

3GPP TSG-RAN Meeting #94e

RP-21xxxx

Electronic, 6 – 17 December 2021

Agenda Item: 8.6.1

Source: Email discussion moderator (Intel)

Title: Email discussion summary for [94e-06-R18-PositionEvo]

Document for: Discussion and decision

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## 1 Introduction

This document reports on [94e-06-R18-PositionEvo] that discusses the potential Rel-18 item on positioning evolution.

The pre-RAN#94e email discussion summary can be found in RP-212666 and the draft WID created from that email discussion can be found in RP-212707. The RAN Chair and RAN WG Chairs have prepared a "Summary for RAN Rel-18 Package" in RP-213469. The summary provides TU allocations for the WGs and provides the objectives to be used as a starting point for this discussion - they are based on the outcome of the last email discussion with a few modifications. Furthermore the summary proposes that the work should start with a 9 month study item, in contrast to the pre-meeting email discussion where it was assumed to be a work item with study phases for many of the objectives.

A draft SID has been created based on the draft WID from the last discussion with appropriate changes to make it a study item and with the other changes from the chair's summary. All changes compare to the previous version are shown in revision marks. The WID is stored Inbox/Drafts/[94e-06-R18-PositionEvo]/draft-SID. Please refer to the draft SID in the inbox in order to provide your feedback - the justification and objective text is not copied into this NWM document as revision marks are not supported in NWM. At least in the early rounds of discussion, companies are asked to provide suggested modifications via NWM and not upload their own proposed revisions of the WID - this approach may be changed for later rounds.

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## 2 Justification Text

### 2.1 Initial Round

Companies are asked to provide comments and suggestions to the justification text.

**Feedback Form 1: Justification Text - Initial Round**

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**1 – Nokia Denmark**

On the justification section for LPHAP: The 2nd sentence reads a bit like the requirements are set for RAN already as battery life up to one year. It would be better to repeat that this is a SA1 requirement to make it clear where the requirement comes from. Also, Rel-17 only introduced support for *RRCinactive* so *RRCidle* should be removed.

**2 – NTT DOCOMO INC.**

RedCap positioning part (e.g. Release-17 has specified support for RedCap UEs...) may need to be updated if the corresponding item (i.e. third sub-bullet in the RedCap positioning objective) is removed from this SID.

**3 – Samsung R&D Institute UK**

Since Rel-17 NR positioning has introduced the support for positioning in *RRC\_INACTIVE* states only, *RRC\_IDLE* should be removed in the current justification text.

**4 – Guangdong OPPO Mobile Telecom.**

Regarding the higher accuracy part, the following sentences seem not needed. The main reason is that the current NR positioning method can also achieve shorter latency and lower power consumption compared to GNSS. Thus, better performance than GNSS for indoor scenarios is not the motivation to introduce NR carrier phase positioning. The justification of NR carrier phase positioning should be based on the performance gain compared to the existing NR positioning method.

~~”GNSS carrier phase positioning also has longer positioning latency and larger power consumption than GNSS code phase positioning due to the need to implement a carrier phase tracking loop to lock the very weak carrier signals. NR carrier phase positioning has potential for significant advantages over GNSS carrier phase such as shorter positioning latency and lower UE power consumption, and application to indoor deployments.”~~

**5 – New H3C Technologies Co.**

We have the similar view on positioning in inactive mode supported in Rel-17 with Samsung and idle mode shouldn't be mentioned in justification text.

**6 – Intel Corporation (UK) Ltd**

No specific comments at this stage.

**7 – Motorola Mobility Germany GmbH**

We are generally fine with the justification text, however any potential down-scoping will necessitate corresponding changes to the justification text. Also agree that Rel-17 only provided targeted support for *RRC\_INACTIVE* positioning and therefore *RRC\_IDLE* positioning can be removed.

**8 – VODAFONE Group Plc**

LPHAP: One editorial: "whether and whether" ->"whether and how" (or just "whether")

**9 – Qualcomm Incorporated**

- In the paragraph on PRS/SRS bandwidth aggregation, in the sentence: "increase the bandwidth for the transmission and reception of the positioning reference signals through the carrier aggregation", We

suggest to write it as: “increase the bandwidth for the transmission and reception of the positioning reference signals through the carrier aggregation based on PRS/SRS bandwidth aggregation for intra-band carriers”

- In this sentence: “While Rel-17 NR positioning has introduced support for positioning in RRC\_IDLE/INACTIVE states”, NR Rel-17 introduced support for positioning in RRC Inactive state, and not in RRC Idle state. We suggest to keep only RRC Inactive state in the sentence.
- There is a repetition of the word “whether” here: there is a need to evaluate whether and whether the current system allows LPHAP requirements to be met

#### 10 – AT&T GNS Belgium SPRL

We are generally fine with the baseline justification text, with only the following few exceptions:

- Propose that we update the following text given this is a SI and it could be envisioned that some integrity solutions could address any/all of the existing supported 3GPP positioning methods: “The focus in Rel-17 work was on GNSS integrity, and for Rel-18 it is natural to be extend this to address other to-RAT-dependent positioning techniques as well...”
- Support removal of RRC\_IDLE positioning in the LPHAP paragraph as others have noted.
- Rephrase the last sentence: “This ~~is gap to be closed by the present WI~~ is to be investigated in the present SI.”

#### 11 – SHARP Corporation

RRC\_IDLE should be removed in the current justification text.

## 2.2 Summary from Initial Round

For the comment from DOCOMO, a moderator’s note has been added to the text to remember to update the justification text when the eventual RedCap objectives are stable. The comment from OPPO has been partially taken into account, with part of the sentence referring to potential benefits of carrier phase being kept. All other comments have been fully taken into account in the updated objective text.

## 2.3 Intermediate Round

Companies are asked to provide comments and suggestions to the updated justification text.

### Feedback Form 2: Justification text - Intermediate Round

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## 3 Sidelink positioning

### 3.1 Initial Round

Companies are asked to provide comments and suggestions to the objectives on sidelink positioning. The summary document from the RAN Chair added “[unlicensed]” to the spectrum to be considered in the study. This is an aspect for which previous email discussions have not managed to reach consensus but, based on the

inclusion in the summary document, we will have another attempt to find an acceptable way forward. A separate feedback form is provided for this discussion of unlicensed.

**Feedback Form 3: Inclusion of unlicensed spectrum - Initial Round**

**1 – Futurewei Technologies**

Not supportive of this inclusion and as in our past comments, inclusion of unlicensed spectrum positioning should be added after the availability of specs support of sidelink in unlicensed spectrum.

**2 – China Mobile E-Commerce Co.**

It should be noted that even for R18 sidelink evolution, operation on unlicensed spectrum is one of the objectives to be studied and specify if necessary, and we don't have any baseline design for SL over unlicensed band. Hence, we prefer first focused on the licensed and ITS spectrum in this release.

**3 – Beijing Xiaomi Mobile Software**

In order to achieve the sidelink positioning accuracy requirements, the large bandwidth for sidelike PRS is required. However, the ITS and licensed spectrum will not provide enough bandwidth for sidelink positioning. For ITS spectrum, the ITS bandwidth in all the regions are no more than 80MHz, and in some regions, it is only 20MHz. For licensed spectrum, operators may have no desire/capability to use a large licensed spectrum bandwidth for sidelink positioning, and the licensed spectrum can't be used for out of coverage scenario. So we think the unlicensed spectrum should be included in the scope. At least, the spectrum and bandwidth requirements should be studied and evaluated to support sidelink positioning accuracy and use cases, instead of excluding the unlicensed spectrum directly.

For how to coordinate with the sidelink enhancements item, we think the sidelink enhancements item should take into account the sidelink positioning signal when designs the LBT mechanism. Maybe we can add a note in the Rel-18 sidelink enhancement WID to clarify that sidelink positioning/ranging signal in unlicensed spectrum should be considered.

**4 – Nokia Denmark**

We see the value of including unlicensed spectrum for sidelink positioning, as otherwise the spectrum available for sidelink positioning may be limited in some regions. However, we are also conscious that (a) the sidelink enhancement item is likely to be considering basic sidelink operation in unlicensed spectrum in parallel, and (b) the overall effort required for sidelink positioning is already rather large. Therefore a possible way forward could be to try to phase sidelink unlicensed and sidelink unlicensed positioning sequentially, such as "unlicensed to be included if time permits, after basic sidelink operation in unlicensed spectrum has made sufficient progress".

**5 – CATT**

Our suggestion is not to consider unlicensed spectrum in Rel-18.

**6 – NTT DOCOMO INC.**

We do not think unlicensed spectrum should be included since the current scope is large and SL communication for unlicensed spectrum has not yet been discussed. Rel-18 SL positioning should focus on ITS and licensed spectrum.

## 7 – CITC

Focusing on ITS and licensed spectrum in R18 NR sidelink positioning can be firstly considered to meet the qualified positioning accuracy and latency requirements. Moreover, when the standardization work on SL communication in unlicensed spectrum is completed, then we can further discuss the unlicensed spectrum.

## 8 – Samsung R&D Institute UK

We don't support including unlicensed spectrum in the scope since it is not yet supported in SL. It is better to wait first for the introduction of unlicensed spectrum to SL. In Rel-18 positioning, we need to study/specify sidelink positioning at first and determine whether licensed band can provide the required positioning accuracy and latency.

## 9 – Deutsche Telekom AG

We do not support this inclusion. SL is not supported in unlicensed and should be dropped from Rel-18 (see thread 05)

The SL positioning evolution should only consider ITS spectrum.

Licensed spectrum is also not supported in the SA1 requirements

## 10 – Huawei Tech.(UK) Co., Ltd

Inclusion of unlicensed spectrum for SL positioning should rely on the progress of overall SL over unlicensed spectrum in Rel-18. Thus, it would be reasonable to take a step-by-step approach

and start only with licensed and ITS spectrum in this release.. Therefore our view hasn't changed, and considering that most of the discussion on this SI will be on how to better focus the work, we should not expand the scope to the study.

We prefer to keep the following bullets in the objective section, with the deletion of [unlicensed] and the deletion of the moderator's comment.

· Scenario/requirements [~~Moderator comment: These could be moved to the justification section in the final WID~~]:

- Coverage scenarios to cover: in-coverage, partial-coverage and out-of-coverage
- Requirements: Based on requirements identified in TR38.845 and TS22.261 and TS22.104
- Use cases: V2X (TR38.845), public safety (TR38.845), commercial (TS22.261), IIOT (TS22.104)
- Spectrum: ITS, licensed, [~~unlicensed~~]

## 11 – ZTE Corporation

We understand there may be some benefit to support unlicensed spectrum for SL positioning. However, considering the scope has been very large already and Rel-18 V2X will design the basic operation for regular SL in unlicensed spectrum, we suggest to specify SL positioning in unlicensed spectrum in Rel-19 or decide it in WI phase after regular SL in unlicensed spectrum is completed.

**12 – MediaTek Inc.**

We see significant benefits from SL positioning in unlicensed spectrum; as noted in RP-213354, the motivations for SL-U are also valid in relation to positioning. At the same time, we acknowledge that the positioning WI scope is large and there are cross-WI coordination challenges. Our suggestion is that, at a minimum, the SL positioning objectives should target forward compatibility with positioning in unlicensed spectrum, so that the functionality can be introduced later in Rel-18 or in a future release without requiring a redesign, with checkpoints between the positioning WI and the SL WI (e.g. at the transition from the positioning study phase) to confirm compatibility of the designs.

**13 – TELECOM ITALIA S.p.A.**

Fully agree with DT. No SL-U to be considered in this proposal

**14 – ROBERT BOSCH GmbH**

Considering the targeted use-cases and mainly V2X we highly encourage the inclusion of unlicensed spectrum. In our understanding, the available ITS band will not provide enough bandwidth to meet the requirements for V2X use cases in all regions. Inline with Nokia's comment we would propose to depend the detail of consideration of unlicensed spectrum for sidelink on the progress of sidelink operation in unlicensed spectrum.

**15 – New H3C Technologies Co.**

We think SL positioning in unlicensed spectrum shouldn't be considered in Rel-18 due to limited TUs and large work load.

**16 – Intel Corporation (UK) Ltd**

In our view, current SI has already quite large scope. Adding unlicensed spectrum for Rel.18 sidelink positioning further increases workload and opens new dimensions for discussions. We understand that availability of unlicensed bandwidth can provide accuracy benefits but considering large scope of the SI, our recommendation is to postpone this work to future releases or at least reduce current NR positioning objectives for improved accuracy, integrity, and power efficiency of NR positioning work for Rel.18

**17 – LG Electronics Inc.**

There were discussions at the GTW session yesterday on the scope of Rel.18 positioning enhancement WI was too broad. In addition, considering that it's not clear whether to support SL CA in Rel.18, the use of the unlicensed spectrum for ITS seems not urgent. We're in line with other companies that SL positioning based on the unlicensed band can be discussed in a later release, after the completion of SL communication based on the unlicensed band.

**18 – Telia Company AB**

SL-Unlicensed should not be considered as current SI is already too large vs. TU amount.

**19 – InterDigital France R&D**

The use of unlicensed spectrum should not be included in the scope for sidelink positioning. It should be considered once the use of unlicensed spectrum is stable for sidelink communication.

**20 – Apple Benelux B.V.**

Unlicensed support for sidelink positioning and ranging in Rel-18 should be de-prioritized. We need a functional sidelink unlicensed design before we can integrate positioning into this. This is especially due to the fact that there is no guarantee that the channel access scheme chosen for sidelink unlicensed will be decided early in the discussion of the unlicensed SL WI if we are dealing with both the sub-6 GHz and 60 GHz bands. Case in point, in the 60 GHz WI which is just concluding, channel access schemes were very controversial and were still under discussion in RAN1 #107-e at the end of the WI.

**21 – Motorola Mobility Germany GmbH**

Lenovo, Motorola Mobility :

We do understand the benefits for improved SL positioning performance using the unlicensed bands, we think that careful coordination is required between the objectives in the SL evolution WI and the SL positioning objective. Certain milestones with respect to SL Unlicensed framework should be first achieved before SL positioning work can leverage such features, which can also avoid potential redundant work in the different projects.

**22 – VODAFONE Group Plc**

Agree with Telia Company.

**23 – Qualcomm Incorporated**

As we also pointed out in our submission (RP-212923) we support including Unlicensed spectrum in the scope of the study for several important reasons:

- To achieve the V2X positioning accuracy requirements, sidelink PRS will require a bandwidth of the order of 100MHz or better.
  - o No region has allocated this much spectrum for ITS, and there is no clear indication of plans from operators to allow the use of sufficient licensed spectrum for V2X positioning operation.
- For the out-of-coverage use case, where only ITS and unlicensed spectrum are available, absent support of unlicensed band SL-PRS, the limited ITS spectrum precludes successful Sidelink Positioning operation.
  - o Note that that for V2X, vehicles may sometimes be frequently entering and leaving network coverage areas which could damage in-coverage performance as well as out-of-coverage performance if PRS resources are being added and removed.
- We support the current proposal and suggest the SID be revised to reflect that as,
  - o “Spectrum: ITS, licensed, unlicensed”

**24 – AT&T GNS Belgium SPRL**

We appreciate the benefits that could be achieved with inclusion of support of unlicensed spectrum for SL positioning. However, without existing SL support for unlicensed it may be difficult to achieve completion of this objective. We suggest SL positioning with unlicensed spectrum may be a 2nd priority following completion of the SL evolution WI.

**25 – Sony Europe B.V.**

The usage of unlicensed spectrum should not be considered in Rel-18 or it can be revisited later (if time permits).

In our view we should focus on the introduction of sidelink positioning operation. There are many aspects to be studied as shown in the objectives (use-cases, L1 aspects (reference signals, measurement, resource allocations, etc), protocol/signaling procedure, and architecture).

**26 – SHARP Corporation**

We should wait to consider the inclusion of unlicensed spectrum positioning until after the availability of specs supporting sidelink in unlicensed spectrum.

**27 – Philips International B.V.**

We support Xiaomi, Nokia and several other companies that unlicensed spectrum should be considered to be able to reach the accuracy requirements and to make it easier to deploy sidelink positioning in the market.

**28 – Ericsson LM**

Ericsson does not support inclusion of unlicensed spectrum in the study given that SL unlicensed has yet to be specified.

**29 – Volkswagen AG**

If sidelink is included in this WID then it should focus on the ITS band and / or FR1 unlicensed bands.

**Feedback Form 4: Sidelink positioning - Initial Round**

**1 – vivo Mobile Communication Co.**

The following can be merged:

Study and evaluate performance and feasibility of potential solutions for SL positioning, considering *relative positioning, ranging and absolute positioning*: [RAN1, RAN2]

**2 – Futurewei Technologies**

Support text as proposed.

**3 – Nokia Denmark**

On the first sub-bullet of the last main bullet for SL: What is the distinction between relative positioning and ranging? I would prefer this just said ‘relative and absolute positioning’. Ranging could be considered one of the methods (e.g., RTT) which is already captured below.

**4 – CATT**

The work scope for SL positioning may be too large. For Rel-18, our suggestion is to focus on the basic functionalities of the sidelink positioning, and then in Rel-19 we may consider the further enhancements. Our suggestions are:

1) Deprioritized partial-coverage: For the coverage scenarios, we may first focus on in-coverage and out-of-coverage. The scenario for partial-coverage can be deprioritized in Rel-18.



2 □ Deprioritized IIOT use case: For the use cases, when if all use cases of V2X, public safety, commercial and IIOT are included, the workload for simulation evaluation is too much. Thus, our suggestion is to focus on V2X, public safety and commercial use cases in Rel-18. We may further consider IIOT use cases in Rel-19.

#### 5 – Samsung R&D Institute UK

We suggest the following revision (marked in **bold**) to clean the wording (since we have signal design, we do not need repeat saying PHY layer control signaling) as

- Study of sidelink reference signals for positioning purposes **from PHY layer perspective**, including signal design, ~~phy layer control signalling~~, resource allocation, ~~physical layer~~ measurements and associated ~~physical layer~~ procedures, etc [RAN1]

#### 6 – Samsung R&D Institute UK

In addition, just one question for clarification, what is the difference between ranging and relative positing, do we need to include both? It is good to have this clarity to avoid endless discussions in the RAN working groups. If both are the same, then we should only list one

#### 7 – Deutsche Telekom AG

As this work will ONLY be performed for the ITS spectrum (as no licensed SL pos is supported in SA1 and unlicensed SL is not defined) the scenario is only out-of-coverage !

#### 8 – Beijing Xiaomi Mobile Software

We would like to point out the difference between Ranging and relative positioning, based on the definition in the TS 22.261, **Ranging**: refers to the determination of the distance between two UEs and/or the direction of one UE from the other one via direct device connection. **Relative positioning**: relative positioning is to estimate position relatively to other network elements or relatively to other UEs. So the relative positioning should calculate distance and angle simultaneously but ranging can acquire only distance or angle. We also see companies may have different understanding on the definition of ranging and relative positioning, we can further discuss and clarify it in the SI phase.

So we think the original wording should be kept as ‘Relative positioning, ranging and absolute positioning’.

#### 9 – Guangdong OPPO Mobile Telecom.

We are fine with the current version of this objective

#### 10 – Huawei Tech.(UK) Co.. Ltd

It is not clear what “identified use cases and coverage scenarios” refer to since there is no objective to specifically identify. Perhaps the word “identified” could simply be deleted from the bullet point below:

- Define evaluation methodology with which to evaluate SL positioning for the ~~identified~~ uses cases and coverage scenarios, reusing existing methodologies from sidelink communication and from positioning as much as possible [RAN1].

We suggest removing “phy layer control signaling” from the third sub-subbullet of the fourth subbullet. With the current TU, we believe phy layer control signaling design should only focus on resource allocation and physical layer procedure, which results in duplicated description in the bullet.

- Study of sidelink reference signals for positioning purposes, including signal design, ~~phy-layer control signalling~~, resource allocation, physical layer measurements, associated physical layer procedures, etc [RAN1]

**11 – MediaTek Inc.**

We have the same understanding as Xiaomi about the distinction between ranging and relative positioning, and we tend to think it would be useful to keep this distinction in the objective.

In general we are OK with the current form of the SL positioning objectives.

**12 – TELECOM ITALIA S.p.A.**

Since vehicles already have radars and lidars, we do not see the need to work on sidelink positioning in 3GPP and propose to drop the objective.

If the objective is kept, the difference between relative position and ranging should be clarified

**13 – ROBERT BOSCH GmbH**

We support the current objectives for sidelink positioning.

**14 – New H3C Technologies Co.**

we have the similar view with CATT

**15 – Intel Corporation (UK) Ltd**

- Move the bullet with “Scenario/requirements” to justification section as mentioned by moderator
- Change the wording in the following bullet “Identify specific target performance requirements to be considered for the evaluation based on existing 3GPP work and inputs from industry forums [RAN1]”
  - o Note: Our understanding is that there is no intention to ask RAN1 to come up with a new set of target requirements for positioning work in Rel.18. Oppositely, RAN1 is expected to rely on existing 3GPP work and inputs received from industry forums that have been provided to 3GPP.
- Modify the following sub-bullet (Relative positioning, ranging and absolute positioning) as follows
  - o “Relative positioning, (including ranging) and absolute positioning”
- Make change in the following sub-bullet with a reasoning that type(s) of control signaling needs to be also studied
  - o “Study of sidelink reference signals for positioning purposes, including signal design, ~~phy-layer control signalling~~, resource allocation, physical layer measurements, associated physical layer procedures, etc. [RAN1]”

**16 – LG Electronics Inc.**

We support the draft WID proposed by moderator.

**17 – InterDigital France R&D**

We support the WID.

**18 – Apple Benelux B.V.**

We are fine with the current objectives

**19 – Motorola Mobility Germany GmbH**

Lenovo, Motorola Mobility :

Support the SL Positioning objective text with high priority for Rel-18, although we also think that the SL positioning scope should also cover SL RAT-independent positioning methods as is the case with the Uu positioning framework. This would enable support of hybrid positioning between RAT-dependent and RAT-independent methods in partial coverage and out-of-coverage scenarios to improve absolute and relative positioning accuracy performance.

We therefore suggest a minor edit to the 2nd sub-bullet of the 4th bullet under SL positioning to accommodate this aspect:

”Study of positioning methods (e.g. TDOA, RTT, AOA/D, etc) including combination of SL positioning measurements with other RAT dependent positioning measurements (e.g. Uu based measurements) and **support of RAT-independent positioning methods over SL [RAN1, RAN2]**”.

The RAT-independent positioning work can be also be mainly handled by RAN2.

**20 – VODAFONE Group Plc**

If there are workload/TU issues, we see this as lower priority than NR Carrier Phase.

**21 – Qualcomm Incorporated**

Unlicensed spectrum is crucial for V2X Positioning and it should therefore be included in the scope. Assuming the above aspect is addressed, we are OK with the scope of this study item.

**22 – SHARP Corporation**

We support the comment made by Xiaomi to differentiate between Ranging and relative positioning. And we think the original wording should be kept as ‘Relative positioning, ranging and absolute positioning’

**23 – Sony Europe B.V.**

Generally support. In our view, we need to explicitly define the definition of (1) relative positioning and (2) ranging.

**24 – AT&T GNS Belgium SPRL**

We support the SL positioning objectives with the following small modifications:

- Agree with some comments on ambiguity of terms referring separately to relative positioning and ranging given they are related terms. We propose the following text: Relative positioning (e.g., ranging) and absolute positioning.
- Remove “RAT-dependent” from the 2nd sub-bullet in the last objective. RAT-independent measurements could also be envisioned, e.g., barometric pressure measurements, etc. We don’t feel there is a need to make this exclusion/distinction in the SI phase. The objective would simply change to: Study of positioning methods (e.g., TDOA, RTT, AOA/D, etc.) including combination of SL positioning measurements with other ~~RAT-dependent~~ positioning measurements (e.g., Uu-based measurements).

## 25 – Philips International B.V.

In general we are OK with the current SL positioning objectives. We agree with Xiaomi about the distinction between ranging and relative positioning, and we think it is useful to keep this distinction in the objective.

## 26 – Ericsson LM

The current objectives assign the study of positioning architecture and signaling procedures to RAN2 “including coordination and alignment with SA2 as required”. We suggest to add RAN3: “...alignment with RAN3 and SA2 as required.”

The scenarios and requirements bullet can be moved to the justification.

The last bullet for the SL objective: “Recommend solutions, if any, to be specified in the normative phase [RAN1, RAN2] “ is the reason why any 3GPP study is conducted. We suggest to remove this bullet.

In order to limit the scope, we think the sidelink positioning measurements to study should be limited to sidelink timing and power measurements. We think SL AOA/AOD can be left to future releases. We note that the corresponding Uu features, DL AOA and UL AOD, have not yet been specified. We also note that UEs typically don’t have antennas suitable for SL AOA/SL AOD/DL AOA/UL AOD. SL AOA/SL AOD/DL AOA/UL AOD could still be of interest for certain use cases, such as for UEs with antennas mounted on the roof of a car. Still, considering the large scope of the work this can preferably be left to a later release. We thus propose the following modification of the second sub-bullet under the SL positioning performance and feasibility study objective:

- Study of positioning methods based on SL timing and power measurements (e.g. TDOA, RTT, ~~AOA/D~~, etc) including combination of SL positioning measurements with other RAT dependent positioning measurements (e.g. Uu based measurements) [RAN1]

In the study components for sidelink communication and from positioning should be re-used as far as possible. We therefore propose the following modification to the third sub-bullet under the SL positioning performance and feasibility study objective:

- Study of sidelink reference signals for positioning purposes, including signal design, phy layer control signalling, resource allocation, physical layer measurements, associated physical layer procedures, etc , reusing existing reference signals, procedures etc, from sidelink communication and from positioning as much as possible [RAN1]

## 27 – InterDigital France R&D

We would like to make a small correction in our previous input. We support **the draft objective** for sidelink positioning.

## 3.2 Summary from Initial Round

### Summary on unlicensed

Unsurprisingly, the situation is not much different from previous discussions of this topic. A significant majority of companies have the view that unlicensed should not be included in the scope of the study item with the main arguments being:

1. SL communication in unlicensed should be specified first

2. Complexity of managing SL communication in unlicensed and SL positioning in unlicensed in parallel
3. Workload considerations

A minority of companies maintain a strong opinions that unlicensed should be included for the following reasons:

1. ITS spectrum may not have sufficient bandwidth to meeting the accuracy requirements for V2X
2. Operators may be reluctant to allow the use of their licensed spectrum for sidelink and/or positioning.
3. When out of network coverage the only spectrum that can be used is ITS and as per above this may not be sufficient.

One company (DT) proposed that the SL positioning evolution should only consider ITS spectrum as licensed spectrum is not supported in the SA1 requirements. The moderator's assumption is that this comment may be directed at SL positioning for V2X use cases, but that other uses cases such as public safety would be targeted as licensed spectrum. Hence no change is proposed based on this comment.

Based on this feedback, the moderator's recommendation to not include unlicensed within the scope of the SI.

**Proposal 1:** Unlicensed spectrum is not included in the scope of the study into SL positioning

There were also a number of proposals for a possible compromise way forward and the moderator considers that the following approach might be worth to discuss in the Tuesday GTW:

**Proposal 2:** Discuss whether one or both of the following could be acceptable (in additional to proposal 1):

1. As part of the study, the spectrum and bandwidth needed to meet the accuracy requirements should be evaluated. When this evaluation is complete the necessity to add unlicensed spectrum to the Rel-18 study can be reviewed. [The aim here is to have better information on which to make a decision]
2. To assist the potential extension to unlicensed in a future release, add a statement to the objectives saying that "The SL positioning study should consider forward compatibility to potential future extension to unlicensed spectrum"

### **Summary on sidelink positioning objectives**

Several comments were received regarding the terms "relative positioning" and "ranging" which has been discussed previously. Xiaomi explained their understanding based on TS 22.261 that ranging refers to estimating distance or angle, and relative positioning refers to distance and angle. To the moderator, this distinction seems quite subtle and very unlikely to have a substantive impact to the potential solutions that need to be studied. The moderators proposal is to leave the text unchanged.

Regarding the question of moving of the scenarios and use cases to the justification. only 3 companies commented, 2 in favour and one against. The moderator assumes that other companies find the current location of the text acceptable so no change has been made and the note in [] has been removed.

Although only commented by one company, the bullet "Recommend solutions, if any, to be specified in the normative phase [RAN1, RAN2]" has been removed. This seems to be a natural outcome of any study and so it seem reasonable to remove. It is also noted that the other objectives did not have a similar bullet.

The following changes have not been taken into account. Each comment is only made by one or two companies and the the moderator considers them unlikely to be acceptable based on previous discussions, or because they are expanding the scope of the work, etc:

- Removing the whole objective
- Deprioritising 'partial coverage' scenario and IIoT use case
- Removal of AOA/AOD in order to reduce the scope of work
- Adding support for RAT-independent positioning methods over SL [expansion of scope]
- Removal of 'RAT dependent' in the bullet "o Study of positioning methods (e.g. TDOA, RTT, AOA/D, etc) including combination of SL positioning measurements with other RAT dependent positioning measurements" [expansion of scope]

Other changes have been taken into account in the revised SID text.

### 3.3 Intermediate Round

Following the lengthy discussion on the Tuesday GTW, the proposal is to discuss the following way forward on unlicensed:

1. The study will not explicitly consider unlicensed spectrum
2. The study will evaluate the bandwidth requirements to meet the accuracy requirements
3. When the bandwidth requirements have been determined and the study of sidelink communication in unlicensed spectrum has progressed, it can be reviewed whether unlicensed spectrum can be considered in further work. Checkpoint at RAN#97 to see if sufficient information is available for this review.

Note that so far no changes have been proposed in the SID text. This will be proposed after receiving feedback to the proposed way forward above.

Companies are requested to comment constructively towards finding an acceptable way forward. Simply repeating arguments already made in the Initial Round is not productive.

#### **Feedback Form 5: Unlicensed spectrum - Intermediate Round**

Companies are asked to provide comments and suggestions to the updated objectives.

#### **Feedback Form 6: Sidelink positioning - Intermediate Round**

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## 4 Improved accuracy, integrity, and power efficiency

### 4.1 Initial Round

Companies are asked to provide comments and suggestions to the objectives on Improved accuracy, integrity, and power efficiency. A separate feedback form is provided for each of the sub objectives

#### **Feedback Form 7: Integrity for RAT dependent positioning - Initial Round**

<p><b>1 – vivo Mobile Communication Co.</b></p> <p>The workload of current scope is far beyond capacity of WG resources. We don't see strong need for integrity enhancement. The whole item should be postponed to next release.</p>
<p><b>2 – Futurewei Technologies</b></p> <p>Support</p>
<p><b>3 – CATT</b></p> <p>We are fine to include objective for integrity for RAT dependent positioning as shown in SID, although we consider the support integrity for RAT dependent positioning is low priority for Rel-18.</p>
<p><b>4 – THALES</b></p> <p>We are supportive of the objectives on Improved accuracy and integrity,</p>
<p><b>5 – Samsung R&amp;D Institute UK</b></p> <p>Just one question for clarification, what is the RAN1 role for the below bullet?</p> <ul style="list-style-type: none"><li>- Identify the error sources, failure modes, [RAN1, RAN2].</li></ul>
<p><b>6 – Guangdong OPPO Mobile Telecom.</b></p> <p>We are fine with this objective</p>
<p><b>7 – Deutsche Telekom AG</b></p> <p>Improved accuracy (in well defined local and/or indoor deployments, not general wide-area) has higher priority than improved power efficiency and RAT dependent positioning integrity</p>
<p><b>8 – ZTE Corporation</b></p> <p>Support</p>
<p><b>9 – Huawei Tech.(UK) Co., Ltd</b></p> <p>We suggest removing "failure modes" because it is not clear what that means, and even in Rel-17, study of it was not requested by RAN2 LS.</p>

- Identify the error sources, failure modes, [RAN1, RAN2].

**10 – Beijing Xiaomi Mobile Software**

We support the objective.

**11 – TELECOM ITALIA S.p.A.**

We support the objectives

**12 – MediaTek Inc.**

We are concerned about the size of the WI, and RAT-dependent integrity has the potential to be a difficult objective. As the comments in this discussion and previous rounds make clear, there is some uncertainty from companies about how RAN1 would attack the initial objective to understand the error sources and failure modes, so this seems like a risk of a time sink. So far we haven't seen a strong requirement to drive this objective; we aren't opposed to it in principle, but we think it's lower priority than some of the other objectives and could be downscoped for this release.

**13 – ROBERT BOSCH GmbH**

Support

**14 – New H3C Technologies Co.**

we support this objective

**15 – Intel Corporation (UK) Ltd**

For the sake of RAN1 workload reduction and considering that new positioning solutions may be introduced in Rel.18, we are open postponing of integrity work to the next release.

**16 – Telia Company AB**

Objective is ok for us.

**17 – InterDigital France R&D**

We support the objective. The framework for RAT-independent integrity can be the starting point for this study.

**18 – Apple Benelux B.V.**

We think that this objective could be postponed to the next release as a way to reduce the overall workload in Rel-18

**19 – InterDigital France R&D**

We would like to make a correction for a typo in our previous input.

We support the objective. The framework for GNSS positioning integrity can be the starting point for this study.



**20 – Motorola Mobility Germany GmbH**

Lenovo, Motorola Mobility :

We are fine with the updated objective text as this forms part of the improved integrity goal in Rel-18.

**21 – Qualcomm Incorporated**

Even though integrity is lower priority from our side, we can accept the package proposal for the “improved accuracy, integrity, power efficiency”

**22 – VODAFONE Group Plc**

If there are workload issues then this could be postponed to a later release (as we see GNSS as being used outdoors and RAT dependent solutions being used indoors - and indoors it may be easier to ensure the integrity of the RAT signals by other means.)

**23 – SHARP Corporation**

We support the objective.

**24 – Sony Europe B.V.**

Support.

This part ”Identify the error sources, failure modes” can be led by RAN2.

**25 – Philips International B.V.**

We support this objective. It is important to consider the integrity of the RAT dependent positioning and improve the reliability of the position estimations.

**26 – AT&T GNS Belgium SPRL**

We support this objective, but understand the scope is quite broad. Given the framework that was created for GNSS integrity in Rel-17, we should state that this will be used as a starting point. If there is a general framework for e.g., signalling support, it could apply to both RAT-dependent and other non-GNSS RAT-independent positioning methods.

**27 – Ericsson LM**

3GPP should continue the Integrity work in Rel-18. Providing Integrity for GNSS SSR message will be mature as part of Rel-17, while some parts can be remaining (e.g. GNSS local environment such as jamming, spoofing, multipath details). Then the same concept; i.e the Integrity KPIs etc. can be applied for RAT dependent positioning method. Further RTCM input can be taken for OSR Integrity discussion in Rel-18. Integrity for RAT-independent and RAT-dependent positioning is low hanging fruit which should be continued in Rel-18.

**28 – ESA**

We think the work carried out by RAN2 on GNSS integrity can be leveraged on for RAT-dependent integrity. In addition, we would like to emphasise that there is need to further enhance also GNSS integrity beyond Release 17. Therefore, we support including integrity for RAT-dependent and RAT-independent on the list with objectives for Rel18 positioning works.

**Feedback Form 8: PRS/SRS bandwidth aggregation - Initial Round**

**1 – vivo Mobile Communication Co.**

RAN1 has already studied this issue. It is not necessary to study again in RAN1. This could be led by RAN4.

**2 – Futurewei Technologies**

Support. Also ok if RAN4 leads this.

**3 – ZTE Corporation**

Support. We are also ok if RAN4 leads this.

**4 – CATT**

RAN1 has studied PRS/SRS bandwidth aggregation in Rel-17 and identified that there is a need for RAN4 to study the feasibility of PRS/SRS bandwidth aggregation. There is no need for RAN1 to study it again in Rel-18. Our suggestion is that RAN4 should lead the study of accuracy improvement based on PRS/SRS bandwidth aggregation for intra-band carriers. RAN1 may lead the normative work if RAN4 decides that it is feasible to support PRS/SRS bandwidth aggregation for intra-band carriers.

Also, during the SI, RAN2 and RAN3 may not need to be involved in PRS/SRS bandwidth aggregation positioning in our view.

The updated objectives from us as follows,

- Study solutions for accuracy improvement based on PRS/SRS bandwidth aggregation for intra-band carriers[RAN1, RAN4, RAN2, RAN3]:
  - o RAN4 to consider implications of PRS/SRS bandwidth aggregation (e.g. timing errors, phase coherency, frequency errors, power imbalance, etc).

**5 – Nokia Denmark**

Suggestion to make this RAN4 led:

- Study solutions for accuracy improvement based on PRS/SRS bandwidth aggregation for intra-band carriers[RAN1, RAN4, RAN2, RAN3]:
  - o RAN4 to consider implications of PRS/SRS bandwidth aggregation (e.g. timing errors, phase coherency, frequency errors, power imbalance, etc).

**6 – NTT DOCOMO INC.**

Support and ok with RAN4-led.

**7 – THALES**

Support. It is fine if RAN4 leads this

**8 – Samsung R&D Institute UK**

Just one question for clarification. Is the bandwidth aggregation is only for RRC connected mode, or could allow RRC inactive + RRC connected?

**9 – China Mobile E-Commerce Co.**

We share similar views as other companies that as SRS/PRS carrier aggregation has been studied in R17 SI phase, RAN1 does not need to do it again. We support RAN4 to lead it.

**10 – Deutsche Telekom AG**

Support

**11 – Guangdong OPPO Mobile Telecom.**

Considering the limited TU capability (i.e., 3TU), the current scope is too large and some further down-scoping is needed for the accuracy enhancement, e.g., down-selection between PRS/SRS bandwidth aggregation and NR carrier phases.

In Rel-17, there were evaluations for the PRS/SRS bandwidth aggregation. The main concern is about the feasibility. During R17 discussions, both UE vendors and NW vendors doubted the feasibility for UE and gNB, respectively. Thus, the study should focus on the feasible and RAN4 should be the leading WG. Thus, if the objective is included, we suggest the following modification

Study **the feasibility and** solutions for accuracy improvement based on PRS/SRS bandwidth aggregation for intra-band carriers[~~RAN4~~, RAN1, ~~RAN4~~, RAN2, RAN3]:

- RAN4 to consider implications of PRS/SRS bandwidth aggregation (e.g. timing errors, phase coherency, frequency errors, power imbalance, etc).

**12 – Huawei Tech.(UK) Co.. Ltd**

We suggest to only task RAN4 if this objective (and the whole item) is converted to a study, since RAN1 study is already complete. We suggest the following objective instead:

- Study feasibility of PRS/SRS bandwidth aggregation (e.g. timing errors, phase coherency, frequency errors, power imbalance, etc) for solutions for accuracy improvement based on PRS/SRS bandwidth aggregation for intra-band carriers documented in TR38.857 [RAN4]

**13 – Beijing Xiaomi Mobile Software**

We agree with other companies that this objective can be RAN4-led.

**14 – TELECOM ITALIA S.p.A.**

if the objective is to be kept in scope, ok to leave it to RAN4 only, pending there is enough capacity in RAN4.

Clearly if there is no room in RAN4, the objective should be dropped.

<p><b>15 – MediaTek Inc.</b></p> <p>We have some doubt about the real applicability of this objective, considering typical deployments: Intra-band contiguous deployments are limited, and the benefit in other scenarios is less clear. We see this as a candidate for downscoping in this release, but if it is pursued, the level of effort should be limited.</p>
<p><b>16 – LG Electronics Inc.</b></p> <p>We support PRS/SRS bandwidth aggregation, also we are fine if RAN4 leads this.</p>
<p><b>17 – New H3C Technologies Co.</b></p> <p>Support it if only RAN4 is involved</p>
<p><b>18 – Intel Corporation (UK) Ltd</b></p> <p>According to the objective description: “RAN4 to consider implications of PRS/SRS bandwidth aggregation (e.g., timing errors, phase coherency, frequency errors, power imbalance, etc.)”), we think this objective can be led directly by RAN4 and are open to change leading WG. From physical layer perspective, PRS/SRS bandwidth aggregation is beneficial and does not require additional RAN1 study.</p>
<p><b>19 – InterDigital France R&amp;D</b></p> <p>We support the objective.</p>
<p><b>20 – Apple Benelux B.V.</b></p> <p>We are fine with the objective and if it is RAN4 led</p>
<p><b>21 – Motorola Mobility Germany GmbH</b></p> <p>Lenovo, Motorola Mobility :</p> <p>We are fine to prioritize this objective for improved accuracy in Rel-18.</p>
<p><b>22 – Qualcomm Incorporated</b></p> <p>We support the objective. We prefer to keep RAN1 as the first Working Group as shown in the current draft WID. We acknowledge that RAN4 needs to consider the RF-related implications, which is captured in the subbullet already, so we don’t see the necessity to this doesn’t mean that RAN4 should be the main Working Group for the study.</p>
<p><b>23 – SHARP Corporation</b></p> <p>Support and are ok with RAN4-led.</p>
<p><b>24 – Sony Europe B.V.</b></p> <p>RAN1 has studied during Rel-17 study item. At this stage, it should be led by RAN4 as it is related to their expertise (e.g., on the impact of imperfections, such as timing errors, phase coherency, frequency errors, power imbalance)</p>
<p><b>25 – Philips International B.V.</b></p> <p>Agree with Mediatek. Is potential candidate for downscoping.</p>

## 26 – Ericsson LM

Given the large scope of this SID and the complexity and cost involved in intra-band PRS bandwidth aggregation, we propose to limit the scope to intra-band, **contiguous** PRS bandwidth aggregation.

### Feedback Form 9: NR carrier phase - Initial Round

#### 1 – vivo Mobile Communication Co.

We don't think RS should be part of the study.

- Study solutions for accuracy improvement based on NR carrier phase measurements [RAN1, RAN4, RAN2, RAN3]
  - o ~~Reference signals~~, physical layer measurements, physical layer procedures to enable positioning based on NR carrier phase measurements for both UE-based and UE-assisted positioning [RAN1]
  - o Focus on reuse of existing PRS and SRS, ~~with new reference signals only considered if found necessary~~
  - o Signalling for configuration and measurement reporting [RAN2, RAN3]

#### 2 – Futurewei Technologies

This has been studied in the past without further proceeding. Our preference is to allocate resources and TU for other enhancements.

#### 3 – ZTE Corporation

We are OK with the current wording, and can also accept vivo's suggestion

#### 4 – DanKook University

We strongly support including discussion on new PRS signal in the scope of the carrier phase positioning study.

We believe little can be achieved just by using Rel-17 PRS signal for achieving the goal of centimeter grade accuracy. The theoretical bound and experimental study showed that it is hard to achieve more than a meter accuracy using the Rel-17 PRS. Rather, PTRS type block signal may be appropriate because it is designed for phase tracking and good for applying the 'periodogram' style repetition method for improving SNR. We have mathematical, simulation, and field test results to present in the study to prove this argument. Therefore, a broad range of proposals on different approaches of signaling and phase measurement should be open and discussed during the study phase.

Further, we suggest deleting the limiting term 'only considered...' in the 3rd sub-bullet. It only suppresses innovative suggestions.

- Study (for study phase of 9 months and, if found beneficial, specify solutions for accuracy improvement based on NR carrier phase measurements [RAN1, RAN4, RAN2, RAN3])
  - o Reference signals, physical layer measurements, physical layer procedures to enable positioning based on NR carrier phase measurements for both UE-based and UE-assisted positioning [RAN1]

- Focus on reuse of existing PRS and SRS, with new reference signals ~~only considered~~ if found necessary
- Signaling for configuration and measurement reporting [RAN2, RAN3]

#### **5 – Nokia Denmark**

We see NR carrier phase positioning as the top priority for positioning enhancement due to its unique ability to create new commercial value by bringing a step-change in accuracy, especially indoors

#### **6 – CATT**

In our view, NR carrier phase positioning is one of the most important objectives in Rel-18. We support the objective for carrier phase positioning in the draft SID.

Also, during the SI, RAN2 and RAN3 may not need to be involved in NR carrier phase positioning in our view.

#### **7 – NTT DOCOMO INC.**

We support the objective and slightly prefer vivo's updated one. Considering the current large scope, Rel-18 may be better to focus on reuse of existing PRS and SRS.

#### **8 – Samsung R&D Institute UK**

We suggest that NR carrier phase measurements can be studied both Uu and sidelink. For Uu positioning, the benefit from NR carrier phase measurements is not clear since LOS cannot be guaranteed in cellular communication environments.

We could add a note saying:

Note: carrier phase based method could apply to sidelink if found beneficial

#### **9 – China Mobile E-Commerce Co.**

We are supportive of this objective.

Regarding the reference signal part, we are open to include it. Note that using carrier phase measurement to improve the accuracy is insensitive to BW of the reference signals, and with the potential enhancement of reference signals, the solution may be reused by Redcap UE positioning, if needed.

#### **10 – Deutsche Telekom AG**

We support and see this important for deployment scenarios where improved pos is required (i.e. indoor industrial for example)

#### **11 – Guangdong OPPO Mobile Telecom.**

Considering the TU limited capability (i.e., 3TU), the current scope of R18 positioning is too large, and we suggest that this objective be down-scoped in order to keep a manageable SID based on the following reasons:

- There will be a large workload for NR carrier phase based positioning. Considering the limited TUs, it should be deprioritized.

- From R16/R17, there were some discussions on this feature. That is to say, it was already been discussed for at least two releases. However, no progress was achieved
- According to the evaluation of R16/R17, the bottlenecks of positioning accuracy are NLOS and timing error. But, NR carrier phase based positioning cannot address these bottlenecks. That is to say, the performance of carrier phase measurement in cellular system with rich multipath is not justified at all.

#### **12 – Beijing Xiaomi Mobile Software**

Based on the previous study, the carrier phase positioning will not achieve the high positioning accuracy in the NLOS environments, and there are two different objectives for improved positioning accuracy, moreover, the current scope is too large based on the limited TU, so we think the carrier phase positioning can be treated with low priority.

#### **13 – Huawei Tech.(UK) Co.. Ltd**

We suggest removing reference signaling design from the SID scope, given the limited TU and large scope. Only Rel-15/Rel-16/Rel-17 reference signals should be considered.

- ~~Reference signals~~, physical layer measurements, physical layer procedures to enable positioning based on NR carrier phase measurements for both UE-based and UE-assisted positioning [RAN1]
- Focus on reuse of existing PRS and SRS, ~~with new reference signals only considered if found necessary~~
- Signalling for configuration and measurement reporting [RAN2, RAN3]

#### **14 – TELECOM ITALIA S.p.A.**

We support this objective and think it is important in industrial applications (therefore also solving RedCap positioning).

Of course we need to take into account the impact on RAN4

#### **15 – MediaTek Inc.**

We think this is OK as a study objective, and for the study phase we would prefer to leave open the possibility of needing new reference signals (which of course would only be specified if found to be necessary).

#### **16 – LG Electronics Inc.**

We support NR carrier phase as the top priority for improved accuracy. Also, we support the objective for NR carrier phase in the draft SID.

#### **17 – ROBERT BOSCH GmbH**

We are supportive considering NR carrier phase positioning.

#### **18 – TELEFONICA S.A.**

We support carrier phase positioning to be part of Rel-18. Accuracy enhancements are required for indoor industrial scenarios

**19 – New H3C Technologies Co.**

We are supportive for this objective without any enhancement on reference signal.

**20 – Locaila**

We support studying new reference signal including PRS in the scope of NR carrier phase positioning.

We have a question for the companies (vivo, ZTE, Huawei..), whether they have any evidence that centimeter grade accuracy can be achieved by reusing the previous reference signals and they can submit the result in the study.

If so, that's good. However previous study showed that it is very unlikely to see improvement with current PRS design and the carrier phase method based on it.

We may need to explore new approach.

There is no harm to invite new ideas in the study phase.

The main purpose of the study is to use it for reference.

Carrier phase technique has already been accepted in the industry and commercial products are available in the market.

If there's any good idea for competing with existing products, why don't we learn a new idea?

**21 – Intel Corporation (UK) Ltd**

For the sake of scope reduction, it is recommended to preclude study on introduction of new reference signals for carrier phase measurements in Rel.18.

**22 – Telia Company AB**

We support NR carrier phase positioning objectives in the draft SID. NR carrier phase positioning should be integral part of Release 18 and especially due to future increased indoor location accuracy requirements such as industrial and factory use cases.

**23 – Apple Benelux B.V.**

As this has not been addressed in 3GPP up till now, before being introduced, the relative performance compared with the existing positioning schemes should be investigated in both LOS and NLOS environments. Unless there is a compelling reason to add this method, to reduce work-load consider down-selecting this objective. Removal of the new reference signals can also be considered.

**24 – InterDigital France R&D**

Our first preference is to remove this objective from the SID due to large coverage of the SID. Similar to OPPO, this study may require considerable amount of time for the study.

The second preference is to limit the scope of the study, i.e., no new design of RS is considered and we focus on the existing RS and the study focuses only on Uu positioning.

**25 – Verizon UK Ltd**

Supportive. We see accuracy enhancement as the top priority for R18. Among all techniques we think NR carrier phase positioning is the one most likely delivers the performance we have in mind. We need a step-change in accuracy as Nokia said, especially for IIOTs and indoors.



<p><b>26 – TELENOR ASA</b></p> <p>Several use cases would benefit from improved positioning accuracy. Hence we support NR carrier phase positioning.</p>
<p><b>27 – Motorola Mobility Germany GmbH</b></p> <p>Lenovo, Motorola Mobility :</p> <p>Our view is to deprioritize this objective for improved accuracy in Rel-18, considering the workload. PRS/SRS bandwidth aggregation can suffice with regard to the improved accuracy objectives.</p>
<p><b>28 – Qualcomm Incorporated</b></p> <p>Even though NR carrier phase measurements are lower priority from our side, we can accept the package proposal for the “improved accuracy, integrity, power efficiency”</p>
<p><b>29 – VODAFONE Group Plc</b></p> <p>Inline with other operators we support carrier phase positioning to be part of Rel-18. High accuracy enhancements are required for indoor industrial scenarios.</p>
<p><b>30 – SHARP Corporation</b></p> <p>We support NR carrier phase for improved accuracy.</p>
<p><b>31 – Sony Europe B.V.</b></p> <p>RAN1 has studied this topic during Rel-17 SI and the scope of Rel-18 is already too large.</p> <p>We propose to down scoped this topic, so that we can spend more efforts in other areas (e.g. sidelink positioning).</p>
<p><b>32 – Orange</b></p> <p>We support carrier phase positioning, improving positioning in industrial environment is requested by the market.</p>
<p><b>33 – Philips International B.V.</b></p> <p>This could be part of a study to determine the potential accuracy benefits. Given the Line-of-Sight requirement and that it likely works best for short distances it may be useful to reduce the scope only to sidelink for initial study, if workload is an issue.</p>
<p><b>34 – Ericsson LM</b></p> <p>The sub-objective “Signalling for configuration and measurement reporting [RAN2, RAN3]” is more appropriate for normative work and should be removed for the SI phase.</p>

**Feedback Form 10: LPHAP - Initial Round**

<p><b>1 – vivo Mobile Communication Co.</b></p> <p>Fine with this part, with RAN2 leading the work.</p>
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<p><b>2 – Futurewei Technologies</b></p> <p>Support</p>
<p><b>3 – CATT</b></p> <p>We are fine with the objective for LPHAP in the draft SID.</p>
<p><b>4 – CITC</b></p> <p>We support the objective for LPHAP in the draft SID.</p>
<p><b>5 – Samsung R&amp;D Institute UK</b></p> <p>Just one question for clarification. How to define the power consumption evaluation methodology/scenario, together with the positioning requirement?</p>
<p><b>6 – Deutsche Telekom AG</b></p> <p>Support but with lower prio (see our input above)</p>
<p><b>7 – Guangdong OPPO Mobile Telecom.</b></p> <p>We are fine with the current version of this objective.</p>
<p><b>8 – ZTE Corporation</b></p> <p>We are generally fine. But if some companies still have concern on workload or on vague scope for this item, we suggest limiting the potential LPHAP study or enhancement on RRC_INACTIVE and/or RRC_IDLE state</p>
<p><b>9 – Huawei Tech.(UK) Co.. Ltd</b></p> <p>No need to have “if found beneficial”, since the condition is the judgement based on outcome of the study. In addition, we think that the use case 6 in TS 22.104 could serve as the baseline for evaluation, and could help focus the work within the limited TUs available.</p> <ul style="list-style-type: none"> <li>- Study the requirements on LPHAP as developed by SA1 and evaluate whether existing RAN functionality can support these power consumption and positioning requirements. Based on the evaluation, and, if found beneficial, study potential enhancements to help address any limitations [RAN2, RAN1] <ul style="list-style-type: none"> <li>o Note: Use case 6 of TS 22.104 is considered as the baseline use case for evaluation.</li> </ul> </li> </ul> <p>We would then suggest adding the details of use case 6 in the justification section. For the example, the justification for LPHAP can revised as below:</p> <p>SA1 has introduced requirements for LPHAP (Low Power High Accuracy Positioning) for industrial IoT scenarios including use cases such as massive asset tracking, AGV tracking in industrial factory and person localization in danger zones. Requirements are for high accuracy, extreme low power consumption with battery life sustainable up to one or more years. A typical scenario of interest is use case 6 as defined TS 22.104, which corresponds to tracking of workpiece (in- and outdoor) in assembly area and warehouse</p>

with the target accuracy of <1m, the positioning interval of 15-30 seconds, and the battery life of 6-12 months. While Rel-17 NR positioning has introduced support for positioning in RRC\_IDLE/INACTIVE states, there is a need to evaluate whether and how the current system allows LPHAP requirements to be met.

**10 – Beijing Xiaomi Mobile Software**

We are fine with the current version of the objective.

**11 – MediaTek Inc.**

We are in general OK with this objective. We understand that the "if found beneficial" condition was added to clarify that we do not pre-commit to pursue any enhancements; the evaluation may conclude that existing RAN functionality is adequate and nothing new needs to be worked on. Without this phrase, the wording seems to guide the WGs to study the potential enhancements unconditionally.

**12 – New H3C Technologies Co.**

we are fine with this objective.

**13 – Intel Corporation (UK) Ltd**

For the sake of scope reduction, it is recommended either to limit the scope to RAN2 led objective or even consider to down-scope LPHAP studies from Rel.18

**14 – Telia Company AB**

We see that this should be with lower priority compared to NR carrier phase positioning.

**15 – InterDigital France R&D**

Due to large scope of the SID, we have similar view as ZTE; focus on further enhancement on RRC INACTIVE and RRC IDLE state in the LPHAP study.

**16 – Motorola Mobility Germany GmbH**

Lenovo, Motorola Mobility :

Supportive of the updated LPHAP objective text with the focus on achieving high accuracy positioning and power efficiency in Rel-18. We are also fine if the enhancement considers RRC\_INACTIVE positioning to narrow down the scope. Perhaps, this could be mentioned in the objective text as guidance.

**17 – Qualcomm Incorporated**

OK with the suggested objective and the modification shown in changemarks

**18 – VODAFONE Group Plc**

We are generally supportive of this objective.

**19 – SHARP Corporation**

We support the objective for LPHAP

**20 – Sony Europe B.V.**

We support the objective.

**21 – Philips International B.V.**

We agree with ZTE about RRCINACTIVE and RRC\_IDLE

**22 – Ericsson LM**

There are 9 use cases captured in 22.104 for LPHAP. To shorten the study, we propose to at least shorten the list to something manageable, ideally pick a single use case.

## 4.2 Summary from Initial Round

Note that an overall summary addressing potential downscoping is provided at the end of this section

### Summary for integrity

Samsung raised the question on what is the expected role of RAN1. The moderator understands that RAN1 will have a role in determining error sources. Error sources may arise from both physical layer and protocol layer considerations so it seems both RAN1 and RAN2 will need to be involved. The moderators thinks that it may be difficult to say that RAN1 and RAN2 is the lead group on this objective, and no change has been made.

The 'failure modes' has been removed (the moderator also does not understand what this refers to)

### Summary for PRS/SRS aggregation

A large number of companies indicated support for this objective to be lead by RAN4, and a number of those suggested that RAN1 does not need to be involved in the study as they already studied in Rel-17. Only one company preferred to keep RAN1 as the lead group. The SID has been updated to make this a RAN4 objective.

One company (Samsung) raised the question whether this objective is applicable for Inactive as well as Connected. At least the moderator's assumption is that this would only be application for Connected as this is the only state in which CA can be configured. This question will be asked to all as part of the Intermediate Round.

One company (Ericsson) suggested to limit the objective to contiguous carriers. This was proposed by the moderator in the last discussion but was not agreeable and so the change has not been include in the updated SID.

### Summary for carrier phase

A number of companies made the suggestion that the scope could be reduce to some degree by limiting the study to the existing PRS/SRS only. At the same time a number of companies expressed the view that the existing RS will be very limiting to the performance of carrier phase positioning. The moderator proposed to discuss this potential scope reduction in the Tuesday GTW:

**Proposal 1:** Discuss whether the scope of the carrier phase study can be reduced by limiting the study to the

existing PRS/SRS only

2 companies commented that the RAN2/3 objective is not necessary for the study item and this has been removed from the SID.

### **Summary for LPHAP**

Huawei proposal to point out one specific use case in the justification text has been included. A question for the next phase is whether the study should focus on this use case only in order to help control the work.

**Proposal 2:** The study only focuses on use case 6 in TS 22.104 as a representative use case in order to limit the scope of the study

A few companies (ZTE, IDC, Moto, Philips) suggested to limit the scope to enhancements on RRC\_INACTIVE and/or RRC\_IDLE state. This question should also be addressed in the next phase.

**Proposal 3:** The scope of the study is limited to enhancements on RRC\_INACTIVE and/or RRC\_IDLE state

One company (Huawei) suggested to remove the 'if found beneficial' and another company (MediaTek) prefer to keep it. This aspect was discussed last time and the phase was added to cover the possibility that the study could conclude that existing functionality is sufficient to meet the requirements. Therefore, this change has not been included in the updated SID.

Samsung questioned how to define evaluation methodology to consider power consumption and positioning. The moderator considers this is a valid question but more likely one that will have to be addressed in the study rather than in the SID.

### **Overall summary on Improved accuracy, integrity, and power efficiency**

All of the 4 sub objectives have wide support, and they all have a few companies (at most 8 companies for any one item) proposing that the item should be removed or can be deprioritised. From the moderator point of view it is very difficult to propose one or more items to be removed from the SI scope. Overall status and proposals to be discussed in Tuesday GTW:

- **Integrity**
  - o No proposal for reducing the scope of this objective
- **PRS/SRS aggregation**
  - o Study to be conducted in RAN4 only with no RAN1/2/3 work. [This had very wide support and so have been directly applied to the draft SID and is not proposed to be discussed in the GTW]
- **Carrier phase**
  - o **Proposal 1:** Discuss whether the scope of the carrier phase study can be reduced by limiting the study to the existing PRS/SRS only
  - o Objective relating to RAN2/3 removed from the study [This been directly applied to the draft SID and is not proposed to be discussed in the GTW]
- **LPHAP**

- **Proposal 2:** The study only focuses on use case 6 in TS 22.104 as a representative use case in order to limit the scope of the study
- **Proposal 3:** The scope of the study is limited to enhancements on RRC\_INACTIVE and/or RRC\_IDLE state

### 4.3 Intermediate Round

Improved accuracy, integrity, and power efficiency was not discussed during the Tuesday GTW. Therefore the 3 proposals from the Initial Round should be discussed during the Intermediate round. Further comments on the updates SID may also be provided.

**Feedback Form 11: Integrity for RAT dependent positioning - Intermediate Round**

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**Feedback Form 12: PRS/SRS bandwidth aggregation - Intermediate Round**

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**Feedback Form 13: NR carrier phase - Intermediate Round**

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**Feedback Form 14: LPHAP - Intermediate Round**

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## 5 Positioning support for RedCap UEs

### 5.1 Initial Round

Companies are asked to provide comments and suggestions to the objectives on Positioning support for RedCap UEs

**Feedback Form 15: RedCap positioning - Initial Round**

<p><b>1 – vivo Mobile Communication Co.</b></p> <p>Considering the large amount of evaluation work in RAN1, it should start later than other work. RAN4 could start the work first as the leading WG.</p>
<p><b>2 – Futurewei Technologies</b></p> <p>Support. Also ok if RAN4 leads this</p>

### **3 – CATT**

There is no need to include RedCap positioning in the SI in our view. RedCap positioning can be included directly in WI.

In the proposed WID objective, both RAN1 and RAN4 works on the evaluate positioning performance of existing positioning procedures and measurements with RedCap UEs. The duplication seems to be unnecessary. In our understanding, RAN4 needs always to go through the simulation evaluation procedure when defining the performance requirements for positioning measurements, thus it seems there is no need for RAN1 to be involved in the simulation evaluation. Thus, we suggest that RedCap positioning can be handled by RAN2 and RAN4. RAN1 does not need to be involved.

The updated objectives from us as follows,

- *Positioning support for RedCap UEs, considering the following:*
  - o *Evaluate positioning performance of existing positioning procedures and measurements with RedCap UEs [RAN1, RAN4]*
  - o *Based on the evaluation, assess the necessity of enhancements and, if needed, identify enhancements to help address limitations associated with RedCap UEs [RAN1, RAN2]*
  - o *Define core and performance requirements for positioning measurements performed by RedCap UEs [RAN4]*

### **4 – NTT DOCOMO INC.**

Assuming WI part will be discussed further after this SI is completed, we are fine with the current text including first and second sub-bullets.

### **5 – Samsung R&D Institute UK**

We want to make clear for the below. What is the RAN1 and RAN4 role for evaluating the performance?

- Evaluate positioning performance of existing positioning procedures and measurements with RedCap UEs [RAN1, RAN4]

In addition, target requirements and specification impacts for RedCap positioning are not clear. In this situation, how can we decide the necessity of enhancement?

Also, we need to make clear that RedCap UE is for Rel-17 and not for Rel-18.

### **6 – Guangdong OPPO Mobile Telecom.**

Positioning is an important feature for RedCap UEs and the typical scenarios. We support the objective and are fine with the current version.

### **7 – China Mobile E-Commerce Co.**

We share similar views as vivo and CATT that the current scope is far beyond what we can handle within 3 TUs. As we commented under carrier phase section, since some potential solutions can be reused, at least the RAN1 work of the second bullet can be postponed at this stage.

**8 – Deutsche Telekom AG**

We are not clear what is specific for REDCAP .. if it is onyl the CBW supported, then the limited devices will have limited accurary. We do not see that we should develop something specific for REDCAP in contrast to reuse what is defined for other devices. Most be clarified what the aim on this is ...

**9 – ZTE Corporation**

We also think it is unnecessary to let both RAN4 and RAN1 involve the simulation. Perhaps, RAN4 can define the requirement first, then RAN1 can do simulation and check if some enhancements are needed.

**10 – Huawei Tech.(UK) Co.. Ltd**

We think that RedCap positioning could be carried out directly as a WI without study phase. According to the email discussion of [RAN94e-R18Prep-06], the objective of RedCap positioning is quite clear and specific, which is suitable to be handled as a work item. However, if the whole item is a study item, then it is fine to progress on the RedCap solutions as part of the study first.

**11 – Beijing Xiaomi Mobile Software**

For the simulation, both RAN1 and RAN4 should be involved and the Redcap positioning accuracy can be evaluated. So we support the current version of the objective.

**12 – TELECOM ITALIA S.p.A.**

several comments:

- we share the concern of DT: why need to develop something specific, therefore further fragmenting the market and increasing costs
- why the duplication of simulation work in RAN1 and RAN4?

as a general statement, we suggest to drop this objective and reuse techniques already defined by 3GPP for other types of devices

**13 – MediaTek Inc.**

The evaluation phase is OK to pursue, but we should not commit now to working on further enhancements. With the concerns about the size of the WI, we should only go on to work on enhancements if it is clear from the evaluation that they are really necessary, and we can consider the scale of further work after the evaluation results are in.

**14 – LG Electronics Inc.**

We support RedCap positioning, also we are fine if RAN4 leads this.

**15 – New H3C Technologies Co.**

The motivation of enhancement on redcap UE isn't clear and first of all, the proponent need clarify it.

**16 – Intel Corporation (UK) Ltd**

We are OK with the current objective. RAN1 has already provided a lot of NR positioning studies and the objective on RedCap enhancements does not seem to require significant extra efforts



<p><b>17 – Telia Company AB</b></p> <p>We agree with DT and TIM on the question raised developing something specific for RedCap devices and so fragmenting the market.</p> <p>We agree also with dropping the objective specifically for RedCap devices.</p>
<p><b>18 – Verizon UK Ltd</b></p> <p>We support RedCap positioning and are fine with objective. We want the performance of positioning of RedCap UEs to be on par with that regular NR UEs in terms of accuracy, latency, power consumption... and everything. With the limitations of RedCap, do we know now for certain if it is the case? If yes, we can drop the objective. Otherwise, we should keep it.</p> <p>Also we don't know the result of the study enough now to see it as something that will fragment the market. We can discuss the factor after the evaluation when the candidate techniques have been identified.</p>
<p><b>19 – Apple Benelux B.V.</b></p> <p>We are fine RedCap positioning starting as a study item. We think that there needs to be a discussion on whether there are different performance requirements for RedCap UEs and if so, what they are before the evaluation phase by RAN1/RAN4. On the issue of down-scoping, we prefer setting the objectives in the Improved accuracy, integrity, and power efficiency section as lower priority to this objective.</p>
<p><b>20 – Motorola Mobility Germany GmbH</b></p> <p>Lenovo, Motorola Mobility :</p> <p>Generally fine with the updated RedCap positioning objective text.</p>
<p><b>21 – Qualcomm Incorporated</b></p> <p>OK with the objective</p>
<p><b>22 – VODAFONE Group Plc</b></p> <p>We are supportive of indoor positioning for RedCap devices - but I will leave other companies to debate what work is needed to deliver this in rel 18.</p>
<p><b>23 – Sony Europe B.V.</b></p> <p>Support and it should be RAN1-led as we need to investigate positioning enhancement techniques.</p>
<p><b>24 – Philips International B.V.</b></p> <p>We support redcap positioning, but agree with CATT's proposal to clarify the subbullets.</p>

## 5.2 Summary from Initial Round

Quite diverse comments were received which is surprising when the objectives seemed quite stable after the last discussion.

A number of companies commented about the need to clarify the roles of RAN1 and RAN4, and different views were expressed about whether RAN1 or RAN4 should be the lead group. Based on previous discussions, the moderator understands that RAN4 are the group responsible for measurement accuracy but

they do not have simulation capability to evaluate positioning performance. Therefore, for the first bullet, the moderator’s understanding is that RAN4 needs to evaluate measurement accuracy based on the BW limitations of RedCap UEs, and RAN1 needs to evaluate the impact of the measurement accuracy to the positioning performance. This has been reflected in the SID as follows:

- Evaluate positioning performance of existing positioning procedures and measurements with RedCap UEs[RAN1, RAN4]
  - Evaluate measurement accuracy achievable with RedCap UEs [RAN4]
  - Evaluate impact of measurement accuracy to the positioning performance [RAN1]

Regarding the second bullet, a number of companies suggest to not consider any enhancements for RedCap UEs to improve their positioning performance - the consequence would be that the positioning performance will just be what it is given the reduced measurement accuracy. The moderator acknowledges that this would also remove some workload from RAN1 and enable the work to be fully within RAN4 domain. This possibility has been discussed in previous discussions and up to now has not been acceptable. No change has been made to this objective in the SID text, but other companies can comment in the Intermediate Round whether this would be acceptable.

Samsung asked how it will be possible to decide the necessity of enhancements given that there are no positioning requirements specific to RedCap UEs. This was discussed during the last discussion and the moderator understands that the decision on enhancements will be a subjective assessment given that accuracy that might achieved with and without the enhancement, rather than a hard decision based on whether requirements can be met. No change has been made to this objective in the SID text.

### 5.3 Intermediate Round

Companies are asked to provide comments and suggestions to the updated objectives. Companies can also comment on whether keep the objective to study enhancements.

#### **Feedback Form 16: RedCap positioning - Intermediate Round**

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## 6 Other aspects of the SID

### 6.1 Initial Round

Companies are asked to provide comments and suggestions to any other aspect of the SID. Note that no new positioning enhancements will be discussed for inclusion in the SID at this stage of the process.

#### **Feedback Form 17: Other aspects of the SID - Initial Round**

<b>1 – DanKook University</b> Please include ‘DanKook University’ in the list of supporting IM.
<b>2 – Samsung R&amp;D Institute UK</b>

Just one question for clarification. Is the current formatting intentionally to make the whole item to be a study item instead of the SI phase in one WI?

### **3 – Deutsche Telekom AG**

The entire topic still seems to be far to large ... All aspects, but SL and REDCAP aspects in particular need to be down-scoped significantly (as per our suggestion)

### **4 – Huawei Tech.(UK) Co.. Ltd**

The title of the TR is the same as TR 38.857. Does it imply that the same TR is reused for the SID?

We prefer either one the following two methods.

Method 1: A new TR titled “Study on NR SL positioning” to capture the study outcome of the SL positioning objective, and TR 38.857 is updated to capture the study outcome of other improved Uu positioning objectives.

Method 2: A new TR titled “Study on expanded and improved positioning” to capture the study outcome of all positioning objectives.

If it is a SID, then the “WID includes a” table at the start should be empty

Section 2.3 could list the Rel-16/17 SL work items (5G-V2XNRSL, NRSL\_enh); or at least Rel-16.

Since the whole item is now considered as a study, we suggest that for each of the main objectives there is a sub-bullet asking for recommending solutions, if any, to be specified in the normative phase. This is currently only present under the objective on sidelink positioning.

### **5 – TELECOM ITALIA S.p.A.**

- propose to drop sidelink and redcap-related objectives in order to have a manageable project.
- The impact on RAN4 should clearly identified (in terms of TUs and required resources)

### **6 – Locaila**

Please include ‘Locaila’ in the list of supporting IM.

### **7 – Intel Corporation (UK) Ltd**

In our view, it is desirable to discuss potential scope reduction at least by refining the NR positioning objectives for improved accuracy, integrity, and power efficiency.

### **8 – Apple Benelux B.V.**

There is an objective on positioning in NTN that is under discussion. We may need to have a discussion on what the relationship of that objective is to the current SID.

<p><b>9 – VODAFONE Group Plc</b></p> <p>We support downscoping to make the work manageable.</p>
<p><b>10 – Sony Europe B.V.</b></p> <p>In our view, all of the study item outcomes will be captured in a TR document.</p>
<p><b>11 – Ericsson LM</b></p> <p>Generally, we think the scope of this SID is very large. In order to have a high quality output, it's better to limit the scope and leave some aspects to future releases.</p>
<p><b>12 – AT&amp;T GNS Belgium SPRL</b></p> <p>We support this SI with the additional modifications:</p> <ul style="list-style-type: none"> <li>- Acronym: Since this is a study item, the acronym needs to start with FS</li> <li>- Remove check marks for core and performance parts</li> <li>- There is some guidance text in {{ }} that can be removed</li> <li>- Section 8: To match the text in the objectives, SA2 should be added.</li> </ul> <p>We strongly support the SL positioning objectives as a follow-on of the RAN-led study item. For the other objectives, we may also consider having some defined as a 2nd priority.</p>
<p><b>13 – Fraunhofer IIS</b></p> <p>Please include both “Fraunhofer IIS“ and “Fraunhofer HHI” in the list of supporting IM.</p>

## 6.2 Summary from Initial Round

To response to Samsung’s question, it is intentional that this is now a Study Item rather than a Work Item with study phases for some objectives. This is as per the RAN Chair’s ”Summary for RAN Rel-18 Package” in RP-213469 that was endorsed in the Monday GTW.

The SI title needs to be considered. The draft SID has the title ”Study on NR Positioning Enhancements” but very little thought went into this when it was drafted. The proposal from Huawei is ”Study on expanded and improved positioning” which seems reasonable to the moderator. The TR title will be aligned with the SI title once agreed.

## 6.3 Intermediate Round

Companies are asked to:

- Comment on the proposed title ”Study on expanded and improved positioning”
- Indicate if they would like their name added to the supporting company list

**Feedback Form 18: Other comments - Intermediate Round**

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