicated/licensed spectrum available. We support studying and specifying SL-PRS transmission on unlicensed spectrum. However, due to workload, we would be ok if this is deferred to a later release as indicated in our contribution.
4. We support including FR2 spectrum. To limit workload, we would be ok with not introducing specific optimization.
5. We prefer to focus on the objectives that have a clear recommendation from the study. There was no conclusion/recommendation in the Study for SL-AoD.
6. O.K. to prioritize dedicated resource pool. Shared resource pool can be 2nd priority.
7. We prefer to focus on the objectives that have a clear recommendation from the study. Combination of Uu- and PC5-based positioning was recommended for normative work and should not have lower priority.
8. Unclear what "privacy concerns" comprise but can be handled in the WI phase (e.g., in cooperation with SA2/3, if required).

27 – LG Electronics Inc.

1. We support SL-TDOA for Rel.18 positioning. When UE has only a single antenna, SL-TDOA has benefit in latency compared to SL-RTT for supporting absolute SL positioning. The synchronization issue is identical to the case of Uu link positioning, and the solution development is expected in WI phase
2. Congestion control is essential in scheme 2 resource allocation, without which SL positioning will not work properly in congested channel condition. Inter UE coordination is a good mean to solve so-called hidden node problem in scheme 2 resource allocation, which cannot be solved solely based on sensing. We support both scheme in Rel.18 positioning.
3. As almost all the evaluation in SI phase were based on FR1 licensed spectrum, we do not see any justification to support the unlicensed spectrum for SL positioning in Rel.18.
4. As almost all the evaluation in SI phase were based on FR1 licensed spectrum, we do not see any justification to support FR2 spectrum for SL positioning in Rel.18.
5. We share the concerns of the majority companies that it's premature to support SL-AoD in Rel.18 because SL beamforming in FR2 spectrum was not investigated even in SL communication agenda.
6. We support to prioritize the dedicated resource pools for SL PRS transmission (other channels like SCI can be transmitted in SL communication resource pool). Achieving backward compatible transmission of SL PRS in a shared resource pool seems hardly feasible, which may cause unnecessary high level of workload of Rel.18 SL positioning.
7. We support to prioritized PC5-only SL positioning in Rel.18. The combined Uu/PC5 positioning can be developed after the completion of PC5-only positioning.
8. We do not have discussions on this topic during the SI phase. We share the views with the majority of companies that the privacy issue may not need to be included in Rel.18 SL positioning WI.
9. UE-based positioning may be prioritized over UE-assisted positioning for Rel.18 SL positioning. Unlike the conventional Uu link positioning, SL positioning could be efficient when UE directly computes the location as there could be no gNB or LMF.

28 – Sony Europe B.V.

1. Support the inclusion of SL-TDOA
2. Support resource allocation scheme 2 with congestion control / IUC.
3. Do not support the inclusion of unlicensed spectrum in Rel-18.
4. Do not support the inclusion of FR2 in Rel-18.
5. Do not support SL-AoD
6. No need to define prioritization.

7. No need to define prioritization.
8. Privacy consideration is typically discussed in other WGs (e.g., SA2, SA3).

29 – Motorola Mobility Germany GmbH

[Lenovo]

1. Support the inclusion of SL-TDoA as part of the WID objectives since it has been clearly agreed to be introduced during the SI phase. Mitigation of all related impairments w.r.t to SL-TDoA, e.g., synchronization error, anchor node location uncertainty can be discussed and tackled during the normative phase.
2. Support the inclusion of RA congestion control and IUC schemes as part of the WID objective as per the recommendation of the study. In our view, this is a key aspect of the SL Positioning design.
3. Support Option 3b). The unlicensed aspect can be considered in future releases due to the already large scope of this objective.
4. FR2 aspects can be deprioritized for this release until the FR2 SL design covering beam management has been stabilized.
5. Supportive in general of SL-AoD, but ok to follow the TR38.859 recommendation that this is deprioritized and can be considered in future releases.
6. Follow the TR38.859 recommendations that both dedicated and shared RPs for SL positioning are considered. We could set a priority for dedicated RP design but doubt that would change the work load since both RP options will be considered in any case.
7. The agreed operational scenarios to be supported and considered feasible have been captured in TR38.859 including PC5-only and both Uu and PC5 (hybrid) positioning, so we tend to support the recommendation to include both scenarios as part of the WID.
8. According to our understanding this is under the scope of the SA3 work to determine the potential security and privacy concerns. There is no need to explicitly capture this in the WID. According to the draft WID in RP-222983, the following is captured, which can be considered sufficient: “*NOTE: RAN working groups will take into account the work from other working group SA/CT which involves the same or related objectives.*”

30 – KT Corp.

For 6) KT believes dedicated resource pool and shared resource pool should treat equally.

For 7) KT believes Uu/PC5 and PC5 only positioning should be treated with the same priority.

For 8) We are still unclear whether this is RAN discussion? Or may be the best way forward is to prepare for sending LS to SA3.

31 – OPPO Beijing

1. SL TDOA requires tight synchronization among UEs, this has already been taken into account by RAN1 in study item phase, it was still recommended by RAN1 at the end because this is feasible when anchor UEs are fixed, e.g., RSU, and the method is beneficial from PRS overhead perspective.
2. Congestion control and inter-UE coordination are both components of legacy mode 2 resource selection mechanism, according to RAN1 agreement below, we think both of them should be included in the WI.

Agreement

For Scheme 2, with regards to Resource allocation mechanism for SL-PRS, pick one or both of the following options:

- *Option 1: A sensing based resource allocation should be introduced*
- *Option 2: A random resource selection should be introduced*
- *In either option 1 or 2, the legacy designs for UE autonomous resource allocation should be used as a starting point. Study if/what enhancements may be needed.*

3. According to RAN1 conclusion, up to 100MHz on FR1 is needed, in our view unlicensed spectrum is crucial for SL positioning. Our proposal is, if time permits, to have a study objective in R18 NR positioning WI for unlicensed spectrum, such that we can expedite the progress of this item in next release.
4. FR2 is supported in Rel-16 sidelink communication, but no specific enhancement (such as beam management) was introduced except PT-RS, therefore, in our understanding SL PRS should be able to be transmitted on FR2, but no specific optimization should be introduced.
5. SL AoD was discussed extensively in RAN1, but it was down prioritized at the end of the study phase.
6. SL spectrum on ITS/licensed band is extremely limited, so far only 40MHz on ITS band can be used for SL, it is used to accommodate both LTE V2X and NR V2X, and already congested. There is no room to configure dedicated resource pool for SL PRS transmission, as dedicated resource pool would degrade the resource efficiency significantly and further congest the channel. Therefore, in our view, shared resource pool should be prioritized, if prioritizing dedicated resource pool, unlicensed spectrum should be considered.
7. Prefer to treat all recommended features equally.
8. Fine in principle, but we are fine to discuss this at UE capability phase.

32 – OPPO Beijing

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7. Prefer to treat all recommended features equally.
8. Fine in principle, but we are fine to discuss this at UE capability phase.

38 – VODAFONE Group Plc

For us unlicensed spectrum and FR2 could be de-prioritised. Privacy is not a RAN topic and we should leave it up to SA3/SA2. If there are any requirements in this area, corresponding groups would contact RAN if needed.

39 – CEWiT

1. We support to include SL-TDOA in the scope of WI. We do not see too much workload to include this method. We believe that the deployment with RSU will benefit with this method and it is one of the very important deployment scenarios specially on highways. For highway scenario, SL-TDOA will be more

beneficial compared with the RTT based solution due to latency constraints. Therefore, it is important to consider the SL-TDOA in WI scope.

2. Congestion/ inter-UE coordination is important for scheme 2 of resource allocation and should be included in the scope.

4. Though we were one of the active contributors on the FR2 discussion during study phase, the progress of FR2 work on sidelink evolution take us on backfoot. Therefore, we are okay to extend the FR1 solution to FR2 without any FR2 specific optimization.

6. We need not to down prioritize shared resource pools in WI scoping.

7. According to study it is important to have SL only and Uu+SL joint positioning to meet the set target. This clearly hints that combined Uu/SL is equal important to SL only positioning. So we support it strongly.

40 – Deutsche Telekom AG

We do only support Inclusion of SL-TDOA positioning method for ITS bands (automotive use case)
The rest of the proposal we do not support.

41 – HUAWEI TECHNOLOGIES Co. Ltd.

1. SL-TDOA: Support to include it. The synchronization procedure between anchor UEs could be up to implementation.

2. Congestion control/IUC: Support to include at least IUC.

3. Unlicensed spectrum: We did not see plenary contributions/discussions clearly clarify the scope and work load for unlicensed sidelink positioning. We therefore suggest not to include unlicensed sidelink in Rel-18. It can be considered in later releases.

4. FR2: do not support. FR2 sidelink is still in discussion in the on-going sidelink evolution item. We suggestion not to include FR2 sidelink positioning in Rel-18.

5. AoD: Support. It can be second priority, and it can be even supported without additional spec effort.

6. Shared pool/dedicated pool: Do not support. We prefer no guidance on priority between shared/dedicated pool from RAN plenary.

7. PC5+Uu: Do not support. We prefer no guidance on priority from RAN plenary.

8. Privacy considerations: Do not support. Not RAN business.

42 – Philips International B.V.

1. We support the inclusion of SL-TDOA.

5. We do not support AoD at this stage.

7. We are okay with the proposal.

8. We are fine to include the topic on privacy in the WID. We agree that some privacy issues may need to be resolved, such as privacy of PRS signals. Note that in our opinion, transmission of SL-PRS signals is meaningful to support SL-based positioning, and should be mandatory in some cases.

43 – IIT Kanpur

1. We support including SL-TDOA in the work item phase.
2. Inter-UE coordination is essential to support the resource allocation sachem 2. It should be part of the normative phase.
7. Uu+PC5 positioning is equally important as PC5 only positioning. PC5+Uu should be part of normative work.

In additional to the discussion of the high level objectives on sidelink positioning, companies may also provide detail comments to the text proposed by the rapporteurs in RP-222983

Feedback Form 3: Sidelink positioning - Comments to WID text - Initial Round

1 – vivo Mobile Communication Co.

We suggest removing “methods and” before ” measurements to support RTT-type solutions using SL, SL-AoA, [and SL-TDOA]”.

- Specify ~~methods and~~ measurements to support RTT-type solutions using SL, SL-AoA, [and SL-TDOA] [RAN1, RAN2].

Our understanding is that the specified measurement is not necessarily associated with specific method, which was explicitly noted and agreed in RAN1 discussion. This understanding is also reflected in the previous WID in Rel-16/Rel-17 with no explicit description to specify methods as following.

- Define UE measurements based on DL reference signals applicable for NR positioning. The following UE measurements are specified for serving, reference, and neighboring cells [RAN1]

For the sub-bullet of signaling enhancement, we prefer to modify it as follows since “ the enhancement of LPP “may preclude other solutions (e.g, Use of SLPP/RSPP between the UE and the LMF that are agreed upon in RAN2)

- Specify ~~the enhancement of LPP and LMF functionalities~~ and signaling between UE and LMF for supporting SL positioning.

2 – MediaTek Inc.

We generally agree with vivo's last point above: It was left for normative work in RAN2 to determine which protocol is used between the UE and LMF for SL positioning, and the WID should not assume that this will be done by enhancing LPP.

The WID should not presumptively identify the name "SLPP"; this was taken as a working name in RAN2 during the study phase, but there were also concerns expressed (e.g., it collides with the existing abbreviation for Subscriber LCS Privacy Profile) and there is a clash with SA2 (who used "RSPP"). It's just a naming issue and not a big deal technically, but we should align between groups where we discuss the same protocol (and we think it would be best to avoid colliding acronyms, so we would favour RSPP).

3 – Samsung R&D Institute UK

Thanks for the discussion. We suggest the following update (marked in bold) since TR says that the following was studied: " $N \geq 1$ (where $N=1$ corresponds to full RE mapping pattern)".

- Specify SL PRS for support of sidelink positioning such that the SL PRS uses a comb-based **(including full RE mapping pattern)** frequency domain structure and a pseudorandom-based sequence where the existing sequence of DL-PRS is used as a starting point [RAN1].

4 – Intel Corporation (UK) Ltd

We would be fine with the suggested revisions from vivo.

5 – Nokia France

The first line should be changed as follows: "Specify enhancements for enabling LPHAP use-case 6s..."

6 – Qualcomm CDMA Technologies

1. "Specify solutions for support of sidelink positioning (including ranging) in NR systems..."

→ It is unclear what is meant by "NR systems". Should be clarified.

2. "Specify the protocol and procedures for SL positioning between UEs (SLPP)."

→ "SLPP" could be deleted, since this requires confirmation during WI. However, if included the abbreviation should be explained.

3. "Specify the enhancement of LPP and LMF functionalities for supporting SL positioning."

→ As already commented by others, according to the study result, it is not clear whether an enhancement of LPP is needed. The TR lists 3 options in section 5.2.2.3, which will be further discussed/down selected in normative work. Suggest using the same wording as for protocols between UEs (item 2):

”Specify the protocol and procedures for SL positioning between UEs and LMF.”

4. The draft WID lists a new specification for SLPP (38.xxx). However, according to the TR section 5.2.2.2:

”SLPP is a separate ASN.1 module from LPP (this does not necessarily imply whether it is included in TS 37.355 [16]).”

→ Suggest leaving this issue open for now, since there was no decision from RAN2 yet on whether it would be included in a separate specification or as part of LPP (TS 37.355).

7 – CATT

As been specified in R3-226887 (TP to TR), RAN3 should be involved in the work on support of the Sidelink Positioning and the Ranging Service Authorizations signalling to NG-RAN as needed. So we suggest adding one more bullet in WID as below:

- Specify the support of the Sidelink Positioning and the Ranging Service Authorizations signalling to NG-RAN as needed, taking into account SA2 decisions on this aspect. [RAN3, RAN2]

8 – Motorola Mobility Germany GmbH

[Lenovo]

Share vivo’s revisions to better reflect the RAN1 and RAN2 state of discussions.

Share a similar doubt as CATT’s comment. According to the attached RAN3 TP in R3-226887 (part of RP-222717 LS), RAN3 had listed a set of recommended WI objectives. Regarding SL Positioning, the first objective was not captured in the TR38.859 under clause 5.2.2.1 nor the WID. Is this because, this particular RAN3 recommended objective has a dependency on SA2 ?

If so, perhaps it would be better to indicate this aspect, perhaps as a sub-bullet under the main NOTE: “NOTE: RAN working groups will take into account the work from other working group SA/CT which involves the same or related objectives.” or as a separate note or as a separate bullet in WID as suggested by CATT.

9 – OPPO Beijing

- Specify support for SL PRS bandwidths of up to 100 MHz in FR1 spectrum.

->Specify support for SL PRS bandwidths of up to 100 MHz in FR1 spectrum [RAN1, RAN4].

- Study and ~~if needed~~ specify support of sensing-based resource allocation, and/or a random resource selection [RAN1].

- Support resource allocation for shared resource pool with Rel-16/17/18 sidelink communication and dedicated resource pools for SL PRS [RAN1].

10 – HUAWEI TECHNOLOGIES Co. Ltd.

The RAN3 objective should be added according to TR:

Support of sidelink positioning and ranging service authorizations signaling to NG-RAN as needed.

3.1.2 Summary from Initial Round

For questions 1 to 4 and 7 there was a high degree of consensus in the responses received and the recommendation from this discussion is clear.

For question 5 regarding the inclusion of SL-AOD, there were 9 companies expressing support and another 2 indicating that they could accept it as a second priority. A greater number of company did not support the inclusion of SL-AOD with many referring to the fact that the SI was not able to agree a recommendation for this method. Therefore the moderator's proposal from this discussion is that SL-AOD should not be included in the WI.

For question 6 regarding prioritisation of dedicated resource pools over shared resource pools, there was a degree of support (9 companies) plus a further 4 companies open to the proposal. A greater number did not support the prioritisation so the moderator's proposal is not agree this prioritisation

For question 8, there were varied responses. A number of companies acknowledged the importance of privacy considerations but were not clear what should be done within this RAN WI to address it given that privacy requirements are normally address within SA. A number of companies commented that this aspect had not been studied at all during the SI. It was clear that there was very little support to add anything the WI.

Regarding the comments on the detail wording, the rapporteur will consider these in an update of the WID text.

Moderator's proposal on sidelink positioning:

1. SL-TDOA is included in scope
2. Resource allocation scheme 2 congestion control/inter UE coordination is included in scope
3. Unlicensed spectrum is not included in scope
4. FR2 spectrum is not included in scope
5. SL-AOD is not included in scope
6. Proposal that dedicated resource pools should be treated with higher priority than shared resource pools is not agreed.
7. Proposal that combined Uu/PC5 position should be treated with a lower priority than PC5 only is not agreed Privacy aspects are not included in the WI

8. Privacy aspects are not included in the WI

3.1.3 Intermediate Round

Companies are asked to comment on the proposals from the moderator in the summary from the Initial Round.

Feedback Form 4: Sidelink positioning - high level objectives - Intermediate Round

<p>1 – AT&T GNS Belgium SPRL</p> <p>We support the moderator proposal with the exception of #5. However, since we mention in TR 38.859 that SL-AoD would be a 2nd priority, we would support having this also shown as a 2nd priority (or a RAN checkpoint to evaluate WI progress) in the WI objectives.</p>
<p>2 – Classon Consulting</p> <p>[for FUTUREWEI] we can accept</p>
<p>3 – FirstNet</p> <p>We support AT&T’s recommendations.</p>
<p>4 – Nokia France</p> <p>We support the Moderator’s proposals. We could also accept AT&T’s proposal.</p>
<p>5 – Apple France</p> <p>We are fine with the moderator’s proposals including the proposal for item 8 given that SL-TDoA is in the scope. This gives a positioning method that is entirely target UE based and as such we can support the overall scope of this agenda item.</p>
<p>6 – InterDigital</p> <p>We support the proposal from the moderator</p>
<p>7 – KT Corp.</p> <p>Moderator’s proposal are acceptable. In addition, as suggested by AT&T and others we prefer to have SL-AoD as a 2nd priority.</p>

<p>8 – ZTE Corporation</p> <p>Support Moderator’s assessment. We prefer not to include SL-AOD, this method cannot work well anyway in this Release. Let’s design it in Rel-19 since this method is mainly used for FR2. From industrial/commercial perspective, we prefer to more focus on Uu enhancement listed in other agenda rather than SL positioning</p>
<p>9 – Intel Corporation (UK) Ltd</p> <p>We can accept the proposals from the moderator.</p>
<p>10 – CATT</p> <p>For proposal 5 (SL-AoD), we prefer to keep it in the scope with 2nd priority. We are fine with other moderator’s proposals.</p>
<p>11 – New H3C Technologies Co.</p> <p>support this proposal</p>
<p>12 – Samsung R&D Institute UK</p> <p>Support the moderator’s proposal</p>
<p>13 – Samsung R&D Institute UK</p> <p>Support the moderator’s proposal</p>
<p>14 – Samsung R&D Institute UK</p> <p>Support the moderator’s proposal</p>
<p>15 – MediaTek Inc.</p> <p>OK with the moderator’s proposal.</p>
<p>16 – NTT DOCOMO INC.</p> <p>We can live with the proposal though workload of SL pos or whole pos WI is still worried...</p>
<p>17 – CEWiT</p> <p>Support the moderator proposal. But question for clarification is on FR2. Will it mean that FR2 band is explicitly precluded from scope or FR1 enhancement are applicable to the FR2 without optimization specific to FR2?</p>
<p>18 – Beijing Xiaomi Mobile Software</p> <p>Support the moderator’s proposal</p>

19 – Qualcomm CDMA Technologies

2. We propose to separate congestion control and inter-UE coordination into separate items to clarify what “in scope” means for each. In our view, congestion control is essential and “in scope” here would be interpreted as to be specified. Whereas inter-UE coordination is an enhancement and RAN1 agreed to further study in the WI phase, hence the sentence about inter-UE coordination should be clarified to say “in scope for further study”.

4. We propose to remove this bullet. FR2 spectrum does not need to be explicitly excluded. SL-PRS could still be transmitted on FR2 spectrum but without FR2 specific enhancements/optimizations (e.g., beam management).

20 – China Mobile E-Commerce Co.

6. We still prefer to prioritize dedicated RP to reduce RAN1’s workload.

21 – HUAWEI TECHNOLOGIES Co. Ltd.

We can accept moderator proposal. In our view this proposal provides tradeoff between workload and applicable scenarios.

22 – LG Electronics Inc.

For making progress, we can accept the moderator’s proposal.

23 – OPPO Beijing

3. Although we prefer to have a study objective in Rel-18 for unlicensed spectrum, considering the workload, we are fine to defer this feature to next release.

4. Basic sidelink transmission has already been supported on FR2 from Rel-16, beam management being discussed in SL_enh WI is further enhancement for FR2. For SL positioning, which is built on the basis of SL communication, FR2 (w/o beam management) should be supported.

24 – NEC Corporation

We can accept the proposals from the moderator.

25 – Motorola Mobility Germany GmbH

[Lenovo]

Support Moderator’s Proposals from the Initial Round. We are also fine with AT&T’s suggestion on DL-AoD.

26 – Sony Europe B.V.

We accept the moderator’s proposal. We consider the 2nd priority aspect in #6 and #7 means we will start the WI with the 1st priority items and followed by the 2nd priority one.

<p>27 – Sony Europe B.V.</p> <p>We accept the moderator’s proposal. We consider the 2nd priority aspect in #6 and #7 means we will start the WI with the 1st priority items and followed by the 2nd priority one.</p>
<p>28 – Sony Europe B.V.</p> <p>We accept the moderator’s proposal. We consider the 2nd priority aspect in #6 and #7 means we will start the WI with the 1st priority items and followed by the 2nd priority one.</p>
<p>29 – Erik Sunell Consulting</p> <p>[On behalf of TOYOTA Info Technology Center]</p> <p>We support the moderator’s proposal.</p>
<p>30 – Ericsson LM</p> <p>Agree with the moderator’s proposal on all 8 points.</p>
<p>31 – Philips International B.V.</p> <p>We accept the moderator’s proposal. For #7 it seems logical to us to focus initially on PC5-only and Uu/PC5 later but, for progress, we can go with the majority view.</p>
<p>32 – Fraunhofer IIS</p> <p>We are fine with the moderator’s proposal.</p>
<p>33 – Deutsche Telekom AG</p> <p>BRAVO !</p> <p>Nice down - selection !!!</p> <p>(-> we could even drop the entire topic from Rel-18 to ne honest !)</p>

Companies may continue to make comments to the detail text of the WID.

**Feedback Form 5: Sidelink positioning - Comments to WID
text - Intermediate Round**

<p>1 – Nokia France</p> <p>Our comments were already made in the initial round. It would be helpful to see an updated draft WID before commenting further.</p>
<p>2 – Intel Corporation (UK) Ltd</p>

Considering the comments during Initial round, we recommend the following modifications:

- Specify ~~methods and~~ measurements to support RTT-type solutions using SL, SL-AoA, ~~and SL-TDOA~~ [RAN1, RAN2].
- Specify the protocol and procedures for SL positioning between UEs (**Protocol for Sidelink positioning procedures (SLPP)**).
- Specify the ~~enhancement of LPP and LMF functionalities for supporting SL positioning~~ **protocol and procedures for SL positioning between UEs and LMF**.

To respond to the comment from **Qualcomm** on the phrase “in NR systems” in the first bullet, it is relevant to the discussion in RAN2 on whether LTE PC5 is in scope or not. RAN2 decided not to work on LTE PC5 during the Study Item and the current phrase in the first bullet follows from this.

Also, we recommend adding the following objective.

- **Support of sidelink positioning and ranging service authorizations signaling to NG-RAN as needed.** [RAN3, RAN2]

@Lenovo/MotMob: The related statement from RAN3 is captured in the TR in Subclause 5.4:

“From the perspective of NG-RAN interface, the following have been identified to have potential specification impact for support of sidelink positioning:

- *Support of sidelink positioning and ranging service authorizations signaling to NG-RAN as needed.”*

3 – Intel Corporation (UK) Ltd

On new specs for SLPP:

RAN2 has agreed to introduce a new protocol for sidelink positioning procedure between UEs, and also a separate ASN.1 module although it is still open on whether it should be included in TS37.355. To our understanding, separate specification is the cleanest way since the procedure and ASN.1 of SLPP will be specified separately from LPP.

4 – CATT

We suggest adding one more bullet in WID as below, since RAN3 should be involved in the work on support of the Sidelink Positioning and the Ranging Service Authorizations signalling to NG-RAN as needed, specified in R3-226887 (TP to TR):

- Specify the support of the Sidelink Positioning and the Ranging Service Authorizations signalling to NG-RAN as needed, taking into account SA2 decisions on this aspect. [RAN3, RAN2]

5 – MediaTek Inc.

To Intel’s comments, we continue to think that SLPP is a problematic name (acronym collision) and it shouldn’t be built into the WID without more discussion. We would prefer to keep the objective as ”Specify the protocol and procedures for SL positioning between UEs”.

3.1.4 Summary from Intermediate Round

For the high level objectives the conclusion from the intermediate round and the Wednesday GTW discussion of RP-223446

Conclusions on sidelink positioning:

1. SL-TDOA is included in scope
2. Resource allocation scheme 2 congestion control/inter UE coordination is included in scope
3. Unlicensed spectrum is not included in scope
4. FR2 spectrum specific enhancements are not included in scope (but there would be no explicit restrictions against transmission of SL-PRS in FR2)
5. SL-AOD is not included in scope
6. Proposal that dedicated resource pools should be treated with higher priority than shared resource pools is not agreed.
7. Proposal that combined Uu/PC5 position should be treated with a lower priority than PC5 only is not agreed
8. Privacy aspects are not included in the WI

The rapporteur will update the WID to reflect these conclusions and also take into account the detail comments to the WID text.

3.1.5 Final Round

Companies are asked to comment on the updated WID shared at after the intermediate round.

Feedback Form 6: Sidelink positioning - Final Round

1 – AT&T GNS Belgium SPRL

Firstly, thank you Richard for all of the efforts in moderating this extensive discussion. Given some of the other potential enhancements and accuracy related objectives, we are ok to leave SL-AoD out of the Rel-18 scope and consider it for a future release. We support the proposal.

2 – ZTE Corporation

For the wording of the updated WID, we have the following comments:

(1) Sorry for the comment on TU allocation here. We suggest to start RAN3 discussion later than RAN1/RAN2, e.g. starts from Q2 2023 or decide the TU allocation in March RAN meeting. That is because RAN3 highly relies on RAN1/2's progress as RAN3 chair commented during GTW. Without details of RAN1/2 agreements, it is hard for RAN3 to get efficient discussion and progress. If we can decide TU budget in next March for RAN3, maybe more suitable TU allocation can be determined, e.g. more than 0.5 TUs may be needed depending on the outcome of RAN1/2.

(2) For SL: we prefer to change the new note as 'Note: optimization specifically for SL positioning in FR2 is precluded' to more align with the outcome in GTW

3 – OPPO Beijing

Our comments are as below, most of them have been raised in the first round:

1. Channel bandwidth is defined by RAN4, so far the max bandwidth defined by RAN4 in FR1 for SL is 40MHz, therefore, RAN4 should be involved for the sub-bullet “Specify support for SL PRS bandwidths of up to 100 MHz in FR1 spectrum”.

2. At least one of sensing-based or random should be specified, otherwise there is no scheme 2:

“Study and ~~if needed~~ specify support of sensing-based resource allocation, and/or a random resource selection [RAN1].”

3. In the last GTW it has been agreed that both congestion control and inter-UE coordination are included:

”Study and ~~if necessary~~, specify solutions for congestion control for SL PRS and/or inter-UE coordination [RAN1].”

4. It is better to align the wording as that in the NOTE of the sub-bullet:

”Support resource allocation for shared resource pool with Rel-16/17/18 sidelink communication and dedicated resource pools for SL PRS [RAN1]”

4 – NTT DOCOMO INC.

Generally fine, but some comments.

- Probably ‘no FR2 specific requirements to be specified’ should be ‘no FR2 specific **enhancements** to be specified’

- Is there any reason/necessity to study further sensing-based/random RA and congestion control/IUC? Why directly ‘specify’ is insufficient?

- For shared/dedicated resource pools, we prefer OPPO’s suggesting text to have common understanding.

5 – CATT

Fine with the objectives for SL positioning in draft WID with few editorial changes:

- Study and if needed, specify support of sensing-based resource allocation, and/or a random resource selection [RAN1].

- Study and if necessary, specify solutions for congestion control for SL PRS and/or inter-UE coordination for SL PRS [RAN1].

6 – Samsung R&D Institute UK

Thanks for the discussion. Our previous suggestion in the below (marked in bold) was not reflected.

- Specify SL PRS for support of sidelink positioning such that the SL PRS uses a comb-based (**including full RE mapping pattern**) frequency domain structure and a pseudorandom-based sequence where the existing sequence of DL-PRS is used as a starting point [RAN1].

We suggested this update (red marked) since TR says that the following was studied: “ $N \geq 1$ (where $N=1$ corresponds to full RE mapping pattern)”

We have one clarification question. Without this update, full RE mapping pattern is not precluded. Is it correct understanding? If ‘Yes’, we can live with current WID.

7 – LG Electronics UK

We agree to OPPO’s comments #2 (deletion of “if needed”), #3 (deletion of “if necessary”), #4 (clarification of shared resource pool), and DOCOMO’s first comment (change to “no FR2 specific enhancements”).

On the RAN4-related part, we think the last bullet generally covers all the necessary core part work; we can add RF aspects to it. With this, new RF requirements in support of transmitting and receiving up to 100 MHz sidelink PRS can be covered. Also, it seems a bit unclear if RAN4 work is also limited to FR1 and we need to clarify it as follows:

Specify corresponding new core requirements for FR1, as well as discuss and identify the impact on the existing RAN4 specification, including RRM measurements and procedures as well as RF aspects [RAN4].

8 – LG Electronics UK

We would like to add one more comment. As RAN1 recommended both sensing-based and random resource allocations, we think normative work needs to start for both operations.

Study and ~~if needed~~ specify support of sensing-based resource allocation, and/or a random resource selection [RAN1].

9 – Intel Corporation (UK) Ltd

@Samsung: (*Rapporteur’s note*) Thanks and sorry for missing it in previous round. The proposed clarification text in the parentheses “(including full RE mapping pattern)” can be added in the next update.

We are also okay to remove “if needed”/“if necessary” phrases pointed out by OPPO.

10 – MediaTek Inc.

The WID is generally OK with a few detailed points to be raised. We agree with OPPO’s comments 2/3/4 and DOCOMO’s first comment; also, we are still concerned with the name “SLPP” because of the colliding acronym.

11 – Qualcomm CDMA Technologies

We are fine with the SL objective in the updated WID.

12 – Nokia France

We agree with the three points made by Docomo.

In addition, for the newly-added penultimate bullet, we propose the following polishing of the wording:

- ~~Specify signalling to NG-RAN for support of sidelink positioning and ranging service authorizations~~
~~signaling to NG-RAN as needed. [RAN3, RAN2]~~

13 – CATT

There is a new specification for SLPP in the draft WID. However some companies showed the concern and thought 37.355 can be reused for SLPP. If new specification creating should be decided by RAN plenary, it is proposed to discuss the issue at the online session on Friday, i.e. make the decision on whether a new spec would be built for SLPP.

14 – Nokia France

Also, for the last bullet:

Specify corresponding new core requirements, as well as ~~discuss and~~ identifying and specifying the impact on the existing RAN4 specifications, including RRM measurements and procedures [RAN4].

15 – Sony Europe B.V.

Generally OK. We also suggest to update the following:

- Study and ~~if needed~~ specify support of sensing-based resource allocation, and/or a random resource selection [RAN1].
- Study and ~~if necessary~~, specify solutions for congestion control for SL PRS and/or inter-UE coordination [RAN1].

16 – Motorola Mobility Germany GmbH

[Lenovo]:

Generally supportive of the updated WID text. Just a few comments:

- 1) On the first note, It would also be beneficial to clarify that no specific optimizations are to be specified as well as follows: “NOTE: SL PRS transmission in FR2 is not precluded but no FR2 specific requirements/optimizations to be specified.”
- 2) For the bullet resource allocation mechanism for SL PRS in Scheme 2, the study and if needed portion of the text can be removed, since the sensing/random resource reselection techniques are absolutely needed for Scheme 2 to operate.
- 3) Editorial: On 5th sub-bullet “*many to one*” may be edited to “*many-to-one*”

17 – Ericsson LM

OK with the conclusions. Regarding the WID objective, we have the following comments:

- 1) we agree with Docomo that the wording for the note on FR2 should be updated from “requirements” to “enhancements”. Considering the note, we think we can strike out “in FR1 spectrum”, if FR2 is not precluded.

2) remove “if needed” from the sensing and congestion control, which are clearly needed at least for shared resource pools.

3) remove “at least”, for power control of SL PRS, we have never studied closed loop PC and only recommended OLPC.

4) since one of the objective is to specify SLPP *between two UEs*, we think the following objective should clarify what protocol should be updated:

- Specify the protocol and procedures for SL positioning between UEs and LMF

We propose the following rewording:

- Specify **LPP extensions or enhancements for the support of** protocol and procedures for SL positioning between UEs and LMF

- o **NOTE : possible LPP enhancements or extensions are listed in 38.859, section 5.2.2.3**

5) we wonder if RAN2 needs to be added for the first sub-bullet, considering at least the configuration of the SL PRS in scheme 1 will come from the gNB.

6) for broadcast support, there was an LS sent from RAN2 to SA2/3 during the November meeting on the feasibility of broadcast considering security. We propose adding a note that the response to this LS should be taken into account when deciding how /whether to specify broadcast support.

- Specify signalling and associated UE behavior for support of unicast, groupcast (not including many to one) and broadcast of SL PRS transmissions [RAN1, RAN2].

- o **NOTE: RAN WGs to take into account SA2/3 input regarding the feasibility of broadcast.**

18 – Philips International B.V.

We support the objectives in the updated WID.

19 – Classon Consulting

[for FUTUREWEI], generally OK, can remove the “if needed” as pointed out by OPPO

3.1.6 Summary from Final Round

The main discussion was around the text on FR2. The moderator’s understanding is that the intention is to avoid any FR2 related discussion in the WGs in order to control workload. If the work for FR1 results in a spec that would allow for DL-PRS transmission in FR2 then this would not be precluded. The moderator’s concern is that the proposed changes to this bullet would open the door to FR2 discussions based on the argument that they are not enhancements. Therefore the moderator’s proposal is that keep the text introduced after the Wednesday GTW.

There was also some discussion of RAN4 responsibility. The moderator proposes that the final objective for RAN4 should be enough to capture all of RAN4's work arising any of the other sub-objectives.

Other more minor text proposals have been reflected in the updated WID as appropriate.

3.2 Integrity for RAN dependent positioning

3.2.1 Initial Round

Many company contributions expressed support for the inclusion of an objective on Integrity for RAN dependent positioning:

- Intel (2984), AT&T/Firstnet (3007), Xiaomi (3017), Spreadtrum (3035), CMCC (3042), vivo (3095), Qualcomm (3124), CATT(3135), docomo(3163), MediaTek(3244), Ericsson (3286), Futurewei (3336), Lenovo (3360), Samsung (3085)

No company contribution expressed the view that this should not be included in the WI, and furthermore, company contributions didn't comment at a high level on the objectives. Therefore, the moderator proposal is that this will be included in the WID and companies are requested to provide detail comments to the text proposed by the rapporteurs in RP-222983.

Feedback Form 7: Integrity for RAN dependent positioning - Comments to WID text - Initial Round

1 – vivo Mobile Communication Co. We are fine with the wording from the moderator
2 – Ericsson LM We support the objective as worded in the draft WID. We think that RAN1 should not be included in the list of WGs for this objective, i.e. no agenda item is needed in RAN1 for integrity (LSs should be enough).
3 – Classon Consulting [for FUTUREWEI] support along with other WG recommendations
4 – MediaTek Inc. We are OK with the wording in the draft WID.
5 – AT&T GNS Belgium SPRL We support the proposal and the wording in the draft WID.
6 – InterDigital We support the moderator's proposal and RAN1 should be included in the list of WGs as there is work to be finished by RAN1 including details of error models and error distribution for AoA based positioning method. RAN1 can start work on those issues without waiting for RAN2 to trigger.

<p>7 – Beijing Xiaomi Mobile Software</p> <p>We support the moderator’s proposal and the wording in the draft WID.</p>
<p>8 – China Mobile E-Commerce Co.</p> <p>We are fine with the wording in the draft WID.</p>
<p>9 – Guangdong OPPO Mobile Telecom.</p> <p>We are OK with the wording in the draft WID.</p>
<p>10 – Samsung R&D Institute UK</p> <p>Thanks for the discussion. In our understanding, no recommended RAN1 work for integrity. So, we suggest to delete RAN1 as</p> <p>Specify the error modelling parameters, signalling, and procedures to support UE-based and LMF-based integrity of RAT-dependent positioning methods [RAN2, RAN3, RAN1].</p>
<p>11 – Intel Corporation (UK) Ltd</p> <p>We are fine with the current description in the draft WID. It would be safer to include RAN1 as there are some left-overs requiring RAN1 time.</p>
<p>12 – SHARP Corporation</p> <p>We support the proposal.</p>
<p>13 – Spreadtrum Communications</p> <p>We are fine with the wording in the draft WID</p>
<p>14 – NTT DOCOMO INC.</p> <p>We support the moderator’s proposal.</p>
<p>15 – CATT</p> <p>We are fine with the wording in the draft WID. Also fine not to explicitly include RAN1 in the list of WGs.</p>
<p>16 – Nokia France</p> <p>Overall we do not see this being among the highest priority topics based on the discussions during the study item.</p>
<p>17 – Qualcomm CDMA Technologies</p> <p>Although, LMF-based integrity was recommended for normative work, we would also be O.K. to exclude LMF-based integrity or treat it as 2nd priority, if required to manage workload (e.g., since RAN1 work would be required for additional UE reporting).</p>

18 – Sony Europe B.V.

In principle, we support the moderator’s proposal. Most of RAN1 work has been completed during SI phase. Hence, we prefer to delete RAN1. RAN1 task (if any) can be triggered by the LS from other WG(s).

19 – Motorola Mobility Germany GmbH

[Lenovo]

Supportive of the objective in principle.

On the proposed wording of the objective in RP-222983, it is not clear as to the meaning and applicability of “error modelling parameters” since this has already been performed by RAN1 during the study phase and it is also unclear if this applies to other techniques outside of RAT-dependent techniques. Suggest to add the following more high-level wording to better clarify:

“Specify the ~~error modelling~~ *RAT-dependent integrity* parameters, signalling, and procedures to support UE-based and LMF-based integrity of RAT-dependent positioning methods [RAN2, RAN3, RAN1]”.

We also tend to share the view that the majority of the work has been completed in RAN1. Sony’s view that perhaps the remaining aspects (if any) can be managed via LSs is also reasonable from our side.

20 – Deutsche Telekom AG

We do not support this in Rel-18

21 – HUAWEI TECHNOLOGIES Co. Ltd.

We support the suggested revision from a number of companies that there is no need to explicitly list RAN1 as impacted working group. [RAN2, RAN3, ~~RAN1~~].

Apart from the above revision, we would like to highlight that RAN2 work was clearly identified in the study, and basically Rel-17 mechanisms will be reused. So from our view, though RAN2 is listed as leading working group. RAN2 work for this objective is rather limited.

22 – Philips International B.V.

We support the proposal.

3.2.2 Summary from Initial Round

Most companies are supporting of the objective and many are happy with the rapporteur’s wording, One company does not support the objective. The rapporteur will consider comments on the detail wording an update of the WID text.

3.2.3 Intermediate Round

Companies may continue to make comments to the detail text of the WID.

Feedback Form 8: Integrity for RAN dependent positioning - Comments to WID text - Intermediate Round

<p>1 – VODAFONE Group Plc</p> <p>We are also ok with moderator summary</p>
<p>2 – AT&T GNS Belgium SPRL</p> <p>We support the moderator’s summary and the wording in the draft WID.</p>
<p>3 – Classon Consulting</p> <p>[for FUTUREWEI] OK</p>
<p>4 – FirstNet</p> <p>We support the moderator’s summary and the wording in the draft WID.</p>
<p>5 – Nokia France</p> <p>We are OK with the conclusion of the initial round.</p>
<p>6 – Apple France</p> <p>We are fine with the moderator’s summary</p>
<p>7 – ZTE Corporation</p> <p>RAN1 should be the second work group in WI.</p> <p>In SI, RAN1 did simulation, and make agreement for error distribution of some error sources either. However, all the details of the error distribution for AOA, timing measurement, etc. are not determined yet. I am wondering how RAN2 decide the details of error distribution, e.g. the candidate values of mean, standard deviation. Those should belong to RAN1 discussion.</p> <p>Furthermore, for error distribution of AOA measurement, two candidates are agreed as below in RAN1. The down-selection should be further decided in RAN1 in WI which may be based on simulation. We don’t think RAN2 can do such decision.</p> <ul style="list-style-type: none">- Alt. 1: No conversion (e.g., the measurement error is expressed as error in AoA or ZoA in LCS/GCS)- Alt. 2: conversion function (defined as function of AoA/ZoA in LCS). <p>In short, we believe RAN1 should be included at least in the first one or two meetings in WI. Only LS is not sufficient.</p>
<p>8 – InterDigital</p> <p>We support moderator’s summary and also agree with ZTE regarding remaining work for RAN1 and RAN1 as listed WG .</p>

<p>9 – Intel Corporation (UK) Ltd</p> <p>We are okay with the summary from the moderator and support the text in the draft WID.</p>
<p>10 – CATT</p> <p>We are fine with the wording in the draft WID. Also fine not to explicitly include RAN1 in the list of WGs.</p>
<p>11 – New H3C Technologies Co.</p> <p>we are fine with FL summary</p>
<p>12 – Samsung R&D Institute UK</p> <p>We find with the moderator’s summary. Also, we prefer RAN1 is not included in the list of WGs.</p>
<p>13 – MediaTek Inc.</p> <p>We are fine with the moderator’s summary. We would prefer to include RAN1 as an involved WG; some work from RAN1 will be needed, and it seems safer not to have hidden impact of the objective.</p>
<p>14 – Beijing Xiaomi Mobile Software</p> <p>We support the moderator’s summary and prefer to include RAN1 as the second WG.</p>
<p>15 – Beijing Xiaomi Mobile Software</p> <p>We support the moderator’s summary and prefer to include RAN1 as the second WG.</p>
<p>16 – Beijing Xiaomi Mobile Software</p> <p>We support the moderator’s summary and prefer to include RAN1 as the second WG.</p>
<p>17 – NTT DOCOMO INC.</p> <p>We support the moderator’s summary and the wording in the draft WID.</p>
<p>18 – HUAWEI TECHNOLOGIES Co. Ltd.</p> <p>We support moderator summary. As we suggested in the initial round, we prefer not to list RAN1 as impacted working group [RAN2, RAN3, RAN1].</p>
<p>19 – OPPO Beijing</p> <p>We support the moderator’s summary and the wording in the draft WID.</p>
<p>20 – LG Electronics Inc.</p> <p>As pointed out by several companies, there is no need to explicitly include RAN1 in the list of WGs. We tend to agree that RAN1 work triggered by LS would be enough to handle remaining/additional issues, if necessary.</p>

21 – Motorola Mobility Germany GmbH

[Lenovo]:

Just to re-iterate the comment made in the previous round regarding the wording update of the WID text. On the proposed wording of the objective in RP-222983, it is not clear as to the meaning and applicability of “error modelling parameters” since this has already been performed by RAN1 during the study phase and it is also unclear if this applies to other techniques outside of RAT-dependent techniques (although the study was only applicable to RAT-dependent techniques). Suggest to add the following more high-level wording to better clarify:

“Specify the *error-modelling* required RAT-dependent integrity parameters, signalling, and procedures to support UE-based and LMF-based integrity of RAT-dependent positioning methods [RAN2, RAN3, RAN4]”.

We also tend to share the view, that the majority of the work has been completed in RAN1 and there is no need for RAN1 involvement.

22 – Motorola Mobility Germany GmbH

[Lenovo]:

Just to re-iterate the comment made in the previous round regarding the wording update of the WID text. On the proposed wording of the objective in RP-222983, it is not clear as to the meaning and applicability of “error modelling parameters” since this has already been performed by RAN1 during the study phase and it is also unclear if this applies to other techniques outside of RAT-dependent techniques (although the study was only applicable to RAT-dependent techniques). Suggest to add the following more high-level wording to better clarify:

“Specify the *error-modelling* required RAT-dependent integrity parameters, signalling, and procedures to support UE-based and LMF-based integrity of RAT-dependent positioning methods [RAN2, RAN3, RAN4]”.

We also tend to share the view, that the majority of the work has been completed in RAN1 and there is no need for RAN1 involvement.

23 – Sony Europe B.V.

We support the moderator’s summary.

24 – Ericsson LM

OK with the rapporteur’s summary. As commented in the previous round, we do not think RAN1 needs to be listed for this objective in the WID.

3.2.4 Summary from Intermediate Round

The main open question regarding Integrity for RAN dependent positioning seems to be whether there is a need for RAN1 involvement in the objective. Therefore, for the final round companies are asked to express their view in the need for RAN1 involvement.

3.2.5 Final Round

Companies may continue to make comments to the detail text of the WID. Specifically companies are asked to express their view in the need for RAN1 involvement in this objective.

Feedback Form 9: Integrity for RAN dependent positioning - Final round

1 – AT&T GNS Belgium SPRL

Per our proposal in RP-223007, we **do not** see the need for RAN1 to be explicitly included in this objective. This is based on the conclusions of the SI phase and the aspects that RAN1 already studied/completed on, e.g., error sources, etc. and if clarifications are necessary, RAN2/RAN3 can send an LS to RAN1 for checking.

2 – ZTE Corporation

We don't think RAN1 has completed the job in SI. At least we need to decide the following issues in RAN1 during WI:

- (1) whether conversion function is needed for AOA/ZOA measurement error distribution, if yes, what is the details of the conversion function. If no, normal distribution is used for AOA and ZOA respectively?
- (2) the details of synchronization error distribution (uniform or normal distribution?), timing measurement error distribution for TDOA and Multi-RTT, i.e. what is value range of the mean and std?

We think these issues should be completed in the first one or two RAN1 meetings, rather than RAN1 waiting for the LS from RAN2.

3 – NTT DOCOMO INC.

In our understanding, the work is mostly related to assistance data enhancements. We guess the RAN1's work is not clear at this moment. To offload RAN1's workload, LS-based discussion in RAN1 may be reasonable for this item.

4 – CATT

We are fine to include RAN1 in integrity objective since the error modelling parameters in WID relies on RAN1.

5 – InterDigital

It is very clear that RAN1 should work on at least error distributions for AoA measurement and SFN initialization time, and the value range of mean/standard deviation for all distributions of the identified error sources. Removing RAN1 from the WG list is just looks like hiding the workload no matter how big or small as RAN1 workload will be the same whether it is triggered by RAN2 LS or just started from RAN1. To avoid any hidden workload, we should include RAN1 in the WG list and take it into account for the TU budget properly even if it requires small TU.

We also agree with ZTE that RAN1 should start the work earlier rather than waiting for the LS from RAN2.

6 – Samsung R&D Institute UK

We have supported to remove RAN1 so far since normative RAN1 work was not recommended. However, now we think there would be potential RAN1 work for error distribution modeling and many other RAN1 works triggered by RAN2 request. In this regard, it would be better to include RAN1 as the responsible working group. Since including both bandwidth aggregation and CPP clearly increases workload, RAN1 needs to be included to estimate RAN1 workload clearly rather than to hide the workload.

7 – vivo Mobile Communication Co.

We originally believe RAN1 should not be involved to alleviate the workload. But it seems now everything is explicitly indicated with RAN1 involvement.

For this specific topic for integrity, our understanding is that there are remaining issues, e.g., AoA measurement error that needs additional RAN1 work. If RAN1 is not explicitly involved for this topic, then there is potential problem that this topic would have lower priority than other with explicitly mentioned ones.

Thus for now we strongly support to include RAN1 as the WGs involved.

8 – Intel Corporation (UK) Ltd

We support to explicitly capture RAN1 as a responsible WG and should not hide RAN1 work since, as also pointed out by ZTE, there are some elements that RAN1 needs to work on as continuation of the study. Regarding the wording of the objective, we think “error modelling parameters” should be included to reflect that RAN2 (with further necessary inputs from RAN1) would still need to define the models, e.g., by proper parameterization of the error distributions identified by RAN1.

9 – MediaTek Inc.

We agree with other companies expressing the need to identify RAN1 as an involved WG. Otherwise OK.

10 – Qualcomm CDMA Technologies

O.K. to remove RAN1. If RAN1 input should be required during the work, RAN2 could send an LS to RAN1.

11 – Nokia France

We do not see a need for RAN1 involvement. RAN1 has already identified error sources and modelled them. RAN2 can work on specifying signalling and procedures, and if any need arises for RAN1 to be involved, it can be handled by LSs.

12 – Sony Europe B.V.

As expressed in the previous rounds, in our view, RAN1 does not have to be explicitly written. This could reduce the overall work load. RAN1 work can be triggered by LS (if any).

13 – Beijing Xiaomi Mobile Software

We support to explicitly include RAN1 as an involved WG.

14 – Motorola Mobility Germany GmbH

[Lenovo]:

We also tend to share the view that the majority of the work has been completed in RAN1. We are fine to remove RAN1, otherwise a similar NOTE as LPHAP may be added: “NOTE: Inputs from RAN1 as necessary may be facilitated via LSs”

15 – Ericsson LM

The wording in the WID says that the modelling parameters, signalling and procedure should be specified. It seems RAN1 is not involved in these steps. RAN1 already provided the model distributions, and there will be a parameter LS to RAN2 form RAN1 as usual. We agree with the many companies above and suggest removing RAN1 to remove at least the agenda item from the WG, and handle any open issue with RAN2 LSs.

3.2.6 Summary from Final Round

Regarding the explicit question from the moderator on listing RAN1 in the objective, not all companies share a view. Of those that shared a view, a large majority thought that RAN1 should not be listed. It is of course still possible for RAN2 to send an LS to RAN1 to initiate some work if found necessary. Based on this the moderator concludes that RAN should not be listed in the objective.

One other comment proposal was made about changing 'error modelling parameters' to 'RAT dependent integrity parameters'. This comment had also been made in earlier rounds and not commented by any other companies, to the moderator concludes that this is not an critical change.

3.3 LPHAP

3.3.1 Initial Round

Companies are requested to provide comments on the high level objectives for LPHAP (not commenting on the detail wording of the text for which a separate feedback form is provided). Specifically companies are requested to comment on the following (noting that it is not necessary to comment simply to repeat a company position that is already correctly captured in the summary):

1. DRX in RRC_INACTIVE beyond 10.24s. This was the only objective within LPHAP which was not included as blue text within the rapporteur's draft WID. Views from the contributions are summarised below:
 - a) Supportive to include: Intel (2984), Huawei (3005), vivo (3095), ZTE (3255) (other companies may have been implicitly supportive based on supporting recommendations from the study).
 - b) Not supportive to include: Qualcomm (3124)
2. SRS configuration enhancements for UL and DL+UL positioning in RRC_INACTIVE based on validity area (blue text within the rapporteur's draft WID). Views from the contributions are summarised below:

- a) Supportive to include: Intel (2984), Nokia (2991), Huawei (3005), AT&T/Firstnet (3007), Xiaomi (3017), vivo (3095), Qualcomm (3124), OPPO(3020), LG(3121)
 - b) Not supportive to include: Ericsson (3286)
3. DL-PRS measurements in RRC_IDLE (blue text within the rapporteur's draft WID). Views from the contributions are summarised below:
- a) Supportive to include: Intel (2984), Huawei (3005), AT&T/Firstnet (3007), Xiaomi (3017), vivo (3095), Qualcomm (3124), docomo(3163), MediaTek(3244), ZTE (3255), Ericsson (3286), LG(3121)
4. Alignment between DRX and PRS configurations (blue text within the rapporteur's draft WID). Views from the contributions are summarised below:
- a) Supportive to include: Intel (2984), Huawei (3005), AT&T/Firstnet (3007), Xiaomi (3017), vivo (3095), Qualcomm (3124), ZTE (3255), Ericsson (3286), LG(3121)
5. Skipping paging reception in RRC_INACTIVE (blue text within the rapporteur's draft WID). Views from the contributions are summarised below:
- a) Supportive to include: Huawei (3005), Xiaomi (3017), CMCC (3042)
 - b) Not supportive to include: Intel(2984), vivo (3095), Qualcomm (3124), Ericsson (3286)
 - c) Study and if needed specify: ZTE (3255)
6. DL PRS configuration with 1-symbol PRS (not covered within the rapporteur's draft WID). Views from the contributions are summarised below:
- a) Supportive: Huawei (3005), Xiaomi (3017), CMCC (3042), ZTE (3255)
 - b) Not supportive: Qualcomm (3124)
7. Study UL positioning in RRC_IDLE (not covered within the rapporteur's draft WID). Proposed by CMCC (3042)
8. Others. Companies may comments on other high level aspects of the objectives for sidelink positioning

Feedback Form 10: LPHAP - Comments to high level objectives - Initial Round

1 – ZTE Corporation

1. It should be clarified the enhancement in this WID should be on positioning, rather only support eDRX with >10.24s. We suggest to follow the wording of the TR, i.e. 'LPHAP and is recommended for normative work **on Rel-18 positioning enhancements** from RAN1's perspective'
2. Support as it is recommended by both RAN1 and RAN2. The candidate solutions can be further down-selected/discussed in WI.
5. Support, we can use the wording of the TR. Further discussion can be continued in RAN1.
6. Support, we can use the wording of the TR. Further discussion can be continued in RAN1. This is a very simple solution, but it is very useful for power saving, resource overhead reduction, capacity improvement, also useful for RedCap since it reduces PRS gaps.
7. This was not discussed in SI at all. We prefer not to include this bullet in WID.

2 – vivo Mobile Communication Co.

We think all recommendations should be kept except paging skipping which needs further confirmation of RAN1. So, the following features should be included

- DRX in RRC_INACTIVE beyond 10.24s. It should be kept since it is the most important enhancement towards LPHAP power consumption requirement. The main feature of extending DRX cycle beyond 10.24s may be defined as part of Rel-18 WI on eRedCap, and the impact on positioning should be specified in as part of Rel-18 WI on expanded and improved NR positioning.
- SRS configuration across cells. It should be kept since it is both recommended by RAN1 and RAN2, and the feasibility has been confirmed by RAN1.
- DL PRS measurement in RRC_IDLE. No company seems to object
- Alignment between DRX and PRS configurations. No company seems to object

3 – Ericsson LM

- 1a: We are fine if it is covered by RedCap.
- 2a: To minimize workload, we should avoid UL SRS validity area feature.
- 3 and 4: We are supportive
- 5: To minimize workload and as this is non-positioning specific; we should avoid this.
- 6: We support 1-symbol PRS.
- 7: To minimize workload, we should avoid UL positioning in RRC_IDLE.

4 – Fraunhofer IIS

We think at least 2) and 3) should be within the scope of the WID.

5 – Classon Consulting

[For FUTUREWEI] Support all

6 – MediaTek Inc.

There were a lot of recommended enhancements under LPHAP, and we think some downselection is necessary. It makes sense to prioritise the enhancements that were recommended by both RAN1 and RAN2.

- 1. We understand several companies have expressed a view that this objective could be included in the positioning WID but coordinated with the RedCap WI, which would limit the impact on the positioning WI. We would be OK with this way forward.
- 2. MediaTek are also supportive of this objective.
- 3. Support this objective as a low-impact enhancement.
- 4-7. We see the benefits of these putative objectives, but to avoid overload, we think they could be down-scoped for this release.

7 – TELECOM ITALIA S.p.A.

We have a strong concern on the workload and the number of objectives is not sustainable. We should keep at maximum 1-3 objectives. The proposal from Mediatek could be an acceptable way forward

8 – InterDigital

1-4: We are ok to include the objective in WID

5-7: If the workload is reasonable, we are supportive to include

9 – Beijing Xiaomi Mobile Software

We are supportive for all the objectives except objective 7 since we didn't make any conclusion on the UL positioning in RRC_IDLE. However, if we have to down scope the LPHAP, we think at least objectives 1-3 should be included.

10 – China Mobile E-Commerce Co.

In general, all recommended solutions should be treated equally and included in the WID.

1. We think that it can be covered by the scope of R18 RedCap.

2. Support. SRS enhancement was recommended by both RAN1 and RAN2 and should be specified in the normative work.

3. Support. DL measurements in RRC_IDLE state was recommended by both RAN1 and RAN2 and should be specified in the normative work.

4. Support.

5. Support. RAN2 concluded that paging skipping is recommended for normative work if its feasibility and benefits are confirmed by RAN1. In RAN1, we have results on paging skipping with significant gains, but RAN1 just had no time to further check the feasibility. In our views, it is unfair to preclude such objective in this stage, as this is a RAN2 led objective. We suggest that at least we can spend 1 RAN1 meeting to confirm the feasibility on paging skipping.

6. Support. The conclusion on 1-symbol PRS from RAN1 is that it can be studied and specified if needed, we have such objectives in Rel-17, such as the multipath/NLOS mitigation. I think it is no harm to include this in LPHAP because it shows gains in RAN1 and it has very limited normative workload.

11 – Samsung R&D Institute UK

Thanks for the discussion. Basically, we are OK to include the recommended work for LPHAP. However, in case of the paging skipping, it was captured in TR with the condition 'if feasible and beneficial from RAN1's perspective' and in our understanding there seems no consensus on the benefit of specifying this in RAN1. In RAN1 aspect, it's not quite clear what paging skipping exactly means. Rel-17 supported paging skipping already by PEI, so not sure what extra paging skipping means here.

12 – Intel Corporation (UK) Ltd

1. We support the objective as it is the single most significant feature towards achieving the target battery lifetimes for LPHAP use-case 6. In our view, most of the work to introduce the feature may be performed as part of Rel-18 WI on eRedCap while as part of Rel-18 positioning, the work can be limited to determination of specific values of eDRX relevant to LPHAP and associated UE capabilities (the work in eRedCap is expected to be limited for RedCap UEs only).

2. We support to include the objective on SRS configuration enhancements. Although some further studies are necessary in RAN1 to address aspects on interference, TA, spatial relations, pathloss reference, etc., most of these may even be addressed by proper NW implementation in appropriate scenarios and thus, should not be a roadblock to the basic feature that can relax the current requirement of obtaining new configuration of SRS for positioning upon change of cells under certain conditions.

3. Support to include if there may be room.

4. Support to include if there may be room.

5. Paging skipping feature is an asymptotic extension of the first objective, and in our view, it would be sufficient to just work on the first objective (extending DRX cycles beyond 10.24 s). With choices of proper DRX cycles and considering of PRS periodicities when deciding DRX cycles, most of the practical gains can be realized. Thus, introducing yet another feature that would require additional studies in RAN1 to establish feasibility (as captured in the TR) and also involve further dependency on SA2 is not recommended.

6. The proposal of introducing 1-symbol PRS has nothing to do with LPHAP objectives. This should be evident from the non-existent gains in UE battery lifetime reported by the proponent company during the SI. This was the reason RAN1 could not recommend this feature. If normative work is to be pursued on this for other motivations (PRS user capacity/system overhead), it should not be limited to LPHAP and should be considered separately, preferably as Rel-18 TEI.

7. UL positioning in RRC_IDLE has been briefly discussed in RAN1/RAN2 during SI and both WGs seem to face difficulties in determining exact feasibility considerations. Thus, this objective would first require careful studies across RAN WGs. In view of the current work scope and since there are no recommendations from WGs on this, it would be more appropriate to not introduce a study objective here and instead consider it for a future release.

13 – NTT DOCOMO INC.

Given that down-scope is necessary and there is no company to object, we think that at least 3.DL-PRS measurements in RRC_IDLE can be included in the WID.

14 – ZTE Corporation

@ Intel, in Rel-17, one-sample PRS measurement was discussed only for UE in RRC connected state for the purpose of latency reduction. Finally, we further agreed it is also applicable for UE in RRC inactive state during UE capability discussion even though the motivation of positioning in RRC inactive state is for power saving. The logic is the same here. 1-symbol PRS can be introduced for LPHAP, we can further decide whether it can be extended during UE capability discussion.

15 – CATT

1, 2, 4, 5, 6: Please add CATT as a supporting company of 1a), 2a), 4a), 5a), and 6a).

16 – Nokia France

The items 1, 2, 3, and 4 shown in blue in the draft WID in 2983 were actually recommended by either RAN1 or RAN2, so we support including them. Item 5 was recommended by RAN2 provided it is feasible from RAN1 perspective, so this can be considered if it can fit into the scope of the WID. We do not support adding additional items that are not shown in 2983.

17 – Qualcomm CDMA Technologies

1. "Extending DRX cycle beyond 10.24s" should not be an objective in a Positioning WI since it is a generic power saving enhancement. However, the draft WID notes that this item will be covered in the Rel-18 WI on eRedCap, and the positioning WI may just provide additional input (e.g., additional values, etc.). We are O.K. with this approach.

5. We prefer to focus on the objectives that have a clear recommendation from the study. "Paging relaxation" received only conditional recommendation by RAN2. RAN1 didn't confirm its benefits. Therefore, we proposed to exclude it from Rel-18.

6. We have excluded 1-symbol PRS in our input contribution because there was no clear recommendation from the study. However, Qualcomm was supportive of this already in previous releases. Given that this is a rather small item, we are O.K. to include this item per TR conclusion: "study further and if needed, specify during normative phase."

7. We prefer to focus on the objectives that have a clear recommendation from the study. There was no conclusion/recommendation in the Study for this.

18 – OPPO Beijing

1. Support. Extending DRX cycle to more than 10.24s is key approach to save power. If supported, this feature should be captured in positioning WI, rather than that of eRedCap.

2. Support. For multi-cell SRS configuration in validity area, the feasibility of it has been studied and confirmed in RAN1 according to RAN2's request. At least this item should be kept within the WID.

7. Not support. For UE in RRC_IDLE, the UL transmission would consume more power than DL reception. From this sense, it is not battery friendly. To balance the workload in Rel.18 WI phase, we suggest to consider others covered in rapporteur's draft.

19 – Sony Europe B.V.

We need to limit the scope and ensure the work are specifically relevant for positioning. We support item 2, 3, and 4.

1. Do not support DRX in RRC_INACTIVE beyond 10.24 sec. At least, this should be further discussed. In our view, this can also be applicable to other devices/use-cases (e.g., RedCap). Not sure, if it should be discussed in Positioning topic.
2. Support SRS configuration enhancements
3. Support DL-PRS measurements in RRC_IDLE
4. Support Alignment between DRX and PRS configurations
5. Do not support skipping paging reception in RRC_INACTIVE.
6. We prefer not to include DL PRS with 1-symbol PRS. RAN1 didn't make the recommendation during SI phase. There are many other topics too during Rel-18.
7. Do not support UL Pos in RRC_IDLE. It was not in the scope of the SI phase.

20 – Motorola Mobility Germany GmbH

[Lenovo]

1. Support this DRX enhancement, minimal spec. work is foreseen.
2. Ok to support SRS config. enhancements based on validity area in WI.
3. Supportive of DL-PRS measurements in RRC_IDLE inclusion in WI.
4. Supportive of Alignment between DRX and PRS, inclusion in WI.
5. Ok to support Paging reception skipping enhancements in WI, but can be omitted if WI scope is too large.
6. Supportive of 1-symbol DL-PRS configuration since minimal spec impact is foreseen.
7. Not supportive as it hasn't been discussed as part of the study.

21 – LG Electronics Inc.

Considering the workload within limited TU, down scoping the objectives for LPHAP seems necessary.

In our view, we need to focus on the items that are related to positioning enhancement itself in this work item.

Meanwhile, some items which are related to paging enhancement rather than positioning enhancement shall be discussed in a proper WI (e.g. extending DRX cycle and skipping paging reception)

Based on the views from the contributions, we think SRS enhancement, DL-PRS measurement in RRC_IDLE, and alignment between DRX and PRS configurations can be considered as candidates for WI.

22 – Deutsche Telekom AG

We do not support this proposal (for workload reasons) - could come with Rel-19

23 – HUAWEI TECHNOLOGIES Co. Ltd.

1. eDRX longer than 10.24s: We share the same view as ZTE/VIVO and other companies that this objective should not be limited to extending DRX beyond 10.24s. There are positioning specific handling (e.g. positioning interval smaller than the extended DRX cycle) need to be included this positioning item. The current note in the draft WID (*particular values of eDRX cycles and associated UE capabilities*) is not sufficient. We agree that some coordination or work split between positioning work item and eRedcap work item is needed, while the work split between positioning work item and eRedCap work item should be clearly listed, i.e. what is in which item. Suggested revision:

- Extending DRX cycle beyond 10.24s in RRC_INACTIVE state towards meeting the battery life requirement for LPHAP [RAN2, RAN3, RAN4]

i. NOTE: Work on this objective should be coordinated with that in Rel-18 WI on eRedCap.

ii. ~~Towards this, the feature of extending DRX cycle beyond 10.24s may be defined as part of Rel-18 WI on eRedCap, particular values of eDRX cycles and associated UE capabilities are~~ Positioning specific aspects for eDRX (beyond 10.24s) to be defined as part of Rel-18 WI on expanded and improved NR positioning.

NOTE: Inputs from RAN1 as necessary may be facilitated via LSs

2. SRS configuration enhancement: Support. It should be RAN2 led objective, coordinated by RAN1 and RAN3.

3. DL PRS measurement in IDLE: Support.

4. Alignment of DRX and PRS: Support. RAN2 could lead it, coordinated by RAN3.

5. Skipping paging: Support to include it. RAN2 concludes that "Skipping paging reception in RRC_INACTIVE is recommended for normative work for achieving LPHAP requirements, if feasible and beneficial from RAN1's perspective." The study and observation from RAN1 captured in TR indicate that "configuring a DRX cycle longer than positioning periodicity (up to 81.92s) or without paging reception can achieve 44.32%~89% power saving gain and is beneficial to improve battery life". Which means the benefit is observed in RAN1. So following SI recommendation, paging skipping should be included in the WI.

To answer Samsung's question: paging skipping in RRC_INACTIVE discussed in RAN2 means that a UE does not need to monitor paging in RRC_INACTIVE, which is same as "no paging" in RAN1 TR.

6. 1-symbol PRS: Support to include it.

In additional to the discussion of the high level objectives on LPHAP, companies may also provide detail comments to the text proposed by the rapporteurs in RP-222983

Feedback Form 11: LPHAP - Comments to WID text - Initial Round

1 – ZTE Corporation

For DRX cycle beyond 10.24s, the enhancement should be on positioning enhancement as described in the TR. We suggest wording as 'Positioning enhancement if identified related to extended DRX cycle beyond 10.24s in RRC_INACTIVE state [RAN2, RAN3]'

2 – vivo Mobile Communication Co.

We think all recommendations should be kept except paging skipping which needs further confirmation of RAN1. So, the following features should be included

- DRX in RRC_INACTIVE beyond 10.24s. It should be kept since it is the most important enhancement towards LPHAP power consumption requirement. The main feature of extending DRX cycle beyond 10.24s may be defined as part of Rel-18 WI on eRedCap, and the impact on positioning should be specified in as part of Rel-18 WI on expanded and improved NR positioning.
- SRS configuration across cells. It should be kept since it is both recommended by RAN1 and RAN2, and the feasibility has been confirmed by RAN1.
- DL PRS measurement in RRC_IDLE. No company seems to object
- Alignment between DRX and PRS configurations. No company seems to object

3 – vivo Mobile Communication Co.

Sorry for above misplaced input. Please check the following comments for WID text:

For ‘DRX in RRC_INACTIVE beyond 10.24s’, we share similar understanding as ZTE. We suggest modifying it as follows since the objective in Rel-18 eRedCap is ‘Enhanced eDRX in RRC_INACTIVE (>10.24s)’ and what we should do is to specify the impact of enhanced eDRX on positioning.

- Extending eDRX cycle beyond 10.24s in RRC_INACTIVE state towards meeting the battery life requirement for LPHAP [RAN2, RAN3, RAN4]
 - o NOTE: Work on this objective should be coordinated with that in Rel-18 WI on eRedCap. Towards this, the feature of extending eDRX cycle beyond 10.24s may be defined as part of Rel-18 WI on eRedCap, potential impacts for positioning (e.g., particular values of eDRX cycles and associated UE capabilities) are to be defined as part of Rel-18 WI on expanded and improved NR positioning.
 - o NOTE: Inputs from RAN1 as necessary may be facilitated via LSs

For ‘DL PRS measurement in RRC_IDLE’, we think RAN1 needs to be involved to modify TS 38.215.

state [RAN2, RAN1 .]

4 – Ericsson LM

In order to keep the work load reasonable, the items in [] should be left out of the WID. At least UL SRS Validity and Skip paging feature should not be included.

5 – Samsung R&D Institute UK

Thanks for the discussion. For the below note and spatial relation information, we think it would be good to have the spatial relation information based on the Rel-17 unified TCI state framework. So, we suggest to add the text marked in bold in the below.

Note: Details including issues such as interference, timing advance, spatial relation information (**based on the Rel-17 unified TCI state framework**), pathloss reference and common SRS parameters across multiple cells can be further discussed during normative work [RAN1]

6 – Intel Corporation (UK) Ltd

In response to the comment from ZTE, it is not necessary to add "Positioning enhancement if identified ..." since the impact should already be clear. As also mentioned in our response in Feedback Form 5, the expected impact would be in terms of determining suitable values of eDRX cycles appropriate for LPHAP (use-case 6) and corresponding UE capabilities.

7 – ZTE Corporation

@Intel we disagree with the understanding. During the SI, we never agreed the items you mentioned (eDRX cycles for LPHAP and UE capabilities). From our view, a single/independent UE capability is valid for both LPHAP UE and RedCap UE (there may not be a new UE for LPHAP UE), so no enhancement particularly for positioning. For eDRX cycles, we are also not sure why the cycles agreed in RedCaps should not separate from positioning. We cannot agree something without conclusion in SI.

8 – Nokia France

1. The bullet for SRS for positioning configurations in multiple cells could be refined as follows:

"SRS for positioning configurations in multiple cells, including addressing issues such as interference, timing advance, spatial relation information, pathloss reference and common SRS parameters across multiple cells [RAN2, RAN1]."

2. RAN1 responsibility should be added for "Specify solutions for DL PRS measurements for a UE in RRC_IDLE state".

9 – Qualcomm CDMA Technologies

"Specify solutions for DL PRS measurements for a UE in RRC_IDLE state and reporting of the measurements in RRC_CONNECTED state [RAN2]."

-> It is unclear what solutions RAN2 should specify. We think this is a RAN1/4-centric objective as the measurements and requirements must be defined in RAN1 and RAN4, respectively.]

10 – Deutsche Telekom AG

LPHAP - Comments to high level objectives - Initial Round

ZTE Corporation

1

1. It should be clarified the enhancement in this WID should be on positioning, rather only support eDRX with >10.24s. We suggest to follow the wording of the TR, i.e. 'LPHAP and is recommended for normative work **on Rel-18 positioning enhancements** from RAN1's perspective'

2. Support as it is recommended by both RAN1 and RAN2. The candidate solutions can be further down-selected/discussed in WI.

5. Support, we can use the wording of the TR. Further discussion can be continued in RAN1.

6. Support, we can use the wording of the TR. Further discussion can be continued in RAN1. This is a very simple solution, but it is very useful for power saving, resource overhead reduction, capacity improvement, also useful for RedCap since it reduces PRS gaps.

7. This was not discussed in SI at all. We prefer not to include this bullet in WID.

vivo Mobile Communication Co.,

2

We think all recommendations should be kept except paging skipping which needs further confirmation of RAN1. So, the following features should be included

- DRX in RRC_INACTIVE beyond 10.24s. It should be kept since it is the most important enhancement towards LPHAP power consumption requirement. The main feature of extending DRX cycle beyond 10.24s may be defined as part of Rel-18 WI on eRedCap, and the impact on positioning should be specified in as part of Rel-18 WI on expanded and improved NR positioning.
- SRS configuration across cells. It should be kept since it is both recommended by RAN1 and RAN2, and the feasibility has been confirmed by RAN1.
- DL PRS measurement in RRC_IDLE. No company seems to object
- Alignment between DRX and PRS configurations. No company seems to object

Ericsson LM

3

1a: We are fine if it is covered by RedCap.

2a: To minimize workload, we should avoid UL SRS validity area feature.

3 and 4: We are supportive

5: To minimize workload and as this is non-positioning specific; we should avoid this.

6: We support 1-symbol PRS.

7: To minimize workload, we should avoid UL positioning in RRC_IDLE.

Fraunhofer IIS

4

We think at least 2) and 3) should be within the scope of the WID.

Classon Consulting

5

[For FUTUREWEI] Support all

MediaTek Inc.

6

There were a lot of recommended enhancements under LPHAP, and we think some downselection is necessary. It makes sense to prioritise the enhancements that were recommended by both RAN1 and RAN2.

1. We understand several companies have expressed a view that this objective could be included in the positioning WID but coordinated with the RedCap WI, which would limit the impact on the positioning WI. We would be OK with this way forward.

2. MediaTek are also supportive of this objective.

3. Support this objective as a low-impact enhancement.

4-7. We see the benefits of these putative objectives, but to avoid overload, we think they could be down-scoped for this release.

TELECOM ITALIA S.p.A.

7

We have a strong concern on the workload and the number of objectives is not sustainable. We should keep at maximum 1-3 objectives. The proposal from Mediatek could be an acceptable way forward

InterDigital, Europe, Ltd.

8

1-4: We are ok to include the objective in WID

5-7: If the workload is reasonable, we are supportive to include

Beijing Xiaomi Mobile Software

9

We are supportive for all the objectives except objective 7 since we didn't make any conclusion on the UL positioning in RRC_IDLE. However, if we have to down scope the LPHAP, we think at least objectives 1-3 should be included.

China Mobile E-Commerce Co.

10

In general, all recommended solutions should be treated equally and included in the WID.

1. We think that it can be covered by the scope of R18 RedCap.

2. Support. SRS enhancement was recommended by both RAN1 and RAN2 and should be specified in the normative work.

3. Support. DL measurements in RRC_IDLE state was recommended by both RAN1 and RAN2 and should be specified in the normative work.

4. Support.

5. Support. RAN2 concluded that paging skipping is recommended for normative work if its feasibility and benefits are confirmed by RAN1. In RAN1, we have results on paging skipping with significant gains, but RAN1 just had no time to further check the feasibility. In our views, it is unfair to preclude such objective in this stage, as this is a RAN2 led objective. We suggest that at least we can spend 1 RAN1 meeting to confirm the feasibility on paging skipping.

6. Support. The conclusion on 1-symbol PRS from RAN1 is that it can be studied and specified if needed, we have such objectives in Rel-17, such as the multipath/NLOS mitigation. I think it is no harm to include this in LPHAP because it shows gains in RAN1 and it has very limited normative workload.

Samsung R&D Institute UK

11

Thanks for the discussion. Basically, we are OK to include the recommended work for LPHAP. However, in case of the paging skipping, it was captured in TR with the condition 'if feasible and beneficial from RAN1's perspective' and in our understanding there seems no consensus on the benefit of specifying this in RAN1. In RAN1 aspect, it's not quite clear what paging skipping exactly means. Rel-17 supported paging skipping already by PEI, so not sure what extra paging skipping means here.

Intel Corporation (UK) Ltd

12

1. We support the objective as it is the single most significant feature towards achieving the target battery lifetimes for LPHAP use-case 6. In our view, most of the work to introduce the feature may be performed as part of Rel-18 WI on eRedCap while as part of Rel-18 positioning, the work can be limited to determination of specific values of eDRX relevant to LPHAP and associated UE capabilities (the work in eRedCap is expected to be limited for RedCap UEs only).

2. We support to include the objective on SRS configuration enhancements. Although some further studies are necessary in RAN1 to address aspects on interference, TA, spatial relations, pathloss reference, etc., most of these may even be addressed by proper NW implementation in appropriate scenarios and thus,

should not be a roadblock to the basic feature that can relax the current requirement of obtaining new configuration of SRS for positioning upon change of cells under certain conditions.

3. Support to include if there may be room.

4. Support to include if there may be room.

5. Paging skipping feature is an asymptotic extension of the first objective, and in our view, it would be sufficient to just work on the first objective (extending DRX cycles beyond 10.24 s). With choices of proper DRX cycles and considering of PRS periodicities when deciding DRX cycles, most of the practical gains can be realized. Thus, introducing yet another feature that would require additional studies in RAN1 to establish feasibility (as captured in the TR) and also involve further dependency on SA2 is not recommended.

6. The proposal of introducing 1-symbol PRS has nothing to do with LPHAP objectives. This should be evident from the non-existent gains in UE battery lifetime reported by the proponent company during the SI. This was the reason RAN1 could not recommend this feature. If normative work is to be pursued on this for other motivations (PRS user capacity/system overhead), it should not be limited to LPHAP and should be considered separately, preferably as Rel-18 TEI.

7. UL positioning in RRC_IDLE has been briefly discussed in RAN1/RAN2 during SI and both WGs seem to face difficulties in determining exact feasibility considerations. Thus, this objective would first require careful studies across RAN WGs. In view of the current work scope and since there are no recommendations from WGs on this, it would be more appropriate to not introduce a study objective here and instead consider it for a future release.

NTT DOCOMO INC.

13

Given that down-scope is necessary and there is no company to object, we think that at least 3.DL-PRS measurements in RRC_IDLE can be included in the WID.

ZTE Corporation

14

@ Intel, in Rel-17, one-sample PRS measurement was discussed only for UE in RRC connected state for the purpose of latency reduction. Finally, we further agreed it is also applicable for UE in RRC inactive state during UE capability discussion even though the motivation of positioning in RRC inactive state is for power saving. The logic is the same here. 1-symbol PRS can be introduced for LPHAP, we can further decide whether it can be extended during UE capability discussion.

CATT

15

1, 2, 4, 5, 6: Please add CATT as a supporting company of 1a), 2a), 4a), 5a), and 6a).

Nokia France

16

The items 1, 2, 3, and 4 shown in blue in the draft WID in 2983 were actually recommended by either RAN1 or RAN2, so we support including them. Item 5 was recommended by RAN2 provided it is feasible from RAN1 perspective, so this can be considered if it can fit into the scope of the WID. We do not support adding additional items that are not shown in 2983.

Qualcomm CDMA Technologies

17

1. "Extending DRX cycle beyond 10.24s" should not be an objective in a Positioning WI since it is a generic power saving enhancement. However, the draft WID notes that this item will be covered in the

Rel-18 WI on eRedCap, and the positioning WI may just provide additional input (e.g., additional values, etc.). We are O.K. with this approach.

5. We prefer to focus on the objectives that have a clear recommendation from the study. "Paging relaxation" received only conditional recommendation by RAN2. RAN1 didn't confirm its benefits. Therefore, we proposed to exclude it from Rel-18.

6. We have excluded 1-symbol PRS in our input contribution because there was no clear recommendation from the study. However, Qualcomm was supportive of this already in previous releases. Given that this is a rather small item, we are O.K. to include this item per TR conclusion: "study further and if needed, specify during normative phase."

7. We prefer to focus on the objectives that have a clear recommendation from the study. There was no conclusion/recommendation in the Study for this.

OPPO Beijing

18

1. Support. Extending DRX cycle to more than 10.24s is key approach to save power. If supported, this feature should be captured in positioning WI, rather than that of eRedCap.

2. Support. For multi-cell SRS configuration in validity area, the feasibility of it has been studied and confirmed in RAN1 according to RAN2's request. At least this item should be kept within the WID.

7. Not support. For UE in RRC_IDLE, the UL transmission would consume more power than DL reception. From this sense, it is not battery friendly. To balance the workload in Rel.18 WI phase, we suggest to consider others covered in rapporteur's draft.

Sony Europe B.V.

19

We need to limit the scope and ensure the work are specifically relevant for positioning. We support item 2, 3, and 4.

1. Do not support DRX in RRC_INACTIVE beyond 10.24 sec. At least, this should be further discussed. In our view, this can also be applicable to other devices/use-cases (e.g., RedCap). Not sure, if it should be discussed in Positioning topic.

2. Support SRS configuration enhancements

3. Support DL-PRS measurements in RRC_IDLE

4. Support Alignment between DRX and PRS configurations

5. Do not support skipping paging reception in RRC_INACTIVE.

6. We prefer not to include DL PRS with 1-symbol PRS. RAN1 didn't make the recommendation during SI phase. There are many other topics too during Rel-18.

7. Do not support UL Pos in RRC_IDLE. It was not in the scope of the SI phase.

Motorola Mobility Germany GmbH

20

[Lenovo]

1. Support this DRX enhancement, minimal spec. work is foreseen.

2. Ok to support SRS config. enhancements based on validity area in WI.
3. Supportive of DL-PRS measurements in RRC_IDLE inclusion in WI.
4. Supportive of Alignment between DRX and PRS, inclusion in WI.
5. Ok to support Paging reception skipping enhancements in WI, but can be omitted if WI scope is too large.
6. Supportive of 1-symbol DL-PRS configuration since minimal spec impact is foreseen.
7. Not supportive as it hasn't been discussed as part of the study.

LG Electronics Inc.

21

Considering the workload within limited TU, down scoping the objectives for LPHAP seems necessary.

In our view, we need to focus on the items that are related to positioning enhancement itself in this work item.

Meanwhile, some items which are related to paging enhancement rather than positioning enhancement shall be discussed in a proper WI (e.g. extending DRX cycle and skipping paging reception)

Based on the views from the contributions, we think SRS enhancement, DL-PRS measurement in RRC_IDLE, and alignment between DRX and PRS configurations can be considered as candidates for WI.

Deutsche Telekom AG

22

We do not support this proposal (for workload reasons) - could come with Rel-19

Post

Feedback Form 5: LPHAP - Comments to high level objectives - Initial Round

11 – Deutsche Telekom AG

SORRY ANOTHER (NEW) MISTAKE IN NWM !!!!

I just made the very last statement of DT #22 for copying ...

SO: We do not support this proposal

12 – HUAWEI TECHNOLOGIES Co. Ltd.

The brackets for LPHAP should be removed.

For eDRX part, we agree with the direction suggested by ZTE/VIVO, suggested revision from us is as below:

a. Extending DRX cycle beyond 10.24s in RRC_INACTIVE state towards meeting the battery life requirement for LPHAP [RAN2, RAN3, RAN4]

i. NOTE: Work on this objective should be coordinated with that in Rel-18 WI on eRedCap.

ii. ~~Towards this, the feature of extending DRX cycle beyond 10.24s may be defined as part of Rel-18 WI on eRedCap, particular values of eDRX cycles and associated UE capabilities are~~ **Positioning specific aspects for eDRX (beyond 10.24s)** to be defined as part of Rel-18 WI on expanded and improved NR positioning.

NOTE: Inputs from RAN1 as necessary may be facilitated via LSs

On the SRS configuration enhancement, we do not think the Note is needed. We should not set the objective to a WG in a Note.

~~Note: Details including issues such as interference, timing advance, spatial relation information, pathloss reference and common SRS parameters across multiple cells can be further discussed during normative work [RAN1].~~

3.3.2 Summary from Initial Round

For questions 1 to 4, there is a clear majority in favour of including this in the scope of the WI. Regarding DRX in RRC_INACTIVE beyond 10.24s, several companies commented on the relationship with RedCap and necessity to avoid overlap of work. The suggested way forward is that the positioning WI would only address those aspects that are specific to positioning.

Inclusion of paging skipping - the company views are split. Some companies supporting the inclusion noted that this feature was recommended by RAN2 if feasible and beneficial from RAN1's perspective, and suggested that RAN1 could study this aspect for 1 meeting. Noting that there is clearly no consensus on this item, and that workload in RAN1 from this WI is already high, the moderator's proposal is that this should not be included in the WID.

Inclusion of DL PRS with 1 symbol - there was a small majority in favour of including this feature. Supportive companies commented that this was a relatively small items that will not consume a lot of WG time. Companies not supportive pointed to the lack of clear recommendation from the study item (conclusion was 'study and if needed specify'). Again, noting that there is no consensus on this item, the moderator's proposal is that this should not be included in the WID.

Study UL positioning in RRC_IDLE - there was a clear majority that preferred not to include this study objective into the WID, noting that the topic had not been considered during the study item. The moderator's proposal is that this should not be included in the WID

Regarding the comments on the detail wording, the rapporteur will consider these in an update of the WID text.

Moderator's proposal on LPHAP

1. DRX in RRC_INACTIVE beyond 10.24s is included in scope. The precise scope of the positioning WI will be those aspects that are specific to LPHAP, with other aspects covered by the RedCap WI.
2. SRS configuration enhancements for UL and DL+UL positioning in RRC_INACTIVE based on validity area is included in scope
3. DL-PRS measurements in RRC_IDLE is included in scope
4. Alignment between DRX and PRS configurations is included in scope
5. Skipping paging reception in RRC_INACTIVE is not included in scope
6. DL PRS configuration with 1-symbol PRS is not included in scope
7. Study UL positioning in RRC_IDLE is not included in scope

3.3.3 Intermediate Round

Companies are asked to comment on the proposals from the moderator in the summary from the Intermediate Round.

Feedback Form 12: LPHAP - high level objectives - Intermediate Round

<p>1 – AT&T GNS Belgium SPRL</p> <p>We are ok with the moderator proposal.</p>
<p>2 – Classon Consulting</p> <p>[for FUTUREWEI] OK with one addition. The moderator proposal of recommended items should not be reduced, and the recommended paging skipping should be added. TU is easily sufficient for these.</p>
<p>3 – Nokia France</p> <p>We support the Moderator’s proposal.</p>
<p>4 – ZTE Corporation</p> <p>As moderator mentioned that 1-symbol PRS got a bit majority, we request to include it.</p> <p>What is the moderator’s criteria to make decision? majority or consensus? it is better to use the same criteria for all bullets. I assume all bullets should be based on majority rather than consensus because almost all item had concern by a few companies, e.g. one or two companies think eDRX with >10.24s should be discussed in RedCap. Based on that, 1-symbol PRS should be included.</p>
<p>5 – Intel Corporation (UK) Ltd</p> <p>We support the proposal from the moderator.</p>
<p>6 – CATT</p> <p>We are fine with the Moderator’s proposal 1 to 4. In addition, our preference is to include “Skipping paging reception in RRC_INACTIVE” and “DL PRS configuration with 1-symbol PRS” in the WI scope.</p>
<p>7 – New H3C Technologies Co.</p> <p>we are fine with Fl proposal</p>
<p>8 – Samsung R&D Institute UK</p> <p>We support the moderator’s proposal.</p>

9 – MediaTek Inc.

We think the moderator’s proposal strikes a good balance. We see the value in some of the other enhancements, but scope needs to be controlled, so we would prefer not to expand this objective further.

10 – vivo Mobile Communication Co.

We support the moderator’s proposal.

11 – Beijing Xiaomi Mobile Software

We support the moderator’s proposal.

12 – China Mobile E-Commerce Co.

5. We insist that paging skipping should be included in the WID. RAN2 clearly recommended such solution and power saving gains are observed in RAN1. At least RAN1 should study the feasibility rather than directly exclude it from the WI scope.

6. We share similar views as ZTE that 1-symbol PRS can be included as it gets slightly majority views.

13 – NTT DOCOMO INC.

We support the moderator’s proposal.

14 – HUAWEI TECHNOLOGIES Co. Ltd.

Moderator proposal goes in to a good direction. We have a couple of further comments/suggestions below:

1. DRX in RRC_INACTIVE beyond 10.24s: we agree with moderator summary that “The precise scope of the positioning WI will be those aspects that are specific to LPHAP, with other aspects covered by the RedCap WI”. We support this way forward be captured in the WID objective.

5. Skipping paging reception in RRC_INACTIVE: we do not think RAN2 work load is that heavy so to justify down-scope of LPHAP. Paging skipping was recommended by RAN2 and the benefit was observed and captured in the TR by RAN1. Based on existing mechanism, the specification impact for paging skipping is rather limited. We therefore suggest to include skipping paging into the WI with RAN2 as leading WG.

15 – OPPO Beijing

We support the moderator’s proposal.

16 – LG Electronics Inc.

We support the moderator’s proposals 2 to 7, but still have concern on the first proposal.

We agree that the ‘DRX in RRC_INACTIVE beyond 10.24s’ would be beneficial from power saving perspective, but think normative work in eRedCap WI would be enough for this purpose.

At least, it should have lower priority than other objectives.

<p>17 – Motorola Mobility Germany GmbH</p> <p>[Lenovo]</p> <p>We are fine with the Moderator’s latest recommendations for the WID text update, although 6) will incur minimum spec. impact in our view.</p>
<p>18 – Sony Europe B.V.</p> <p>We are OK with the moderator’s proposal (in order to make the progress), particularly accepting the 1st item. We prefer to modify the WID text so that it express specifically that the work on DRX beyond 10.24sec is specifically for positioning.</p>
<p>19 – Ericsson LM</p> <p>We agree with above except 2. We still think to reduce the workload 2 should be omitted.</p>
<p>20 – Apple France</p> <p>We are fine with the moderator’s proposal</p>
<p>21 – Fraunhofer IIS</p> <p>We support the moderator’s proposal.</p>

Companies may continue to make comments to the detail text of the WID.

Feedback Form 13: LPHAP - Comments to WID text - Intermediate Round

<p>1 – Nokia France</p> <p>Our comments were already made in the initial round.</p>
<p>2 – Intel Corporation (UK) Ltd</p> <p>We are fine with the text in the draft WID; only update the NOTE as below to address comments regarding clarifying the handling of DRX > 10.24 s:</p> <ul style="list-style-type: none">- NOTE: Work on this objective should be coordinated with that in Rel-18 WI on eRedCap. Towards this, the feature of extending DRX cycle beyond 10.24s mayshould be defined as part of Rel-18 WI on eRedCap, and particular values of eDRX cycles and associated UE capabilities are to be defined as part of Rel-18 WI on expanded and improved NR positioning.

3 – ZTE Corporation

Regarding the bullet on DRX>10.24s, we more prefer the wording of the note from Huawei, it is more general. Since the current wording seems to emphasize 'particular values of eDRX cycles and associated UE capabilities' which was not discussed/agreed before, we are not OK.

Work on this objective should be coordinated with that in Rel-18 WI on eRedCap. **Positioning specific aspects for eDRX (beyond 10.24s)** to be defined as part of Rel-18 WI on expanded and improved NR positioning

4 – HUAWEI TECHNOLOGIES Co. Ltd.

Please find our revision of the WID text as below including:

1. Adding LPHAP/positioning-specific aspects in the objective to align with moderator suggested way forward;
2. Adding an "e" to DRX cycle to make it technically correct and aligned with eRedCap WID;
3. Including some of the revision from Intel above.

- Extending eDRX cycle beyond 10.24s in RRC_INACTIVE state towards meeting the battery life requirement for LPHAP [RAN2, RAN3, RAN4]

- o **Positioning-specific aspects for eDRX cycle beyond 10.24s to be defined as part of Rel-18 WI on expanded and improved NR positioning.**
- o NOTE: Work on this objective should be coordinated with that in Rel-18 WI on eRedCap. Towards this, the feature of extending eDRX cycle beyond 10.24s ~~may~~**should** be defined as part of Rel-18 WI on eRedCap. ~~particular values of eDRX cycles and associated UE capabilities are to be defined as part of Rel-18 WI on expanded and improved NR positioning.~~
- o NOTE: Inputs from RAN1 as necessary may be facilitated via LSs

3.3.4 Summary from Intermediate Round

For the high level objectives the conclusion from the intermediate round and the Wednesday GTW discussion of RP-223446 was:

Conclusions on LPHAP:

1. DRX in RRC_INACTIVE beyond 10.24s is included in scope. The precise scope of the positioning WI will be those aspects that are specific to LPHAP, with other aspects covered by the RedCap WI.
2. SRS configuration enhancements for UL and DL+UL positioning in RRC_INACTIVE based on validity area is included in scope

3. DL-PRS measurements in RRC_IDLE is included in scope
4. Alignment between DRX and PRS configurations is included in scope
5. Skipping paging reception in RRC_INACTIVE is not included in scope
6. DL PRS configuration with 1-symbol PRS is not included in scope
7. Study UL positioning in RRC_IDLE is not included in scope

The rapporteur will update the WID to reflect these conclusions and also take into account the detail comments to the WID text.

3.3.5 Final Round

Companies are asked to comment on the updated WID shared at after the intermediate round

Feedback Form 14: LPHAP - Final Round

1 – AT&T GNS Belgium SPRL

We are ok with the moderator proposal as we attempt to strike a balance between workload/scope.

2 – ZTE Corporation

The current wording for DRX>10.24s is not OK as we commented in the initial and intermediate round. We don't know yet whether '**particular values of eDRX cycles and associated UE capabilities**' should be the part of Rel-18 positioning enhancement, this never be discussed before, and also not the outcome of the TR. Lets make it more general (Huawei and vivo also commented before). Here is our suggestion which is similar as Huawei's wording

Positioning-specific enhancement for eDRX cycle beyond 10.24s to be defined as part of Rel-18 WI on expanded and improved NR positioning.

- NOTE: Work on this objective should be coordinated with that in Rel-18 WI on eRedCap. Towards this, the feature of extending eDRX cycle beyond 10.24s **should** be defined as part of Rel-18 WI on eRedCap.
- NOTE: Inputs from RAN1 as necessary may be facilitated via LSs

3 – vivo Mobile Communication Co.

We share similar understanding as ZTE/Huawei mentioned above.

We would like to revise eDRX>10.24s bullet as below.

Positioning-specific enhancement for eDRX cycle beyond 10.24s to be defined as part of Rel-18 WI on expanded and improved NR positioning.

- NOTE: Work on this objective should be coordinated with that in Rel-18 WI on eRedCap. Towards this, the feature of extending eDRX cycle beyond 10.24s **should** be defined as part of Rel-18 WI on eRedCap.
- NOTE: Inputs from RAN1 as necessary may be facilitated via LSs

4 – InterDigital

We support the modification from vivo and ZTE in principle. The WID should clarify that enhancements identified for "Extending DRX cycle beyond 10.24s in RRC_INACTIVE state " should be relevant to enhancements for positioning.

5 – vivo Mobile Communication Co.

One additional comment:

SRS for positioning activation is not explicitly recommended during study and only discussed in RAN1 as one potential topic to be discussed in the work item phase. The bullet should not involve activation as following if RAN1 is not involved.

- SRS for positioning ~~activation~~/request procedure(s) [RAN2].

6 – HUAWEI TECHNOLOGIES Co. Ltd.

Our revision suggestion in the intermediate round is not captured.

For the positioning-specific enhancement under eDRX, we support the revision from ZTE (supported by VIVO, interdigital) above.

Regarding DRX/eDRX, we would like to remind that they are two different configurations. eRedCap WI is expected to extend the eDRX cycle instead of the DRX cycle. Our understanding is extending eDRX cycle (instead of DRX cycle) is relevant for this positioning item. So, apart from ZTE revision on the sub-bullet, the main bullet should be revised as well.

o Extending eDRX cycle beyond 10.24s in RRC_INACTIVE state towards meeting the battery life requirement for LPHAP [RAN2, RAN3, RAN4]

7 – CATT

We share similar understanding as ZTE/Huawei/vivo mentioned above.

We support the update of eDRX from ZTE, and suggest RAN4 launching the item in normative work at first.

Positioning-specific enhancement for eDRX cycle beyond 10.24s to be defined as part of Rel-18 WI on expanded and improved NR positioning.

- NOTE: Work on this objective should be coordinated with that in Rel-18 WI on eRedCap. Towards this, the feature of extending eDRX cycle beyond 10.24s **should** be defined as part of Rel-18 WI on eRedCap.
- NOTE: Inputs from RAN1 as necessary may be facilitated via LSs

8 – China Mobile E-Commerce Co.

We share similar views as ZTE, vivo, HW and other companies that positioning related enhancements for extending eDRX cycle beyond 10.24s should be clearly captured in the WID. The wording change from HW and ZTE is fine to us.

9 – LG Electronics Inc.

We tend to agree with other companies that positioning specific enhancement shall be discussed in the positioning WI. Thus we support the updated version from ZTE and HW.

10 – Intel Corporation (UK) Ltd

We support the latest version with an update for the eDRX bullet as indicated below.

- NOTE: Work on this objective should be coordinated with that in Rel-18 WI on eRedCap. Towards this, the feature of extending DRX cycle beyond 10.24s should be defined as part of Rel-18 WI on eRedCap, and particular values of eDRX cycles and associated UE capabilities **related to LPHAP** are to be defined as part of Rel-18 WI on expanded and improved NR positioning.

Hopefully, this can address some of the comments above that the scope for positioning WI should be clear.

The eDRX cycle lengths for LPHAP and related UE capabilities should be decided considering LPHAP (use-case 6). This cannot be done in eRedCap WI and needs to be addressed as part of positioning WI.

Along with the objective on aligning “eDRX and PRS configurations”, WGs can discuss what values of eDRX cycle lengths to introduce based on consideration of positioning intervals for LPHAP use-case 6.

Also, we agree with updating the first and fourth LPHAP objectives with eDRX.

11 – MediaTek Inc.

We are OK with the wording change for the eDRX extension objective, as proposed by ZTE/HW above.

12 – HUAWEI TECHNOLOGIES Co. Ltd.

Adding of “Related to LPHAP” in the response from Intel/Rapporteur does not seem address comments from ZTE/VIVO/InterDigital/Huawei/CATT/CMCC/LGE/MediaTek above, at least from our view. The wording “particular values of eDRX cycles and associated UE capabilities related to LPHAP” does not come from the TR. We would suggest to use the wording from ZTE and supported by many companies above.

13 – Qualcomm CDMA Technologies

On

- Specify solutions for DL PRS measurements for a UE in RRC_IDLE state and reporting of the measurements in RRC_CONNECTED state [RAN2].

This has RAN1 impacts (e.g., 38.215) and RAN4 impacts (measurement requirements currently exist for RRC_CONNECTED and RRC_INACTIVE only).

On RAN4, it is not clear if this is covered by the last (generic) bullet ("Specify corresponding new core requirements, as well as discuss and identify the impact on the existing RAN4 specification, including RRM measurements and procedures [RAN4]"). If so, it is not clear why eDRX has explicit RAN4 impact.

On this last bullet, we actually see RAN4 impact only for the 3rd bullet (RRC_IDLE), and maybe for the 1st bullet (eDRX). This last bullet could then be deleted, if RAN4 is listed on the specific objectives anyhow, or moved under the specific objective bullet.

14 – Nokia France

We have the following minor suggestions for improvement:

1. For clarity, we suggest the following rewording:

For UL and DL+UL positioning for UEs in RRC_INACTIVE state, specify SRS configuration enhancements to configuration of SRS based on SRS positioning validity area for positioning to avoid frequent RRC connection for SRS (re)configuration ~~based on SRS positioning validity area~~ [RAN2, RAN1, RAN3].

2. SRS for positioning configurations in multiple cells could be combined with the note as follows:

SRS for positioning configurations in multiple cells, including addressing details such as interference, timing advance, spatial relation information, pathloss reference and common SRS parameters across multiple cells [RAN2, RAN1].

RAN1 should be moved to the main bullet, instead of the Note.

3. Specify solutions for DL PRS measurements for a UE in RRC_IDLE state... This should include RAN1 as well as RAN2, as 38.215 will need to be updated to make the measurements applicable to IDLE.

4. Specify corresponding new core requirements, as well as ~~discuss and identifying and specifying~~ the impact on the existing RAN4 specifications, including RRM measurements and procedures [RAN4].

15 – Sony Europe B.V.

Generally support, except for the extended DRX beyond 10.24 sec. As we expressed in the previous round, we prefer to state that the work on the DRX extension is specifically for positioning purpose. Hence, we prefer the modified version made by ZTE. (i.e. **Positioning-specific enhancement for eDRX cycle beyond 10.24s to be defined as part of Rel-18 WI on expanded and improved NR positioning.**)

16 – Motorola Mobility Germany GmbH

[Lenovo]:

We are fine with the Moderator’s latest recommendations for the WID text update.

Regarding the Note under ”SRS for positioning configurations in multiple cells [RAN2]” objective, we are don’t think that RAN1 should be listed as a leading WG for a NOTE. A Note is usually meant to convey any additional information related to the main objective. The issues listed in the Note can be handled as LSs with RAN1 where necessary, in order to reduce load as was done already during the SI phase.

17 – Beijing Xiaomi Mobile Software

Reagrding the extending DRX cycle beyond 10.24s in RRC_INACTIVE state, we share the same view as HW that ”particular values of eDRX cycles and associated UE capabilitiesrelated to LPHAP” is not from the TR conclusion, so we are fined the wording proposed by ZTE.

18 – Ericsson LM

Considering the huge RAN1 load that is expected during SL positioning, we think RAN1 involvement should be minimized for other topics. LPHAP already has a lot of enhancements driven by RAN2 listed in the objective, so we propose to remove the one involving RAN1. The sub-objective proposes 2 different enhancements (same SRS configuration across cells in the validity area, or pre-configuration of SRS with configuration change indication) to the same problem anyway.

- ~~{SRS for positioning configurations in multiple cells [RAN2].~~
 - o ~~Note: Details including issues such as interference, timing advance, spatial relation information, pathloss reference and common SRS parameters across multiple cells can be further discussed during normative work [RAN1].~~

tions [RAN2, RAN3 .]

procedure(s) [RAN2 .]

19 – HUAWEI TECHNOLOGIES Co. Ltd.

Ericsson’s proposal is not aligned with TR conclusion/recommendation. it is not acceptable.

20 – Classon Consulting

[for FUTUREWEI] disagree w/ Ericsson to remove ran1/ran2 recommended from what was discussed in GTW and in the draft WID

3.3.6 Summary from Final Round

The main discussion point relates to the wording of the objectives on extending the eDRX cycle. The proposal supported by 10 companies was to revise the wording to say:

- Positioning-specific enhancement for eDRX cycle beyond 10.24s to be defined as part of Rel-18 WI on expanded and improved NR positioning.
 - NOTE: Work on this objective should be coordinated with that in Rel-18 WI on eRedCap. Towards this, the feature of extending eDRX cycle beyond 10.24s should be defined as part of Rel-18 WI on eRedCap.
 - NOTE: Inputs from RAN1 as necessary may be facilitated via LSs

The moderator considers that this expands the scope of the objective, potentially allowing enhancements beyond simply extending eDRX cycle. However, acknowledging the level of support for this revision, the moderator proposes that this wording is included in the WID text alongside the previous wording and during the extended email discussion companies that have not yet expressed a view are requested to comment whether this is acceptable.

There was also some discussion of RAN4 responsibility. The moderator proposes that the final objective for RAN4 should be enough to capture all of RAN4's work arising any of the other sub-objectives.

Other more minor text proposals have been reflected in the updated WID as appropriate.

3.4 RedCap positioning

3.4.1 Initial Round

Many company contributions expressed support for the inclusion of an objective on RedCap positioning:

1. Intel (2984), Nokia (2991), Huawei (3005), AT&T/Firstnet (3007), , CMCC (3042), vivo (3095), Qualcomm (3124), CATT(3135), docomo(3163), MediaTek (3244), ZTE (3255), Ericsson (3286), Futurewei (3336), OPPO(3020), Lenovo (3360), Samsung (3085), LG(3121), Bosch(3425)

No company contribution expressed the view that this should not be included in the WI, and furthermore, company contributions didn't comment at a high level on the objectives. Therefore, the moderator proposal is that this will be included in the WID and companies are requested to provide detail comments to the text proposed by the rapporteurs in RP-222983.

Feedback Form 15: RedCap positioning - Comments to WID text - Initial Round

1 – vivo Mobile Communication Co.

We prefer to control the overall workload and address the most interested scenarios. Towards this direction, we would like to limit the scope of PRS hopping, e.g., by dropping it from WI.

<p>2 – Ericsson LM OK with WID text</p>
<p>3 – Apple France Support</p>
<p>4 – Sony Europe B.V. Support the moderator’s proposal.</p>
<p>5 – FirstNet Support moderator’s proposal.</p>
<p>6 – Classon Consulting [for FUTUREWEI] support along with other recommendations</p>
<p>7 – MediaTek Inc. OK with the objective in the proposed WID.</p>
<p>8 – AT&T GNS Belgium SPRL We are OK with the objectives in the draft WID.</p>
<p>9 – InterDigital We support the moderator’s proposal</p>
<p>10 – Beijing Xiaomi Mobile Software Fine with wording in the draft WID.</p>
<p>11 – China Mobile E-Commerce Co. We are fine with the wording in the draft WID.</p>
<p>12 – Intel Corporation (UK) Ltd Support the description in the WID. In addition, we are also okay to add a RAN4-only objective to specify performance requirements for RedCap UEs considering reduced number of Rx branches but without any frequency hopping, i.e., limited to max RedCap UE bandwidth of 20 MHz/100 MHz (FR1/FR2).</p>
<p>13 – SHARP Corporation We support the proposal.</p>
<p>14 – NTT DOCOMO INC. We support the moderator’s proposal.</p>

15 – CATT

Okay with draft WID.

16 – Nokia France

We support inclusion of RedCap. We have the following detailed comments:

1. “Support of frequency hopping ... for reception of DL PRS” does not make it clear whether PRS tx hopping is also included. We propose to change to ”for transmission/reception of DL PRS”.
2. RAN3 should be included in the frequency hopping objective as there may be NRPPa impacts to at least UL frequency hopping.

17 – NEC Corporation

We are OK with the objectives in draft WID for positioning of RedCap UE.

18 – Qualcomm CDMA Technologies

”Discuss and specify new requirements as well as the impact on the existing RAN4 requirements for positioning and other RRM measurements and corresponding procedures [RAN4].”

→ RAN4 requirements for RedCap UEs are needed for the Rel-16/17 measurements/features and the additional Rel-18 features. This should be clarified. ”Discuss” in the objective text seems not needed.

19 – OPPO Beijing

Okay with the text in the draft WID for RedCap UE positioning.

20 – Sony Europe B.V.

We support the moderator’s proposal.

21 – Motorola Mobility Germany GmbH

[Lenovo]

Supportive of proposed objective as described in RP-222983

22 – LG Electronics Inc.

Support the moderator’s proposal

23 – Deutsche Telekom AG

We are not supportive as the solutions identified by RAN1 would require additional resources (PRS for RedCap) on the broadcast to enable the desired accuracy.

This is unacceptable for mobile operators which requires an economical / efficient spectrum usage. Especially also in terms of Network Energy Savings (NES) this is really doubtful.

If a UE needs a certain accuracy of network based positioning, it should not be a RedCap device !

With such an approach we simply transfer the problem from the UE to the networks, which we as an MNO can not accept at all.

24 – HUAWEI TECHNOLOGIES Co. Ltd.

We prefer to have RAN4 only for the PRS frequency hopping to reduce the RAN1 work load, so that PRS Tx hopping is not specified when only Rx hopping is considered in the RRM requirements considered by RAN4.

We also prefer to explicitly list the 1Rx requirements for RedCap for the unfinished requirements of legacy RedCap UEs.

25 – TELECOM ITALIA S.p.A.

support the view from DT. And also looking to the number of topics in this monster WI proposal, we object to include this proposal

3.4.2 Summary from Initial Round

Most companies are supporting of the objective and many are happy with the rapporteur's wording, Two companies does not support the objective, and one company preferred to drop the PRS hopping. There seems to be the need for some more discussion to conclude on the cases for which RAN4 will specify requirements. The rapporteur will consider comments on the detail wording an update of the WID text.

3.4.3 Intermediate Round

Companies may continue to make comments to the detail text of the WID. In particular companies are asked to comment on the RAN4 scope.

Feedback Form 16: RedCap positioning - Comments to WID text - Intermediate Round

1 – VODAFONE Group Plc

We feel that this part (Redcap Positioning) could be down prioritised a bit, especially parts which would require extensive measurements and measurement reporting on UE side.

2 – AT&T GNS Belgium SPRL

We support the moderator summary. On the RAN4 scope, we should include some objective, such as the following proposal:

”Evaluate and specify requirements as well as the impact on the existing requirements for positioning/RRM measurements and corresponding procedures. [RAN4]”

3 – FirstNet

We support the moderator’s summary. We also support AT&T’s proposal for RAN4 scope.

4 – Classon Consulting

[for FUTUREWEI] OK with it, but it is a lower priority than the other items so also OK to downscope a bit as suggested by a number of companies.

5 – Intel Corporation (UK) Ltd

We support the text in the draft WID.

For PRS, the objective in the draft WID says “... Frequency Hopping (FH) ... for reception of DL PRS”. Thus, it includes the case when the gNB may transmit PRS over a larger BW across multiple symbols and UE performs retuning to receive PRS over different frequency resources/hops. However, it cannot be a RAN4-only item since RAN1 needs to work on the core design taking inputs from RAN4 to define details of the PRS transmission across multiple symbols and the related UE behavior.

As commented during Initial round, we support adding a RAN4-only objective to specify performance requirements for RedCap UEs considering reduced number of Rx branches but without any frequency hopping, i.e., limited to max RedCap UE bandwidth of 20 MHz/100 MHz (FR1/FR2).

We also propose to delete “Discuss” in the current RAN4 objective and generalize it to include both FH and no-FH cases:

Specify support of positioning for UEs with Reduced Capabilities (RedCap UEs)

- Specify support of Frequency Hopping (FH) beyond maximum RedCap UE bandwidth for reception of DL PRS and transmission of UL SRS for positioning [RAN1, RAN2].
 - o NOTE: The complexity of the corresponding capabilities for RedCap UEs should be addressed for the introduction of appropriate capabilities for RedCap UEs.
- ~~Discuss and s~~ Specify new as well as the impact on the existing RAN4 RRM requirements for positioning and other including RRM measurements and corresponding procedures for RedCap UEs **for both with and without frequency hopping** [RAN4].

<p>6 – CATT</p> <p>We are fine for RAN4 to define explicitly 1Rx requirements for RedCap UEs.</p>
<p>7 – New H3C Technologies Co.</p> <p>we support FL summary</p>
<p>8 – Apple France</p> <p>We are fine with Intel’s update</p>
<p>9 – Verizon UK Ltd</p> <p>OK with the WID text in general, also ok with Intel’s revision - our bottom-line is RedCap shall have positioning capability, with reasonable performance, hopefully matching or getting close to match regular UE positioning performance</p>
<p>10 – MediaTek Inc.</p> <p>OK with the general text. We think a RAN4 objective is needed not just for performance requirements, but to give some early guidance to RAN1 on the feasible retuning time, to inform the hopping design.</p>
<p>11 – NTT DOCOMO INC.</p> <p>We support the draft WID and also fine with Intel’s update.</p>
<p>12 – ZTE Corporation</p> <p>Intel’s update is good for us except ‘without frequency hopping’ part. Without considering frequency hopping, nothing difference between RedCap UE and regular UE because Rel-17 positioning supports 5M and 20MHz PRS depending on the UE capability.</p> <p>We are not OK to clearly mention ‘RAN4-only objective to specify performance requirements for RedCap UEs considering reduced number of Rx branches’, it is out of scope. We don’t see any recommendation even with study on this.</p>
<p>13 – Qualcomm CDMA Technologies</p> <p>We understand that an objective on core and performance requirements for positioning measurements performed by RedCap UEs was not included in the SID because it was understood as an objective that could move directly to the normative phase.</p> <p>Requirements for RedCap UEs are currently missing and should be introduced as part of the WI.</p>
<p>14 – HUAWEI TECHNOLOGIES Co. Ltd.</p> <p>We share similar concern as the operators that PRS Tx frequency hopping means that it cannot be shared by eMBB UEs. From this point, we prefer to limit the PRS frequency hopping to Rx hopping only based on the wideband PRS transmission to reduce the work load. Then there should be no new design of PRS hopping patterns in RAN1, and all the work can be up to RRM requirements in RAN4.</p>

<p>15 – OPPO Beijing</p> <p>We are fine with the update from Intel</p>
<p>16 – LG Electronics Inc.</p> <p>We think RAN1 work would be needed for designing FH for reception of DL PRS. For RAN4 objective, Intel’s revision seems better for us, but we are not sure ‘without frequency hopping’ case needs to be considered.</p>
<p>17 – Motorola Mobility Germany GmbH</p> <p>[Lenovo]:</p> <p>The RAN4 scope will have to inevitably include the specification of RRM requirements in order to support RedCap positioning. We are ok to add a separate bullet to qualify this objective.</p>
<p>18 – Sony Europe B.V.</p> <p>We support the modified WID proposed by Intel (i.e., to include RAN4 requirements).</p>
<p>19 – Nokia France</p> <p>For RAN4, there will need to be some discussion in RAN4 to identify and agree the impacts. We propose the following:</p> <p><i>Identify and specify RRM requirements for positioning including RRM measurements and procedures for RedCap devices, with and without frequency hopping for 1Rx RedCap devices, and with frequency hopping for 2Rx RedCap devices, with the PRS/SRS bandwidth(s) to be determined by RAN4 [RAN4]</i></p>
<p>20 – Nokia France</p> <p>(building on the proposal from Intel above.)</p>
<p>21 – Ericsson LM</p> <p>We are OK with Intel’s proposed WID text update.</p>
<p>22 – ZTE Corporation</p> <p>We more prefer to remove ‘for both with and without frequency hopping’, let RAN4 to decide whether RRM requirement is needed for the case without hopping.</p>
<p>23 – Deutsche Telekom AG</p> <p>We do not support this objective</p> <p>As pointed out in the initial round we think there is the issue of additional resource usage which minimises the spectrum efficiency and increases the energy consumption. If a UE needs high position accuracy it should not rely on being a RedCap device ...</p>

3.4.4 Summary from Intermediate Round

An update to the WID text will be provided to reflect the comments as much as possible.

3.4.5 Final Round

Companies are asked to comment on the updated WID shared at after the intermediate round

Feedback Form 17: RedCap positioning - Comments to WID text - Final Round

<p>1 – ZTE Corporation</p> <p>For RAN4 part, we prefer to remove 'for both with and without frequency hopping' to make it more general, RAN4 group will decide whether the case of 'without frequency hopping' is needed or not</p>
<p>2 – vivo Mobile Communication Co.</p> <p>We would like to clarify whether the following wording means DL PRS Transmission hopping is not included and only PRS Rx hopping is included?</p> <ul style="list-style-type: none">- Specify support of Frequency Hopping (FH) beyond maximum RedCap UE bandwidth for reception of DL PRS and transmission of UL SRS for positioning [RAN1, RAN2]
<p>3 – NTT DOCOMO INC.</p> <p>We support the updated WID.</p>
<p>4 – CATT</p> <p>We are fine with RedCap objectives in draft WID.</p>
<p>5 – LG Electronics Inc.</p> <p>We are fine with the updated WID.</p>
<p>6 – China Mobile E-Commerce Co.</p> <p>We support the current wording in the draft WID.</p>
<p>7 – Intel Corporation (UK) Ltd</p> <p>We support the latest version. In our view, the “without frequency hopping” part should be kept since the DL positioning feature should also be supported for RedCap UEs w/o FH configuration, and in this regard, it is better to include here for proper dimensioning and planning of the work in RAN4.</p>

<p>8 – MediaTek Inc.</p> <p>OK with the draft WID. We agree with Intel about the need to keep the ”without frequency hopping” aspect.</p>
<p>9 – Qualcomm CDMA Technologies</p> <p>We are fine with the RedCap objective in the updated WID.</p>
<p>10 – Nokia France</p> <p>For the RAN4 requirements, requirements already exist for 2Rx UEs without frequency hopping, but requirements are needed for 2Rx UEs with frequency hopping and for 1Rx UEs with and without frequency hopping.</p> <p>The PRS/SRS bandwidths for the requirements need to be determined, but this can be discussed in RAN4.</p> <p>We therefore suggest replacing the current bullet with the following:</p> <p><i>Specify RRM requirements for positioning including RRM measurements and procedures for RedCap devices, with and without frequency hopping for 1Rx RedCap devices, and with frequency hopping for 2Rx RedCap devices, with PRS/SRS bandwidth(s) to be determined by RAN4 [RAN4]</i></p>
<p>11 – Sony Europe B.V.</p> <p>We support the updated draft WID on RedCap UE.</p>
<p>12 – Motorola Mobility Germany GmbH</p> <p>[Lenovo]: Support Moderator’s updated WID text.</p>
<p>13 – Ericsson LM</p> <p>OK with the current wording of the updated WID.</p>

3.4.6 Summary from Final Round

The objective wording is acceptable to most companies. The main discussion was around the wording of the objective for RAN4. The moderator proposed that the text from Nokia is captured in the RAN4 objective apart from the last part on ”with PRS/SRS bandwidth(s) to be determined by RAN4” as it seems natural this will part of RAN4 work.

3.5 Bandwidth aggregation for positioning measurements

3.5.1 Initial Round

The top level objective on bandwidth aggregation for positioning measurements is included as blue text within the rapporteur's draft WID. Views from the contributions are summarised below:

1. Supportive to include: Intel (2984), Huawei (3005), AT&T/Firstnet (3007), Xiaomi (3017), , CMCC (3042), CATT(3135), MediaTek(3244), ZTE (3255), Ericsson (3286), Futurewei (3336), Lenovo (3360), LG(3121), Bosch(3425)
2. Not supportive to include: vivo (3095), Qualcomm (3124), docomo(3163), Samsung (3085)

Companies are requested to provide comments on whether to include bandwidth aggregation for positioning measurements, noting that it is not necessary to comment simply to repeat a company position that is already correctly captured in the summary.

Feedback Form 18: Bandwidth aggregation - Comments to high level objectives - Initial Round

1 – ZTE Corporation

This feature has been concluded as feasible in RAN4 (equivalent to recommend to WI, just wording difference between RAN1 and RAN4), and obviously it is beneficial to improve the accuracy. We don't understand why down-scope is needed here.

We should note that, from the feasibility and complexity perspective, this feature is similar as and even better than RedCAP PRS/SRS hopping.

2 – vivo Mobile Communication Co.

RANP should take on the responsibility to control the overall workload. Compared to the study phase, RAN1 workload is even more increased with this newly added input from RAN4. We prefer to drop this one in Rel-18 WI.

3 – Ericsson LM

We support the objective. We see BW aggregation as a relatively small objective considering the aggregation conditions of contiguous, single RF carriers.

4 – Classon Consulting

[for FUTUREWEI] Can consider to support as long as the [] items for LPHAP are included.

5 – MediaTek Inc.

As indicated by the moderator, we proposed to include an objective following the WG recommendations, but we think this is a somewhat lower priority than other objectives. We also understand that it should be scoped to intra-band contiguous carriers in line with the study conclusions (the justification in the WID already reflects this, but the objective does not).

6 – AT&T GNS Belgium SPRL

We support the objective and perhaps we can state more specifically, based on PRS/SRS bandwidth aggregation for intra-band contiguous carriers.

7 – InterDigital

Although we are supportive for this objective, we are ok not to include this due to the workload concern.

8 – China Mobile E-Commerce Co.

Support. PRS/SRS bandwidth aggregation is beneficial of improving positioning accuracy from RNA1's perspective, and is feasible from RAN4's perspective, it should be recommended for the normative work.

9 – Samsung R&D Institute UK

Thanks for the discussion. Based on RAN4 LS, we think that assumptions for contiguous carrier and single chain Tx/Rx architectures are very restrictive. Also, as RAN1 didn't consider BW aggregation in the SI phase and given the large scope of positioning WI it is not recommended to add more work to RAN1.

10 – SHARP Corporation

Open to discuss. The workload should be considered carefully.

11 – LG Electronics Finland

We support the objective. But, we are fine to exclude this if there is a workload concern.

12 – Beijing Xiaomi Mobile Software

We support the objective. But we are OK to drop it in R18 Positioning, considering the workload.

13 – Nokia France

For accuracy enhancement, carrier-phase positioning brings the greater benefits, and it is not clear how common is the case of suitable spectrum for intra-band aggregation. Nevertheless, we are OK to include bandwidth aggregation if there is strong operator support.

14 – Qualcomm CDMA Technologies

To clarify our position, we are supportive of adding PRS/SRS Aggregation, which has already been studied in previous releases with the recommendation "study further and if needed, specify during normative work" (TR 38.857). RAN4 now also concluded the study and confirmed feasibility. As already shown in previous studies, bandwidth aggregation can achieve cm-level accuracy. This is like ultra-wideband (UWB) positioning but using NR signals.

However, our concern is on the large list of objectives and corresponding workload in the WGs. Given that Rel-16/17 has already specified features and enhancements for accuracy improvements, we suggested to defer any accuracy improvement features to Rel-19. Rel-19 can then also include the completion of the study on carrier phase positioning (see our comments on carrier phase in next section).

15 – OPPO Beijing

In our view it is a low priority feature, considering the workload, we propose to drop it.

16 – Sony Europe B.V.

There are other high priority features for Rel-18. Our preference is to down-prioritized this topic. We may reconsider if there is a strong support from the operators.

17 – Motorola Mobility Germany GmbH

[Lenovo]

Generally supportive of this objective in the WI in terms of accuracy enhancement, but to further clarify, we would also be fine as other companies suggested to defer this objective to forthcoming releases if the overall RAN1 workload is too high, which seems to be already the case.

18 – NTT DOCOMO INC.

Considering the workload of current recommended items is too large, we think bandwidth aggregation may be considered as low priority in Rel-18.

19 – Deutsche Telekom AG

No support -> work load ! Out of Rel-18 !

20 – HUAWEI TECHNOLOGIES Co. Ltd.

We support this objective.

We share similar view with many companies that this feature improve positioning accuracy clear.

We think that the specification impact on bandwidth aggregation in RAN1/RAN2/RAN3 is mainly the configuration and UE capabilities, which does not increase the overall work load much. RAN4 RRM requirements are the primary impact.

To company mentioning this feature is not studied/concluded in RAN1. We just would like to remind that this feature has been studied and recommended in Rel-17, but not included in Rel-17 WI as RAN4 feasibility is missing at that time. Now RAN4 confirmed the feasibility in Rel-18, it would be reasonable to include this objective now in Rel-18.

21 – TELECOM ITALIA S.p.A.

no support for workload issues

In additional to the discussion of the high level objective on bandwidth aggregation, companies may also provide detail comments to the text proposed by the rapporteurs in RP-222983

Feedback Form 19: Bandwidth aggregation - Comments to WID text - Initial Round

<p>1 – Ericsson LM</p> <p>OK with the text.</p>
<p>2 – Samsung R&D Institute UK</p> <p>Thanks for the discussion. We have one question for RP-222983. The current WID seems to include both intra-band contiguous carrier and intra-band non-contiguous carrier. Is it correct understanding?</p>
<p>3 – ZTE Corporation</p> <p>@Samsung, based on RAN4’s feedback, only intra-band contiguous carriers are feasible now.</p>
<p>4 – Nokia France</p> <p>The last sub-bullet could be clarified as follows: ”Specify corresponding new core requirements, as well as discuss and identifying <u>and specifying</u> the impact on the existing RAN4 specifications including RRM measurements and procedures [RAN4]”</p>
<p>5 – HUAWEI TECHNOLOGIES Co. Ltd.</p> <p>Brackets should be removed. RAN3 should be also added as impacted working group.</p>

3.5.2 Summary from Initial Round

Very few companies expressed any technical concerns with the support of this feature, with most of the concern expressed coming from a workload perspective. Quite a number of companies expressed support for the feature but either prefer to or are at least open to defer the work to a later release. There is no clear majority in favour of including this feature in the WI and so the moderator’s proposal is that this is not included.

Moderator’s proposal: Bandwidth aggregation for positioning measurements is not included in the scope of the WI.

3.5.3 Intermediate Round

Companies are asked to comment on the proposal from the moderator in the summary from the IntermediateRound

Feedback Form 20: Bandwidth aggregation - high level objectives - Intermediate Round

1 – AT&T GNS Belgium SPRL

With workload a concern but no technical concerns on the specification work to support this, perhaps we can include "PRS/SRS bandwidth aggregation for intra-band contiguous carriers" in the WID objectives as a "second priority" given dependency on how progress will be on this WI.

2 – Classon Consulting

[for FUTUREWEI] Can live without it, though also OK to consider it after the recommended items are included.

3 – ZTE Corporation

We have strong concern on this conclusion. We did numerous evaluation in Rel-17, we further spend a lot of time to discuss the feasibility in RAN4 in Rel-18. Now, just down-scope this feature without any technical concern.

We would like emphasize again that we have 3 TUs in RAN1, all features discussed in this meeting are from SID. And this feature is only for intra-band contiguous CA in which RAN4 already concluded that single RF chain is used. Hence, the spec enhancement will be very concrete in RAN1. No much workload impact at all.

The procedure here is quite weird that, we agreed to study the feasibility in SID, and RAN4 concluded it is feasible. Then we suddenly refuse this feature into WID in RAN meeting. In such case, why did we waste time to discuss this in SI.

If companies still have concern, we are fine to shrink each topic, e.g. drop unlicensed spectrum, FR2 for sidelink spectrum as we did, rather drop the whole feature of BW aggregation here.

4 – Intel Corporation (UK) Ltd

We are okay with the proposal considering workload by pushing out the discussion later.

5 – Chinatelecom Cloud

Support, we are fine with the proposal to include bandwidth aggregation for positioning measurements into the WI scope.

6 – New H3C Technologies Co.

support

7 – Apple France

We are fine with the Moderator's proposal

8 – Samsung R&D Institute UK

We support the moderator's proposal

9 – MediaTek Inc.

We see some value in the CA objective but also have workload concerns, and as indicated in the initial round, we think the scoping to intra-band contiguous carriers should be clear. AT&T’s proposal seems to represent a reasonable way forward.

10 – Beijing Xiaomi Mobile Software

Fine with the proposal from AT&T to treat the SRS/PRS bandwidth aggregation as the second priority.

11 – Qualcomm CDMA Technologies

We disagree with the Moderator’s proposal.

This topic was extensively studied in RAN1 during Rel-17 (TR 38.857) as an enhancement for improving positioning accuracy, and in RAN4 during Rel-18 (38.859). From the company comments provided, we have not observed any technical comments disputing the RAN1/4 outcome of the study on benefits and feasibility.

If workload is a concern, but cm-level accuracy is desired, we should include PRS/SRS aggregation in Rel-18, which has proven benefits and feasibility, and postpone carrier-phase-positioning for which there are no conclusive study results available (see comments on carrier phase positioning in section 3.6.2).

We also believe that PRS/SRS aggregation has significant less specification impacts overall (primarily RAN4 requirements and configuration/capability signalling), and therefore, less workload compared to carrier phase positioning.

Therefore, we believe the more proven capability with the lesser specification and deployment impact should be the one to include.

12 – China Mobile E-Commerce Co.

We are not supportive of moderator’s proposal. During the study in RAN1 in R17, PRS/SRS bandwidth aggregation provide valuable gains, and now the study in RAN4 confirms the feasibility, we don’t see the reason why it is not included in the WI scope. From workload perspective, we don’t think it is a big issue, not too much spec work is expected of specifying bandwidth aggregation.

13 – NTT DOCOMO INC.

We support the moderator’s proposal. If there is no workload concern, we are open to discuss AT&T’s proposal (i.e., second priority in the WID objectives).

14 – HUAWEI TECHNOLOGIES Co. Ltd.

We have concern to drop this feature from Rel-18 and delay it further to Rel-19. Bandwidth aggregation was recommended in Rel-17 and its feasibility is confirmed by RAN4 in Rel-18, and there is no technical concern raised in the initial round discussion. Regarding work load, we share similar view with ZTE/Qualcomm and few other companies that not much specification work is actually needed to enable this feature. Both

<p>bandwidth aggregation and CPP are techniques for accuracy improvement. So one way forward could be to include both bandwidth aggregation and CPP in the Rel-18 WI, then accuracy improvement for multiple scenarios can be supported in this release.</p>
<p>15 – OPPO Beijing</p> <p>We support the moderator’s proposal</p>
<p>16 – LG Electronics Finland</p> <p>We have a similar view with AT&T. If there is a workload concern, then we prefer this feature in the WID objectives as a second priority than a drop.</p>
<p>17 – LG Electronics Finland</p> <p>We have a similar view with AT&T. If there is a workload concern, then we prefer this feature in the WID objectives as a second priority than a drop.</p>
<p>18 – Motorola Mobility Germany GmbH</p> <p>[Lenovo]:</p> <p>We do not support the moderator’s view on this proposal, PRS/SRS BW aggregation has been studied extensively by both RAN1 and RAN4. However, given that fact that CPP has also been included as per the moderator’s subsequent proposal in 3.6.2, this seems to imply that the workload aspect is not a big issue by companies. We now prefer that this aspect be included without any prioritization.</p>
<p>19 – Sony Europe B.V.</p> <p>We support the moderator’s proposal.</p>
<p>20 – Ericsson LM</p> <p>We do not support the moderator’s proposals. We would like the objective to stay in the WID. If the concern is not technical, we should treat the objectives equally. For example, considering the workload we think some of the LPHAP agenda could be trimmed to make space for bandwidth aggregation</p>
<p>21 – Nokia France</p> <p>We are OK with the moderator’s proposal, but we could also accept AT&T’s proposal to enable this to be included.</p>
<p>22 – Deutsche Telekom AG</p> <p>We support not including this (for workload reasons)</p>

3.5.4 Summary from Intermediate Round

For the high level objectives the conclusion from the intermediate round and the Wednesday GTW discussion of RP-223446 was:

Conclusions on bandwidth aggregation:

- Bandwidth aggregation for positioning measurements is included in scope. To be scoped to minimise workload as much as possible.

The rapporteur will update the WID to reflect these conclusion and also take into account the detail comments to the WID text.

3.5.5 Final Round

Companies are asked to comment on the updated WID shared at after the intermediate round.

Feedback Form 21: Bandwidth aggregation - Final Round

1 – AT&T GNS Belgium SPRL

We support this objective to be included with limited scope as follows:

- Specify support for bandwidth aggregation for positioning measurements across intra-band contiguous carriers [RAN1, RAN4].
 - Specify procedures to support aggregation of PRS/SRS (respectively) resources across PFLs/-carriers (respectively) for positioning measurements under the assumption that the signals over aggregated resources are transmitted and received (respectively) using a single RF chain (same antenna) [RAN1].
 - Specify RRM requirements, including PRS measurement period/reporting/accuracy (including margins) [RAN4].

2 – ZTE Corporation

RAN2 is included in the main bullet, but not in any subbullets.

3 – Samsung R&D Institute UK

Based on Wednesday GTW discussion, the remaining controversial issues were bandwidth aggregation and CPP. Now, the current direction includes both in the work item scope by minimizing the scope of each. We think that the issue is not just the work scope, but whether we can have meaningful functionality for these objectives at the end of the release. CPP was not recommended based on RAN1 study. This means its benefit is very limited, without careful mitigation of error sources such as multi-path and addressing the integer ambiguity issues. During the SI several solutions have been proposed to mitigate error sources, we can imagine long discussions during the WI phase for down-selection and specification. These are essential aspects to consider for having meaningful carrier phase accuracy. Bandwidth aggregation is feasible only in intra band contiguous carriers. Based on Wednesday GTW discussion, only two operators in China seems have this contiguous band. Therefore, the benefit of this feature seems to be limited. Hence, we prefer not to include both in the work scope.

4 – CATT

1) In addition to the RF constraint of single chain Tx/Rx architectures at both the UE and gNB, RAN4 has additional assumptions for bandwidth aggregation for positioning (see Section 6.2 in TR 38.859), e.g.,

- A common numerology is required across all intra-band contiguous PFLs/carriers to be aggregated.
- PRS/SRS resources to be aggregated from different PFLs/carriers are transmitted in the same slot and in the same symbols
- PRS resources to be aggregated from different PFLs are transmitted by the same TRP and associated with a common Antenna Reference Point (ARP).

It would be better to mention, or refer TR 38.859, for these assumptions in WID.

2) Our understanding for the benefits of bandwidth aggregation is mainly for timing related measurements (e.g., RSTD, RTOA, and UE/gNB Rx-Tx time difference). Thus, to minimize the WI workload and to make the WI scope clear, we propose adding a note in WID that the support of bandwidth aggregation for positioning measurements applies only to timing related measurements (e.g., RSTD, RTOA, and UE/gNB Rx-Tx time difference).

So the update is suggested to add two NOTES:

- Specify procedures to support aggregation of PRS/SRS (respectively) resources across PFLs/carriers (respectively) for positioning measurements under the assumption that the signals over aggregated resources are transmitted and received (respectively) using a single RF chain (same antenna) [RAN1].

§ NOTE: Refer to Section 6.2 in TR 38.859 for the detailed assumptions.

§ NOTE: The support bandwidth aggregation for positioning measurements applies only to timing related measurements (e.g., RSTD, RTOA, and UE/gNB Rx-Tx time difference).

5 – vivo Mobile Communication Co.

We would like to further clarify the following:

1. For PRS aggregation across multiple PFLs, our understanding is that each PFL would not go beyond the bandwidth of a carrier otherwise we may need to design complicated signaling for such scenarios. We hope this can be clarified with necessary limitation, otherwise this issue would trigger additional discussion in RAN1, for example with the following note:

- Note□the case of 1 PFL covering multiple contiguous carriers is not included

2. RAN4 conducted the corresponding study in Rel-18. The expected work in RAN1/RAN2 according to supporting companies is not much. Also considering RAN1 is overloaded now with too many objectives, we prefer to make this item as RAN4 leading rather than RAN1 leading. And we add necessary signaling and procedure in the first subbullet and remove RAN1 as the responsible WG, since this bullect cover a lot of restrictions from RAN4.

- Specify ~~signaling and procedures to support~~ bandwidth aggregation for positioning measurements across intra-band contiguous carriers [RAN4, RAN2, RAN1].

- Specify **necessary signaling and** procedures to support aggregation of PRS/SRS (respectively) resources across PFLs/carriers (respectively) for positioning measurements under the assumption that the signals over aggregated resources are transmitted and received (respectively) using a single RF chain (same antenna) [RAN4, RAN2, RAN1]~~[RAN1]~~.
- Specify corresponding new core requirements, as well as discuss and identify the impact on the existing RAN4 specification, including RRM measurements and procedures [RAN4].

6 – ZTE Corporation

CATT's revision seems good to limit the workload. We support that.

For vivo's revision on signaling/procedures design, it is a bit weird to let RAN4 lead such discussion. We think RAN1 work is still manageable.

7 – vivo Mobile Communication Co.

Let me reword the bullet based on ZTE's comment.

- Specify ~~signaling and procedures to support~~ bandwidth aggregation for positioning measurements across intra-band contiguous carriers [RAN4, RAN2, RAN1].
- Specify **necessary signaling and procedures** to support aggregation of PRS/SRS (respectively) resources across PFLs/carriers (respectively) for positioning measurements under the assumption that the signals over aggregated resources are transmitted and received (respectively) using a single RF chain (same antenna) [RAN2, RAN1, RAN4] ~~[RAN1]~~.
 - **Note1** □ **the case of 1 PFL covering multiple contiguous carriers is not included**
 - **Note2: RAN4 to specify solutions first and the solution is used as input for RAN1/RAN2 signaling design.**
- Specify corresponding new core requirements, as well as discuss and identify the impact on the existing RAN4 specification, including RRM measurements and procedures [RAN4].

8 – China Mobile E-Commerce Co.

We support moderator's proposal.

In Rel-18 SLEvo, LTE-V/NR-V co-channel coexistence was also included in the WI scope to specify solutions which is a regional problem (only in Europe), we don't see why bandwidth aggregation should not be included just because contiguous band only exists in China. In addition, there is no contiguous band scenario in other countries and operators does not imply that it won't happen in the future.

9 – MediaTek Inc.

OK with the draft WID.

10 – Intel Corporation (UK) Ltd

We support the latest version. We can also accept the version for the RAN4 bullet as suggested by ATT.

RAN2 is included as a responsible WG for the support of the related signalling of the configuration, etc., once the solution is designed by RAN1. This is business as usual, and a separate objective may not be strictly needed to state this. In this regard, we would also be okay to remove RAN2 from the list as recommended by ATT with the understanding that RAN2 would need to work on the signalling part anyway.

In response to the suggested additional bullets as notes, in our view, they are not necessary. As typical practice, the agreements so far in WGs (and also captured in TR in this case) would automatically define the starting point of the work.

On the second note suggested by Vivo we agree with ZTE that the physical layer design to enable this feature should be RAN1's responsibility.

11 – HUAWEI TECHNOLOGIES Co. Ltd.

We think that the proposal from CATT is going to a good direction in terms of controlling the work load. However, for the second Note proposed by CATT, we prefer to revise it as **The performance requirement with bandwidth aggregation for positioning measurements applies only to timing related measurements...**It should not have impact on the core part and signaling design for it.

For the comments from vivo, we think that this can be WG-level discussion, and we think the Note should be a common understanding considering the gap between contiguous carriers.

12 – Qualcomm CDMA Technologies

We are generally O.K. with the updated objective.

Since we got the task to "minimise workload as much as possible", we suggest focussing on connected mode and gap-based measurements only in this release; e.g.:

"Specify signaling and procedures to support bandwidth aggregation for positioning measurements performed within measurement gaps in connected mode, across intra-band contiguous carriers [RAN1, RAN2, RAN4]."

13 – Ericsson LM

We support QC's suggested changes to the objective i.e. positioning measurements within gaps and in RRC connected state.

Another possible reduction of work load will be that RAN4 requirements are defined for limited number of PFLs preferably 2 adjacent FPLs.

14 – Motorola Mobility Germany GmbH

[Lenovo]:

Support the Moderator’s updated WID text, and share QC’s and Ericsson’s suggestions for reduced work load.

15 – Nokia France

RAN2 should be added as a responsible group on the main bullet.

In the interests of minimising the workload, we also propose to limit the bandwidth aggregation to two carriers, as we don’t see more than two carriers being a useful case for operators:

- Specify signaling and procedures to support bandwidth aggregation for positioning measurements across two intra-band contiguous carriers [RAN1, RAN2, RAN4]
 - o Specify procedures to support aggregation of PRS/SRS (respectively) resources across two PFLs/carriers...

For RAN4, we suggest the following for clarity with minimum impact:

- **Specify corresponding RRM requirements, including requirements for PRS measurement period/reporting [RAN4].**

16 – Sony Europe B.V.

We support the Qualcomm’s proposal with the motivation to reduce the work-load.

17 – China Unicom

As operator who has been allocated with 3*100M CC for 5G network, we don’t agree to limit the number of PFLs to 2 adjacent PFLs.

18 – China Telecommunications

We don’t think the number of PFLs should be limited to 2. There are 3 contiguous carriers in n78 in China. So 3 PFLs is preferred.

19 – ZTE Corporation

We share the same view as China Unicom and China Telecom. We don’t agree to limit the number of PFLs to 2.

3.5.6 Summary from Final Round

As recommended from the Wednesday GTW discussion, the main discussion has been related to proposals to keep the scope constrained. The moderators suggest to handle these as follows:

- Constraint to ”within measurement gaps in connected mode” - moderator proposes to include this in the

WID

- Constraint to 2 carrier - this was supported by a number of companies but concerns were raised by an operator with 3 carriers that could be suitable for aggregation. Moderator proposal is capture a limit of 'up to three' carriers.
- Suggestion to refer to "Section 6.2 in TR 38.859 for the detailed assumptions" - proposed by one company but another company suggested this should not be added as the work during the study as captured in the TR anyway forms a basis for the future work. The moderator proposal is to not capture this.
- Suggestion to add "the case of 1 PFL covering multiple contiguous carriers is not included". To the moderator it seems a natural assumption that one PFL corresponds to one carrier and to avoid starting down a path to capture such things in the WID, the moderator's proposal is to not add this text.
- Constraint to "timing related measurements (e.g., RSTD, RTOA, and UE/gNB Rx-Tx time difference)." - the moderator proposes to capture this in the WID.

Other more minor proposals have been included in the updated WID as appropriate.

3.6 NR carrier phase positioning

3.6.1 Initial Round

The top level objective on NR carrier phase positioning is included as blue text within the rapporteur's draft WID. Views from the contributions are summarised below:

1. Supportive to include: Nokia (2991), Huawei (3005), AT&T/Firstnet (3007), Xiaomi (3017), Spreadtrum (3035), CMCC (3042), CATT(3135), docomo(3163), CEWiT et al (3225), MediaTek(3244), ZTE (3255), LG(3121)
2. In addition to individual company contributions expressing support, RP-223134 is a multi-company contribution supporting inclusion of carrier phase positioning and co-sourced by: CATT, Nokia, Nokia Shanghai Bell, ZTE, CMCC, LG Electronics Inc., MediaTek, CAICT, China Telecom, IIT Kanpur, Xiaomi, CEWiT, Fraunhofer IIS, Fraunhofer HHI, China Unicom, Huawei, HiSilicon, Telecom Italia, Verizon
3. Not supportive to include: Qualcomm (3124), Ericsson (3286), Bosch(3425).
4. Discussion needed: Intel (2984), Futurewei (3336), Lenovo (3360)

Companies are requested to provide comments on whether to include NR carrier phase positioning, noting that it is not necessary to comment simply to repeat a company position that is already correctly captured in the summary.

Feedback Form 22: Carrier phase positioning - Comments to high level objectives - Initial Round

1 – ZTE Corporation

Support this feature in WID. we see some performance gain. For workload manageable, we can make the enhancement focus on measurement report, i.e. include phase measurement in the existing measurement

report element.
2 – KT Corp. Support this feature in the WID
3 – Ericsson LM We should respect the SI outcome and not include carrier phase positioning. The study did not recommend the feature to be specified, it simply said that the PRS could be used to obtain carrier measurements. The SI could not agree on performance requirements for CPP. Considering the accuracy requirements of previous releases (i.e. positioning error at the 90th percentile), we note that the performance of CPP is on the same level or sometimes worse than already specified legacy methods. Moreover, the CPP evaluations assumed the use of densely deployed and exactly located PRUs, this is not realistic in practical situations. We saw that CPP accuracy was dropping for even centimeters in location errors for the TRP (the PRU location error was never evaluated).
4 – Fraunhofer IIS We support this feature in the WID.
5 – ROBERT BOSCH GmbH As mentioned in our TDoc, we don't support this feature in the WID. Considering overall workload constraints and fairly demanding evaluation assumption which are unrealistic in practice we think other features are more important to be considered in the WID.
6 – Classon Consulting [for FUTUREWEI] OK to discuss but some concerns. Recommended items need to be supported before this one.
7 – MediaTek Inc. As noted during GTW, carrier phase positioning is the only candidate for a RAT-dependent technique offering cm-level accuracy. The main concern in the WG discussion (also reflected in Ericsson's comment above) was the impact of antenna placement; we see this as an implementation/deployment issue that can be addressed when this level of accuracy is needed, and it doesn't need to be a blocking issue for specification of the feature.
8 – AT&T GNS Belgium SPRL We support inclusion of CPP in the WID objectives. It seems to be a low hanging fruit as far as the specification work is concerned. We are re-using the existing DL PRS and UL SRS and can define new NR carrier phase measurements/signaling.
9 – TELECOM ITALIA S.p.A. supportive

10 – InterDigital

We are supportive for this objective as long as the workload is reasonable.

11 – China Mobile E-Commerce Co.

We support to include NR carrier phase measurements in Rel-18 normative work.

12 – Samsung R&D Institute UK

Thanks for the discussion. Basically, we prefer to follow the recommendation in TR. CPP was not recommended. However, we see many operator's support on CPP. In this aspect, we will take a neutral position about this issue. However, specification impacts on CPP should be minimized considering workload.

13 – Intel Corporation (UK) Ltd

We are open to considering normative work on NR CPP to enable higher positioning accuracy, but prefer to limit the work to only specifying basic carrier phase measurements and their reporting. Mitigation of impact from practical impairments like multipath, initial phases, or integer ambiguity can be left up to implementation. Note that for handling of multipath, there are already tools available from Rel-17 to aid in this direction.

14 – Verizon UK Ltd

We also support to include NR CPP in Rel-18

15 – OPPO Beijing

The carrier phase positioning was studied and evaluated during SI but RAN1 did not agree any recommendation for normative work. Furthermore, we should consider the work load for WID. Thus we prefer not to include this feature in WID.

16 – NTT DOCOMO INC.

We are supportive to include NR CPP in the WID.

17 – Beijing Xiaomi Mobile Software

We support to include the CPP in the WID.

18 – CATT

We strongly support including this feature in the WID. As shown in TR 38.859, under the same evaluation condition as Rel-17, NR CPP has reached 1cm@80% for InF-SH scenario and 1cm@50% for InF-DH scenario, whereas the positioning errors of legacy approach is much larger as shown in TR 38.857 under the same evaluation conditions w/o considering time/frequency/ARP/PCO errors. The evaluation results in TR 38.857 in the SI also shows the impact of timing/frequency errors can be eliminated by the use of the double differential technique.

Mainly due to the impact of ARP errors on NR carrier phase positioning accuracy, RAN1 could not reach a consensus to recommend the support of carrier phase measurements for positioning in R18. Clearly, how

to reduce the ARP/PCO errors, which is common for both GNSS carrier phase positioning and NR carrier phase positioning, should/can be handled in the implementation.

About the support of NR CPP in R18, we suggest limiting the scope to the support of the carrier phase measurement and reporting based on the existing DL PRS/UL SRS. With this limitation, we don't see any significant workload for RAN1/2/3/4, but with the potential to support cm-level positioning accuracy, at least for some scenarios in which precise determination of the ARP location is possible.

19 – Nokia France

RAN1 concluded that it is feasible to use CPP to achieve cm level accuracy. This is a very important new capability for operators, especially in indoor scenarios, where GNSS is not available. This is therefore the most important objective to include in this WI, as shown by the strong support from many companies including major operators.

That said, it is fine to reuse existing reference signals.

(Note also that the assumptions used for the evaluations were fully realistic; it is surprising that a company suggests that it might not be possible to locate the ARPs to cm level accuracy, while we aim to locate UEs to cm level! This is not at all a problem.)

20 – Qualcomm CDMA Technologies

RAN1 did not include a recommendation for this item to be part of a normative phase (RAN1 only concluded that it is feasible to achieve a "few cm" accuracy performance at 50% under a set of conditions/scenarios).

In the above statement from the TR conclusion, there are at least three main aspects that need to be emphasized: First, a "few cm" accuracy may already be possible for Rel-16/17 positioning techniques. However, there was no direct comparison performed, nor documented in the TR, even in the individual company sections. Second, an accuracy observation for the 50% percentile point, doesn't provide much value since, accuracy for the 80%, or 90, or 95% percentiles is really needed to be known for any high accuracy positioning system; however, RAN1 was not able to converge on what is the accuracy of carrier phase at such percentiles. Third, the need of cm-level accuracy for gNB/PRU location, along with the need of deploying PRUs, makes such a technology more difficult to be deployed in practice compared to a Rel-16/17 positioning techniques.

Furthermore, note that the study could not conclude on accuracy requirements for carrier phase positioning, and there is no obvious known use-case (e.g., see the SA1 requirements) that require just "a few cm" accuracy at the 50%. As we pointed out above, we believe that a "few cm" accuracy, especially at 50%, can already be achieved with the Rel-16/17 methods under certain conditions, and certainly with PRS/SRS aggregation discussed in section 3.5. From our understanding, at higher percentiles (>50%), carrier phase positioning performance and that of Rel-16/17 methods can actually be similar, or even worse than that of Rel-17 positioning methods; proponents of the CPP should observe that, in the TR, there was no observation/conclusion achieved for those percentiles (e.g. 80% or 90%), nor any conclusion was captured on the benefits of carrier phase positioning over any Rel-16/17 positioning method. The lack of such observation/s/conclusions means that there was no consensus in RAN1 on these aspects, otherwise they would appear in the TR. To add to that, there was no consensus what is the performance at the 50% percentile beyond the vague statement of "few cm" (or in other words, what does "a few cm" really mean?).

Finally, RAN4 has not studied the feasibility, as they clearly pointed out in their LS (in contrast to the PRS/SRS aggregation which has been evaluated and concluded). The CPP would require significant work in RAN4: new measurements that were never studied before in 3GPP would require new performance requirements that were never considered before, and ways of actually testing these requirements (again, such test cases would be new in 3GPP). In this sense, adding CPP in this normative phase is not "a low hanging fruit" from the specification standpoint; it is actually the opposite; a rather difficult and time-consuming task, that would require significant time, at least in RAN4, in order to define requirements and test cases, if first, found feasible from their perspective.

Hence, we think it is premature to include an objective for the normative phase on carrier-phase positioning in this Release. Given that PRS/SRS Aggregation has been fully studied in both, RAN1 and RAN4, we prefer to support PRS/SRS Aggregation to achieve cm-level accuracy in this Release, if there is room for an "accuracy enhancement" objective.

21 – LG Electronics Inc.

We support for including CPP in the WID objective. To reduce the workload, we may focus on introducing basic features, such as measurement/reporting, in Rel-18.

22 – Sony Europe B.V.

CPP sounds attractive to obtain cm-level of accuracy. However, during SI phase RAN1 did not manage to recommend CPP. In our observations: CPP is quite sensitive to various error sources. It also requires, dense PRUs deployment. Hence, in practice, it becomes challenging to achieve cm-level accuracy. We prefer to down prioritize CPP.

23 – Motorola Mobility Germany GmbH

[Lenovo]

While we in general, welcome any accuracy enhancements, CPP has been concluded with conditional requirements, e.g., need for PRUs, cm-level up to 50%ile requirements, error sensitivity. In comparison with the other discussed accuracy enhancements, PRS/SRS BW aggregation has undergone RAN1 and RAN4 feasibility studies with more positive recommendations in both Rel-17 (RAN1) and Rel-18 (RAN4). In general due to the foreseen heavy work load, we would be also ok to forego any accuracy-related enhancements including the previous aspect of PRS/SRS BW aggregation and CPP for the Rel-18 WI and defer them to future releases.

In general, we should also be mindful of not creating a precedent, whereby inconclusive (not fully clear) study recommendations as noted in CPP are pushed through to the WI phase, especially knowing that the workload is high.

24 – Orange

We support this proposal and believe carrier-phase positioning is a promising technique to achieve cm-level accuracy, which is the main differentiator brought by Rel-18 on positioning.

25 – Deutsche Telekom AG

Support

<p>26 – Telia Company AB</p> <p>We support CPP to be included in the WID objectives.</p>
<p>27 – HUAWEI TECHNOLOGIES Co. Ltd.</p> <p>It is concluded in RAN1 that centi-meter level accuracy can be achieved, which gives good performance. We support the inclusion of carrier phase positioning by specify the first path and additional path phase measurement. The use of such a measurement may not be limited to carrier phase positioning</p>
<p>28 – CEWiT</p> <p>It is quite clear that carrier phase provides cm level accuracy. Usecases and requirements in Rel 18 demands such accuracy. Therefore Rel 18 positioning WI should include carrier phase positioning and we support it strongly.</p>
<p>29 – Philips International B.V.</p> <p>We are supportive.</p>
<p>30 – IIT Kanpur</p> <p>RAN1 study shows that cm-level accuracy could be achieved by CPP. We support CPP in the normative phase.</p>

In additional to the discussion of the high level objective on bandwidth aggregation, companies may also provide detail comments to the text proposed by the rapporteurs in RP-222983

Feedback Form 23: Carrier phase positioning - Comments to WID text - Initial Round

<p>1 – CATT</p> <p>We are fine with the proposed NR CPP objectives in the RP-222983.</p>
<p>2 – Nokia France</p> <p>The work scope could be more clearly defined, especially to clarify that no new reference signals would be specified. We propose the following:</p> <ul style="list-style-type: none">- Specify physical layer measurements and related signalling to support NR carrier phase positioning using existing DL PRS and UL SRS for both UE-based and UE-assisted positioning [RAN1, RAN2, RAN4].<ul style="list-style-type: none">o Define UE DL carrier phase measurement(s) [RAN1]o Define gNB UL carrier phase measurement [RAN1]

- Specify reporting and signaling to facilitate support of NR carrier phase positioning [RAN2, RAN3]
- Specify corresponding new core requirements, as well as identifying and specifying the impact on RRM measurements and procedures [RAN4].

3.6.2 Summary from Initial Round

There is a strong majority of companies that are in favour to include carrier phase positioning in the scope of the WI. At the same time, those companies not in favour to include carrier phase positioning point to the fact that RAN1 was not able to agree a recommendation from the study item. Based on the level of company support the following proposal is made:

Moderator’s proposal: NR carrier phase positioning is included in the scope of the WI

3.6.3 Intermediate Round

Companies are asked to comment on the proposals from the moderator in the summary from the Intermediate Round.

Feedback Form 24: Carrier phase positioning - high level objectives - Intermediate Round

1 – AT&T GNS Belgium SPRL We support the moderator proposal.
2 – Classon Consulting [for FUTUREWEI] OK to consider as long as the recommended items are included. Otherwise drop it.
3 – FirstNet We support moderator’s proposal.
4 – Nokia France We support the moderator’s proposal.
5 – KT Corp. KT supports moderator’s proposal.

6 – Intel Corporation (UK) Ltd

We are fine with the proposal from the moderator.

7 – New H3C Technologies Co.

support

8 – CATT

We support Moderator’s proposal.

· In addition, from the standard effort point of view, we believe the workload for supporting NR carrier phase positioning is small, if we limit the effort to the carrier phase measurement reporting. From RAN1’s perspective, the effort will be in defining the DL/UL carrier phase measurement based on the existing DL PRS/UL SRS signals. From RAN2/3 perspective, the effort will be defining the signaling for reporting the measurements on top of the existing signaling. From RAN4’s perspective, the main effort will be defining the performance requirements for carrier phase measurements, similar to other existing positioning measurements.

· About the feasibility studies for RRM aspects of carrier phase measurements, RAN4 has indicated clearly that it needs to wait for conclusive RAN1 study outcomes. In RAN1 study, it has the conclusion that “Based on the study, it is concluded that it is feasible to use existing DL PRS and SRS signals to obtain the carrier phase measurements for achieving a horizontal accuracy of up to a few centimeters at least at 50% under certain conditions, ..”. By the way, GNSS carrier phase for positioning is already widely used in cm-level positioning. In comparison with GPS signal power (<125dBm/whole carrier), NR signal power (>90dBm/subcarrier) is much stronger. Thus, no single company mentioned the need for RAN4 to perform the feasibility study during the SI phase. This is different from DL PRS/UL SRS aggregation for positioning measurement. During Rel-17 SI, there was a consensus in RAN1 that it needed RAN4 to perform the feasibility study for DL PRS/UL SRS aggregation for positioning.

· We share a similar view as many other companies that the challenges for supporting NR carrier phase positioning should be and can be resolved in the implementation. The existing methods developed for GNSS carrier phase positioning can be borrowed for supporting NR carrier phase positioning for resolving the integer ambiguity, eliminating the impact of the ARP errors, multipath, etc. From the specification point of view, what we need is to simply support the UE/gNB to provide the carrier phase measurements.

9 – Verizon UK Ltd

Fine with moderator’s proposal

10 – MediaTek Inc.

Support the moderator’s proposal. We generally agree with CATT’s comments and do not see the specification work as prohibitive.

11 – Beijing Xiaomi Mobile Software

We support Moderator’s proposal.

12 – NEC Corporation

We support this proposal, and we recommend to focus on how to reduce overall workload in the next round discussion.

13 – IIT Kanpur

We support the moderator's proposal.

14 – Qualcomm CDMA Technologies

We disagree with the Moderator proposal.

As noted in our comments in the 1st round (and by others), the study did not conclude whether there are any benefits, and consequently, did not recommend the feature to be specified.

We understand that there is a majority of companies in favour to include carrier phase positioning in the scope of the WI, but we can not accept that inconclusive study results are pushed to normative work. The purpose of a study normally is to prove benefits and feasibility, which both have not been accomplished for carrier phase positioning yet. Specifically, performance benefits over already specified positioning techniques have not been proven; performances at >50%ile are inconclusive; RAN4 feasibility (in particular antenna/RF/testing possibility) has been ignored; requirements on reference receiver density/deployment (PRUs) and impacts on accuracy are unclear.

We also want to repeat that "cm-level accuracy" (or to be more precise on what RAN1 observed so far: "a few cm accuracy at 50% percentile under a certain conditions") is not unique to carrier phase positioning and can be possible with the already specified techniques, or equally be achieved using PRS/SRS aggregation, but with less burden on deployment, since e.g., no reference stations (PRUs) need to be deployed. Unfortunately, RAN1 did not study the benefits of CPP over Rel-17 positioning methods, and therefore, at this point, there is no guidance from the technical working group on what we would expect as performance improvement using CPP.

Hence, as already commented previously, if workload is a concern, but cm-level accuracy is desired, we should include PRS/SRS aggregation in Rel-18, which has proven benefits and feasibility, and postpone carrier-phase-positioning for which there are no conclusive study results available yet.

15 – NTT DOCOMO INC.

We support the moderator's proposal.

16 – HUAWEI TECHNOLOGIES Co. Ltd.

We support the proposal from moderator to include CPP in Rel-18

17 – LG Electronics Inc.

We support the moderator's proposals.

18 – OPPO Beijing

We prefer to respect RAN1 study outcome and not to include this in R-18.

19 – Motorola Mobility Germany GmbH

[Lenovo]:

While we understand that the majority would support this enhancement, we tend not to agree with the Moderator's proposal, given that this discussion is deviating away from the traditional procedure of considering WI objectives with clear study recommendations.

If there is no perceived workload issue by the majority, we would then prefer the compromise where both PRS/SRS aggregation and CPP are introduced in R18. This would imply the introduction of two features which achieve the same accuracy enhancement objective.

20 – Chinatelecom Cloud

We support the proposal of the moderator.

21 – Sony Europe B.V.

We disagree with the moderator's view. During the study item phase, we have identified some issues (prone to errors, dense PRUs, etc). Furthermore, the cm-level accuracy is at low-medium percentile (50%), which is not good enough.

22 – ROBERT BOSCH GmbH

We disagree with the moderators proposal. Yes, it is true that some source show that cm-level accuracy was achieved. However, from an industrial vertical point of view, we think the practical potential considering the assumed deployment conditions is extremely low. Especially, as many companies mentioned the workload argument to justify limiting the scope of other topics (SL pos unlic., SL pos FR2, etc.), we don't understand the reasoning to include CPP in Rel.18 WI scope as the practical benefit could not be demonstrated. There was no recommendation from RAN1 to proceed with a normative phase for CPP. There seems to be a consensus that the WI scope needs to be wisely chosen to keep workload manageable. Therefore, we think it would be inconsistent to bring CPP to the normative phase and exclude other topics. We prefer to respect the RAN1 study outcome – hence, CPP should not be in the scope of the Rel. 18 WI.

23 – Philips International B.V.

We support the moderator's proposal.

24 – CEWiT

We support the moderator's proposal

25 – Ericsson LM

We wish to reiterate our technical concern on CPP proposed method. As noted in Qualcomm's comment, the accuracy performance of CPP are inconclusive at best. The centimeter accuracy requires an additional deployment of nodes, and even in that case, once we consider realistic impairments and evaluate applicable percentiles for performance, the results are showing that CPP does not provide an enhancements to existing features from release 17.

Additionally, we are confused with the way prioritization is discussed. Bandwidth aggregation has had no technical concerns, and is proposed to be excluded based on workload, while several companies expressed perfectly reasonable technical concerns regarding carrier phase-based positioning, which by the way has a comparatively higher work load, and yet the proposal is to include CPP in scope. At least when workload is considered, we should treat all non-recommended objectives fairly.

26 – Nokia France

To respond to some of the comments: The TR did conclude that it is feasible to use existing DL PRS and SRS signals to obtain the carrier phase measurements for achieving a horizontal accuracy of up to a few centimeters at least at 50% under appropriate conditions. Further, the specification impact is small and well understood from the GNSS carrier phase positioning that is already specified in NR since Rel-15. The measurements and reporting are therefore straightforward to specify.

27 – Fraunhofer IIS

We support the moderator's proposal.

28 – Deutsche Telekom AG

Support

29 – TELECOM ITALIA S.p.A.

support

Companies may continue to make comments to the detail text of the WID.

Feedback Form 25: Carrier phase positioning - Comments to WID text - Intermediate Round

1 – Nokia France

We already made some comments in the initial round; the existing DL PRS and UL SRS should be used.

2 – Intel Corporation (UK) Ltd

The existing text in the draft WID should be sufficient.

@Nokia: The existing text already states that existing signals are used. In our view, the sub-bullets on defining UE and gNB measurements and reporting suggested during Initial round are redundant to the main bullet that mentions “**measurements**, and related **signalling** ... for both **UE-based** and **UE-assisted** positioning”. Having said that, we are open to further improvements of the text if necessary.

3 – CATT

About the WID text, Nokia’s proposal is in general fine to us. The main bullet needs to include RAN3.

3.6.4 Summary from Intermediate Round

For the high level objectives the conclusion from the intermediate round and the Wednesday GTW discussion of RP-223446 was:

Conclusions on Carrier phase positioning

- NR carrier phase positioning is included in scope. To be scoped to minimise workload as much as possible.

The rapporteur will update the WID to reflect these conclusions and also take into account the detail comments to the WID text.

3.6.5 Final Round

Companies are asked to comment on the updated WID shared at after the intermediate round

Feedback Form 26: Carrier phase positioning - Final Round

1 – AT&T GNS Belgium SPRL

We support this objective to be included with a limited scope as follows, per the discussion during the GTW:

- Specify NR carrier phase measurements and signaling for UE-based and UE-assisted positioning [RAN1, RAN2, RAN3, RAN4]
 - o Specify NR carrier phase measurements using existing DL PRS and UL SRS [RAN1]
 - o Specify corresponding signaling to support NR carrier phase measurement reporting [RAN2, RAN3]
 - o Specify corresponding requirements, including RRM measurements and procedures, using existing GNSS carrier phase positioning as a starting point [RAN4].

2 – ZTE Corporation

Why RAN3 is included for CPP, but not for BW aggregation. Since both features may need SRS discussion, we suggest either to delete RAN3 from CPP or add RAN3 for BWP aggregation

3 – Samsung R&D Institute UK

Based on Wednesday GTW discussion, the remaining controversial issues were bandwidth aggregation and CPP. Now, the current direction includes both in the work item scope by minimizing the scope of each. We think that the issue is not just the work scope, but whether we can have meaningful functionality for these objectives at the end of the release. CPP was not recommended based on RAN1 study. This means its benefit is very limited, without careful mitigation of error sources such as multi-path and addressing the integer ambiguity issues. During the SI several solutions have been proposed to mitigate error sources, we can imagine long discussions during the WI phase for down-selection and specification. These are essential aspects to consider for having meaningful carrier phase accuracy. Bandwidth aggregation is feasible only in intra band contiguous carriers. Based on Wednesday GTW discussion, only two operators in China seems have this contiguous band. Therefore, the benefit of this feature seems to be limited. Hence, we prefer not to include both in the work scope.

4 – LG Electronics Inc.

The updated WID is fine for us. In addition to the current objectives, any potential enhancements that might be essential to support new measurement/signaling for CPP needs to be considered. To avoid increasing the workload, only essential enhancements shall be discussed and specified if WGs found it necessary. From this perspective, we would like to suggest modification of the main bullet of the objective as bellow:

Specify physical layer measurements, and related signalling **and enhancements if necessary**, to support NR carrier phase positioning for both UE-based and UE-assisted positioning [RAN1, RAN2, RAN3, RAN4].

5 – InterDigital

We are ok with the updated WID. Also, we support LG's revision considering that there could be an essential enhancement to support CPP-related measurement/signaling which we couldn't identify at this point.

6 – CATT

We are fine with NR carrier phase positioning objectives in draft WID.

7 – Verizon UK Ltd

We are fine with including CPP.

8 – China Mobile E-Commerce Co.

We support moderator’s proposal.

9 – MediaTek Inc.

We are OK with the draft WID.

10 – Intel Corporation (UK) Ltd

We support the latest version.

@ATT: Similar to the case of bandwidth aggregation, the signalling needs to be specified by RAN2/RAN3 based on RAN1 designs as part of usual process. Thus, a separate objective dedicated to RAN2/3 may not be necessary.

For the modification to the RAN4 bullet suggested by ATT, it is not clear if we can exactly use GNSS CPP as starting point due to some inherent differences between NR CPP and GNSS CPP (including waveform). Thus, we would prefer to keep it generic. It is understood that RAN4 would specify the requirements based on the measurements defined by RAN1.

@ZTE: RAN3 is included for NR CPP to specify the signalling of the new measurement reports from gNB to LMF. However, for bandwidth aggregation, the existing reporting structures can be reused.

11 – Qualcomm CDMA Technologies

Since we got the task to ”minimise workload as much as possible”, we suggest focussing on connected mode/single carrier/layer measurements only in this release; e.g.:

[...]

- Specify measurements on single carrier/layer in connected state only

12 – Ericsson LM

We support QC’s proposal to specify the measurements on single PFL in RRC connected state only.

13 – Beijing Xiaomi Mobile Software

We are fine with the latest draft WID.

14 – Motorola Mobility Germany GmbH

[Lenovo]:

Still the scope seems to be too large in our view. We could clarify a bit as the Moderator suggested during Wednesday’s GTW session:

“Specify physical layer measurements, and related measurement report signalling...”

We prefer to be a bit more specific with regard to “related signalling”, e.g., “report signalling” or something similar.

We don’t think enhancements should be added as there are no previous CPP measurements that require enhancements.

Further suggestion for reduced scope is to focus on either DL CPP or UL CPP, or clarify if both are in scope of the main bullet.

15 – Nokia France

A few comments:

Both DL and UL CPP must be included. This should be clear from the first sub-bullet, but it could also be added to the main bullet:

”Specify NR DL and UL carrier phase measurements...”

As the new bullet ”Define extensions of signalling, protocol, and procedure for NR positioning enhancement, as needed for the above objectives” has been added, we do not see the need to include RAN3 specifically for CPP.

We are OK to limit to a single carrier, but not to limit the measurements to RRC_Connected: any effort saved would be negligible, and such a restriction would increase power consumption.

16 – VODAFONE Group Plc

We are fine with including CPP.

17 – Ericsson LM

We think the scope is not clear enough and this could lead to unintended additional work in WGs. The minimal scope is to define the carrier phase measurement in RAN1 and the reporting in RAN2, without any optimization or enhancements to the existing PRS assistance data, and leave remaining issues to implementation. Further, carrier phase measurements shall be defined for the full reference signal bandwidth, not for individual subcarriers or parts of the reference signal. The later would imply significant standard impact but no benefit has been concluded during the SI.

Additionally, we do not support the proposed rewording from LGE regarding “enhancements” in the WID. The objective should be limited to specifying measurements and reporting. Since there are no target requirements, we should not discuss enhancements.

- Specify ~~physical layer~~ **Uplink and Downlink carrier phase** measurements, and ~~signalling reporting~~ **ing** for NR carrier phase positioning for both UE-based and UE-assisted positioning [RAN1, RAN2, RAN3, RAN4].
 - o Existing DL PRS and UL SRS for positioning are used for NR carrier phase measurements.
 - o **NOTE: Carrier phase measurement refers to the phase of the received path for a received SRS /PRS symbol**

- Specify corresponding new core requirements, as well as discuss and identify the impact on the existing RAN4 specification, including RRM measurements and procedures [RAN4].

18 – Sony Europe B.V.

The exercise is to reduce the work load but we also need to be clear.

We are fine with the suggested proposal from Qualcomm.

Additionally, the main bullet point says: ”Specify physical layer measurements, and related signalling to support NR carrier phase positioning for **both UE-based and UE-assisted positioning** [RAN1, RAN2, RAN3, RAN4].”

We interpret this as supporting DL-based. Why do we still need UL SRS? We suggest to update the relevant sub-bullet point, i.e:

- Existing DL PRS ~~and UL SRS for positioning~~ are used for NR carrier phase measurements.

19 – Philips International B.V.

We support the objectives in the updated WID.

3.6.6 Summary from Final Round

A few companies proposed to add ”and enhancements if necessary” because they think that some ’essential enhancements’ might be necessary. Given the instruction from the Wednesday GTW was to minimise the scope, the moderator considers that this should not be added as it will cause confusion and open the door to WG discussion of enhancements. If some change can be justified as essential to make the new functionality work then there should be no concern about introducing it based on the existing text.

Regarding the suggestion to add ”Specify measurements on single carrier/layer in connected state only” in order to control scope, the moderator proposed to add ”specify measurements on single carrier/layer only”. A concern was raised by one company regarding the limitation to connected state and so the moderator suggested this aspect could be left to RAN2 discussion.

Other more minor proposals have been included in the updated WID as appropriate.

3.7 GNSS positioning integrity enhancement

3.7.1 Initial Round

RP-223278 and RP-223281 sourced by Vodafone, Spirent, Ericsson propose to include an objective in the WID on GNSS positioning integrity enhancement based on LOS/NLOS and multipath information. Furthermore they propose that if this cannot be agreed for inclusion in the WID then it should be considered to be worked on under TEI17 or TEI18. This proposal is distinct from the previous WID scope discussion points in that this was not discussed as part of the Rel-18 study item.

Companies are requested to provide comments on whether to include an objective on GNSS positioning integrity enhancement based on LOS/NLOS and multipath information, and also on the possible option to do

this work as either TEI17 or TEI18.

**Feedback Form 27: GNSS positioning integrity enhancement
- Initial Round**

<p>1 – ZTE Corporation</p> <p>Per chair’s guidance, no new bullet should be included. Hence, we more prefer to discuss this issue in RAN2.</p>
<p>2 – Ericsson LM</p> <p>The multipath aspects of the GNSS local environment was discussed in the Rel 17 SI and is summarized in that TR. Assistance data in general is either to enable a positioning feature or facilitate the processing involved with a feature. The A-GNSS assistance data is one existing example of the latter, facilitating the GNSS signal detection and measurement of the device, and the proposed LoS/NLoS assistance data is another example, facilitating the selection of relevant signals for the device. We are fine treating this in either the WID or in TEI.</p>
<p>3 – MediaTek Inc.</p> <p>We think the contribution is valid, but the enhancement seems better suited as a TEI item, since it was not discussed in the study phase and has no particular connection to the other objectives.</p>
<p>4 – AT&T GNS Belgium SPRL</p> <p>We are fine to treat this proposal as TEI since it was not discussed in the scope of the Rel-18 SI, nor included in the TR 38.859 set of recommendations.</p>
<p>5 – TELECOM ITALIA S.p.A.</p> <p>supportive in general. ok to treat it as TEI</p>
<p>6 – Beijing Xiaomi Mobile Software</p> <p>We suggest to postpone the discussion to the R19 since we didn’t discuss it in the study phase of the R18 positioning.</p>
<p>7 – Samsung R&D Institute UK</p> <p>Thanks for the discussion. The accuracy from the proposal mainly depends on the accuracy of 3D maps, which we think that it has quite limited availability, and if so, we do not see much gain to have the feature. Furthermore, as indicated earlier, it is already specified in the TR that NLOS aspects can be handled by UE itself without having assistance data, so then we do not see the significant need to include such objective to the Rel-18 WID.</p>
<p>8 – Intel Corporation (UK) Ltd</p> <p>We prefer TEI as the scope may be isolated to RAN2 and the expected impact should be limited (only TS38.305 and TS37.355 may be affected). Additionally, we prefer to clarify as it needs more discussion in RAN2 on how LMF can generate/provide assistance information to a UE and how it is applied at UE side.</p>

9 – OPPO Beijing

Since it was not discussed in the study phase, we propose not to include the objective in the WID.

10 – Spreadtrum Communications

We can treat this part as TEI since it was discussed in the scope of R17 SI.

11 – Nokia France

This was not discussed during the SI, but we could be open to look into it further in RAN2 if time permits after higher priority items have been addressed.

12 – CATT

Share the similar view as ZTE and others. For any enhancement not included in Rel-18 SI, we prefer to discuss it in a future release.

13 – Qualcomm CDMA Technologies

We should focus on the objectives that have a clear recommendation from the study.

We would prefer that this item is studied first before initiating specification work, incl. investigations on requirements, benefit, preferred type of assistance data/solution, etc.

14 – LG Electronics Inc.

As there are already many candidates that requires normative works, It is not preferable to add new objectives in WID that has not been discussed during the SI phase.

15 – NTT DOCOMO INC.

We prefer to treat this proposal as TEI since it will add some information related to positioning integrity to the current function.

16 – VODAFONE Group Plc

As highlighted by Ericsson, this topic was discussed in Rel 17 SI. It has a clear benefit in enhancing accuracy and integrity. It has a very restricted impact to specifications (actually just LPP) and we have a clear demand.

For us, it is absolutely not acceptable to wait till Rel. 19.

We could accept having it as TEI if the amount of TUs for TEIs (rel 17 or rel 18) we could use is clear.

To Samsung: There are multiple 3D map data providers available. They have 84,000,000 km² of 3D mapping data available at 1m resolution, covering all major cities globally. Hence the availability of mapping data is not a constraint for the availability of this service at all.

<p>17 – Motorola Mobility Germany GmbH</p> <p>[Lenovo]</p> <p>RAN2 workload is already high and in addition there should have been a study aspect. Therefore supportive of deferring this objective to future releases.</p>
<p>18 – Spirent Communications</p> <p>As noted by Vodafone and Ericsson, this proposal increases GNSS positioning performance and integrity by supplying information to the UE from an independent source.</p> <p>We would prefer this solution to be standardised in the Release 18 timeframe.</p>
<p>19 – Deutsche Telekom AG</p> <p>Support</p> <p>(wasn't this on the table already for Rel-17 ?!)</p>

3.7.2 Summary from Initial Round

Diverse views were expressed. Based on the comments, there is clearly no consensus to include this proposal in the Rel-18 positioning WID. The most that seems possible to agree at this meeting is that it can be discussed as a TEI18 proposal. Note that this does not mean that there is any agreement at this stage that it will be included in the spec under TEI18.

Moderator's proposal: GNSS positioning integrity enhancement can be discussed as a TEI18 proposal (following normal process for TEI discussions in RAN2)

3.7.3 Intermediate Round

Companies are asked to comment on the proposal from the moderator in the summary from the Intermediate Round.

Feedback Form 28: GNSS positioning integrity enhancement - Intermediate Round

<p>1 – AT&T GNS Belgium SPRL</p> <p>We support the moderator's proposal.</p>
<p>2 – Classon Consulting</p> <p>[for FUTUREWEI] No conclusion is really needed, but can accept the conclusion</p>
<p>3 – FirstNet</p> <p>We support the moderator's proposal.</p>

<p>4 – ZTE Corporation</p> <p>We share the similar view as FUTUREWEI. RAN2 TEI should belong to RAN2 discussion, RAN plenary does not need to make decision.</p>
<p>5 – Intel Corporation (UK) Ltd</p> <p>We are fine with the proposal from the moderator.</p>
<p>6 – New H3C Technologies Co.</p> <p>support</p>
<p>7 – CATT</p> <p>Moderator’s proposal is fine to us.</p>
<p>8 – Apple France</p> <p>We are fine with the moderator’s proposal</p>
<p>9 – Samsung R&D Institute UK</p> <p>We support the moderator’s proposal.</p>
<p>10 – MediaTek Inc.</p> <p>We agree with the moderator’s proposal. No formal plenary conclusion seems needed; this can be treated as a TEI proposal at WG level (business as usual).</p>
<p>11 – Beijing Xiaomi Mobile Software</p> <p>Support</p>
<p>12 – NTT DOCOMO INC.</p> <p>We support the moderator’s proposal.</p>
<p>13 – LG Electronics Inc.</p> <p>We support the moderator’s proposals.</p>
<p>14 – OPPO Beijing</p> <p>We support the moderator’s proposals.</p>
<p>15 – Motorola Mobility Germany GmbH</p> <p>[Lenovo]: Support the Moderator’s Proposal</p>

<p>16 – VODAFONE Group Plc</p> <p>There are good examples like IDC Rel-16 or DSS as TEI16 where RAN Plenary gave a clear guidance to RAN groups to standardise particular features and we believe this is the best way forward.</p> <p>Taking received comments into account, we might compromise, but we believe it is needed to capture the chairman proposal with 2 minor changes:</p> <ol style="list-style-type: none">1. I would propose to remove ”(following normal process for TEI discussions in RAN2)”. The TEI process is clear and means that it will be treated in RAN2 based on the TUs allocated for the TEI and is subject to RAN WG2 chairman decision.2. It is also clear that once the topic is scheduled under TEIs, it will get treated, but as always the outcome is the subject to the 3gpp decision and we believe ”Note that this does not mean that there is any agreement at this stage that it will be included in the spec under TEI18.” could be removed from the summery as it is normal TEI process.
<p>17 – Spirent Communications</p> <p>We support the moderator’s proposals with the addition of the comment from Vodafone.</p> <p>It is important to capture this proposal in RAN Plenary minutes.</p>
<p>18 – Qualcomm CDMA Technologies</p> <p>We support the moderator’s proposal. No formal plenary conclusion is needed; technical discussions can take place in WGs (as usual).</p>
<p>19 – Ericsson LM</p> <p>We agree with Vodafone’s proposed way forward</p>
<p>20 – Deutsche Telekom AG</p> <p>Support</p>

3.7.4 Summary from Intermediate Round

Several companies commented that no formal conclusion is required. Vodafone commented that the text in brackets should be removed but they also acknowledged that it will be submitted and discussed under the RAN2 TEI process which is clear.

In the moderator’s view it is OK to remove the text in brackets but this does not actually make any real difference to the situation regarding how the proposal will be treated in future if it is submitted as TEI. In the moderator’s view, this proposal does not constitute ’clear guidance to RAN groups to standardise the feature’ which was mentioned in the Vodafone comment.

Moderator’s proposal: GNSS positioning integrity enhancement can be discussed as a TEI18 proposal

3.7.5 Final Round

Companies are asked to the moderator's proposal from the intermediate round.

Feedback Form 29: GNSS positioning integrity enhancement - Final Round

<p>1 – AT&T GNS Belgium SPRL</p> <p>We agree with the summary from the moderator. This is a technical discussion that is to take place in the WG(s), following the normal TEI process. It should be noted that RAN4 may need to specify some corresponding requirements if this enhancement is to be included in TEI-18.</p>
<p>2 – NTT DOCOMO INC.</p> <p>We support the moderator's proposal.</p>
<p>3 – Samsung R&D Institute UK</p> <p>Support the moderator's proposal</p>
<p>4 – CATT</p> <p>Support the moderator's proposal</p>
<p>5 – LG Electronics Inc.</p> <p>Support the moderator's proposal</p>
<p>6 – MediaTek Inc.</p> <p>Support the moderator's proposal.</p>
<p>7 – Intel Corporation (UK) Ltd</p> <p>We support the proposal from the moderator.</p>
<p>8 – Motorola Mobility Germany GmbH</p> <p>[Lenovo]: Support Moderator's Proposal.</p>
<p>9 – VODAFONE Group Plc</p> <p>we are ok with the proposal as It reflects the discussion sofar. On AT&T comment: I am not aware that any assistance information provided sofar in the LPP frame work, required RAN4 work. Additionally, I would prefer to add "at this point of time" to the moderator sentence, please: In the moderator's view, this proposal does not constitute 'clear guidance to RAN groups to standardise the feature' which was mentioned in the Vodafone comment.</p>

10 – Spirent Communications We support the moderator’s proposal.
11 – Ericsson LM We are fine with the moderators proposal

3.7.6 Summary from Final Round

All companies can agree to the moderator’s proposal from the intermediate round.

Conclusion for GNSS positioning integrity enhancement: GNSS positioning integrity enhancement can be discussed as a TEI18 proposal

3.8 LPP Bluetooth enhancement

3.8.1 Initial Round

RP-223286 (Ericsson) proposes to include an objective in the WID on LPP Bluetooth enhancements to support Bluetooth 5.1 AoA/AoD. Like GNSS positioning integrity enhancements, this was not discussed as part of the Rel-18 study item.

Companies are requested to provide comments on whether to include this objective on LPP Bluetooth enhancements.

Feedback Form 30: LPP Bluetooth enhancement - Initial Round

1 – ZTE Corporation Per chair’s guidance, no new bullet should be included. We sympathize the enhancement. It is truly needed. In addition, we think both UWB positioning and Bluetooth should be included in 3GPP specifications for both LPP and NRPPa signaling. For all those enhancement, we prefer to discuss them in Rel-19.
2 – Ericsson LM 3GPP LPP already supports Bluetooth positioning as a RAT dependent positioning method, which was introduced in Rel 13 based on Bluetooth 4.2. Bluetooth 5.1 introduced support for AoA/AoD positioning to provide an accuracy that falls within the RedCap requirements of 3m. Therefore, it can be seen as a readily available enhancement with limited work to support in Rel 18 WI since it has been completed and tested in Bluetooth SIG. It should be noted that this objective was already discussed when the Rel-18 WID was discussed, but left for the WI phase since no study was needed.

3 – ROBERT BOSCH GmbH

We agree with ZTE's comment. In general, further positioning techniques as UWB etc. should be added. Nevertheless, we propose to postpone those discussions to Rel. 19.

4 – MediaTek Inc.

We generally agree with ZTE's comment; we see the value but would prefer not to expand the WID.

5 – Beijing Xiaomi Mobile Software

Considering the current workload of the R18 positioning WI, we suggest to defer to the R19.

6 – Samsung R&D Institute UK

Thanks for the discussion. We understand the intension of the proposal. Since we already have too many candidate solutions for normative work in the TR, we prefer not to include this in R18 WI. It can be discussed in TEI session or in later release.

7 – Intel Corporation (UK) Ltd

We agree with ZTE's comments. The proposal was proposed in last RAN2 meeting as a competing solution to carrier phase for RedCap positioning. But no recommendations were made either by RAN1 or RAN2.

8 – OPPO Beijing

We share similar view as others, to contain the scope of Rel-18, we propose not to include the objective in the WID.

9 – Spreadtrum Communications

We can defer to the R19.

10 – Nokia France

This was not discussed at all during the SI.

11 – CATT

Share the similar view as ZTE and others. For any enhancement not included in Rel-18 SI, we prefer to discuss it in a future release.

12 – Qualcomm CDMA Technologies

We should focus on the objectives that have a clear recommendation from the study.

We would prefer that this item is studied first before initiating specification work, incl. investigations on requirements, benefit, preferred type of assistance data/solution, etc

<p>13 – NTT DOCOMO INC.</p> <p>We should focus on the items recommended in Rel-18 SI phase and prefer to discuss LPP Bluetooth enhancement in future release.</p>
<p>14 – LG Electronics Inc.</p> <p>We share similar view with other companies that it would be better not to deal with such issues in Rel-18.</p>
<p>15 – Motorola Mobility Germany GmbH</p> <p>[Lenovo]</p> <p>Although we also are supportive of including any non-3GPP technology enhancements to expand the flexibility of the current positioning framework, we share the similar view with other companies that this could best deferred to future releases.</p>
<p>16 – Deutsche Telekom AG</p> <p>No discussed => new proposal => no time => no upscoping => not in Rel-18 ! (so simple — isn't it ?)</p>
<p>17 – HUAWEI TECHNOLOGIES Co. Ltd.</p> <p>We prefer to discuss this in later releases.</p>
<p>18 – TELECOM ITALIA S.p.A.</p> <p>Move to future releases (if further enhancements are still needed)</p>

3.8.2 Summary from Initial Round

A very clear majority of companies expressed the view this should not be included in the scope of the Rel-18 positioning WID,

Moderator's proposal: LPP Bluetooth enhancements are not included in scope of the WI

3.8.3 Intermediate Round

Companies may comment on the proposal from the moderator in the summary from the Initial Round

Feedback Form 31: LPP Bluetooth enhancements - Intermediate Round

<p>1 – Classon Consulting [for FUTUREWEI] OK not to include</p>
<p>2 – ZTE Corporation We would like to make the proposal clearer since this is only for Rel-18. So we suggest: LPP Bluetooth enhancements are not included in scope of the Rel-18 WI</p>
<p>3 – Intel Corporation (UK) Ltd We are fine with the proposal from the moderator.</p>
<p>4 – New H3C Technologies Co. support</p>
<p>5 – Apple France support Moderator’s proposal</p>
<p>6 – Samsung R&D Institute UK We support the moderator’s proposal.</p>
<p>7 – MediaTek Inc. Support the moderator’s proposal.</p>
<p>8 – Beijing Xiaomi Mobile Software Support the moderator’s proposal.</p>
<p>9 – NTT DOCOMO INC. We support the moderator’s proposal.</p>
<p>10 – HUAWEI TECHNOLOGIES Co. Ltd. Support moderator proposal</p>
<p>11 – LG Electronics Inc. We support the moderator’s proposals.</p>

<p>12 – OPPO Beijing</p> <p>We support the moderator’s proposals.</p>
<p>13 – Motorola Mobility Germany GmbH</p> <p>[Lenovo]: Support Moderator’s Proposal</p>
<p>14 – Qualcomm CDMA Technologies</p> <p>Support the moderator’s proposal.</p>
<p>15 – Ericsson LM</p> <p>Given the limited work effort involved due to the completed specification work by Bluetooth SIG, it is a pity to leave this very simple enhancement out. It was left out of the SI due to now study needed and should be discussed based on its usefulness which is larger than for many of the techniques coming out of the SI</p>
<p>16 – Deutsche Telekom AG</p> <p>Fine to exclude</p>

3.8.4 Summary from Intermediate Round

The conclusion from the intermediate round seems to be acceptable. Clarification that this refers to Rel-18 positioning WI has been added, although this should be clear from the context of the this NWM discussion. No further discussion is required in the final round.

Conclusion for LPP Bluetooth enhancements: LPP Bluetooth enhancements are not included in scope of the Rel-18 positioning WI

4 Summary

This section provides a summary of all conclusions from earlier sections of the document.

Conclusions regarding completion of Study Item:

- RP-222717 (LS from RAN3) can be noted
- RP-222726 (LS from RAN4) can be noted
- RP-222982 (Status Report) can be noted
- RP-222982 (38.859v1.0.0) can be approved

Conclusions on sidelink positioning:

1. SL-TDOA is included in scope
2. Resource allocation scheme 2 congestion control/inter UE coordination is included in scope
3. Unlicensed spectrum is not included in scope
4. FR2 spectrum specific enhancements are not included in scope (but there would be no explicit restrictions against transmission of SL-PRS in FR2)
5. SL-AOD is not included in scope
6. Proposal that dedicated resource pools should be treated with higher priority than shared resource pools is not agreed.
7. Proposal that combined Uu/PC5 position should be treated with a lower priority than PC5 only is not agreed
8. Privacy aspects are not included in the WI

Conclusions on LPHAP:

1. DRX in RRC_INACTIVE beyond 10.24s is included in scope. The precise scope of the positioning WI will be those aspects that are specific to LPHAP, with other aspects covered by the RedCap WI.
2. SRS configuration enhancements for UL and DL+UL positioning in RRC_INACTIVE based on validity area is included in scope
3. DL-PRS measurements in RRC_IDLE is included in scope
4. Alignment between DRX and PRS configurations is included in scope
5. Skipping paging reception in RRC_INACTIVE is not included in scope
6. DL PRS configuration with 1-symbol PRS is not included in scope
7. Study UL positioning in RRC_IDLE is not included in scope

Conclusions on bandwidth aggregation: Bandwidth aggregation for positioning measurements is included in scope. To be scoped to minimise workload as much as possible.

Conclusions on Carrier phase positioning: NR carrier phase positioning is included in scope. To be scoped to minimise workload as much as possible.

Conclusion for GNSS positioning integrity enhancement: GNSS positioning integrity enhancement can be discussed as a TEI18 proposal

Conclusion for LPP Bluetooth enhancements: LPP Bluetooth enhancements are not included in scope of the Rel-18 positioning WI

<https://nwm-trial.etsi.org/#/documents/8394>

Tdocs relation to Rel-18 WI scope:

RP-222983 (New WID) is revised to RP-223532 (and RP-223532 will be seen in the Friday GTW)

All other tdocs assigned to this discussion can be noted