

3GPP TSG RAN Meeting #98-e

RP-22xxxx

Electronic Meeting, December 12 - 16, 2022

Agenda Item: 9.3.2.7 - NR NTN enhancements [New RAN2 WI: NR_NTN_enh]

Source: Thales (moderator)

Title: Moderator's summary of discussion [98e-24-R18-NR-NTN]

Document Type: Report

Document for: Information & Decision

The discussion in this thread covers the topic # 98e-24-R18-NR-NTN

The objectives of this mail discussion are to

- Decide about a possible normative phase for the network verified UE location
- Update if needed the normative objectives of the UL Coverage enhancement

With the aim of getting a consolidated revision of the WID for approval by the end of the email discussion period.

Deadlines and NWM organization is based on the guidelines provided by the RAN Chair in its mail "[98e-01-Organizational] Set of email threads » of xx December 2022.

1 Initial round

The initial round will focus on collecting views on the proposals in the relevant documents:

- RP-222823 discussion R18 NTN network verified UE location WF THALES
- RP-222916 discussion On network verified UE location for NTN Qualcomm Incorporated

- RP-222978 discussion On Network-verified UE location for NR NTN Intel Corporation
- RP-223088 discussion On work scope of Rel-18 NR NTN enhancements Samsung
- RP-223109 discussion Discussions on coverage enhancement and UE location verification in NTN vivo
- RP-223122 discussion Discussion the working scope for the Rel-18 NR-NTN Beijing Xiaomi Mobile Software
- RP-223142 discussion Views on Coverage Enhancement and UE location verification for Rel-18 NR NTN CATT
- RP-223169 discussion Discussion on Rel-18 NR NTN NTT DOCOMO, INC.
- RP-223189 discussion On network verified UE location in NR NTN Ericsson
- RP-223206 discussion On Rel-18 NR NTN Network Verified UE Location Apple
- RP-223258 discussion Discussion on the location verification for NR-NTN ZTE, Sanechips
- RP-223363 agenda On NTN NW verified UE location Lenovo
- RP-223370 discussion On network-verified UE location for NR NTN Nokia, Nokia Shanghai Bell

Based on 1st round feedbacks, we shall elaborate draft revisions.

1.1 Collection of company views

1.1.1 Network verified UE location

Companies should provide comments/suggestions in the each associated feedback forms.

Proposal 1.1.1/ On the need of a normative work on Network verified UE location, one of the following options should be selected in RAN#98:

Option 1: On the basis of the evaluation of solutions carried out in RAN1, 2 and 3, the need for specifications update to support Network verified UE location specification in Rel-18 has been identified

Option 2 [RP-223206/P1]: In Rel-18, no specification support is needed for Network verified UE location.

You are expected below to agree or disagree (with comments/suggestions) with respect to the above proposal

Feedback Form 1: NR_NTN-nwk verification (Objective - 1)

1 – Guangdong OPPO Mobile Telecom.

From the evaluations in RAN1 study item, the existing DL-TDOA method can be reused to achieve the network verified UE location. But whether there is a need on the spec change to support DL-TDOA in NTN needs to be discussed in normative work.

2 – NTT DOCOMO INC.

Agree and prefer Option 1. At least one mechanism should be specified for NTN.

3 – Apple GmbH

We strongly prefer Option 2. We believe before agreeing to any normative work, we need to address at the least the following issues

- There is no regulatory requirement/country law/act requiring the NW verified UE location, we would like to have clear reference of those requirement since we believe there is fundamental misunderstanding of the justification for the normative work.
- Everything starts from SA3-LI LS, in that LS, SA3-LI does not requirement RAT dependent positioning based NW verified UE location. We believe there is clear misunderstanding of the SA3-LI LS at RAN level.
- Any RAT dependent positioning discussed in RAN1 requires UE report, either Tx-Rx timing different or RSTD. There is no clear evidence that this type of UE report is more trustable compared GNSS based report (the positioning to be verified by the NW). In fact, the whole SA3-LI concern is that UE report may not trusted. Therefore, we need to consult SA3/SA3-LI about the trustworthiness comparison between GNSS location report and the UE report needed for RAT dependent positioning for NW verified UE location. Furthermore, we believe there are other more attractive solutions such as RAN4 test or UE certificate, etc.
- The justification is based on the 5 use cases in TR38.882, however, the performance of RAT dependent positioning has many issues including latency and reliability, geometry issue for example near orbit or mirror image. In fact, SA2 reply LS requires at most 60 seconds while evaluation results from RAN1 suggested 180 seconds which is 3X over SA2 recommendation.
- For the UE that is not malicious, RAT dependent positioning causes very unnecessary privacy concern without any performance benefit or commercial use case.

4 – THALES

We support Option 1:

We would like to recall the following:

- The need to define a network based solution which aims at verifying the reported UE location information was identified as already approved in RP-221875 at RAN#96.
- The study in RAN1 has identified the need for Network verified UE location specification support in Rel-18: It was concluded that existing RAT dependent positioning framework (e.g. multi-RTT) may be reused with potential enhancements to adapt it to NTN context.
- Network verified UE location framework is already defined /specified in SA (e.g. refer to clause 6.10.1 of TS 23.273)

Therefore, the study on network verified UE location should be turned into a WI.

5 – HUGHES Network Systems Ltd

We support Option 1.

6 – Qualcomm Incorporated

Option 1, in line with the conclusion in the WGs.

7 – Inmarsat

We generally agree with Option 1 and that tools allowing the network to verify the UE location are useful, but we tend to agree on a couple points raised by Apple, namely:

- Today for satellite services, there are no regulatory requirements that say that this framework is required. Regulatory requirements are happily satisfied by satellite systems today including LI requirements. That said, the introduction of Network-verified UE location is a forward-looking approach to enhance the reliability of NTN systems to provide location-based services, therefore we think it should be implemented.

- We agree that if there is a concern with trustworthiness of information provided by the UE, same as GNSS position reported by the UE cannot be trusted, any other piece of information cannot necessarily be trusted. However, that is not the point. The point is to provide the Network with multiple tools to establish the plausibility (and validity) of the UE reported GNSS location with a sufficient degree of certainty. Therefore it doesn't matter whether any single piece of information provided by the UE can be trusted or cannot be trusted.

We agree also that ultimately the network may utilize different methods or a combination of multiple methods with past and present information to establish the validity of the UE reported GNSS position.

8 – vivo Communication Technology

Option 2 is preferred given limited TU we have and the fact that network can verify to some extent the UE location based on implementation or still rely on GNSS which is actually assumed to be correct for NTN network synchronization. However, if there is consensus on specification support, we prefer to focus on DL-TDoA method which relies only on downlink reference signal, without any enhancement. Regarding the clock drift issue, as is already specified in section 10.1.23.2 of 38.133 v17.7.0, $32T_c=16\text{ns}$ is the maximum error for the measurement gap no larger than 160ms, and for measurement gap larger than 160ms, UE is able to adjust the timing error since the SSB period is no larger than 160ms.

9 – Transion Holdings

Option 1. Signaling change should be specified in specification.

10 – Beijing Xiaomi Mobile Software

We prefer option 1, the need of the verification is clearly concluded in the outcome of the RAN-level SI. The normative work can be started based on the WG level study

11 – CATT

We share same view with OPPO. When DL-TDOA method is used, the specification work can be identified in normal work phase. May be or may not.

<p>12 – Spreadtrum Communications</p> <p>We support option 1. Some aspects involved in RAN1,RAN2 and RAN3 may need to be specified.</p>
<p>13 – ZTE Corporation</p> <p>We slightly prefer Option 1 with the understanding that only compact scope will be defined. Regarding the solutions without RAN1 conclusion or requiring further study, it should be deferred.</p>
<p>14 – Samsung Electronics Romania</p> <p>Option 1 based on the agreed conclusion of the RAN1 study. RAN1 concluded the framework of some existing positioning solution may be reused with potential enhancements to adapt it to NTN context. Thus, a normative phase can start.</p>
<p>15 – Lenovo (Beijing) Ltd</p> <p>Lenovo: Agree with option 1</p>
<p>16 – PANASONIC R&D Center Germany</p> <p>We share Oppo’s view. Identify the need for specification during the normative phase.</p>
<p>17 – Intel Corporation SAS</p> <p>In our view specification updates are needed to enable solutions for NTN network-verified UE location (Option 1).</p>
<p>18 – TURKCELL</p> <p>We support Option 1.</p>
<p>19 – HISPASAT SA</p> <p>We support Option 1.</p>
<p>20 – Ericsson LM</p> <p>Although RAN1 has indicated some potential areas in the existing positioning framework which may need to be enhanced for NTN, it is not clear if normative work is absolutely necessary. We are open to Option 1 only if it is absolutely necessary.</p>
<p>21 – NEC Corporation</p> <p>We prefer Option 1.</p>

<p>22 – HUAWEI TECHNOLOGIES Co. Ltd.</p> <p>We support Option 1. RAN1 made observations and conclusions on network verified UE location and showed that under certain conditions, at least multi-RTT can fulfill the accuracy requirement within reasonable latency. We therefore support a normative phase for NTN network verified UE location.</p> <p>We would also suggest to keep the scope reasonably focused, as the TU in RAN1 for network verified UE location is rather limited.</p>
<p>23 – ROBERT BOSCH GmbH</p> <p>We support Option 1</p>
<p>24 – Philips International B.V.</p> <p>We support option 1.</p>
<p>25 – Eutelsat S.A.</p> <p>Option 1 - other approaches to verify the UE location (a method or two or more methods combined - which may not be standardised in R18) should not be precluded.</p>
<p>26 – Nokia France</p> <p>We support option 1. It is clear from the SA2 LS that there is a need.</p> <p>We do, however, agree with Apple that the trustworthiness of all UE location reports needs to be carefully considered, but this only speaks to the details of the solution and not the need.</p>
<p>27 – Classon Consulting</p> <p>[for FUTUREWEI] The conclusions were not so clear, with reuse possible for one method and "potential" enhancements mentioned in the other. So it could be option 1 or option 2. The scope for option 1 would have to be minimized in order to keep within the TU.</p>
<p>28 – NOVAMINT</p> <p>We support option 1</p>
<p>29 – Lockheed Martin</p> <p>Agree with Option 1.</p>
<p>30 – ESA</p> <p>We support Option 1.</p>

Proposal 1.1.2/ RAN should specify at least multi-RTT enhancements for network verified UE location with at least a single satellite in view [RAN1, 2, 3, 4] with the assumption that existing framework is used as much as possible ?

You are expected below to agree or disagree (with comments/suggestions) with respect to the above proposal

Feedback Form 2: NR_NTN-nwk verification (Objective - 2)

1 – Guangdong OPPO Mobile Telecom.

we don't agree. First of all, the multi-RTT as described in TR has contained different variants, it may take quite amount of time to discuss how to further down-select among them. Secondly, we see that DL-TDOA can achieve verification requirement and it is quite simple without involving UL measurement nor different variants. The mirror ambiguity issue can be greatly resolved by network implementation and the clock drift error is less than +/- 16ns, which does not change the DL-TDOA performance observation.

2 – NTT DOCOMO INC.

Agree. At least multi-RTT should be specified in consideration of clock drift issue in DL-TDOA. In our understanding, multi-RTT can meet latency requirement of NW verified UE location. Also we agree '*existing framework is used as much as possible*' part.

3 – Apple GmbH

We do not agree with the proposal. The detailed issues are listed in our response to the first question

4 – THALES

Agree

Based on RAN1 conclusion, multi-RTT positioning method using Rx-Tx time difference measurements can meet the accuracy requirement of less than 10km with 90% confidence. RAN1 made also conclusion on DL-TDOA which can meet the same accuracy requirement. However, the conclusion on DL-TDOA was based on evaluation results that didn't account for UE Clock drift. Which means that the requirements of Network verification of UE location using DL-TDOA may not be met if realistic assumption on UE clock drift is considered.

Moreover, the R18 RAN1 Func freeze is planned for 3Q23 with limited TU for NR_NTN_enh. We therefore, propose to focus on multi-RTT enhancements to fit the TU budget.

We propose the following:

Capture in the WID “NR_NTN_enh” the following objective in relation to the network verified UE location :

· **“Based on RAN1#111 conclusion of the study phase, specify multi-RTT enhancements for single satellite [RAN1, 2, 3, 4]”**

5 – MediaTek Inc.

We support Thales comment on proposal to use RAN1#111 conclusions for WID objective for multi-RTT enhancements:

Capture in the WID “NR_Nfor objective on multi-RTT enhancementsTN_enh” the following objective in relation to the network verified UE location :

· **“Based on RAN1#111 conclusion of the study phase, specify multi-RTT enhancements for single satellite [RAN1, 2, 3, 4]”**

6 – HUGHES Network Systems Ltd

We support Thales comment and proposals

7 – Qualcomm Incorporated

Support (with the understanding that the above includes also multi-satellite)

8 – vivo Communication Technology

Do not agree. mRTT method not only relies on downlink reference signal measurement but also relies on uplink reference signal measurement which is more complex compared to DL-TDoA. As we explained, also showed evaluation results in RAN1 (R1-2211027), clock drift at UE is not an issue.

9 – Transion Holdings

Agree with this proposal.

10 – Beijing Xiaomi Mobile Software

We don't agree. We think DL-TDoA based solution should be prioritized as less standard impact is expected given the limited TU. Meanwhile, the UE clock error issue is less a concern even with large observation time as the UE can adjust its DL timing as in legacy.

11 – CATT

We don't agree this proposal. Multi-RTT solution requires UE feedback and network measurement, and much specification work is needed. Currently we prefer DL-TDOA method, which is simple and justified in terrestrial network positioning. In our simulation result, UE clock drift doesn't impact the accuracy significantly.

12 – ZTE Corporation

According to RAN1's conclusion, it seems that we can only go with the multi-RTT based approach. To avoid any ambiguity □ the updated version from Thales is acceptable with the understanding that TA based approach is included.

· **“Based on RAN1#111 conclusion of the study phase, specify multi-RTT enhancements for single satellite [RAN1, 2, 3, 4]”**

13 – Samsung Electronics Romania

According to the conclusion made in RAN1#111, multi-RTT based solution can be specified with potential enhancements respect to the TN solution. However, most of the enhancements have not been justified yet and it would require more time to have clear justification for them. Thus, we prefer to focus only on a non-controversial part - e.g., other assistance data (e.g. ephemeris) to be transferred from gNB to the LMF.

14 – Lenovo (Beijing) Ltd

Lenovo:

Agree with the proposal

15 – PANASONIC R&D Center Germany

We support the proposal.

16 – Intel Corporation SAS

We agree with the above proposal.

17 – TURKCELL

We agree.

18 – HISPASAT SA

We support Thales and Mediatek's way forward.

19 – Ericsson LM

If issues about the trustworthiness of multi-RTT can be resolved, we are ok with the proposal. The scope should be limited to only the cases (e.g., LEO-600, earth fixed cell, etc.) that were mentioned in the RAN1 conclusion for multi-RTT positioning.

20 – NEC Corporation

Support.

21 – HUAWEI TECHNOLOGIES Co. Ltd.

Support the proposal in general. And based on the observations/conclusions made in RAN1, some suggested objective is proposed as following:

- Specify multi-RTT enhancements for single satellite [RAN1, RAN2, RAN3, RAN4], at least including:
 - o Information to be transferred from gNB to the LMF and from UE to the LMF for the assistance of location verification at LMF
 - E.g. satellite ephemeris, etc.
 - o Definition of UE RX-TX time difference measurements for Multi-RTT

<p>- The reporting of the applied Timing Advance after the TAC adjustment by gNB is not precluded</p>
<p>22 – ROBERT BOSCH GmbH</p> <p>We support specifying multi-RTT as long as it includes single and multiple satellites</p>
<p>23 – Philips International B.V.</p> <p>We support the proposal in general. We like the proposal from Thales but we feel that the multi-satellite case should not be precluded. Therefore we propose the following rewording:</p> <p>“Based on RAN1#111 conclusion of the study phase, specify multi-RTT enhancements for at least one satellite [RAN1, 2, 3, 4]”</p>
<p>24 – Nokia France</p> <p>Multi-RTT is useful but is not sufficient on its own.</p>
<p>25 – Eutelsat S.A.</p> <p>At least one method should be specified based on 1 satellite (only) in view. The method discussed in RAN1 (multi-RTT) should be progressed.</p>
<p>26 – Classon Consulting</p> <p>[for FUTUREWEI] Should not go beyond the conclusion, so only single satellite and assume mirror issue handled by implementation (as Oppo mentioned). ”potential” needs to be resolved, agree with ephemeris (s Samsung mentioned).</p>
<p>27 – NOVAMINT</p> <p>We agree with the proposal and support Thales’s comment.</p>
<p>28 – Lockheed Martin</p> <p>Agree with Thales.</p>
<p>29 – ESA</p> <p>It is clear that the scenario with a single satellite in view must be included. We support the proposal and we agree with Thales’ rephrasing.</p>

Proposal 1.1.3/ RAN should specify other positioning methods for network verified UE location, for example:

- **Option 1: DL-TDOA (with multiple satellites only)**
- **Option 2: UL-TDOA**
 - **FFS: How to handle the impact of UE clock drift if UL-TDOA is supported**
- **Option 3: Angle-based positioning techniques may be used in combination with other time-based methods. E.g. to resolve the ambiguity due to the mirror position**
- **Option 4: other**

You are expected below to agree or disagree (with comments/suggestions) with respect to the above proposal

Feedback Form 3: NR_NTN-nwk verification (Objective - 3)

<p>1 – Guangdong OPPO Mobile Telecom.</p> <p>We don't agree that DL-TDOA is a subordinate method to multi-RTT method.</p>
<p>2 – NTT DOCOMO INC.</p> <p>Support option 1, if multi-RTT is not specified for multi-satellites case; otherwise, either specifying or dropping option 1 is fine for us. The important point would be that at least a mechanism is available in multi-satellites case. Maybe one more discussion for multi-RTT in multi-satellites case is necessary.</p> <p>Option 2 is questionable.</p> <p>On option 3, although we agree to resolve the mirror position issue, whether the solution should be angle-based technique would be still unclear. We think WID should just say like 'Specify solution with time-based methods, e.g., to resolve the ambiguity due to the mirror position'.</p>
<p>3 – Apple GmbH</p> <p>We do not support the proposals. Again, we believe we need to resolve fundamental issues we listed in our response to the first question before we proceed discussion of the normative work.</p>
<p>4 – THALES</p> <p>Option 4: Other: Apart from multi-RTT enhancements, at least for GSO, specify single RTT (as subset of multi RTT) combined with beam foot print reported by NG-RAN to LMF [RAN1, 2, 3, 4]</p>
<p>5 – MediaTek Inc.</p> <p>On Option 1, it can be de-prioritized as single satellite is priority. On Option 2, the impact of the clock drift would make workability questionable. On Option 3, this highly depends on the satellite antenna complexity.</p>

We think that Option 4 mentioned by Thales is needed for GSO.

Option 4: Other: Apart from multi-RTT enhancements, at least for GSO, specify single RTT (as subset of multi RTT) combined with beam foot print reported by NG-RAN to LMF [RAN1, 2, 3, 4]

6 – HUGHES Network Systems Ltd

We support Option 1 and can consider Option 4 proposed by Thales

7 – Inmarsat

We think all options should be included in the work item.

We don't think this is the right time or within RAN's remit to discard any of the proposed methods, which have been discussed at length during the RAN WGs. RAN Plenary should not take the job from WGs by making an arbitrary decision to drop any of the above methods without appropriate technical discussion.

The down-selection should happen during the normative phase, as the implementation of the methods is further discussed.

We also think that Option 4 mentioned by Thales and Mediatek is needed for GSO and should be included.

Option 4: Other: Apart from multi-RTT enhancements, at least for GSO, specify single RTT (as subset of multi RTT) combined with beam foot print reported by NG-RAN to LMF [RAN1, 2, 3, 4]

We further believe that should other methods emerge during the normative phase (e.g. differential Doppler, etc) they should not be excluded, particularly for cases in which the methods proposed so far cannot guarantee the level of accuracy targeted.

8 – Qualcomm Incorporated

We would support inclusion of Option 1 for multiple satellites. If workload is a concern, we would suggest to modify the main bullet to "RAN strives to specify [...]"

9 – vivo Communication Technology

We don't agree with formulation of the question, as we commented, DL-TDoA can work for single satellite as well. In our evaluation, timing errors up to 300ns was even considered where as up to 16ns clock drift specified in 38.133. UE can adjust the timing after 160ms.

10 – Beijing Xiaomi Mobile Software

We also don't agree with the formulation of the proposal. The DL-TDOA based solution don't need to be a complementary solution to multi-RTT. meanwhile, the multi-satellite scenario should be precluded from the normative work as the whole study is clearly on the single satellite scenario.

11 – Transsion Holdings

Option 1 would be reasonable.

12 – CATT

We disagree the proposal formulation. DL-TDOA should be one fundamental positioning method, rather than one complementary solution. DL-TDOA can be used in single satellite case and multi-satellite case.

13 – ZTE Corporation

Disagree with this proposal. As highlighted above, the compact scope is preferred for this topic and without a clear justification/conclusion, other solutions should not be part of the normative phase. For Option 1/2, clear drawbacks are highlighted in the WG-level discussion. And Option 3 can also be the implementation-based approach. Option 4 is also unreasonable without any solid approach, the situation will be out of control if we go in this direction.

14 – Samsung Electronics Romania

As per recommendation from TR 38.882, single satellite scenario is high priority. Thus, option 1 doesn't follow the recommendation, and this solution cannot be a unified solution regardless of the number of satellites.

For options 2/3, there are not many evaluation results to make observations. Thus, it is premature to specify related solution, but it is not preferable for us to study option 2/3 more since NR NTN has very limited TU. Also, we don't think there is a need to specify more than one solution to address this issue.

15 – Lenovo (Beijing) Ltd

Lenovo:

Option 1: agree

Option 2: disagree. Given the TUs of the normative work, it would not be feasible to further study UL-TDOA with the impact of UE clock drift.

Option 3: partially agree. This may be decided in normative work which techniques may be needed to resolve ambiguity problem.

16 – PANASONIC R&D Center Germany

We don't think this is necessary. Multi-RTT and DL-TDOA offer sufficient flexibility.

17 – Intel Corporation SAS

If the case of multiple satellites in view is considered, it should be considered for all the positioning methods, not specifically for DL-TDOA.

In our view both DL-TDOA and UL-TDAO under single satellite case can be considered for further specification work. UL- and DL-TDOA are based on the same physical principles (i.e. triangulation based on time difference) except transmission/reception direction and node for time difference calculation. Thus, we don't see a need to preclude one of the solutions. So, we think both (DL/UL-TDOA) or (neither DL- nor UL-TDOA) shall be considered.

So, for the provided options, we can add one more option:

Option 2-1: DL-TDOA

FFS: How to handle the impact of UE clock drift if DL-TDOA is supported

For angle-based positioning techniques, clarification is needed which positioning techniques are considered and if additional specification changes are required for the considered techniques. In our understanding UL-AoA method can be applied for the NTN network-verified UE location without spec changes.

18 – TURKCELL

We don't need to limit the solution to only DL-TDOA.

19 – Ericsson LM

We support Proposal 1.1.3 with Option 3 as it is essential to resolve the ambiguity due to mirror position and/or offers instant trustworthy verification for a large portion of cell UEs located away from regional/-country borders.

20 – NEC Corporation

We support inclusion of Option 1.

21 – HISPASAT SA

We support the inclusion of additional methods, including the proposal from Thales for GEO, but we don't think it is time to decide now on the specific methods to consider. We propose to reformulate:

Proposal 1.1.3/ RAN should analyze and if necessary specify other positioning methods for network verified UE location, ~~for example including but not limited to:~~

Option 1: DL-TDOA (with multiple satellites only)

Option 2: UL-TDOA

FFS: How to handle the impact of UE clock drift if UL-TDOA is supported

Option 3: Angle-based positioning techniques may be used in combination with other time-based methods. E.g. to resolve the ambiguity due to the mirror position

Option 4: Other: Apart from multi-RTT enhancements, at least for GSO, specify single RTT (as subset of multi RTT) combined with beam foot print reported by NG-RAN to LMF [RAN1, 2, 3, 4]

22 – ROBERT BOSCH GmbH

We agree with option 1 (removing the brackets, and clearly specifying it for multiple satellites).

23 – Nokia France

At least options 3 and 4 should be included. Possible text could be as follows:

Angle-based and/or other positioning techniques may also be used. It shall be possible to resolve the ambiguity due to the mirror position, and it shall be possible to complete the verification within the visible time duration of a satellite.

24 – HUAWEI TECHNOLOGIES Co. Ltd.

We do not support this proposal.

As claimed by the WID, the multiple satellites case has low priority and there is no simulation based on the multi-satellite case. There has not achieved any observation and conclusion on the multiple satellite scenarios. Therefore, it is not reasonable to restrict DL-TDOA for multi-satellite case. On the other hand, if the group decides to specify additional solution, DL-TDOA for single satellite case should be specified based on the conclusion and observations.

It is also premature to specify option 2 and option 3 in the normative work phase.

25 – Eutelsat S.A.

Option 3 and other techniques may be helpful to study the need for RAN to specify these is not clear (could be network implementation).

26 – Classon Consulting

[for FUTUREWEI] Do not support. Outside of the conclusion, not necessary, and way outside available TU.

27 – NOVAMINT

We tend to agree with the comments made by Inmarsat and the proposal from Hispasat - it should be the WGs to decide which methods are to be considered.

28 – Lockheed Martin

Agree with Thales and Inmarsat, the proposal from Hispasat is reasonable.

29 – ESA

It is premature to exclude some methods. We agree with Hispasat's proposal.

As per RP-223122/P1

Proposal 1.1.4/ RAN should ask SA3 whether/which UE's reported information can be trusted or not (e.g. UE RX-TX time difference, RSTD).

You are expected below to agree or disagree (with comments/suggestions) with respect to the above proposal

Feedback Form 4: NR_NTN-nwk verification (Objective - 4)

1 – Guangdong OPPO Mobile Telecom.

The original issue of the trustfulness is to argue whether it makes sense to use the UE reporting TA to perform the UE location verification as the TA is directly derived from the UE GNSS location. But we don't understand the intention to question RSTD. All the legacy measurements that are used for positioning should be by default trustful. Only the UE TA reporting is questionable.

2 – NTT DOCOMO INC.

Agree. The main intention is whether TA report based on GNSS can be trusted or not; thus 'TA report based on GNSS' should be included in the example clearly. Regarding other information, although we think legacy measurements should be trusted, at the same time it might be true that it is possible for UE to calculate e.g. fake RSTD based on actual GNSS and fake GNSS. Anyhow SA3 should provide guidance to RAN on whether each information is trusted or not. RAN should not conclude for any information without SA3 clarification.

3 – Apple GmbH

We think this can address one of the issues we raised

4 – THALES

No need

5 – MediaTek Inc.

No need to ask SA3. RAN can focus on the technical solutions. The RAN1 conclusions already clarified assumption on trusted reported information.

6 – HUGHES Network Systems Ltd

No necessary to ask SA3

7 – Qualcomm Incorporated

We do not see the need at this stage, it can be done during normative work if needed.

8 – Inmarsat

We also don't think it's necessary to ask SA3. Moreover, TA is required in order to make the system work, the network does not _need_ to "trust" the TA report from the UE, it can just take it as a piece of information. This is generally true for any piece of information provided by the UE to the network (including any measurement).

The network should take any data that the UE provides and compare it with any other relevant knowledge to evaluate whether the reported GNSS-based location is plausible or not - that is the goal of "Network-Verified UE location", which does NOT imply "Network-based Positioning".

9 – vivo Communication Technology

Regarding whether UE's reported information is trusted or not, it's hard to say. And this topic from the beginning is controversial as different companies have different understandings on what can be trusted and what can not be trusted. UE location from GNSS itself in our view can be trusted or not trusted similar to other UE reported information, which is why companies have concerns on the necessity of such UE location verification. RAN to conclude no specification work is needed is our first choice for this concern. If we really would like to specify some positioning methods for NTN, as our second choice, reusing existing DL-TDoA method is enough except that RSTD is measured at different instances rather than at different TPs.

10 – Beijing Xiaomi Mobile Software

Agree. Looking at the conclusion of the WG level SI, all of them are described with the hypothesis that "if the UE reported information can be trusted". To us, it means RAN1 WG cannot confirm the trustfulness issue. Companies have different understandings on the trustful issues. That's why we think seeking for other group's response is meaningful to avoid such kind of discussion.

11 – Transsion Holdings

There is no needed to query SA3.

12 – CATT

Only TA reporting can be confirmed for its trustfulness. For RSTD measurement or RX-TX timing difference, it has not any problem.

13 – ZTE Corporation

No need.

14 – Samsung Electronics Romania

It seems too early to determine whether RAN needs to send the LS because it is not even decided whether to start a WI. If the WI starts, relevant working group can ask the question directly if necessary.

15 – Lenovo (Beijing) Ltd

Agree to clarify if other companies want, however, in our opinion, there is no need for such proposal as TR 38.882 only specifies GNSS (or RAN-independent techniques) to be untrustworthy and subject to spoofing.

16 – PANASONIC R&D Center Germany

Trustworthiness is an essential aspect and diverse views exist. For clarity's sake we support the involvement of SA3.

<p>17 – Intel Corporation SAS</p> <p>We don't see the need to send the LS. In our view any information generated by 3GPP RAT (e.g. UE Rx-Tx time difference or RSTD) can be trustable.</p>
<p>18 – TURKCELL</p> <p>We don't need to send LS.</p>
<p>19 – Ericsson LM</p> <p>Agree. RAN1 has clearly included statements of the form "if underlying measurements can be assumed to be trusted" since it was out of RAN1 scope to decide on the trustworthiness of UE reported information.</p>
<p>20 – NEC Corporation</p> <p>Agree.</p>
<p>21 – HISPASAT SA</p> <p>We follow the comments from certain partners that it may not be necessary, considering RAN1 conclusions, but it could be handled for clarity during normative phase.</p>
<p>22 – HUAWEI TECHNOLOGIES Co. Ltd.</p> <p>No need to send LS to SA3 for the time being. RAN should do it work first. If working group identify a necessity to send an LS to SA3, then WG(s) can decide to trigger the LS.</p>
<p>23 – Philips International B.V.</p> <p>Agree with others that we can decide whether SA3 input is required during the normative phase.</p>
<p>24 – Nokia France</p> <p>We do not see the need to consult SA3.</p>
<p>25 – Eutelsat S.A.</p> <p>No need to consult SA3 at this time.</p>
<p>26 – Classon Consulting</p> <p>[for FUTUREWEI] no need</p>
<p>27 – NOVAMINT</p> <p>not needed to ask SA3</p>
<p>28 – Lockheed Martin</p> <p>not needed</p>

29 – ESA

SA3 consultation is not needed.

As per RP-222823/P2

Proposal 1.1.5/ Capture in the WID “NR_NTN_enh” the following objective in relation to the network verified UE location :

“at least for GSO, specify single RTT (as subset of multi RTT) combined with beam foot print reported by NG-RAN to LMF [RAN1, 2, 3, 4]”

You are expected below to agree or disagree (with comments/suggestions) with respect to the above proposal

Feedback Form 5: NR_NTN-nwk verification (Objective - 5)

1 – Guangdong OPPO Mobile Telecom.

Within the whole RAN1 evaluations since RAN1#100 meeting, only NGSO is discussed including the simulation assumptions, simulation results, observations. Thus, we think that RAN cannot simply decide this due to the lack of sufficient input.

2 – NTT DOCOMO INC.

Disagree unless sufficient study is done. Same view with OPPO.

3 – Apple GmbH

We do not support the proposals. Again, we believe we need to resolve fundamental issues we listed in our response to the first question before we proceed discussion of the normative work.

4 – THALES

Support

Indeed, with time based methods such as multi RTT, an increase of altitude will negatively impact the positioning/verification accuracy and the required over-the-air latency. Further, geometry relating the UE and positioning anchor points affects the network verified UE location based on Multi-RTT and DL-TDOA methods: The accuracy of verification is degraded for UE located nearby the orbital plane. Therefore further enhancements should be considered especially for MEO and GSO orbits.

For example, a method based on « single RTT with reported beam foot print» may be considered:

- UE location verification is performed based on single-RTT measurement
- The UE location information is considered verified if the reported UE location is consistent with the network based assessment to within [X] meters (corresponding to a maximum timing measurement error dependent of the altitude/orbit)

o For examples, for LEO 600 km, X could be equal to ~60 meters if the maximum timing measurement error is 200 ns.

Further we propose to:

Capture in the justification of the WID “NR_NTN_enh” the following assumption

“The UE reported location information (i.e. GNSS coordinates) can be considered verified if it is consistent with network based assessment,

- **to within 5-10 km (similar to terrestrial network macro cell size)**
- **Or at least for GSO, to within an arc of [X] meters width and bounded by beam foot print (Note that [X] is derived from the maximum timing measurement error)”**

5 – MediaTek Inc.

Support moderator proposal. This is compromise for GSO

6 – HUGHES Network Systems Ltd

Support moderator’s proposal

7 – Inmarsat

Support moderator’s proposal - this is required at least for GSO.

8 – vivo Communication Technology

Do not support this proposal. No evaluations were performed in the study on such hybrid methods.

9 – Transsion Holdings

We are ok with this.

10 – CATT

In RAN1, no evaluation result is provided, so we don’t agree this proposal.

11 – ZTE Corporation

We are negative to this approach since there is no solid study. If the intention is to introduce some solutions with the loose requirement in a specific scenario, we need to re-open the RAN-level SI to justify the value and if such a requirement is based on regulation, the previous one should be applied for all cases.

12 – Samsung Electronics Romania

This objective does not seem to be an outcome of the RAN1 study.

13 – Lenovo (Beijing) Ltd

Lenovo:

Disagree. Single RTT measurement is a subset of multi-RTT so network can always request a single measurement, so no need for this proposal. Moreover, in our opinion, the beam footprint size for GSO is very large so such combination would not guarantee a 5~10 Km accuracy,

14 – PANASONIC R&D Center Germany

The feasibility of this method was not investigated by RAN1. RAN has no evidence to base a specification on.

15 – Intel Corporation SAS

We are not sure how single RTT can work out and therefore we do not support the proposal.

16 – TURKCELL

We don't support the proposal.

17 – NEC Corporation

We have no strong view but believe significant study is still needed before we decide this.

18 – Ericsson LM

Do not support. It is unclear to us how the beam footprint reporting is supposed to work. As mentioned by other, NGSO should have higher priority and be solved first.

19 – HISPASAT SA

Agree with moderator's way forward

20 – HUAWEI TECHNOLOGIES Co. Ltd.

We do not support this proposal. No simulation was done for GSO case and no observation/conclusion was made with respect to this beam footprint solution. Hence no justification to specify this solution.

21 – ROBERT BOSCH GmbH

This needs to be studied first.

22 – Nokia France

In our understanding, the study on this technique was for LEO600. Further study would be needed for GSO.

<p>23 – Eutelsat S.A.</p> <p>This could be considered once results are available. Single RTT could be performed by the network (subset of multi-RTT), so does it need to be standardised?</p>
<p>24 – Classon Consulting</p> <p>[for FUTUREWEI] do not support</p>
<p>25 – NOVAMINT</p> <p>we support the proposal</p>
<p>26 – Lockheed Martin</p> <p>we support this proposal</p>
<p>27 – ESA</p> <p>GSO is part of this work item. We support the proposal as a good compromise to limit the effort.</p>

As per RP-223363/P5

Proposal 1.1.6/RAN1 to lead the specification work related to the RAT-dependent positioning methods used for verification, with RAN2 and RAN3 as secondary WGs

You are expected below to agree or disagree (with comments/suggestions) with respect to the above proposal

Feedback Form 6: NR_NTN-nwk verification (Objective - 6)

<p>1 – Apple GmbH</p> <p>We do not support the proposals. Again, we believe we need to resolve fundamental issues we listed in our response to the first question before we proceed discussion of the normative work.</p>
<p>2 – THALES</p> <p>Agree</p>
<p>3 – HUGHES Network Systems Ltd</p> <p>We are fine with the proposal</p>

<p>4 – Qualcomm Incorporated</p> <p>Agree.</p>
<p>5 – vivo Communication Technology</p> <p>Deprioritize this discussion and focus on discussing the necessity of normative work of this topic.</p>
<p>6 – Beijing Xiaomi Mobile Software</p> <p>Agree</p>
<p>7 – Transsion Holdings</p> <p>We agree with this proposal.</p>
<p>8 – CATT</p> <p>In general, it is ok.</p>
<p>9 – ZTE Corporation</p> <p>Fine with it.</p>
<p>10 – Samsung Electronics Romania</p> <p>It can be an option.</p>
<p>11 – Lenovo (Beijing) Ltd</p> <p>Lenovo: Agree with the proposal</p>
<p>12 – Intel Corporation SAS</p> <p>Agree with proposal but need to add RAN4 as well.</p>
<p>13 – TURKCELL</p> <p>We agree.</p>
<p>14 – NEC Corporation</p> <p>Agree.</p>
<p>15 – Ericsson LM</p> <p>Agree</p>

16 – HISPASAT SA Agree
17 – HUAWEI TECHNOLOGIES Co. Ltd. We are fine with the proposal in general. RAN1 could discuss e.g. which information needs to be reported to the location server, and what would be the definition of NTN Rx-Tx difference
18 – ROBERT BOSCH GmbH Agree
19 – Nokia France OK
20 – Eutelsat S.A. Agree.
21 – Classon Consulting [for FUTUREWEI] OK
22 – NOVAMINT agree
23 – Lockheed Martin agree
24 – ESA Ok

1.1.2 Coverage enhancements

Companies should provide comments in the each associated feedback forms.

As per RP-223109/P2&3

Proposal 1.2.1/ The detailed objectives for NTN in section 4.1.1 should be revised as follow:

**** unchanged text omitted ****

- *To studyspecify DMRS bundling for PUSCH taking into account NTN-specifics (e.g. time-frequency pre-compensation) and, if necessary, specify enhancements to the Rel-17 procedures [RAN1]*

You are expected below to agree or disagree (with comments/suggestions) with respect to the above proposal

Feedback Form 7: NR NTN- cov enh (objectives - 1)

1 – Guangdong OPPO Mobile Telecom. agree based on the RAN1 agreement in the last November meeting.
2 – NTT DOCOMO INC. Disagree. In our understanding, the last RAN1 conclusion does not mean that specification impact is necessary. Further WG discussion on whether spec impact is necessary or not is still required and thus keeping the bullet as it is would be appropriate rather than updating as above.
3 – THALES Support
4 – MediaTek Inc. Support with changes "To specify if necessary ...". RAN1 has not yet reached consensus on what needs to be specified.
5 – HUGHES Network Systems Ltd We support the revision
6 – Qualcomm Incorporated We do not see the need to continuously update the WID after agreements are made in the WGs, but if the majority agrees with the change we are OK.
7 – Inmarsat We support the change.
8 – vivo Communication Technology we support the change
9 – Beijing Xiaomi Mobile Software Fine with the change

<p>10 – Transsion Holdings</p> <p>We are fine with this proposal.</p>
<p>11 – ZTE Corporation</p> <p>We are fine with the original version. In our view, the changes is definitely needed with justified necessity.</p>
<p>12 – Apple GmbH</p> <p>We agree with the proposal. Although RAN1 has not made any recommendation on this topic, we could see the necessity of specifying enhancements for DMRS bundling for PUSCH in NTN.</p>
<p>13 – Samsung Electronics Romania</p> <p>RAN1 has not concluded that specification support is necessary. Thus, it is not needed to change the WID objective.</p>
<p>14 – Lenovo (Beijing) Ltd</p> <p>Lenovo: Fine with the proposal.</p>
<p>15 – CATT</p> <p>Same view with MediaTek, we support the proposal with the change ” <u>if necessary</u> ”, as RAN1 has not yet reached consensus on what needs to be specified.</p>
<p>16 – Intel Corporation SAS</p> <p>We are fine to update the proposal according to the latest RAN1 status.</p>
<p>17 – TURKCELL</p> <p>We agree.</p>
<p>18 – Ericsson LM</p> <p>Disagree. It is not clear if any enhancements are needed that have specification impact. RAN1 should further study whether the current framework for DMRS bundling for PUSCH (e.g., configuration of nominal TDW) needs any enhancements.</p>
<p>19 – HISPASAT SA</p> <p>We support the proposal</p>

<p>20 – HUAWEI TECHNOLOGIES Co. Ltd.</p> <p>RAN1 is still discussing whether the enhancement of DMRS bundling is needed. No need to update the objective. Even RAN1 make some conclusions, we see no need to update the WID just according to working group process. The WID can stay as it is to keep the history.</p>
<p>21 – ROBERT BOSCH GmbH</p> <p>We agree</p>
<p>22 – Nokia France</p> <p>We are OK to clarify the objective, but not with the proposed wording, as it seems to be open to a completely new procedure. Rather, we should be introducing enhancements to the existing DMRS bundling feature without impacting the Rel-17 procedures. We propose: “To specify enhancements to the Rel-17 procedures for DMRS bundling for PUSCH taking into account NTN-specifics (e.g. time-frequency pre-compensation).”</p>
<p>23 – NEC Telecom MODUS Ltd.</p> <p>agree with Qualcomm. We see no need to update it</p>
<p>24 – Eutelsat S.A.</p> <p>Agree (if an update is needed).</p>
<p>25 – Classon Consulting</p> <p>[for FUTUREWEI] WID is fine as it is</p>
<p>26 – NOVAMINT</p> <p>we support the revision</p>
<p>27 – Lockheed Martin</p> <p>support</p>

As per RP-223169/P1

Proposal 1.2.2/ The detailed objectives for NTN in section 4.1.1 should be revised as follow:

**** unchanged text omitted ***

- To specify PUCCH enhancements for ~~Msg4 HARQ-ACK (e.g. repetition)~~ PUCCH transmission when dedicated PUCCH resource configuration is not provided [RAN1, RAN4]

You are expected below to agree or disagree (with comments/suggestions) with respect to the above proposal

Feedback Form 8: NR NTN- cov enh (objectives - 2)

1 – Guangdong OPPO Mobile Telecom. agree
2 – NTT DOCOMO INC. Agree. 'Msg4 HARQ-ACK' is not spec-wise text, so at least clarification on which channel/situation is the intended one should be clarified; otherwise, companies' understandings may not be aligned and at the end of R18 the ambiguity leads to large issue for making R18 specification.
3 – THALES Support
4 – MediaTek Inc. Not support. It is not clear what is the intention of the proposal, and may increase un-necessarily the scope of the objective for the PUCH for Msg4 Ack
5 – HUGHES Network Systems Ltd Support the changes
6 – Qualcomm Incorporated We agree with the intention, but this is being discussed in RAN1 already.
7 – vivo Communication Technology we support the change
8 – Transsion Holdings We are fine with this proposal.
9 – ZTE Corporation No needed. The relevant discussion in RAN1 has already been conducted without any ambiguity.

10 – Apple GmbH

We do not have strong position on this part. On one hand, the proposed modification is accurate in technical. On the other hand, it seems companies are clear on the scope of this objective, and hence, the modification is unnecessary.

11 – Samsung Electronics Romania

Agree in order to align the objective with specification-like wording. Current RAN1 spec has specified that Msg 4 HARQ-ACK is one of PUCCH transmissions when dedicated PUCCH resource configuration is not provided.

12 – Lenovo (Beijing) Ltd

Lenovo:

No strong view. The previous description is also fine.

13 – CATT

No strong view, the existing objective is also fine.

14 – Intel Corporation SAS

In our view it is better to clarify if the enhancement is applied for fallback DCI only or for non-fallback DCI as well. We can consider fallback DCI only to avoid extra work.

15 – TURKCELL

We support the proposal.

16 – Ericsson LM

The current scope is clear to us and the new text potentially extends the scope of PUCCH enhancements beyond Msg4 HARQ-ACK. Then the consequences should be known. E.g., the possibility to dynamically indicate the repetition factor in DCI has not been analyzed for other cases than DCI format 1_0 scrambled with TC-RNTI.

17 – HISPASAT SA

We are fine with the proposal

18 – HUAWEI TECHNOLOGIES Co. Ltd.

Do not support. Agree with MediaTek/Ericsson, the change extends the scope of PUCCH repetition of Msg4 HARQ-ACK.

19 – ROBERT BOSCH GmbH

No strong view except that Msg4 HARQ-ACK is not a speci-wise text as DoCoMo mentioned.

20 – Nokia France We are not sure that the change is necessary.
21 – NEC Telecom MODUS Ltd. we see no need to update, RAN1 will continue the discussion
22 – Eutelsat S.A. Agree (if needed).
23 – Classon Consulting [for FUTUREWEI] do not support
24 – NOVAMINT we support the changes
25 – Lockheed Martin do not have a strong view

As per RP-223109/P1, RP-223142/P1

Proposal 1.2.3/ There's no need of RAN2 work for coverage enhancement specific to VoNR in Rel-18 NR NTN normative phase and the descriptions for the related study phase can be removed from the WID.

You are expected below to agree or disagree (with comments/suggestions) with respect to the above proposal

Feedback Form 9: NR NTN- cov enh (objectives - 3)

1 – NTT DOCOMO INC. Agree.
2 – THALES Agree
3 – MediaTek Inc. Agree based on consensus in RAN2

4 – HUGHES Network Systems Ltd Agreed
5 – vivo Communication Technology agree
6 – Transsion Holdings Agreed with this proposal.
7 – ZTE Corporation Agree
8 – Apple GmbH Agree
9 – Samsung Electronics Romania Agree
10 – Lenovo (Beijing) Ltd Lenovo: Fine with the proposal.
11 – CATT Agree.
12 – Guangdong OPPO Mobile Telecom. agree
13 – Intel Corporation SAS We agree with the proposal.
14 – TURKCELL We agree.
15 – HISPASAT SA Agree

16 – Ericsson LM We are fine with the proposal
17 – HUAWEI TECHNOLOGIES Co. Ltd. Agree that protocol overhead reduction for VoNR should not be considered in WI, as RAN2 has concluded not to pursue PDCP/RLC/MAC enhancements in terms of reducing header size.
18 – ROBERT BOSCH GmbH Agree
19 – Nokia France Agree
20 – NEC Telecom MODUS Ltd. Agree
21 – Eutelsat S.A. Agree.
22 – Classon Consulting [for FUTUREWEI] agree
23 – NOVAMINT Agree
24 – Lockheed Martin agree

As per RP-223142/P1

Proposal 1.2.4/ When repetition transmission scheme is used for PUCCH and PUSCH enhancement, study and specify the segmented UE pre-compensations for PUCCH and PUSCH enhancements [RAN1, RAN2]

You are expected below to agree or disagree (with comments/suggestions) with respect to the above proposal

Feedback Form 10: NR NTN- cov enh (objectives - 4)

1 – Guangdong OPPO Mobile Telecom. agree
2 – NTT DOCOMO INC.

<p>Disagree. Necessity to have this text in WID is unclear. Anyhow WG meetings in future can/will discuss this perspective at least for PUSCH together with DMRS bundling.</p>
<p>3 – THALES</p> <p>Agree</p>
<p>4 – MediaTek Inc.</p> <p>We see no need for revision. RAN1 can further discuss and make agreements as necessary</p>
<p>5 – Qualcomm Incorporated</p> <p>It is unclear why the WID needs to be updated as above. In our understanding, segmented pre-compensation is only one of the solutions being considered in RAN1.</p>
<p>6 – Inmarsat</p> <p>Same comment as Mediatek and Qualcomm, we don't see a need to update the WID - this is being discussed in WG.</p>
<p>7 – vivo Communication Technology</p> <p>Do not agree with this change, this is one of the many schemes being discussed in RAN1.</p>
<p>8 – Beijing Xiaomi Mobile Software</p> <p>We share the view with QC</p>
<p>9 – Transion Holdings</p> <p>Do not agree. We share the same views with MTK and QC.</p>
<p>10 – ZTE Corporation</p> <p>We are fine with this direction since it's straightforward to take segmented pre-compensation to address the synchronization issue due to the drift in long transmission.</p>
<p>11 – Apple GmbH</p> <p>This proposal introduces new sub-objective. Given the limited TU and other potential objectives (e.g., DL coverage enhancement) to be discussed in RAN #99, we do not think the current RAN1/RAN2 workload allows this new sub-objective in Rel-18 NR NTN.</p>
<p>12 – Samsung Electronics Romania</p> <p>Disagree. This is just one of candidate schemes in on-going RAN1 discussion. RAN1 can discuss this issue without updating WID.</p>

13 – Lenovo (Beijing) Ltd

Lenovo:

Support the proposal. However, we think this should be discussed in RAN1 rather than RANP.

14 – CATT

Support, the proponent. This mechanism has been discussed and introduced in Rel-17 IoT NTN, considering the repetition, and also as one separate sub-objective. We wonder what is the difference for the TA pre-compensation for the NTN repetition and IoT NTN repetition.

15 – Intel Corporation SAS

In our understanding the segmented pre-compensation is not needed for NR NTN for PUCCH/PUSCH repetitions. It is only relevant to IoT-NTN.

16 – Ericsson LM

Disagree. It has been agreed to study DMRS bundling enhancements for PUSCH only. Extending the scope with PUCCH has not been justified. For PUSCH, it is not clear if any specification enhancements are needed or if the existing framework for DMRS bundling is sufficient.

17 – HISPASAT SA

We agree with comments from MTK and QC, it'll be decided based on the results of the RAN1 discussions.

18 – HUAWEI TECHNOLOGIES Co. Ltd.

Disagree. The repetition times for NR NTN is not that large compared with IOT NTN, therefore it is not justified whether there will be "long UL transmission" in NR NTN which needs segment based UE pre-compensation.

19 – Nokia France

This is not needed, and has not been identified in RAN1 as something needing study.

20 – NEC Telecom MODUS Ltd.

no need to update, RAN1 will continue the discussion

21 – Eutelsat S.A.

Agree with MediaTek and Qualcomm comments.

22 – Classon Consulting

[for FUTUREWEI] not needed

23 – NOVAMINT Agree with MediaTek and Qualcomm comments - let's discuss this in RAN1
24 – Lockheed Martin not needed

As per RP-223122/P2

Proposal 1.2.5/ Specify enhancements to enable initial blind Msg3 retransmission grant reception

You are expected below to agree or disagree (with comments/suggestions) with respect to the above proposal

Feedback Form 11: NR NTN- cov enh (objectives - 5)

1 – Guangdong OPPO Mobile Telecom. agree
2 – NTT DOCOMO INC. Agree
3 – THALES This is to be added to the scope of the WID as part of RAN2 work on CE
4 – Qualcomm Incorporated This is not needed, in our view. RAN2 can work based on their agreement on this issue.
5 – Inmarsat Agree, this can be useful to add to the WID
6 – vivo Communication Technology No need to revise WID. OK to continue the discussion in RAN2. Note that PDCCH monitoring will be affected which is DL enhancement expected to be concluded in March.
7 – Beijing Xiaomi Mobile Software Agree based on the RAN2's agreement

<p>8 – Transsion Holdings</p> <p>Ok with this proposal.</p>
<p>9 – ZTE Corporation</p> <p>No further updates are needed and RAN2 can continue working on this.</p>
<p>10 – Apple GmbH</p> <p>Agree</p>
<p>11 – Samsung Electronics Romania</p> <p>It is understood that it follows RAN2 agreement. We think that RAN2 can continue follow-up work without updating WID since RAN2 has already made the related agreement.</p>
<p>12 – Lenovo (Beijing) Ltd</p> <p>Lenovo:</p> <p>Don't support the proposal. Not sure why we need such mechanism. PUCCH and PUSCH enhancement should be focused.</p>
<p>13 – CATT</p> <p>No strong view. maybe RAN2 can continue working on this.</p>
<p>14 – Intel Corporation SAS</p> <p>It should be clarified which working groups are considered for the enhancements (e.g. RAN2 only).</p>
<p>15 – TURKCELL</p> <p>We agree.</p>
<p>16 – HISPASAT SA</p> <p>Agree</p>
<p>17 – Ericsson LM</p> <p>We see no strong need to update the WID as RAN2 can continue their work based on the current agreement</p>
<p>18 – HUAWEI TECHNOLOGIES Co. Ltd.</p> <p>Disagree. We see no need to update the WID</p>
<p>19 – NEC Telecom MODUS Ltd.</p> <p>no need to update WID, RAN2 can continue work on this.</p>

20 – Nokia France We support this, in line with the RAN2 agreement in RAN2#120.
21 – Eutelsat S.A. Agree.
22 – Classon Consulting [for FUTUREWEI] WID is ok as it is
23 – NOVAMINT Agree
24 – Lockheed Martin agree

1.1.3 Other topics

Proposal 1.3.1/ Any other topic to be discussed ?

You are expected below to comment with respect to the above proposal

Feedback Form 12: NR_NTN_enh (other - 1)

--

1.2 Moderator Summary and recommendation for further discussion

1.2.1 Network verified UE location

1/ On the need of a normative work on Network verified UE location, one of the following options should

be selected in RAN#98

Only 2 companies (Apple, Vivo) out of 29, disagree to Option 1 (start a normative phase)

Note that 3 companies (Oppo, CATT, Panasonic) would like to further study and possibly specify DL-TDOA as part of the normative phase and 2 companies (FutureWei, Ericsson) are not opposed to a normative phase but they are not strongly in support of it either.

2/ About the specification of at least multi-RTT enhancements for network verified UE location with at least a single satellite in view [RAN1, 2, 3, 4] with the assumption that existing framework is used as much as possible ?

Company views:

Agree

- as is: NTT Docomo, Thales, Mediatek, Hughes, Transsion, Lenovo, Panasonic, Intel, Turkcell, Hispasat, NEC, Huawei, Eutelsat, Nokia, Novamint, Lockheed Martin
- if single and multi satellites: Qualcomm, Bosch, Philips
- if: ZTE (if TA based approach is included), Ericsson (If issues about the trustworthiness of multi-RTT can be resolved, consider LEO@600 & earth fixed cell only), Samsung (focus only on a non-controversial part e.g., other assistance data (e.g. ephemeris) to be transferred from gNB to the LMF)
- but need another way to resolve the mirror ambiguity: Nokia, Futurewei

Disagree

- because would like alternative method (i.e. DL-TDOA): Oppo, Vivo, Xiaomi, CATT
- to any normative phase: Apple

Based on the above, a majority seems in favor of specifying enhancements to multi RTT method but a minority proposes alternative methods too.

3/ About the specification of other positioning methods for network verified UE location, for example:

Views expressed by the 28 participating companies

- Agree to at least one of the proposed method:

- DL-TDOA (single satellites): Oppo, NTT Docomo, Hughes, Inmarsat, Vivo, Xiaomi, CATT, Panasonic, Turkcell, Huawei, Novamint, Lockheed Martin
 - DL-TDOA (multi satellites): Qualcomm, NTT Docomo, Hughes, Inmarsat, Vivo, Transsion, CATT, Lenovo, Intel, NEC, Hispasat, Bosch, Huawei, Novamint, Lockheed Martin
 - UL-TDOA: Inmarsat, Intel, Hispasat, Novamint, Lockheed Martin
 - UL-AoA: Inmarsat, Lenovo, Intel, Ericsson, Hispasat, Nokia, Eutelsat, Novamint, Lockheed Martin
 - single RTT combined with beam foot print reported by NG-RAN to LMF (for GSO) ; Thales, Mediatek, Hughes, Inmarsat, Hispasat, Novamint, Lockheed Martin
- Disagree: Apple, ZTE, Futurewei

Based on the above, a relative majority express interest to also specify enhancements for the DL-TDOA method.

Several companies express interest to specify the enhancements for both single and multi satellite is underlined

4/ About the need for an LS to SA3 on whether/which UE's reported information can be trusted or not (e.g. UE RX-TX time difference, RSTD).

Views of companies

- Agree:
 - As is: Apple, Xiaomi, Panasonic, Ericsson, NEC
 - but restricted to the UE TA reporting: Oppo, NTT Docomo
- Disagree:
 - As is: Thales, Mediatek, Hughes, Inmarsat, Transsion, ZTE, Intel, Nokia, Eutelsat, Futurewei, Novamint, Lockheed Martin
 - but could be decided in normative phase: Qualcomm, Samsung, Hispasat, Huawei, Philips
- Neutral: Vivo, Lenovo

Based on the above, a clear majority indicated that sending an LS to SA3 at this stage is not needed. Therefore, this proposal can be dismissed.

5/ About the specification of single RTT (as subset of multi RTT) combined with beam foot print reported by NG-RAN to LMF (at least for GSO)

Views of companies

- Agree: Thales, Mediatek, Hughes, Inmarsat, Transsion, Hispasat, Novamint, Lockheed Martin
- Disagree: Oppo, NTT Docomo, Apple, Vivo, CATT, ZTE, Samsung, Lenovo, Panasonic, Intel, Turkcell, NEC, Ericsson, Huawei, Bosch, Nokia, Futurewei

Out of 26 companies, a majority of 17 disagree to this proposal which is consequently dismissed

6/ About whether RAN1 should lead the specification work related to the RAT-dependent positioning methods used for verification, with RAN2 and RAN3 as secondary WGs

Views of companies

- Agree : Thales, Hughes, , Qualcomm, Xiaomi, Transsion, CATT, ZTE, Samsung, Lenovo, Intel, Turkcell, NEC, Ericsson, Hispasat, Huawei, Bosch, Nokia, Eutelsat, Futurewei, Novamint, Lockheed Martin
- Disagree : Apple, Vivo

Note that Intel suggest to add RAN4 also in the normative work

A clear majority of companies are in favour of RAN1 leading the normative work if it gets approved

PROPOSED WAY FORWARD

Based on the above, the moderator suggests to discuss in the next round the following proposals

Proposal 2.1.1: RAN to start a normative phase on network verified UE location.

Proposal 2.1.2: RAN to specify the necessary enhancements to multi-RTT and DL-TDOA positioning methods to support the network verified UE location

- ***Assuming at least a single satellite in view and maximum reuse of the existing framework***

Proposal 2.1.3: RAN1 to lead the specification work related to the RAT-dependent positioning methods used for verification, with RAN2, 3 and 4 as secondary WGs

1.2.2 Coverage enhancements

1/ about the proposed revision, of the objective

« To ~~study~~specify DMRS bundling for PUSCH taking into account NTN-specifics (e.g. time-frequency pre-compensation) and, if necessary, specify enhancements to the Rel-17 procedures [RAN1] »

Agree: Oppo, Thales, Mediatek, Hughes, Qualcomm, Inmarsat, Vivo, Xiaomi, Transsion, Apple, Lenovo, CATT, Intel, Turkcell, Hispasat, Huawei, Bosch, Nokia, Eutelsat, Novamint, Lockheed Martin

Disagree: NTT Docomo, ZTE, Samsung, Ericsson, NEC, Futurewei

There is a large majority of companies in favor of the WID revision but some don't see the need for such changes because they are not yet convinced by the need of these enhancements.

Two companies have suggested some new wording to tentatively address those concerns:

- Mediatek : « To ~~study~~specify if necessary DMRS bundling for PUSCH taking into account NTN-specifics (e.g. time-frequency pre-compensation) and, if necessary, specify enhancements to the Rel-17 procedures [RAN1] »
- Nokia: “To specify enhancements to the Rel-17 procedures for DMRS bundling for PUSCH taking into account NTN-specifics (e.g. time-frequency pre-compensation).”

Based on the above, the moderator suggests the following revisions

« To ~~study~~specify if necessary, enhancements to the Rel-17 procedures for DMRS bundling for PUSCH taking into account NTN-specifics (e.g. time-frequency pre-compensation) and, if necessary, specify enhancements to the Rel-17 procedures [RAN1] »

2/ about the proposed revision, of the objective

« To specify PUCCH enhancements for ~~Msg4 HARQ-ACK (e.g. repetition)~~PUCCH transmission when dedicated PUCCH resource configuration is not provided [RAN1, RAN4] »

Company views:

- Agree: Oppo, NTT Docomo, Thales, Hughes, Vivo, Transsion, Samsung, Turkcell, Hispasat, Eutelsat, Novamint
- Disagree: Mediatek, ZTE, Apple, Ericsson, Huawei, Nokia, NEC, Futurewei
- Neutral: Qualcomm, Lenovo, CATT, Bosch, Lockheed Martin

There is a relative majority in favor of the revision of this objective which is insufficient to be considered in the second round of the discussion.

3/ about the need for RAN2 work on coverage enhancements

24 companies have provide their views. They all agree that there's no need of RAN2 work for coverage enhancement specific to VoNR in Rel-18 NR NTN normative phase and the descriptions for the related study phase can be removed from the WID

Based on the above, the moderator suggests to adopt proposal 3 of RP-223109 which reflects that there's no need of RAN2 work for coverage enhancement specific to VoNR in Rel-18 NR NTN normative phase.

4/ About the need to study and specify the segmented UE pre-compensations for PUCCH and PUSCH enhancements when repetition transmission scheme

Company views:

20 out of 24 companies disagree to add this in the WID mostly on the basis that

- As suggested by Mediatek, RAN1 can further discuss and make agreements as necessary
- As stated by Qualcomm, segmented pre-compensation is only one of the solutions being considered in RAN1

Therefore this topic will not be carried out in the second round of this discussion

5/ About the need to specify enhancements to enable initial blind Msg3 retransmission grant reception

Company views:

- Agree: 13 companies
- Disagree: 8 companies

- Neutral: 3 companies

Moderator proposal: No change is needed in the WID as the RAN2 can work based on its agreement on this issue.

PROPOSED WAY FORWARD

Based on the above, the moderator suggests to discuss in the next round the following proposals

Proposal 2.2.1: Part of the detailed objectives for NR_NTN_enh WID in section 4.1.1 should be revised as follow.

« To study specify if necessary, enhancements to the Rel-17 procedures for DMRS bundling for PUSCH taking into account NTN-specifics (e.g. time-frequency pre-compensation) and, if necessary, specify enhancements to the Rel-17 procedures [RAN1] »

Proposal 2.2.2: Part of the detailed objectives for NR_NTN_enh WID in section 4.1.1 should be revised as follow.

“Have a 1-TU 6-month study phase focusing on the following (to derive clear & limited scope):

Evaluate the coverage performance and identify the candidate physical radio channels that have coverage issues specific to NTN with following target services taking into account the studies in TR38.830 where appropriate, as well as general coverage enhancement techniques specified in Rel-18 [RAN1,RAN2,RAN4]VoIP and low-data rate services for commercial handset terminals

The following items are shown as examples of areas to consider in the RAN2 study.

Improved performance of low-rate codecs in link budget limited situation including reducing RAN protocol overhead for VoNRNOTE: Intent is not to introduce a new codec.”

RAN to determine by RAN#97 (for RAN1 items) and RAN#98 (for RAN2 items) whether the study phase has identified any need for NTN-specific coverage enhancements in Rel-18. If needed, the set of NTN-specific work item objectives will be further updated.

2 Second round

2.1 Collection of company views

2.1.1 Network verified UE location

You are expected to agree or disagree (with comments/suggestions) with respect to the below proposal

Proposal 2.1.1: RAN to start a normative phase on network verified UE location.

Feedback Form 13: wrt Proposal 2.1.1

1 – Apple GmbH

Unfortunately, we disagree with proposal 2.1.1. We believe before agreeing to any normative work, we need to address at the least the following issues

- There is no regulatory requirement/country law/act requiring the NW verified UE location, we would like to have clear reference of those requirement since we believe there is fundamental misunderstanding of the justification for the normative work.
- Everything starts from SA3-LI LS, in that LS, SA3-LI does not requirement RAT dependent positioning based NW verified UE location. We believe there is clear misunderstanding of the SA3-LI LS at RAN level.
- Any RAT dependent positioning discussed in RAN1 requires UE report, either Tx-Rx timing different or RSTD. There is no clear evidence that this type of UE report is more trustable compared GNSS based report (the positioning to be verified by the NW). In fact, the whole SA3-LI concern is that UE report may not trusted. Therefore, we need to consult SA3/SA3-LI about the trustworthiness comparison between GNSS location report and the UE report needed for RAT dependent positioning for NW verified UE location. Furthermore, we believe there are other more attractive solutions such as RAN4 test or UE certificate, etc.
- The justification is based on the 5 use cases in TR38.882, however, the performance of RAT dependent positioning has many issues including latency and reliability, geometry issue for example near orbit or mirror image. In fact, SA2 reply LS requires at most 60 seconds while evaluation results from RAN1 suggested 180 seconds which is 3X over SA2 recommendation.
- For the UE that is not malicious, RAT dependent positioning causes very unnecessary privacy concern without any performance benefit or commercial use case.

2 – Nokia France

Agree.

3 – Qualcomm Incorporated

Agree.

4 – Spreadtrum Communications Agree.
5 – Beijing Xiaomi Mobile Software Agree
6 – CATT Agree
7 – HUGHES Network Systems Ltd Agree with proposal.
8 – ZTE Corporation Agree
9 – NTT DOCOMO INC. Agree
10 – China Telecommunication Corp. Agree
11 – Lenovo (Beijing) Ltd Lenovo: Agree
12 – Guangdong OPPO Mobile Telecom. agree
13 – Intel Corporation SAS We agree with the proposal.
14 – NEC Corporation We support.
15 – HUAWEI TECHNOLOGIES Co. Ltd. Agree. At the same time, we suggest the scope of the normative phase to be clear and focused, considering the limited TU for NR NTN in working groups.

16 – THALES Agree
17 – LG Electronics France We agree.
18 – LG Electronics France We agree.
19 – vivo Communication Technology we can accept normative work in RAN with this condition: This UE optional feature, RAN1 to work on necessary configuration, UE capability signaling, without any enhancement of existing mechanism.
20 – vivo Communication Technology we can accept normative work in RAN with this condition: This UE optional feature, RAN1 to work on necessary configuration, UE capability signaling, without any enhancement of existing mechanism.
21 – HISPASAT SA Agree
22 – PANASONIC R&D Center Germany Agreed
23 – ROBERT BOSCH GmbH Agree
24 – NOVAMINT agree
25 – Inmarsat Agree
26 – Ericsson LM We can be fine with this proposal
27 – Classon Consulting [for FUTUREWEI] Can accept but the objective needs to be kept tight (see next question)

You are expected to agree or disagree (with comments/suggestions) with respect to the below proposal

Proposal 2.1.2: RAN to specify the necessary enhancements to multi-RTT and DL-TDOA positioning methods to support the network verified UE location

- *Assuming at least a single satellite in view and maximum reuse of the existing framework*

Feedback Form 14: wrt Proposal 2.1.2

<p>1 – Apple GmbH</p> <p>We object proposal 2.1.2 based on the explanation above</p>
<p>2 – Nokia France</p> <p>This on its own is not sufficient to achieve the goal.</p> <p>We propose the following modifications:</p> <p><i>Specify the necessary methods to enable network-verified UE location, including at least multi-RTT and DL-TDOA positioning, assuming at least a single satellite in view and maximum reuse of the existing framework. Angle-based and/or other positioning techniques may also be considered. It shall be possible to resolve the ambiguity due to the mirror position, and it shall be possible to complete the verification within the visible time duration of a satellite.</i></p>
<p>3 – MediaTek Inc.</p> <p>We think some prioritization is needed. There was near consensus in RAN1 that DL TDOA positioning method is not workable with clock drift for single satellite. Only necessary enhancements of multi RTT positioning method for a single satellite based on RAN1#111 conclusions should be in scope.</p>
<p>4 – Qualcomm Incorporated</p> <p>We are OK if we have a note stating that the feasibility of DL-TDOA with single satellite and realistic clock drift should be checked by RAN WGs.</p>
<p>5 – Beijing Xiaomi Mobile Software</p> <p>Our first preference is to specify the enhancement of DL-TDOA based solution only and we can compromise to current wording. However, we don't see the reason to involve more solutions.</p>
<p>6 – Beijing Xiaomi Mobile Software</p> <p>Our first preference is to specify the enhancement of DL-TDOA based solution only and we can compromise to current wording. However, we don't see the reason to involve more solutions.</p>
<p>7 – CATT</p> <p>Our first preference is to specify the enhancement of DL-TDOA based solution only. However, we are ok with the existing wording as the moderator proposed.</p>

8 – HUGHES Network Systems Ltd

Support proposal + added note suggested by QC

9 – ZTE Corporation

Fine with this direction, but prefer to mark the DL-TDOA as the 2nd priority. Meanwhile, we need to highlights that the discussion should be based on the conclusion in RAN1#111. And the TA part is also included.

10 – NTT DOCOMO INC.

DL-TDOA would have clock drift issue in single satellite case, so DL-TDOA should be specified at least for multi-satellite case. In this sense, '*Assuming at least a single satellite in view*' should be removed. Other part is OK for us.

11 – China Telecommunication Corp.

The proposal is ok for us. RAN WGs can further check the feasibility of DL-TDOA based solution.

12 – Lenovo (Beijing) Ltd

Lenovo:

We partially agree to proposal. In our point of view, DL-TDOA with single satellite would not work when UE clock drift is also considered. There were no evaluation results in study phase that considered UE clock drift as indicated in the conclusion. Therefore, we first need to study the UE clock drift for DL-TDOA that may not be feasible given the TUs left. We would suggest the following:

RAN to specify the necessary enhancements for the following methods and at least for earth-fixed cells to support the network verified UE location with maximum reuse of the existing framework

- **Multi-RTT method at least for a single satellite in view**
- **DL-TDOA positioning method at least for three satellites in view**

13 – Samsung Electronics Romania

Our position was not captured in the first round summary. We are not supportive of DL-TDOA.

It is preferable to focus only multi-RTT for the following reasons.

- 1) For DL-TDOA, RAN1 did not agree a list for potential enhancements compared to multi-RTT. Thus, it is not clear what enhancements are necessary.
- 2) In our understanding, specify multiple schemes to achieve the same goal is not justified.

In current proposal, further down-scoping is also necessary so that RAN1 can focus on only essential feature without debating whether other solution needs justification or not. In that sense, it is preferable to only consider objectives that have been justified in RAN1.

14 – Guangdong OPPO Mobile Telecom.

We disagree with the comment that DL-TDOA with clock drift is not workable. Even in RAN1 conclusions, it does not say it is not workable. Companies claiming this relying on RAN1 recommendation is a mis-interpretation. In RAN1, the clock drift was brought at the last minute and it was not fully analyzed. There was an argument saying that the clock drift can be linearly increased as the measurement duration increases, this is not realistic. This has already been discussed in RAN4 in previous releases on the clock drift issue. Once the UE adjusts the DL synchronization the clock drift can be corrected. Thus a realistic clock drift increase will not go beyond SSB periodicity, leading to the worst case of clock drift caused measurement error being +/-16ns corresponding to a 160ms max sync interval.

Moreover, we think that multi-RTT has too many variants and cannot be all done within the timeframe. It is important to select one variant only. Thus, we suggest to make it clear that the multi-RTT means the existing multi-RTT method with UE RX-TX reporting. And multi-RTT with UE TA reporting is precluded.

15 – Intel Corporation SAS

We object the proposal to include DL-TDOA (multi-RTT is fine). DL-TDOA should be excluded due to lack of study together with UL-TDOA (e.g. UE clock drift).

16 – NEC Corporation

The feasibility of DL-TDOA with a single satellite should be checked by RAN WGs.

17 – THALES

We agree with the proposal 2.1.2 and with QC suggestion to add a note wrt the impact of realistic UE clock drift on DL-TDOA. Therefore the proposal could be revised as follow:

Proposal 2.1.2: RAN to specify the necessary enhancements to multi-RTT and DL-TDOA positioning methods to support the network verified UE location

· Assuming at least a single satellite in view and maximum reuse of the existing framework

Note: the impact of realistic UE clock drift onto DL-TDOA performance should be taken into account as part of the normative phase

18 – LG Electronics France

We agree

19 – HUAWEI TECHNOLOGIES Co. Ltd.

Considering there are quite divergent views on DL-TDOA and DL-TDOA for sure involves more work while RAN1 TU for this work item is rather limited, we suggest to only include multi-RTT in Rel-18.

Regarding single satellite or multi-satellite, as multi-satellite scenario has not been studied in the SI phase, we suggest (with revision below) to make it clear that only single satellite in view is in the scope.

<p>· Assuming at least a single satellite in view and maximum reuse of the existing framework</p>
<p>20 – HISPASAT SA</p> <p>We agree with the moderator’s proposal and the changes shared by Thales.</p>
<p>21 – PANASONIC R&D Center Germany</p> <p>We are fine with the proposal and support the addition of a note saying that RAN WGs check the feasibility of DL-TDOA with single satellite and realistic clock drift.</p>
<p>22 – NOVAMINT</p> <p>we agree with the proposal and the changes proposed by Thales aligned with Qualcomm’s comments</p>
<p>23 – Inmarsat</p> <p>it’s unclear why UE TA report has been discarded and UL-TDOA has been discarded, but somehow DL-TDOA is kept - what’s the rationale? This seems rather arbitrary</p>
<p>24 – vivo Communication Technology</p> <p>We do not agree. As commented in table 2.1.1, we can only accept normative work with the condition with no enhancement on existing mechanism.</p>
<p>25 – Inmarsat</p> <p>Moreover, if the issue with some of the methods discarded is trustability, how is DL-TDOA more trusted exactly? This issue has not been addressed.</p> <p>RAN1#111 conclusions should be taken as a baseline and other methods should not be discarded without technical analysis</p>
<p>26 – Ericsson LM</p> <p>We think that a prerequisite for the normative work should be that the issue of trustworthiness of information reported by the UE is sorted out. Further, if DL-TDOA with single satellite in view is included, a note regarding the issue identified by RAN1 that ”the requirements of Network verification of UE location may not be met if realistic assumption on UE clock drift is considered” should be added.</p>
<p>27 – Classon Consulting</p> <p>[for FUTUREWEI] should not go beyond the conclusion, and may still be too big for the TU. So only single satellite and no DL-TDOA seems OK.</p>

You are expected to agree or disagree (with comments/suggestions) with respect to the below proposal

Proposal 2.1.3: RAN1 to lead the specification work related to the RAT-dependent positioning methods used for verification, with RAN2, 3 and 4 as secondary WGs

Feedback Form 15: wrt Proposal 2.1.3

1 – Apple GmbH We object proposal 2.1.3
2 – Nokia France Agree
3 – Qualcomm Incorporated Agree
4 – Beijing Xiaomi Mobile Software Support but wondering if SA3 may be involved to resolve some trust issues.
5 – CATT Agree.
6 – HUGHES Network Systems Ltd Agree
7 – ZTE Corporation Agree
8 – China Telecommunication Corp. Agree
9 – Lenovo (Beijing) Ltd Lenovo: Agree to Proposal
10 – Guangdong OPPO Mobile Telecom. agree
11 – Guangdong OPPO Mobile Telecom. agree
12 – Intel Corporation SAS We agree with the proposal

13 – NEC Corporation We support.
14 – HUAWEI TECHNOLOGIES Co. Ltd. Agree with the proposal.
15 – THALES Agree
16 – LG Electronics France We agree.
17 – LG Electronics France We agree.
18 – LG Electronics France We agree.
19 – LG Electronics France We agree.
20 – PANASONIC R&D Center Germany Agreed
21 – HISPASAT SA Agree
22 – NOVAMINT Agree
23 – Inmarsat Agree
24 – vivo Communication Technology As commented in table 2.1.1, we can only accept normative work with the condition with no enhancement on existing mechanism.
25 – Ericsson LM Fine

26 – Classon Consulting

[for FUTUREWEI] OK

2.1.2 Coverage enhancements

You are expected to agree or disagree (with comments/suggestions) with respect to the below proposal

Proposal 2.2.1: Part of the detailed objectives for NR NTN_enh WID in section 4.1.1 should be revised as follow.

« To ~~studyspecify~~ specify if necessary, enhancements to the Rel-17 procedures for DMRS bundling for PUSCH taking into account NTN-specifics (e.g. time-frequency pre-compensation) and, if necessary, specify enhancements to the Rel-17 procedures [RANI] »

Feedback Form 16: wrt proposal 2.2.1

1 – Nokia France Agree
2 – MediaTek Inc. Agree
3 – Qualcomm Incorporated We do not see a strong need for this update, but we do not have a strong view.
4 – Spreadtrum Communications Support
5 – Beijing Xiaomi Mobile Software Agree
6 – CATT Agree.
7 – HUGHES Network Systems Ltd Agree
8 – Apple GmbH Agree

9 – ZTE Corporation Agree
10 – NTT DOCOMO INC. Agree
11 – Lenovo (Beijing) Ltd Lenovo: Agree.
12 – Samsung Electronics Romania The update is simply not necessary, but we are not against specifying DM-RS bundling.
13 – Intel Corporation SAS We agree with the proposal.
14 – THALES Agree
15 – PANASONIC R&D Center Germany Agreed
16 – HISPASAT SA Agree
17 – ROBERT BOSCH GmbH Agree
18 – HUAWEI TECHNOLOGIES Co. Ltd. We do not see a need to update the WID like this. The revision does not seem providing any important information or correction.
19 – NOVAMINT agree
20 – vivo Communication Technology agree
21 – Ericsson LM Agree

22 – NEC Telecom MODUS Ltd.

fine with the proposal, even though we do not see the need to update.

23 – Classon Consulting

[for FUTUREWEI] still not clear why this revision is needed, it seems just to shuffle the existing text around without meaningful benefit

You are expected to agree or disagree (with comments/suggestions) with respect to the below proposal

Proposal 2.2.2: Part of the detailed objectives for NR_NTN_enh WID in section 4.1.1 should be revised as follow.

“Have a 1-TU 6-month study phase focusing on the following (to derive clear & limited scope):

- ***Evaluate the coverage performance and identify the candidate physical radio channels that have coverage issues specific to NTN with following target services taking into account the studies in TR38.830 where appropriate, as well as general coverage enhancement techniques specified in Rel-18 [RAN1,RAN2,RAN4]***
 - ***VoIP and low-data rate services for commercial handset terminals***

The following items are shown as examples of areas to consider in the RAN2 study.

- ***Improved performance of low-rate codecs in link budget limited situation including reducing RAN protocol overhead for VoNR***
 - ***NOTE: Intent is not to introduce a new codec.***

RAN to determine by RAN#97 (for RAN1 items) and RAN#98 (for RAN2 items) whether the study phase has identified any need for NTN-specific coverage enhancements in Rel-18. If needed, the set of NTN-specific work item objectives will be further updated. ”

Feedback Form 17: wrt proposal 2.2.2

1 – Nokia France

Agreed.

2 – CATT

Agree

<p>3 – Apple GmbH</p> <p>Agree</p>
<p>4 – ZTE Corporation</p> <p>Agree</p>
<p>5 – NTT DOCOMO INC.</p> <p>Agree.</p> <p>On PUCCH enhancement for Msg4 HARQ-ACK, the intended target is 'PUCCH scheduled by DCI format 1_0 scrambled with TC-RNTI' according to some companies' input in first round. Is this common understanding? If yes, we propose to agree conclusion or WID update for this clarification.</p>
<p>6 – Spreadtrum Communications</p> <p>Support</p>
<p>7 – Lenovo (Beijing) Ltd</p> <p>Lenovo:</p> <p>Agree.</p>
<p>8 – Samsung Electronics Romania</p> <p>Okay with the proposal.</p>
<p>9 – Intel Corporation SAS</p> <p>We agree with the proposal.</p>
<p>10 – THALES</p> <p>Agree</p>
<p>11 – LG Electronics France</p> <p>We agree.</p>
<p>12 – LG Electronics France</p> <p>We agree.</p>
<p>13 – LG Electronics France</p> <p>We agree.</p>
<p>14 – PANASONIC R&D Center Germany</p> <p>Agreed</p>

15 – HISPASAT SA agree
16 – ROBERT BOSCH GmbH Support
17 – HUAWEI TECHNOLOGIES Co. Ltd. We are fine with the proposal
18 – NOVAMINT agree
19 – Ericsson LM Agree
20 – vivo Communication Technology agree
21 – NEC Telecom MODUS Ltd. support
22 – HUGHES Network Systems Ltd agree
23 – Classon Consulting [for FUTUREWEI] OK

2.2 Moderator Summary and recommendation for further discussion

2.2.1 Network verified UE location

1/ About Proposal 2.1.1: RAN to start a normative phase on network verified UE location.

Company views

- All companies support this proposal except Apple which questions the regulatory requirement/country law/act requiring the NW verified UE location

Note that Vivo can accept normative work in RAN and requests that this feature be optional and reuse existing mechanism but focus enhancements on necessary configuration, UE capability signaling

Moderator suggests to discuss on line a revised proposal

Proposal 2.1.1 (revised): RAN to start a normative phase on network verified UE location.

Note: network verified UE location is an optional feature

2/ About Proposal 2.1.2: RAN to specify the necessary enhancements to multi-RTT and DL-TDOA positioning methods to support the network verified UE location

- ***Assuming at least a single satellite in view and maximum reuse of the existing framework***

Company views are very diverse

Agree

- As is: LG Electronic
- But some concerns related to the impact of realistic UE clock drift on DL-TDOA: Qualcomm, Hughes, NTT Docomo, China Telecom, Lenovo, NEC, Thales, Hispasat, Panasonic, NOVAMINT
- But prefer multi RTT method enhancements only: Mediatek, Samsung, Intel, Huawei, FutureWei
- But prefer DL-TDOA method enhancements: CATT, Xiaomi, Oppo
- But more positioning methods to be enhanced: Nokia, ZTE, Inmarsat (TA report)

Disagree

- Apple due to objection to normative work
- Vivo because can only accept normative work with the condition with no enhancement on existing mechanism

Suggestions to improve the wording

- Xiaomi: Clarify multi-RTT method with UE RX-TX reporting

- Qualcomm, Thales: Add note for the realistic UE clock drift issue: the impact of realistic UE clock drift onto DL-TDOA performance should be taken into account as part of the normative phase
- Huawei, NTT Docomo, FutureWei: restrict to single satellite

On the basis of the above, the moderator suggests to consider the revised proposal

Proposal 2.1.2 (revised): RAN to specify the necessary enhancements to multi-RTT (with UE RX-TX reporting) and DL-TDOA positioning methods to support the network verified UE location

- *Assuming at least a single satellite in view and maximum reuse of the existing framework*

Note: the impact of realistic UE clock drift onto DL-TDOA performance should be taken into account

3/ About Proposal 2.1.3: RAN1 to lead the specification work related to the RAT-dependent positioning methods used for verification, with RAN2, 3 and 4 as secondary WGs

Company views are diverse

Agree:

- Proposal as is: Nokia, Qualcomm, Xiaomi, CATT, Hughes, ZTE, China Telecom, Lenovo, Oppo, Intel, NEC, Huawei, Thales, LG, PANASONIC, HISPASAT, NOVAMINT, Ericsson, Futurewei

Disagree : Apple

Suggestions: Involve SA3 if needed

On the basis of the feedbacks, the moderator suggests a revision of the proposal as follow

Proposal 2.1.3 (revised): RAN1 to lead the specification work related to the RAT-dependent positioning methods used for verification, with RAN2, 3 and 4 as secondary WGs

- Note that SA3 may need to be consulted

2.2.2 Coverage enhancements

Based on the above, the moderator suggests to discuss in the next round the following proposals

1/ About Proposal 2.2.1: Part of the detailed objectives for NR_NTN_enh WID in section 4.1.1 should be revised as follow.

« To ~~study~~specify if necessary, enhancements to the Rel-17 procedures for DMRS bundling for PUSCH taking into account NTN-specifics (e.g. time-frequency pre-compensation) and, if necessary, specify enhancements to the Rel-17 procedures [RAN1] »

Majority of companies (18/23) support this change except Huawei, Qualcomm, NEC, FutureWei and Samsung which don't see the need for this change.

Moderator suggests that this change be endorsed.

2/ About Proposal 2.2.2: Part of the detailed objectives for NR_NTN_enh WID in section 4.1.1 should be revised as follow.

“Have a 1-TU 6-month study phase focusing on the following (to derive clear & limited scope):

Evaluate the coverage performance and identify the candidate physical radio channels that have coverage issues specific to NTN with following target services taking into account the studies in TR38.830 where appropriate, as well as general coverage enhancement techniques specified in Rel-18 [RAN1,RAN2,RAN4]VoIP and low-data-rate services for commercial handset terminals

The following items are shown as examples of areas to consider in the RAN2 study.

Improved performance of low-rate codecs in link budget limited situation including reducing RAN protocol overhead for VoNRNOTE: Intent is not to introduce a new codec.”

RAN to determine by RAN#97 (for RAN1 items) and RAN#98 (for RAN2 items) whether the study phase has identified any need for NTN-specific coverage enhancements in Rel-18. If needed, the set of NTN-specific work item objectives will be further updated.

All companies are supporting this change. Moderator suggests that this change be endorsed.

3 Third round

3.1 Collection of company reviews

3.1.1 Network verified UE location

Based on on line discussion, the moderator proposes the following that companies are invited to agree or disagree (with comments/suggestions) :

Proposal

- **Based on RAN1 conclusions of the study phase, RAN to specify the necessary enhancements to multi-RTT and DL-TDOA positioning methods to support the network verified UE location assuming at least a single satellite in view**
- **Note 1: Enhancements assume reuse of the RAT dependent positioning framework**
- **Note 2: The specification of DL-TDOA enhancements will be subject to the study of the impact of realistic UE clock drift onto DL-TDOA performance**
- **Note 3: The enhancements on the existing positioning methods for the verification should be designed to prevent a UE location determination with a granularity lower than [10 km]**

Feedback Form 18: Nwk verified UE location's normative phase objectives

1 – MediaTek Inc.

Support proposal. We however think some prioritization will be needed to keep the scope reasonable. First priority should be to multiple RTT method for single satellite. Based on RAN1 conclusion of study phase the UE RX-TX time difference directly derived from Timing Advance **is not precluded** . This is an alternative way to measuring the UE RX-TX time difference from PRS. The UE RX-TX time difference report can then be reported reusing the multi RTT positioning framework. On Note 3, we think it is very helpful to set a floor on the accuracy of UE location verification so it is clear that the solutions discussed in RAN are for UE location verification ONLY with a coarse UE location verification sufficient for PLMN / country selection. RAN1 can further discuss details.

2 – Eutelsat S.A.

Support the proposal.

With regard to Note 3, this should help make clear the requirement is not to offer a GNSS type accuracy, that comes from the GNSS itself. The requirement intent should be to enable the network check the location is plausible and/or not highly suspect.

3 – Intel Corporation SAS

We are surprised that it is proposed to have additional study for DL-TDOA while UL-TDOA is not considered at all. If the point of this proposal is to support variety of methods for network verification of UE location then UL-TDOA should be included as well. If we want to reduce the scope by considering subset of methods when we suggest to focus on multi-RTT only.

Given the situation in the working groups we think that enabling NTN network-verified UE location focusing on multi-RTT method only is a better way forward for this release. Thus, further study which considers both UL-TDOA and DL-TDAO can be done in later releases, if needed.

4 – Qualcomm Incorporated

We support the updated proposal in general.

We are not supportive or very comfortable with "Note 3", and we think this may lead to some issues down the road in the RAN1 discussion. At the same time, we understand the note was added to try to solve a strong concern raised by a company. Therefore, although our preference would be to not add the note, we can live with it as a compromise if it leads to the objection being dropped.

5 – Apple GmbH

Unfortunately, as we raised in NWM and during GTW consistently, we haven't seen any good technical discussion of the 5 issues we raised.

Without addressing those 5 issues, what proposed is nothing but for 3GPP to specify a positioning solution that performs worse than GNSS for every performance metric, cannot address the SA3-LI concern since SA3-LI's concern is that, fundamentally, UE reports may not be trusted while RAT dependent positioning relies on UE report. Furthermore, the RAT dependent positioning cannot even meet the SA2 recommended latency (180s vs 60s). Moreover, for certain geometry, the reliability of the solution cannot meet regulatory requirement if there is any, due to the mirror image issue or satellite orbit issue. Last but not the least, for the locations that this solution may work, it does nothing but expose UE location and cause privacy concern.

We cannot see any technical reason to continue the normative work. Again, we list 5 issues below to encourage sound technical discussion

1. There is no regulatory requirement/country law/act requiring the NW verified UE location, we would like to have clear reference of those requirement since we believe there is fundamental misunderstanding of the justification for the normative work.
2. Everything starts from SA3-LI LS, in that LS, SA3-LI does not require RAT dependent positioning based NW verified UE location. We believe there is clear misunderstanding of the SA3-LI LS at RAN level.
3. Any RAT dependent positioning discussed in RAN1 requires UE report, either Tx-Rx timing different or RSTD. There is no clear evidence that this type of UE report is more trustable compared to GNSS based report (the positioning to be verified by the NW). In fact, the SA3-LI concern is that UE report may not be trusted. Therefore, we need to consult SA3/SA3-LI about the trustworthiness comparison between GNSS location report and the UE report needed for RAT dependent positioning for NW verified UE location. Furthermore, we believe there are other more attractive solutions such as RAN4 test or UE certificate, etc.
4. The justification is based on the 5 use cases in TR38.882, however, the performance of RAT dependent positioning has many issues including latency and reliability. For certain geometry, the confidence of the

positioning can be even lower than 50% for example near orbit or due to mirror image. In terms of latency, SA2 reply LS requires at most 60 seconds while evaluation results from RAN1 suggested 180 seconds which is 3X over SA2 recommendation.

5. For the UE that is not malicious, RAT dependent positioning causes very unnecessary privacy concern without any performance benefit or commercial use case.

6 – NTT DOCOMO INC.

Generally fine, but we still propose to remove 'assuming at least a single satellite in view'. Multi-satellite case should be included. If available time is the reason to prioritize single satellite case, rather DL-TDOA should be removed and multi-RTT is focused.

7 – vivo Communication Technology

we propose to bring back the note from RP-223464

•Note: network verified UE location is an optional feature

The proposal is to specify "necessary enhancements", this statement which is too broad. Considering there were many solutions discussed in RAN1 for multi RTT positioning method, we don't see it fits into available TU. The scope should be tightened to exclude unnecessary enhancement. Hence, we propose to further added following bullets in the proposal:

- Only single satellite based positioning is considered;
- Measurements of RX-TX time difference, RSTD, UE assistance data and reporting information are the same as mRTT/DL-TDoA for TN except necessary changes due to that measurements are performed at different time instances of single satellite.

8 – CATT

we support the proposal.

Even though we prefer to go for DL-TDOA only, we are ok to include both multi-RTT and DL-TDOA as the compromise way forward.

We should focus on or prioritize the single satellite use case as it's the most essential case for LEO deployment.

9 – HUGHES Network Systems Ltd

We support the proposal. Agree with MediaTek on Note 3

10 – Samsung Electronics Romania

Our main concern is limited TU (i.e 0.5 TU in RAN1) where not only coverage enhancement but also NW verified UE location should be discussed. Further studying of the impact of realistic UE clock drift for DL-TDOA would require additional efforts in related working groups because this impact has not been justified yet (RAN4 should also work on this). Thus, it is not clear to us why we need to consider various schemes for achieving the same goal. In that sense, it is preferable to consider multi-RTT first. If time is available, DL-TDOA may be considered later. For example, in June 2023 RAN can consider to add DL-TDOA if the work on multi-RTT is complete.

11 – ZTE Corporation

We are in general fine to trigger the normative phase with the following comments:

1. We still prefer to prioritize the multi-RTT based solution and if there is sufficient TU, the DL-TDOA based approach can be checked later.
2. We'd like to echo MTK's position to highlight that the TA report based approach is also supported as one way for multi-RTT, which is aligned with RAN1's conclusion.
3. For the "Note: network verified UE location is an optional feature", we prefer to remove it. Since this feature is to satisfy the needs of regulatory requirements, it should be mandated for the UE, which can access the NTN network. Otherwise, it's meaningless to support this feature.
4. Regarding the single satellite part, we prefer to keep it to keep the consistency between SI and WI. Meanwhile, based on the implementation, the defined approaches can be extended to cover other cases once the deployment is mature.

12 – Lenovo (Beijing) Ltd

Lenovo:

Agree to the proposal.

13 – China Telecommunication Corp.

We support the proposal.

14 – LG Electronics France

Generally we are supportive to the proposal but we are also ok to down-prioritize the DL-TDOA which is still subject to the further study.

15 – Guangdong OPPO Mobile Telecom.

Our preference is to support DL-TDOA only.

We disagree with the comment that DL-TDOA with clock drift is not workable. Even in RAN1 conclusions, it does not say it is not workable. Companies claiming this relying on RAN1 recommendation is a mis-interpretation. In RAN1, the clock drift was brought at the last minute and it was not fully analyzed. There was an argument saying that the clock drift can be linearly increased as the measurement duration increases, this is not realistic. This has already been discussed in RAN4 in previous releases on the clock drift issue. Once the UE adjusts the DL synchronization the clock drift can be corrected. Thus a realistic clock drift increase will not go beyond SSB periodicity, leading to the worst case of clock drift caused measurement error being +/-16ns corresponding to a 160ms max sync interval.

16 – HUAWEI TECHNOLOGIES Co. Ltd.

As we expressed our view in the intermediate round, considering there are quite divergent views on DL-TDOA and DL-TDOA for sure involves more work/study while RAN1 TU for this work item is rather limited, we suggest to only include multi-RTT in Rel-18.

Regarding single satellite or multi-satellite, as multi-satellite scenario has not been studied in the SI phase, we suggest (with revision below) to make it clear that only single satellite in view is in the scope.

- Assuming ~~at least~~ a single satellite in view and maximum reuse of the existing framework

We do not fully understand the necessity of Note 3, why should the granularity be limited to 10 km?

17 – NEC Corporation

We support the proposal. With regard to Note 3, we understand this is to ensure that the solutions discussed in RAN are for UE location verification only.

18 – PANASONIC R&D Center Germany

We support the proposal.

19 – THALES

Thales supports the proposal as is

Furthermore, here under are responses to the issues raised by Apple in their post :

1. There is no regulatory requirement/country law/act requiring the NW verified UE location, we would like to have clear reference of those requirement since we believe there is fundamental misunderstanding of the justification for the normative work.

Thales> Among several regulatory service requirements, the lawful intercept is mandated by most countries around the world

In 3GPP TR 22. 926, it has been identified that "To support regulated services and features (e.g. Public Warning System, Charging and Billing, Emergency calls, Lawful Intercept, Data Retention Policy in cross-border scenarios and international regions, Network access), 3GPP networks should have the capability to locate each UE in a reliable manner and determine the policy that applies to their operation depending on their location and/or context."

To obtain a trusted UE location, the requirements for network verification has been clearly stated by SA3-LI in S3i210282 (LS to RAN2) and the accuracy of the trusted UE location is also provided by SA3-LI in another in S3i200056.

Relying only on the GNSS based location information reported by the UE is not considered reliable by SA3-LI in its LSs..

The UE reported location information (for example determined with its GNSS receiver), could be erroneous due to intentional (e.g. maliciously tampering by user or by 3rd party) or unintentional (e.g. interference) causes, hence it cannot be considered trusted by network operators.

In 3GPP TR 38.882, it is stated that

· Already 3GPP has defined a network based functionality to verify the reported UE location with the identifier of the serving cell. However, radio cells in non-terrestrial networks, may be larger than the ones of terrestrial networks and may cover borders between two or more countries. Therefore, such Cell Id information may not be sufficient to discriminate the country in which the UE is located.

· In terrestrial networks, verification is based on Cell Id and hence, the targeted granularity is related to cell size. Similar granularity should be considered for NTN. Terrestrial macro cell size is assumed to be up to 5-10 km diameter.

2. Everything starts from SA3-LI LS, in that LS, SA3-LI does not require RAT dependent positioning based NW verified UE location. We believe there is clear misunderstanding of the SA3-LI LS at RAN level.

Thales> RAN TR 38.822 refers to other documents than SA3-LI LS.

3. Any RAT dependent positioning discussed in RAN1 requires UE report, either Tx-Rx timing different or RSTD. There is no clear evidence that this type of UE report is more trustable compared to GNSS based report (the positioning to be verified by the NW). In fact, the SA3-LI concern is that UE report may not be trusted. Therefore, we need to consult SA3/SA3-LI about the trustworthiness comparison between GNSS location report and the UE report needed for RAT dependent positioning for NW verified UE location. Furthermore, we believe there are other more attractive solutions such as RAN4 test or UE certificate, etc.

=Thales> This issue has been addressed in TR 38.822 stating that some measurements can be assumed to be trusted:

« a) At least some of the information the UE supplies to the network will have to be considered as trusted, to avoid extreme conclusions (at least RRM measurements cannot be faked); »

4. The justification is based on the 5 use cases in TR38.882, however, the performance of RAT dependent positioning has many issues including latency and reliability. For certain geometry, the confidence of the positioning can be even lower than 50% for example near orbit or due to mirror image. In terms of latency, SA2 reply LS requires at most 60 seconds while evaluation results from RAN1 suggested 180 seconds which is 3X over SA2 recommendation.

=Thales> For multi-RTT, the latency issue has been identified for only for one of the sources, and for 2 of the sources for users next to the orbital plane

This is reflected in RAN1 conclusion:

- Five sources observed that multi-RTT positioning method can meet the NTN UE location verification accuracy requirement for LEO 600km:*
- Four sources observed that the positioning horizontal accuracy of less than 10km can be achieved with few seconds over-the-air latency (less or equal to 10s) with 95-percentile confidence level.*
- One source observed that the positioning horizontal accuracy of less than 10km can be achieved with 180 seconds latency for earth fixed beam with 90-percentile confidence level*
- Two sources observed that multi-RTT positioning method require latency larger than 60 seconds for UE located nearby the orbital plane of a satellite during a certain time duration.*

5. For the UE that is not malicious, RAT dependent positioning causes very unnecessary privacy concern without any performance benefit or commercial use case.

=Thales> If the UE is not malicious, it will report its correct GNSS location already, so the privacy impact is not applicable. If there is no user consent for positioning, UE would not report GNSS location or positioning measurements, so this is a non-issue.

Besides the same required granularity for UE location information estimated via GNSS should be considered in NTN as for terrestrial networks.

20 – Beijing Xiaomi Mobile Software

Generally fine. For the note 3, we are not supportive. Our understanding on the note 3 is to resolve the privacy issue. However, we don't see the privacy issue here. when the UE is a normal UE, the UE will report its true GNSS location to the network which is more accurate than the verified location, and then no privacy issue happens. While when the UE is a malicious UE, the verification can deny the UE accessing the network, and then acquiring the malicious UE's location seems no harm.

Adding the note 3 here to us limits the discussion in the WG. However, if it can resolve the concern, we can live with it.

21 – Ericsson LM

As raised earlier, if RAN cannot decide on the trustworthiness of UE reported quantities for multi-RTT/DL-TDOA, then the relevant SA group should. In that case, we should also add a note that the enhancements are subject to SA's input on whether the UE reports needed for multi-RTT/DL-TDOA method can be trusted.

22 – vivo Communication Technology

On additional question for clarification, in Rel-17 NTN there is no such thing as network verification of UE location, right? Rel-17 works fine, then what has changed in Rel-18 so that this becomes so critical?

23 – Philips International B.V.

We generally agree with the proposal with some comments.

1) We prefer to concentrate on the multi-RTT positioning method.

2) Although we understand that work to date has focused on the single-satellite use case, we do not see a reason to explicitly exclude the multi-satellite use case at this stage: thus, we prefer to retain the, "at least a single satellite," wording.

3) Regarding the text, "Note: network verified UE location is an optional feature," we do not support its inclusion.

24 – Nokia France

1. We support Docomo's comment. Multi-satellite should be prioritised over DL-TDOA.

2. It is still not clear how the mirror-image ambiguity would be addressed in the single satellite case. We propose to add another note:

Note 2a: Resolution of mirror-image ambiguity shall be addressed; in this context, UL AoA or other methods are not precluded.

3. In note 3, "be designed to" could be deleted.

Thank you.

25 – NOVAMINT

we support the proposal

26 – Sony Europe B.V.

OK.

It might be preferable if Note 3 discussed a “UE location verification determination” since for the purposes of location verification, we don’t necessarily need to provide an independent report of the location itself.

#####

In terms of the concerns from Apple:

1. There is no regulatory requirement/country law/act requiring the NW verified UE location, we would like to have clear reference of those requirement since we believe there is fundamental misunderstanding of the justification for the normative work.

SONY» This is discussed in SA3 and the RAN-level TR.

2. Everything starts from SA3-LI LS, in that LS, SA3-LI does not require RAT dependent positioning based NW verified UE location. We believe there is clear misunderstanding of the SA3-LI LS at RAN level.

SONY» Thanks for the feedback. We think we do understand the SA3-LI LS.

3. Any RAT dependent positioning discussed in RAN1 requires UE report, either Tx-Rx timing difference or RSTD. There is no clear evidence that this type of UE report is more trustable compared to GNSS based report (the positioning to be verified by the NW). In fact, the SA3-LI concern is that UE report may not be trusted. Therefore, we need to consult SA3/SA3-LI about the trustworthiness comparison between GNSS location report and the UE report needed for RAT dependent positioning for NW verified UE location. Furthermore, we believe there are other more attractive solutions such as RAN4 test or UE certificate, etc.

SONY» This is about location verification and not RAT dependent positioning. As the work progresses, we can ask SA3 if they have issues with any of the reports that are proposed during this work.

4. The justification is based on the 5 use cases in TR38.882, however, the performance of RAT dependent-positioning has many issues including latency and reliability. For certain geometry, the confidence of the positioning can be even lower than 50% for example near orbit or due to mirror image. In terms of latency, SA2 reply LS requires at most 60 seconds while evaluation results from RAN1 suggested 180 seconds which is 3X over SA2 recommendation.

SONY» Our understanding of the statement “evaluation results from RAN1 suggested 180 seconds” is that one company suggested 180 seconds. Most companies found that the latency was lower.

We would also point out that the issue here is about location verification and not RAT dependent positioning. We do not necessarily need to provide an independent position estimate in order to verify a previous GNSS-based location report.

5. For the UE that is not malicious, RAT dependent positioning causes very unnecessary privacy concern without any performance benefit or commercial use case.

SONY» This is out of the scope of RAN1. It can be discussed in SA3. Again, location verification is not about RAT dependent positioning.

3.1.2 Coverage enhancements

Considering that no objection were raised on the following proposals 2.2.1 and 2.2.2 during 2nd round, they can be endorsed and a revised WID implementing the changes is submitted for final review in draft folder.

3.2 Moderator summary and recommendation for further discussion

3.2.1 Network verified UE location

About Proposal

- **Based on RAN1 conclusions of the study phase, RAN to specify the necessary enhancements to multi-RTT and DL-TDOA positioning methods to support the network verified UE location assuming at least a single satellite in view**
- **Note 1: Enhancements assume reuse of the RAT dependent positioning framework**
- **Note 2: The specification of DL-TDOA enhancements will be subject to the study of the impact of realistic UE clock drift onto DL-TDOA performance**
- **Note 3: The enhancements on the existing positioning methods for the verification should be designed to prevent a UE location determination with a granularity lower than [10 km]**

Company views are very diverse

- Agree: Mediatek, Eutelsat, CATT, Hughes, Lenovo, China Telecom, LG, NEC, Panasonic, Thales, Xiaomi, Novamint, Sony
- Agree if (see list of suggestions)
- Disagree: Apple

Suggestions:

- Scope:
 - Minimise it: Vivo

- Prioritise Multi RTT enhancements: Mediatek, ZTE, Samsung, LG, Huawei, Philips
- Prioritise DL-TDOA enhancements: Oppo
- Extend to UL-TDOA: Intel
- Single versus multiple satellites
 - NTT Docomo suggests to remove "assuming at least a single satellite in view"
 - ZTE, Philips prefers to keep "assuming at least a single satellite in view"
 - Huawei wants to restrict to only single satellite
 - Nokia suggests that Multi-satellite be prioritised over DL-TDOA
- Additional notes
 - Network verified UE location is an optional feature »: Vivo would like to add it, but ZTE and Philips are against
 - Note 3 raised the concerns of: Qualcomm, Huawei, Xiaomi, Sony. Nokia suggests to remove "be designed to"
 - Note 2a: Resolution of mirror-image ambiguity shall be addressed; in this context, UL AoA or other methods are not precluded: is suggested by Nokia
 - Trustworthiness of UE reported measurements for multi-RTT/TDOA: Ericsson suggests to add TSG-SA in the loop
- Understanding
 - Do not preclude UE RX-TX time difference directly derived from TA: Mediatek, ZTE

Note that

- Apple raised 5 issues which were addressed by Thales and Sony in their feedbacks
- Vivo questions whether R18 (just as R17) can work without this network verified UE location. Moderator reminds that the handling of this feature was decided for R18 for the support of regulatory services

On the basis of the above, the moderator suggests some revision to the initial proposal

Proposal 1 (revision of initial proposal)

• **Based on RAN1 conclusions of the study phase, RAN to specify the necessary enhancements to multi-RTT and DL-TDOA positioning methods to support the network verified UE location in NTN assuming at least a single satellite in view [RAN1, 2, 3, 4].**

• **Note 1: Enhancements assume reuse of the RAT dependent positioning framework**

• **Note 2: The specification of DL-TDOA enhancements will be subject to the study of the impact of realistic UE clock drift onto DL-TDOA performance**

• **Note 3: The enhancements on the existing positioning methods for the verification should be designed to prevent a UE location determination with a granularity lower than {5 - 10 km}**

• **Note 4 : Multiple satellite in view by the UE may be considered if time allows**

Note 5 : The enhancements may be subject to SA3/SA3-LI feedbacks on the reliability of UE reports needed for multi RTT/DL-TDOA enhancements

Note 6 : The enhancements should take into account the mirror-image ambiguity

Further more, if proposal 1 is agreed, the moderator proposes the following :

Proposal 2: Reflect the proposal 1's text in clause 4.1.3 of the Rel-18 WID NR_NTN_enh

3.2.2 Coverage enhancements

No feedback was provided on the proposed revised WID which can be considered as endorsed.

4 Extended round

4.1 Collection of company views

4.1.1 Network verified UE location

Based on on line discussion, the companies are invited to agree or disagree (with comments/suggestions) the fine tuned proposal below:

Proposal 4.1.1

Based on RAN1 conclusions of the study phase, RAN to specify the necessary enhancements to multi-RTT and DL-TDOA positioning methods to support the network verified UE location in NTN assuming a single satellite in view [RAN1, 2, 3, 4].

- **Note 1: Enhancements assume reuse of the RAT dependent positioning framework**
- **Note 2: The specification of DL-TDOA enhancements will be subject to the study of the impact of realistic UE clock drift onto DL-TDOA performance**
- **Note 3: The enhancements on the existing positioning methods for the verification should prevent a UE location determination with a granularity lower than 5 - 10 km**
- **Note 4 : Multiple satellite in view by the UE may be considered if time allows**
- **Note 5 : The enhancements may be subject to SA3/SA3-LI feedbacks on the reliability of UE reports needed for multi RTT/DL-TDOA enhancements**
- **Note 6 : The enhancements should take into account the mirror-image ambiguity**

Feedback Form 19: Nwk verified UE location's normative phase objectives (fine tuned)

1 – Apple GmbH

We still do not see any direct answer to our questions

@Thales

1. TR22.926 is 3GPP technical report, it is not regulatory requirement.
2. The reason for RAN study that led to TR38.822 is mainly due to SA3-LI LS
3. This statement is not from SA3-LI and against what SA3-LI suggested in their LS. We believe companies are just picking what they like without technical justification. When we say “At least some of the information the UE supplies to the network will have to be considered as trusted”, why we believe GNSS location is not among the “at least” but UE reports needed for RAT dependent positioning is? SA3-LI never said that and how RAN can make that statement?

4. There are only a few simulation resource, less than 10, among which at least 3 results the latency greater than 60s. It is very clear that there is no evidence that the solution can meet the SA2 recommendation. Also what about UE in some geometry (close to orbit), can we say regularly requirement cannot be met if there is regularly requirement to begin with, or it is very evident that latency cannot be met

5. When people use regulatory requirement to justify a design, UE may have to do NW verified location either forced by 3GPP or outside 3GPP. **For example, in the last round, even though vivo repeatedly requested this to be UE optional feature, it is still not part of the notes and we still observed some companies insisting to make it UE mandatory!**

@Sony

1. SA3 and RAN TR is not regulatory requirement, please!

2. Then does SA3-LI consider UE report as trustable? If yes, why we need NW verified UE location. If no, why the RAT dependent solution needs to be in normative work as it also relies on UE report

3. The whole thing is about multi-RTT/DL-TDOA based RAT dependently positioning. We do not understand the statement "This is about location verification and not RAT dependent positioning". So Sony also agrees that we do not need any normative work on multi-RTT/DL-TDOA based RAT dependent positioning?

4. Check the results quoted by Thales, at least 3 companies, and only a few companies in total provides the simulations results anyway. It is almost certain that close to orbit; latency will be higher than 60 seconds

5. When you use regulatory requirement to justify a RAN work, RAN normative work cannot start until we truly understand the problem. You cannot use A to justify the work then you say we do not care about A because it is out of our scope. If RAN does not have enough knowledge, then RAN shall stop the normative work. You cannot cherry picking to listen to the same resource when it says something you like, then close your ears when it says something you may not like.

2 – Qualcomm Incorporated

Our comment in the previous round on Note 3 was assuming that its addition would remove the objection from Apple, but it seems it is not the case. We would like to remove or at least rephrase Note 3, since it will increase the workload of the WG for no apparent benefit (we thought the benefit was the removal of the objection).

Just to give some more details: while it is OK to not target an accuracy of less than 5km, designing the system to "prevent" an accuracy of less than 5-10km in all cases would require a lot of study and non-trivial specification efforts. If no company has a strong view on that note, we would like to either remove it or rephrase it as:

Note 3: The target accuracy for the position determination is as documented in TR 38.882

Also, our strong preference would be to keep multiple satellites in the baseline solution, since it provides much better geometry (and thus accuracy / delay) than single satellite, but we would not object to the current version.

3 – Qualcomm Incorporated

To Apple:

Most of the comments have nothing to do with the study phase at the RAN WGs. Just to recap:

1) There was a study phase in RAN plenary that was documented in 38.882. That study concluded (Section 5): *In this study, we have identified the need to define a network based solution which aims at verifying*

the reported UE location information. All the comments from Apple, while they may be relevant, should have been contributed months ago when we were discussing that. The conclusion from RAN plenary and the TR is clear. This covers points 1,2,3,5 in the Apple comment, which in our view should be dismissed at this stage.

2) Only point 4 in the Apple comment has something to do with the technical work in the WGs. As mentioned before, the conclusions in RAN1 state the following, which to us justifies to start the normative work:

For network verification of UE location in NR NTN based on multi-RTT using UE RX-TX time difference report, if the UE reports needed to perform multi-RTT can be assumed to be trusted, existing multi-RTT framework may be reused with potential enhancements to adapt it to NTN context.

4 – Apple GmbH

To Qualcomm

If there is technical reason to dismiss the issue 1,2,3,5 we raised, companies are more than welcome to explain. What we observed is that there is no technical reason to dismiss and the comment is just to use time as a reason to rush to have some design in the specification. It is very obvious that, in the end, the 3GPP design (RAT dependent positioning) performs worse than the competing technology (GNSS) in every single performance metric without any performance benefit (trustworthiness). 3GPP has specified so many competing solutions and the outcome is very evident without us to call the names. This setup even a worse precedence since it is extremely clear that 3GPP solution is inferior in every single performance metric.

Please explain to us, compared to GNSS based positioning which is mandatory for NTN and which has RAN4 test to verify already, what is the performance advantage of the RAT dependent positioning and why, including which WG made that assessment and in which official document.

Again, TR38.882 is not the regulatory requirement, please do not use TR38.882 to avoid the technical discussion. We have been asking the issues consistently in this meeting, please do not avoid the discussion of the issue by pushing for an inferior solution in 3GPP without technical justification.

TR38.882 cannot be used to answer our question since it is irrelevant, and certainly, it cannot be used to dismiss our questions. TR38.882 cannot be used to guarantee the RAN WG normative work, because it is not the normal 3GPP procedure. We only approve RAN WG normative work based on the solid technical justification. There is no technical reason apparently and companies just dodge the questions in our view.

5 – Nokia France

Here's another attempt to find a way forward:

Ericsson commented that if RAN cannot agree on the trustworthiness of UE reported quantities for multi-RTT/DL-TDOA, then the relevant SA group should be asked to provide input on whether the UE reports needed for multi-RTT/DL-TDOA method can be trusted. This seems sensible.

We also observe that Apple's points 3 and 4 are the most "technical". Inclusion of angle-based techniques (especially UL angle-of-arrival) would surely go a long way towards satisfying these concerns, including trustability, avoiding mirror-image ambiguity, and latency.

We would therefore propose:

Based on RAN1 conclusions of the study phase, RAN to specify the necessary enhancements to multi-RTT and DL-TDOA positioning methods, **potentially in conjunction with angle-based techniques**, to support the network verified UE location in NTN...

...

Note 7: The above enhancements are subject to input from relevant SA groups as to the trustability of the UE reports involved.

We hope that helps to move the discussion forward.

6 – THALES

We do support the proposal

We are open to the following adjustments as suggested by QC and Nokia

Proposal 4.1

• **Based on RAN1 conclusions of the study phase, RAN to specify the necessary enhancements to multi-RTT and DL-TDOA positioning methods to support the network verified UE location in NTN assuming a single satellite in view [RAN1, 2, 3, 4].**

• **Note 1: Enhancements assume reuse of the RAT dependent positioning framework**

• **Note 2: The specification of DL-TDOA enhancements will be subject to the study of the impact of realistic UE clock drift onto DL-TDOA performance**

• **Note 3: The enhancements on the existing positioning methods for the verification should prevent a UE location determination with a granularity lower than 5 - 10 km**

• **~~Note 3: The enhancements on the existing positioning methods for the verification should prevent a UE location determination with a granularity lower than 5 – 10 km~~ The target position accuracy for verification purposes is as documented in clause « recommendations » of the 3GPP TR 38.882**

• **Note 4 : Multiple satellite in view by the UE may be considered if time allows**

• **Note 5 : The enhancements may be subject to relevant SA WGs (e.g. SA3/SA3-LI) feedbacks on the reliability of UE reports involved/needed for multi-RTT/DL-TDOA enhancements**

• **Note 6 : The enhancements should take into account the mirror-image ambiguity**

@ Apple

Firstly with respect to your 5 issues:

· Point 1&2: we do not think RAN can challenge the views of SA3-LI experts

· Point 3: we believe that Note 5 is addressing this concern

· Point 4: This is the only technical issue but has been addressed by RAN1 in the conclusion of its study.

· Point 5: As stated by several companies, the proposed scheme doesn't raise more privacy issues than the reporting of GNSS coordinates

Secondly in your statement “*It is very obvious that, in the end, the 3GPP design (RAT dependent positioning) performs worse than the competing technology (GNSS) in every single performance metric without any performance benefit (trustworthiness)*”, it is necessary to recall that the purpose of the verification is **not** about enabling the network to determine a UE position with comparable accuracy to the one of GNSS measurements. Therefore this verification shall not be considered as a competing positioning solution but rather as a scheme that will help network operators to assess the reliability of the UE reported location information (i.e. GNSS coordinates).

Thirdly, in clause 6.10.1 of TS 23.273, it is stated that the UE Positioning Capability is taken into account in LCS framework. Furthermore in release 17, it has been defined that it will also be taken into account during the network verification procedure in NTN. The same principles will most likely be adopted in release 18. Therefore, it is not needed to add a specific note clarifying whether the UE feature is optional as we already propose to reuse the same LCS framework.

@Nokia: We believe that it is sufficient to add the Note 6 to address the issue related to mirror ambiguity

7 – Lockheed Martin

We agree with Thales proposed proposal.

8 – MediaTek Inc.

We mainly support proposal. We are fine with the Note 3, but we are open to re-phrasing it to avoid un-necessary optimization beyond the target for accuracy of UE location verification as captured in TR 38.882.

We repeat our comment that Multi RTT method with single satellite should be first priority due to limited TU budget in Rel-18. DL TDOA with multiple satellite, and more generally extension to multiple satellites could be second priority.

9 – Eutelsat S.A.

We can support the Thales proposal (Note 3 - see further comment below).

As stated by Thales and others the GNSS location that is reported by the UE that is being verified (put another way, it is “sanity checked”).

Qualcomm’s ‘inaccuracy’ point is a good one; designing a system always to be inaccurate to at least a certain degree (randomised error else mapping to a real location becomes deterministic) could become a task in itself.

Returning to Note 3, we agree with MediaTek that the search for techniques to go beyond the TR (e.g., rival GNSS) is both unnecessary and a distraction to achieving a basic R18 function - “over optimisation” should be avoided.

We also note the time / TU pressure concerns expressed by several companies and would suggest priority is given to ‘one satellite in view’.

Standardized methods could be augmented by implementation - e.g., Nokia/Ericsson (maybe others) suggested angle of arrival may be possible to use to help resolve ambiguity depending upon antenna array/beams.

10 – HUGHES Network Systems Ltd

We support the proposal with the compromised adjustments offered by Thales (incorporating QC and Nokia).

11 – Qualcomm Incorporated

Regarding the points from Apple in the last reply, we think the content in the TR (which was approved by consensus in RAN) contains all the answers to the points raised.

Just to state the obvious: the TR content does not express the views of Qualcomm or any company in particular. The TR is an official 3GPP document approved in RAN after several rounds of discussions and after achieving consensus in RAN.

To reply in detail:

[Apple] It is very obvious that, in the end, the 3GPP design (RAT dependent positioning) performs worse than the competing technology (GNSS) in every single performance metric without any performance benefit (trustworthiness). 3GPP has specified so many competing solutions and the outcome is very evident without us to call the names. This setup even a worse precedence since it is extremely clear that 3GPP solution is inferior in every single performance metric.

[Reply] From the TR, it is clear that the location verification is not intended to provide the same level of accuracy as GNSS, but to provide the possibility of determining the UE is within an area equivalent to the size of a typical terrestrial cell. From TR 38.822 Clause 5:

In this study, we have identified the need to define a network based solution which aims at verifying the reported UE location information.

The verification should be performed independently from the location information reported by UE.

The UE location information for the study is considered verified if the reported UE location is consistent with the network based assessment to within 5-10 km (similar to terrestrial network macro cell size), enabling country discrimination and selection of an appropriate core network in order to support all the regulatory services (i.e. emergency call, lawful intercept, public warning, charging/billing).

Regarding the trustworthiness, the new note in the WI should address that concern, and anyway the TR concluded the following (Subclause 4.1):

At least some of the information the UE supplies to the network will have to be considered as trusted, to avoid extreme conclusions (at least RRC measurements cannot be faked);

[Apple] Please explain to us, compared to GNSS based positioning which is mandatory for NTN and which has RAN4 test to verify already, what is the performance advantage of the RAT dependent positioning and why, including which WG made that assessment and in which official document.

[Reply] The advantage is to have a method independent from GNSS to be able to verify the location of the UE. In TN, this is done by using the cell ID identifier (note that this cell ID identifier has also much lower

accuracy than GNSS, but it is still used for verification purpose - this is the same thing we are trying to achieve here). From TR 38.822, Subclause 4.3:

Relying only on the GNSS based location information reported by the UE is not considered reliable by SA3-LI [4].

The UE reported location information (for example determined with its GNSS receiver), could be erroneous due to intentional (e.g. maliciously tampering by user or by 3rd party) or unintentional (e.g. interference) causes, hence it cannot be considered trusted by network operators.

Already 3GPP has defined a network based functionality to verify the reported UE location with the identifier of the serving cell. However, radio cells in non-terrestrial networks, may be larger than the ones of terrestrial networks and may cover borders between two or more countries. Therefore, such Cell Id information may not be sufficient to discriminate the country in which the UE is located.

It is expected that solutions combining both UE reported GNSS information and network based information for verification of UE location can improve the reliability of core network selection in non-terrestrial networks.

Regarding the last part "which WG made that assessment and in which official document", TSG RAN made that decision as captured in TR 38.822 above.

12 – Intelsat

Intelsat supports this proposal and modifications suggested by Qualcomm and Thales

13 – Apple GmbH

To Qualcomm

[Qualcomm] From the TR, it is clear that the location verification is not intended to provide the same level of accuracy as GNSS, but to provide the possibility of determining the UE is within an area equivalent to the size of a typical terrestrial cell. From TR 38.822 Clause 5:

In this study, we have identified the need to define a network based solution which aims at verifying the reported UE location information.

The verification should be performed independently from the location information reported by UE.

The UE location information for the study is considered verified if the reported UE location is consistent with the network based assessment to within 5-10 km (similar to terrestrial network macro cell size), enabling country discrimination and selection of an appropriate core network in order to support all the regulatory services (i.e. emergency call, lawful intercept, public warning, charging/billing).

[Apple] We believe Qualcomm misunderstands the problem. The location report itself which is based on GNSS, and only after AS security set up, is specified in Rel-17 in RAN2. However, what we discuss here is using another RAT dependent positioning to verify the GNSS location report specified in Rel-17.

The only valid reason for doing such is the SA3-LI LS to RAN2 indicating that NW verified UE location may be needed. However, if you read the SA3-LI LS, the reason for NW verified UE location is that UE report (GNSS location report specified by RAN2 in Rel-17) may not be trustable.

What we discuss here is to have normative work to specify RAT dependent positioning enhancement with the justification of NW verified UE location. However, (1) TR38.882 never confirmed that we need to do have RAT dependent positioning for NW verified UE location (2) RAT dependent positioning also relies on UE report which is even against SA3-LI request.

There is no reason to start normative work to specify solution B that has worse performance in every aspect with the same trustworthiness concern, to verify solution A. It does not make technical sense.

[Qualcomm] Regarding the trustworthiness, the new note in the WI should address that concern, and anyway the TR concluded the following (Subclause 4.1):

At least some of the information the UE supplies to the network will have to be considered as trusted, to avoid extreme conclusions (at least RRC measurements cannot be faked);

[Apple] When start of A (normative work of RAT dependent positioning) heavily relies on the validity of B (trustworthiness of A). We cannot start A assuming B is valid without confirmation.

Again, we already asked Thales the same question, why we believe "at least" does not include GNSS location report, but it includes the UE report needed for RAT dependent positioning. RAN cannot make this decision which is very obvious and it makes no sense to start normative by closing our eyes ignoring the fundamental problem of the issue.

[Qualcomm] The advantage is to have a method independent from GNSS to be able to verify the location of the UE. In TN, this is done by using the cell ID identifier (note that this cell ID identifier has also much lower accuracy than GNSS, but it is still used for verification purpose - this is the same thing we are trying to achieve here). From TR 38.822, Subclause 4.3:

Relying only on the GNSS based location information reported by the UE is not considered reliable by SA3-LI [4].

The UE reported location information (for example determined with its GNSS receiver), could be erroneous due to intentional (e.g. maliciously tampering by user or by 3rd party) or unintentional (e.g. interference) causes, hence it cannot be considered trusted by network operators.

Already 3GPP has defined a network based functionality to verify the reported UE location with the identifier of the serving cell. However, radio cells in non-terrestrial networks, may be larger than the ones of terrestrial networks and may cover borders between two or more countries. Therefore, such Cell Id information may not be sufficient to discriminate the country in which the UE is located.

It is expected that solutions combining both UE reported GNSS information and network based information for verification of UE location can improve the reliability of core network selection in non-terrestrial networks.

[Apple] We believe Qualcomm again misunderstands the problem, this is how things happened

In TN, we have cell ID which is used for location identification for PLMN. However, for NTN, the geographic coverage of an NTN cell is much larger than TN cell, therefore, in Rel-17, RAN2 introduced GNSS location report for NTN with the target accuracy of 2km specified in 38.331 (There was also agreement that GNSS location report is only supported after AS security setup, however the UE consent part is still under heavy debate in SA3)

So, TN cell ID <-> NTN GNSS location report

In TN, there is no such thing called NW verified UE location, i.e., cell ID.

In NTN, there is this thing called NW verified UE location which we are debating now to verify the NTN GNSS location report. Technically, there is no reason the accuracy of GNSS cannot meet 2km requirement. The reason for all these discussion is that SA3-LI suggesting that UE report cannot be trusted, i.e., some malicious UE can hack GNSS location report deliberately.

However, again as we explained, RAT dependent positioning cannot be used for NW verified location because it has all the technical issues (1) It still relies on UE report which is against SA3. If we follow the suggestion from SA3, we need another WI to specify another verification method to verify the method we are going to do, and it will be endless since we never solve fundamental issue raised by SA3-LI (2) It

has unacceptable latency which is against SA2 (3) It has reliability (confidence) issue especially in certain geometry which is against its claimed use case, i.e., regulatory requirement.

14 – HISPASAT SA

We support the proposal from Thales considering the suggestions from Nokia and QC.

15 – Ligado Networks

We support the Thales proposal.

16 – ZTE Corporation

We support the proposal with the following changes:

1. To avoid ambiguity, the following version is preferred on top of QC's changes.

Note-3: The target ~~position~~-accuracy for **position** verification purposes is as documented in clause « recommendations » of the 3GPP TR 38.882

2. We still prefer to prioritize the multi-RTT in the WID given the limited TU for this topic.

17 – HUAWEI TECHNOLOGIES Co. Ltd.

Regarding Apple's claim that "the 3GPP design (RAT dependent positioning) performs worse than the competing technology (GNSS) in every single performance metric without any performance benefit", we share similar view with a number of companies that it is NOT the intention of this work item to provide a technology that to compete with GNSS. So there is no need to compare with GNSS performance and there is no need to state that "the 3GPP design (RAT dependent positioning) performs worse than the competing technology (GNSS) in every single performance metric without any performance benefit"

Then whether it is useful for 3GPP to design something which is NOT performing as good as GNSS? Our understanding is that, SA3 sent LS to RAN2 in (S3i210282, April 2021), saying:

*"SA3LI notes that any method which relies **solely** on UE-generated location information is unlikely to be considered reliable for network selection purposes. Therefore, a method such as **GNSS/A-GNSS cannot be considered as reliable or trusted unless the information provided by the UE can be verified by the network.**"*

SA3 did not say which technology (GNSS or RAT-dependent) is more trustable, but SA3 says "verification" helps. Later there was discussions in WGs and then in the RAN plenary in June 2022, and the RAN-level Study conclude in 38.882 that *"In this study, we have identified the need to define a network based solution which aims at **verifying** the reported UE location information."* *"The **verification** should be performed **independently** from the location information reported by UE."*

It seems reasonable and useful (at least to us) for RAN to design something for the purpose of verification.

For note 3, Thales revision of Qualcomm's proposal (referring to recommendation part of 38.882) looks reasonable to us.

<p>Other than the above, we would suggest to focus on multi-RTT with single satellite in view in Rel-18, taking work load and study outcome into consideration</p>
<p>18 – Samsung Electronics Romania</p> <p>Our preference has not been changed, and we will not repeat the comment. (i.e., Prioritize multi-RTT)</p>
<p>19 – vivo Communication Technology</p> <p>We strongly recommend to bring back the note "This is UE optional feature". Otherwise we will have to object as well.</p>
<p>20 – vivo Communication Technology</p> <p>sorry for multiple posts ... our reason for making it UE optional feature is that it should be possible for the UE to support Rel-17 NTN and additionally Rel-18 DMRS bundling feature, without considering regulatory services</p>
<p>21 – Beijing Xiaomi Mobile Software</p> <p>Our preference is still to specify the necessary enhancement of DL-TDoA in single satellite scenario, but we are generally fine with the current proposal.</p> <p>on the note 3, we also think QC's revision makes more sense.</p>
<p>22 – Guangdong OPPO Mobile Telecom.</p> <p>We can accept the proposal with the rewording of the note 2:</p> <p>Note 2: The specification of DL-TDOA enhancements will take into account be subject to the study of the impact of realistic UE clock drift onto DL-TDOA performance</p> <p>Otherwise, we support vivo's recommendation to add a note to make it as optional feature.</p>
<p>23 – Spreadtrum Communications</p> <p>We share the same views with vivo. We also strongly recommend to add a note to make it as optional feature.</p>
<p>24 – LG Electronics France</p> <p>We are ok with the moderator's proposal and also open to THALES's proposal since it may make the proposal reliable for potential further work. Regarding DL-TDOA, we are ok with down-prioritizing it or adding more practical condition as suggested by several companies.</p>
<p>25 – PANASONIC R&D Center Germany</p> <p>We support Thales proposal. We are also supportive of adding a note to make location verification a UE optional feature.</p>
<p>26 – ESA</p> <p>We support Thales' proposal with the modifications suggested by QCOM and Nokia.</p>

27 – Intel Corporation SAS

Aligned with our comment for previous round, we object DL-TDOA since it requires more efforts in working groups (i.e. study of UE clock drift error and normative work to enable this solution, plus we don't know if it is feasible or not yet). We can revisit it in the next release, if approved.

28 – TTP plc

TTP Approves this proposal and strongly support this!

29 – NOVAMINT

We support the proposal from Thales with the suggestions from Qualcomm and Nokia.

30 – Gatehouse Satcom A/S

We are also aligned with Thales proposal - adjusted to QC and Nokia's comment.
In addition we support Vivo's comment

31 – Lenovo (Beijing) Ltd

Agree to proposal. However, given the TUs left, we think multi-RTT with single satellite may be prioritized. We suggest the following

Based on RAN1 conclusions of the study phase, RAN to **specify prioritize the specification of** necessary enhancements to multi-RTT **and DL-TDOA positioning methods** to support the network verified UE location in NTN assuming a single satellite in view [RAN1, 2, 3, 4]. **DL-TDoA methods for verification may be considered as lower priority and if time permits and condition in Note is satisfied.**

32 – Airbus

We support the proposal from Thales considering the suggestions from Nokia and QC.

33 – Sony Europe B.V.

We support the proposal and the following update to Note 3 from Qualcomm:

Note 3: The target accuracy for the position determination is as documented in TR 38.882

We don't really understand the current note 3 (does it mean that the UE can only signal location verification related information in steps of 10km and not in steps of 1km, 2km? If the UE had some location information that said it was "at 4.9km", would that get rounded down to 0km in the granular signalling, whereas if the UE's location verification information was "at 5.1km", would that get rounded up to 10km in the granular signalling?). The issues we discuss in this paragraph are of the type that should be discussed in RAN WGs, not RAN plenary, hence (and for other reasons) we prefer the Qualcomm version above.

34 – Omnispace

Omnispace supports this proposal, from Thales.

35 – Philips International B.V.

We can support the proposal from Thales. We also support QC’s remark on keeping multi-satellite support in the baseline.

We don’t fully understand vivo’s reasoning to bring back the note ”This is UE optional feature” so we do not support this.

36 – Ericsson LM

We are in general fine with the proposals, but would like to keep the original granularity of 10 km

37 – Classon Consulting

[for FUTUREWEI] Thanks to the moderator to try to resolve comments. It does seem to be getting bigger, to fit into the TU some prioritization is still needed.

38 – vivo Communication Technology

@Philips, for example Rel-17 UE is in the market, and for coverage enhancement it only supports Rel-18 DMRS bundling. If network verification of UE location in Rel-18 becomes mandatory feature then Rel-17 UE cannot support Rel-18 DMRS bundling feature only. Hope this is clear.

if proposal 4.1.1 is agreed, it could be reflected in clause 4.1.3 of the Rel-18 WID NR_NTN_enh.

4.1.2 Moderator Summary and recommendations

About **Proposal 1 (revision of initial proposal)**

- **Based on RAN1 conclusions of the study phase, RAN to specify the necessary enhancements to multi-RTT and DL-TDOA positioning methods to support the network verified UE location in NTN assuming a single satellite in view [RAN1, 2, 3, 4].**
- **Note 1: Enhancements assume reuse of the RAT dependent positioning framework**
- **Note 2: The specification of DL-TDOA enhancements will be subject to the study of the impact of realistic UE clock drift onto DL-TDOA performance**
- **Note 3: The enhancements on the existing positioning methods for the verification should prevent a UE location determination with a granularity lower than 5 - 10 km**
- **Note 4 : Multiple satellite in view by the UE may be considered if time allows**
- **Note 5 : The enhancements may be subject to SA3/SA3-LI feedbacks on the reliability of UE reports needed for multi RTT/DL-TDOA enhancements**

• **Note 6 : The enhancements should take into account the mirror-image ambiguity**

Company views are

- Agree: Thales, Lockheed Martin, Mediatek, Eutelsat, Hughes, Intelsat, Hispasat, Ligado, ZTE, Oppo, LGE, ESA, TTP, Novamint, Gatehouse, Lenovo, Airbus, Sony, Omnispace, Ericsson
- Disagree: Apple, Philips

Suggestions to enhance the scope:

- Core proposal
 - Nokia suggests “Based on RAN1 conclusions of the study phase, RAN to specify the necessary enhancements to multi-RTT and DL-TDOA positioning methods, **potentially in conjunction with angle-based techniques**, to support the network verified UE location in NTN”
 - Lenovo suggests “Based on RAN1 conclusions of the study phase, RAN to **specify/prioritize the specification of** necessary enhancements to multi-RTT ~~and DL-TDOA positioning methods~~ to support the network verified UE location in NTN assuming a single satellite in view [RAN1, 2, 3, 4]. **DL-TDoA methods for verification may be considered as lower priority and if time permits and condition in Note is satisfied.**”
- Note 2
 - Oppo suggests “The specification of DL-TDOA enhancements will take into account ~~be subject to the study of~~ the impact of realistic UE clock drift onto DL-TDOA performance
 - ”
- Note 3:
 - QC, Sony, Airbus suggests the following wording instead “The target accuracy for the position determination is as documented in TR 38.882”
 - Thales, ZTE suggests “The target accuracy for position verification purposes is as documented in clause « recommendations » of the 3GPP TR 38.882”
 - Ericsson suggests to keep the original granularity of 10 km
- Note 5:
 - Nokia suggests to replace “**SA3/SA3-LI**” by relevant SA WGs”
- New note

- Vivo, Oppo, Spreadtrum, Panasonic request to add "This is UE optional feature" while Philips does not support this note

Views on how to reduce the scope

- Positioning methods
 - Multi RTT method with single satellite to be prioritized : Mediatek, ZTE, Huawei, Samsung, LGE, Lenovo
 - DL-TDOA method with single satellite to be prioritized: Xiaomi, (Oppo ?); But Intel objects to DL-TDOA
- Single versus multiple satellite
 - Qualcomm and Philips in favor. Philips wants multiple at same level of priority as single satellite
 - Moderator: The note 4 is reusing the same wording as in TR 38.882
- Futurewei is in favor of reducing scope

Based on the above the Moderator suggests to discuss on line the following

Proposal 1

- **RAN to start a normative phase on network verified UE location.**
 - **Note: network verified UE location is an optional UE feature**

Proposal 2 (normative objectives – core part)

- **Option 1 : Based on RAN1 conclusions of the study phase, RAN to specify the necessary enhancements to multi-RTT and DL-TDOA positioning methods to support the network verified UE location in NTN assuming a single satellite in view [RAN1, 2, 3, 4].**

- **Option 2** : Based on RAN1 conclusions of the study phase, RAN to prioritize the specification of necessary enhancements to multi-RTT to support the network verified UE location in NTN assuming a single satellite in view [RAN1, 2, 3, 4]. DL-TDoA methods for verification may be considered as lower priority and if time permits and condition in Note is satisfied.

Proposal 2bis (normative objectives – clarification notes part)

- **Note 1:** Enhancements assume reuse of the RAT dependent positioning framework
- **Note 2:** The specification of DL-TDOA enhancements will (Option 1: take into account or Option 2: be subject to the study of) the impact of realistic UE clock drift onto DL-TDOA performance
- **Note 3:** The target accuracy for position verification purposes is as documented in clause « recommendations » of the 3GPP TR 38.882 (i.e. 10 km granularity)
- **Note 4 :** Multiple satellite in view by the UE may be considered if time allows
- **Note 5 :** The enhancements may be subject to relevant SA WGs (e.g. SA3/SA3-LI) feedbacks on the reliability of UE reports involved
- **Note 6 :** The enhancements should take into account the mirror-image ambiguity

5 Conclusion

See slide set attached

