RAN102_R19_NR_NTN - Version 0.0.2

RAN

https://nwm-trial.etsi.org/#/documents/8746

3GPP TSG RAN Meeting #102

Edinburgh, Scotland, December 11-15, 2023

Agenda Item: 9.1.2.3

Source: Huawei (moderator, RAN1 Vice-Chair)

Title: Moderator summary on new WI Non-Terrestrial Networks (NTN) for NR Phase 3

Document for: Discussion and decision

1 Introduction

This document is a companion to the draft WID provided in RP-233108 and summary provided in RP-233107, intended to gain clarifications and to check the level of interest on the proposals submitted at RAN#102 in the referenced contributions.

The moderator would like to note that in spite of the amount of support expressed on the various proposed enhancements, all proposals will not fit in the time budget allocated by the RAN Chair. Therefore, an effort is made in this document to focus each potential objective. A final section between stable objectives may still be eventually required to fit in the time budget.

The moderator would also like to note that the RAN Chair's summary in RP-232745 [1] asks whether RAN4-led (or RAN4-only) proposals should rather be discussed towards the approval of the RAN4 package in March 2024. Depending on the decision on this point, RAN4 proposals may be added to the draft WID. For the time-being, companies' views are still invited in the present document.

A number of questions are provided for companies to voluntarily provide their views before the drafting session scheduled for 18:00-20:00 on Monday 11 December. If feedback is to be provided, please provide it before noon UTC on Monday 11 December.

2 Summary of Tdocs submitted at RAN#102

Please refer to section 2 of RP-233107.

3 Questions before Monday drafting session

3.1 DL Coverage Enhancements

Proposed justification text:

Offer optimized performance especially when addressing handset terminals (including smartphones with more realistic assumptions on antenna gains instead of 0 dBi antenna gain with the specific realistic antenna gain assumption to be determined at the working group level) w.r.t. downlink coverage considering the NTN deployment constraints such as payload power limitation, large satellite foot print and limited feeder link bandwidth. DL coverage enhancements are needed to accommodate satellite payload constraints which may be unable to have all its beams active with the « nominal » EIRP density per beam (see Section 6.1.1 in TR 38.821) at a given time due to limited power and limited feeder link bandwidth, while maximizing the number of beams that can be activated simultaneously, and ensuring that all user terminals can be served across the satellite foot print while maximizing the overall satellite throughput and ensuring that all satellite's radio cells are kept alive even without traffic but allowing new users to join or preventing impact on end-user QoS.

DL coverage enhancements should be considered at both

• Link level to improve the link margin of selected physical channels in order to accomodate the EIRP reduction. This include possible techniques such as increased repetition scheme or equivalent techniques depending on the physical channel. A link margin improvement for physical channels (e.g. PDSCH and PDCCH) should be considered without impact on SSB design.

• System level to support an efficient dynamic and flexible power sharing between beams or different beam pattern/size (i.e., wide or narrow) across the satellite foot print for example by leveraging network energy saving techniques. For example, a total number of beams = 1200 may be assumed for NGSO operating in FR1 band. This would correspond to the number of beams necessary to serve a satellite footprint at 30° min elevation with ~50 km diameter beam size.

Feedback Form 1: Is the justification text acceptable?

1 – NTT DOCOMO INC. OK
2 – THALES We agree with the proposed text from the moderator. Enhancements at both Link and System level are necessary. The later is of utmost importance to maximize coverage while optimizing space segment cost. Note that impact on legacy UE should be minimized. We recommend to consider at system level, possible techniques such as time domain techniques addressed in Rel-18 « Network energy savings for NR » SID/WID.(e.g. transmission/reception of common channels/signals, UE specific signals and channels, UE wake up signal (WUS) for gNB, DTX/DRX and/or SSB/SIB1 including on-demand SSB/SIB1) in order to relax the duty cycle of the beams.

3 – Fraunhofer IIS

We agree with the proposed text.

4 – OQTEC

We agree with the proposed text. We agree with Thales that enhancements to both Link Level and System Level are needed.

5 – HUGHES Network Systems Ltd

We agree with the proposed text from the moderator.

Enhancements at both Link and System level are necessary.

6 – Apple Distribution Intl Ltd

We think the justification text is acceptable in general.

One comment we have is on the following sentence:

"(including smartphones with more realistic assumptions on antenna gains instead of 0 dBi antenna gain with the specific realistic antenna gain assumption to be determined at the working group level)"

In Rel-18 NR NTN on the study of coverage enhancement, it was already assumed that smart phone antenna element gain is -5.5 dBi. We could use this value directly or as a starting point.

7 – Gilat

We agree with the proposed text. We believe both link and system level enhancements are required

8 – Airbus

We agree with the proposed text. System level and link level must be considered. These points are of upmost importance if we want to keep reasonable space segment to make NTN solutions feasible and afordable from business prespective.

9 – NEC Corporation

The overall is fine, and we support preventing impact on end-user QoS. For link level enhancement, increasing the repetition number impacts the throughput, which is one of the end-user QoS. There are conflicts in this justification. Should we consider polarization diversity as an alternative?

We propose modifying the first bullet to:

• Link level to improve the link margin of selected physical channels in order to accommodate the EIRP reduction. This includes possible techniques such as ~~increased repetition scheme~~ polarization diversity or equivalent techniques depending on the physical channel. A link margin improvement for physical channels (e.g. PDSCH and PDCCH) should be considered without impact on SSB design.

10 – China Mobile Group Device Co.

We support both link and system level enhancements.

11 – Guangdong OPPO Mobile Telecom.

We are in general ok with the proposed text, but the technics to satisfy this objectives can be further discussed in WGs level, thus we suggest to remove the text: System level to support an efficient dynamic and flexible power sharing between beams or different beam pattern/size (i.e., wide or narrow) across the satellite foot print ~~for example by leveraging network energy saving techniques~~.

12 – Spreadtrum Communications

We are fine with the proposed text. For UE antenna gain, we also think smartphones with -5.5 dBi can be reused as a starting point.

13 – CATT

Generally we are fine to this justification.

14 – Lenovo (Beijing) Ltd

Lenovo:

Acceptable. We think both link-level and system level DL coverage enhancement are necessary.

15 – Transsion Holdings

Fine with this justification

16 – Beijing Xiaomi Mobile Software

We agree with the justification.

17 – Omnispace

we agree with proposed text

18 – NOVAMINT

We support the link and system level enhancements.

19 – PANASONIC R&D Center Germany

Support.

20 – HUAWEI TECHNOLOGIES Co. Ltd.

It is pre-mature to conclude "should" improve before any study is done according to the objective. So we suggest to revise as "DL coverage enhancements ~~**should**~~**can** be considered at both".

21 – SHARP Corporation Support the proposed justification. Both Link level and System level should be considered in this work.
22 – Eutelsat Group We agree with the proposed text from the moderator. Enhancements at System level are necessary (as well as link level). The system level is important - the aim is to improve downlink coverage (vs. present assumptions while providing options to optimise space segment cost/complexity (e.g., power, number of active beams, % of beams active, Tx and Rx beam dwell time and onboard complexity). Performance of systems >10GHz (Sat - VSAT) must be considered alongside FR1.
23 – Nokia France OK. We do not support adding polarisation diversity. For the system level enhancements, it is important to highlight that techniques from NES should be considered for reuse first.
24 – Samsung Research America We support a study item on possible link level and system level DL coverage enhancements. There is no need to include ”specify” for any particular technique before the SI is complete.
25 – Dell Technologies we support the text as it is.
26 – Dell Technologies we support the text as it is.

Proposed objective:

Study and specify downlink coverage enhancements targeting support for additional reference satellite payload parameters covering both GSO and NGSO constellations operating in FR1 or FR2-NTN [RAN1, RAN2]

- Define additional reference satellite payload parameters assuming power sharing among satellite beams or different satellite beam patterns/size (i.e. wide or narrow) across the satellite footprint, such that satellite beams may not all be simultaneously active or may be active below the nominal EIRP density per satellite beam (see section 6.1.1 in TR 38.821) due to limited power and limited feeder link bandwidth.
- Define the corresponding energy consumption model and necessary link level and system level evaluation methodology and relevant KPIs for evaluations of the coverage, to allow for identification of physical channels/signals and system-level aspects that need enhancements and the corresponding needed improvements.

https://nwm-trial.etsi.org/#/documents/8746

- Study and specify solutions, including link level enhancements (e.g. for PDCCH, PDSCH) and/or system level enhancements (e.g. satellite beam switching/hopping/scheduling), allowing dynamic and flexible power sharing between satellite beams or different satellite beam patterns/size (i.e. wide or narrow) across the satellite footprint.
- Notes for this objective:
  - SSB channel enhancement is not considered
  - Antenna gain of UE shall be assumed to be -5.5dBi, and at least 2Rx are considered at the UE
  - NGSO to be considered in priority: LEO Set-1 @ 600 km
  - Non-RedCap UEs are considered in priority
  - FFS whether RedCap 1 Rx UE are considered at least for the link margin improvement
  - FFS whether RedCap UE half duplex constraints are considered for system level enhancements

Feedback Form 2: Is the objective acceptable? Should RedCap UEs be considered in this objective? Can the FFS points be deleted from the objective?

1 – NTT DOCOMO INC.

Generally fine, but two comments.

- "(e.g. satellite beam switching/hopping/scheduling)" should be removed to avoid prioritizing a solution for study phase.
- Although any specified mechanism can be applied to RedCap UEs as well, we do not see any urgency to promote additional RAN1/RAN2 work on a specific RedCap UE type.

2 – THALES

We agree with the proposed text from the moderator

Subject to agreement on the support of ReDCAP UE in NTN (see clause 3.8), we would recommend to remove the FFS accordingly.

3 – Fraunhofer IIS

We agree with the proposed text.

4 – Fujitsu Limited..

Fine in principle. We don't see any strong motivation to introduce/study RedCap specific enhancements.

5 – OQTEC

We agree with the proposed text. We would prefer to see RedCap considered, although we recognize the comments pertaining to the FFS we would prefer to at least see RedCap as in scope with the objective.

6 – HUGHES Network Systems Ltd

We agree with the proposed text from the moderator.

7 – Apple Distribution Intl Ltd

We think the object text is acceptable in general. One comment we have is on the third bullet:

· Study and specify solutions, including link level enhancements (e.g. for PDCCH, PDSCH) and/or system level enhancements (e.g. ~~satellite beam switching/hopping/scheduling),~~ allowing dynamic and flexible power sharing between satellite beams or different satellite beam patterns/size (i.e. wide or narrow) across the satellite footprint).

This modification is to align the justification part, since the main system level enhancement is on dynamic and flexible power sharing. Satellite beam switching/hopping/scheduling is the next level of details, which we do not think they should be listed.

If we want to consider RedCap UEs in DL coverage enhancement, we think not only 1 Rx antenna needs to be considered, but also the smaller antenna element gain than smart phone should also be considered. Overall, we think they could be considered with a lower priority than smart phones. If time allows, we are open to consider RedCap UEs in this objective.

Regarding RedCap UE half duplex constraints, we are not sure it is related to DL coverage enhancement. Maybe it can be considered in the objective of RedCap UE support (i.e., Section 3.8).

8 – Gilat

We are ok with the scope without the FFS

9 – Airbus

Airbus supports the proposed text from the moderator

10 – NEC Corporation

The overall is acceptable. We agree with Apple's suggested modification to the third bullet.

Besides, there is no need to consider RedCap UEs in this objective. The FFS points can be removed from the objective.

11 – China Mobile Group Device Co.

We support the proposed text from the moderator

12 – Guangdong OPPO Mobile Telecom.

we support the restrict the scope to non-Redcap UEs in this release

13 – vivo Communication Technology

The proposed objectives include study on all channels/signals, which is way too much to evaluate given the overall TU budget, Rel-18 evaluations should be taken as baseline and only consider the bottle neck channels/signals considering xdB (e.g. 6dB) power reduction per satellite beam.

14 – Spreadtrum Communications

For the object text, we have the following two comments:

For system level enhancements, the example of satellite beam switching/hopping/scheduling can be removed.

For redcap for NTN, half duplex constraints is out of the scope of DL coverage enhancement.

15 – Qualcomm Incorporated

We are generally fine, with a couple of suggestions:

- For system level enhancements, the objective right now is very general and may consume a large amount of TUs in RAN1 to even converge to a solution space. We would suggest to prioritize techniques based on Rel-18 NES.

- For the FFS on RedCap, we think we would first need to properly specify HD collision rules for NTN before considering the addition in DL CovEnh.

16 – CATT

1□The transmission periodicity of SSB channel and system information can be extended to reduce power consumption and enable multiple beams active with TDM way.

2□RedCap UE can be considered since this UE is more like as MTC UE, which can extend the NTN usage.

17 – Lenovo (Beijing) Ltd

Lenovo:

For system level enhancements, we would like to leverage existing techniques (e.g., NES) with enhancements for efficient dynamic and flexible power sharing.

This objective can be prioritized for RAN1's study except for the Redcap related part considering the limited TU amount.

18 – Transsion Holdings

Fine with thees objectives.

19 – Beijing Xiaomi Mobile Software

We think the RedCap should not be considered in DL coverage for NTN, and the corresponding FFS should be deleted.

The reduced antenna gain e.g., -8.5dBi caused by reduced antenna size of RedCap should be assumed besides 1Rx if RedCap is considered. It is not expected to consider RedCap in DL coverage enhancement in Rel-19, as the antenna gain back off for RedCap is not considered in UL coverage enhancement in Rel-18.

20 – PANASONIC R&D Center Germany

We do not support RedCap for Rel.19.

21 – NOVAMINT

We agree with the proposed text. We also recommend to remove the FFS

22 – HUAWEI TECHNOLOGIES Co. Ltd.

It is preferable to avoid solution that reduces EIRP comes with the cost of increasing transmission time, as this will not be helpful for the stated problem. So we suggest revision below: "such that satellite beams may not all be simultaneously active or may be active **(without changing the active ratio) but** below the nominal EIRP density per satellite beam (see section 6.1.1 in TR 38.821) "

"the corresponding energy consumption model" is not clear. It seems like energy consumption model discussed in Rel-18 network energy saving, but it should not be the model as we understand. Suggest to have revision "the corresponding energy consumption ~~**model**~~ **constraint assumption**"

We prefer no Redcap-specific optimization for coverage enhancement and hence suggest to remove two bullets with FFS.

23 – SHARP Corporation

Fine with the proposed objective. For the system level enhancement part, we assume it can be based on NES functions. As for RedCap UEs, we are open.

24 – Ligado Networks

We are ok with the proposed objectives.

25 – Nokia France

OK. The coverage enhancement techniques may of course be applied to RedCap UEs regardless of their number of Rx antennas. There is no need to introduce specific additional coverage enhancement techniques only for RedCap devices.

A separate RAN1-led study objective should be included to examine the impact of supporting NTN on a RedCap device: it is highly desirable that RedCap devices will support NTN, but currently the cost/complexity implications may be prohibitive, so RAN1 should study the impact of the half-duplex constraint, as well as the number of HARQ processes that should be supported and the possibility of HARQ feedback disabling.

26 – Dell Technologies we support the objective from the moderator
27 – Samsung Research America Agree with the comments by Huawei. Prefer to avoid including RedCap UEs in Rel-19. The ”specify” part can be excluded for now, or can be qualified as ”when needed, specify” as it is not clear what the SI outcomes will be. Also agree with Apple/Spreadtrum and ”satellite beam switching/hopping/scheduling” can be removed from the description of the objective.

3.2 Robust Notification/Alert Channel

Proposed justification text:

Provide a robust notification/alert message capability for UE in adverse SNR conditions (i.e. light indoor).

The definition of a UE specific notification/alert feature is proposed to address the problem of missed paging messages to a UE in low SNR conditions (e.g. Non Line Of Sight) when it is placed in pockets, backpacks or in vehicles, boats, etc., or in conditions where there are clutter losses. The notification is to invite the user to move to a better SNR conditions in order to set-up the call.

The feature should be able to mitigate to the maximum extent the additional loss compared to the link margin required in Line of Sight conditions. In TR 38.811 Table 6.6.2-3: Shadow fading and clutter loss for suburban and rural scenarios - the NLOS due to clutter loss can be over 18 dB. Table 6.6.1-1 LOS probability showed that at 30 degrees elevation, about 10% of users in rural and 50% in urban scenarios will experience NLOS.

Feedback Form 3: Is the justification text acceptable?

1 – NTT DOCOMO INC. OK
2 – THALES We agree with the proposed text from the moderator
3 – HUGHES Network Systems Ltd We agree with the proposed text from the moderator

4 – Apple Distribution Intl Ltd

We think the justification text is acceptable in general.

Although the NLOS due to clutter loss can be over 18 dB, it is still unclear if the design of robust notification channel, within the scope of Rel-19 NR NTN, can close up this big gap. Hence, we prefer not mentioning 18 dB in the justification text.

5 – Gilat

We agree

6 – Airbus

Airbus supports the proposed text from the moderator

7 – NEC Corporation

The overall is acceptable.

8 – Guangdong OPPO Mobile Telecom.

We prefer to have new channel to be considered in this release

9 – Spreadtrum Communications

We are fine with the proposed text. In addition, we suggest a UE-group specific notification/alert feature should be also considered.

10 – Qualcomm Incorporated

In previous discussions it was mentioned that the notification channel may be used also for PWS emergency messages (e.g. ETWS/CMAS). It would be good to add this case to the justification as well.

11 – CATT

The use case is valid.

12 – Lenovo (Beijing) Ltd

Lenovo:

Agree.

13 – Transsion Holdings

Agree with this **justification**

14 – Beijing Xiaomi Mobile Software We agree with the justification.
15 – Omnispace we agree
16 – NOVAMINT We agree with the proposed text from the moderator.
17 – PANASONIC R&D Center Germany We agree.
18 – SHARP Corporation OK
19 – Nokia France When paging is missed, it is not clear how the network would know that it is due to low SNR (as opposed to other factors such as wrong paging area). It should be stated that the false alarm rate has to be zero, given the implications of receiving one of these alerts. Overall, the requirements to support the justification should be provided by SA.
20 – Dell Technologies that is fine
21 – Samsung Research America It is unclear how a UE that cannot receive paging can signal out to the NTN so that the NW knows that UE cannot receive paging. It is also unclear how such UE can camp on a cell associated with the NTN.

Proposed objective:

Study and specify support for a robust notification/alert channel [RAN2, RAN1, RAN3]

- Identify the notification message requirement based on liaison with SA WG(s) [RAN2]
    - The notification message should be addressed to a particular UE or a subset of UEs in a cell
- Identify and specify possible solutions for the support of a robust notification/alert message and its delivery (including paging procedure impact) over a downlink physical channel
- Notes for this objective:
    - Enhancements to existing SSB signal are not considered in this scope.
    - Applicable to all orbits (GSO&NGSO)

- Mitigate to the maximum extend, the additional loss that can be up to 18 dB
- This feature may be applicable for UEs operating in terrestrial networks based on a common design

Feedback Form 4: Is the objective acceptable? Should the downlink physical channel be a new channel or an enhanced existing channel?

1 – NTT DOCOMO INC.

RAN WGs discussion should start AFTER SA discussion/conclusion on the service flow. Service flow-related discussion is not RAN task but SA task. Unless it is fixed, RAN WGs discussion will be complicated.

2 – THALES

We agree with the proposed text from the moderator.

The sub bullet "The notification message should be addressed to a particular UE or a subset of UEs in a cell" should be further clarified.

For example, it should be made clear that the notification to a subset of UE corresponds to public warning system (PWS).

3 – Fujitsu Limited..

As long as we read the justification and objective part for this matter, we are afraid that companies will come up with so many options because of the unclear requirement. This will lead to consuming our precious TUs. Our preference is not to approve this scope in this meeting, and come back after SA requirements become clear.

4 – HUGHES Network Systems Ltd

We agree with the proposed text from the moderator.

Agreed with Thales that the sub bullet "The notification message should be addressed to a particular UE or a subset of UEs in a cell" should be further clarified. It should be made clear that the notification to a subset of UE corresponds to public warning system (PWS) when needed.

There were some questions with regards "What is Notification/Alert in NTN?" And whether there need to be initial work in in SA1 or SA2. Response to the questions and further clarifications on the objective can be found in RP-233948. Thank you

5 – Apple Distribution Intl Ltd

We think the objective text is acceptable in general.

We think the second bullet "Identify and specify possible solutions for the support of a robust notification/alert message and its delivery (including paging procedure impact) over a downlink physical channel" could be under [RAN1, RAN2]

Also following our previous comments, we suggest removing the second last bullet in the Notes.

6 – ZTE Corporation

We prefer to remove "(including paging procedure impact)" since if eventually, the paging channel is used to deliver this message, the corresponding impact will be considered. But no need to highlight it in the objective.

7 – Airbus

Airbus supports the proposed text from the moderator. Airbus agrees with Thales and Hughes that the sub bullet "The notification message should be addressed to a particular UE or a subset of UEs in a cell" need to be further clarified.

8 – NEC Corporation

The overall is acceptable. Shall we add "message size, false alarm rate" as examples for the notification message requirement?

Consider revising the sentence as follows:

• Identify the notification message requirement (e.g. message size, false alarm rate) based on liaison with SA WG(s) [RAN2]

9 – Guangdong OPPO Mobile Telecom.

We understand this bullet is RAN1 centric bullet, thus the leading WG can be RAN1. Besides, we prefer to consider new channel design in this release.

10 – vivo Communication Technology

For Alert message, the MUSIM UE case should also be considered. For an MUSIM capable device (with both IOT-NTN and NR-NTN), the Alert message is carried in NB-IOT NTN.

11 – Spreadtrum Communications

1. For the objective text, we have the following comments:

² Identify and specify possible solutions for the support of a robust notification/alert message and its delivery (including paging procedure impact) over a downlink physical channel **[RAN1, RAN2]**

² We think that an evaluation is necessary first to determine which type of orbit can be applied. So we suggest removing the note of "Applicable to all orbits (GSO&NGSO)".

12 – Qualcomm Incorporated

For the "subset of UEs in a cell" it should be clarified that this applies to the case of PWS. Without this clarification, it may be interpreted that something similar to "group PEI" could be specified, which would lead to an unacceptable user experience due to the high false alarm rate.

13 – CATT

Need to study the following issues:

1) The size of notification message, e.g UE ID bit would be more than 16 bits.

2) Which physical channel is impacted, e.g only synchronization channel, or including PDSCH channel both etc.

3) What is the relationship between this alert notification and normal paging procedure?

4) How many TU are expected in RAN1?

Direct to specify something before get the clear target of above issue is not preferred.

14 – Lenovo (Beijing) Ltd

Lenovo:

We are generally fine with the objective. We think the scheme based on enhanced existing channel or a new channel can be considered or down selected in WI phase in WG level.

15 – Transsion Holdings

Agree with these obectives.

16 – Beijing Xiaomi Mobile Software

We are fine with the objectives, the leading group seems to be RAN1 as the work is RAN1-centric.

17 – NOVAMINT

We agree with the proposed text from the moderator.

Agreed with Thales and Hughes about the sub bullet "The notification message should be addressed to a particular UE or a subset of UEs in a cell" to be further clarified.

18 – HUAWEI TECHNOLOGIES Co. Ltd.

Some part of the objective does not make sense. Addressing a subset of UEs in a cell does not seem make sense for the described scenario. A subset of UEs are used for e.g. PEI, however the described scenario differs from PEI in that it requires manual operation (e.g. taking phone out of pocket or moving to a LOS location). If a group of UEs are altered together, it will be very annoying. Then if a particular UE is alerted at a time, the UE ID length should be made clear, otherwise RAN WGs do not know how to design.

This is an end-to-end service. We agree with few other companies that requirements should be first discussed and decided in SA working groups before RAN starts study feasibility (e.g. is it possible to have 18 dB more coverage without improving SSB and addressing all UEs in the system one by one).

19 – Ligado Networks

We agree with the proposed text.

20 – Nokia France

The requirements should first be discussed and provided by SA.

21 – Samsung Research America

Agree with the comments by Huawei. Also, for RAN involvement, agree with previous comments that RAN1 should be the leading WG.

3.3 Uplink Capacity/Throughput Enhancement

Proposed justification text:

Offer optimized capacity performance on uplink through multiplexing techniques, motivated by:

- The coverage of NTN satellites is very wide, and considering device density, it is expected that a large number of UEs will be within a satellite's coverage. Especially for LEO, a large number of UEs in coverage must succeed in transmitting desired data during a satellite coverage which means that rapid access to and release of satellite resources is required.
- The total spectrum resources available to the network will be limited especially in the early phases of NR NTN deployments.
- Some users will require higher resources than others, depending on their traffic patterns. Therefore, further granularity of resource multiplexing can significantly improve system capacity efficiency.
- Possibility to allocate higher per-UE resources to better support VoNR/VoIP services in coverage-limited scenarios.

Feedback Form 5: Is the justification text acceptable?

1 – NTT DOCOMO INC.

OK

2 – THALES

We agree with the proposed text from the moderator

3 – OQTEC

We agree with the proposed text from the moderator.

4 – HUGHES Network Systems Ltd

We agree with the proposed text from the moderator

5 – Apple Distribution Intl Ltd

We think the justification text is acceptable in general.

Since the similar objective is in discussion for Rel-19 IoT NTN, we think some mechanism should be taken to avoid duplicated work in NR NTN and IoT NTN. One possibility is to delay the start of this objective to a later stage of Rel-19, so that the design of uplink capacity in IoT NTN could be largely reused for NR NTN.

Also, we are open to study whether the bottleneck of enhancing uplink capacity is at control channel or data channel.

6 – Gilat

Agreed

7 – ZTE Corporation

Fine

8 – Airbus

Airbus agrees with the proposed text from the moderator

9 – China Mobile Group Device Co.

Support

10 – NEC Corporation

It is acceptable

11 – Guangdong OPPO Mobile Telecom.

Ok

12 – Spreadtrum Communications

We shared the similar views with apple.

https://nwm-trial.etsi.org/#/documents/8746

13 – CATT It's acceptable.
14 – Lenovo (Beijing) Ltd **Lenovo:** Fine.
15 – Transsion Holdings Agree with this justification.
16 – Beijing Xiaomi Mobile Software We agree with the justification.
17 – Omnispace we agree
18 – NOVAMINT We agree with the proposed text from the moderator.
19 – Inmarsat We agree with the proposed text from the moderator. We think some work on the user plane is required as a minimum, open to look at seeing if there are any control plane bottlenecks in addition.
20 – SHARP Corporation Support
21 – Ligado Networks We agree with the proposed text and Inmarsat's comment above.
22 – Eutelsat Group Agree with moderator.
23 – Samsung Research America The justification is acceptable.

Proposed objective:

Uplink Capacity/Throughput Enhancement [RAN1, RAN2, RAN4]

- Study then specify, if beneficial, DFT-s-OFDM PUSCH enhancements via Orthogonal Cover Codes (OCC) including for initial access, with an attempt to minimize impact on emissions

- Determine the potential capacity improvement (at least 2 times and not more than 12 times compared to legacy) to be targeted taking into account realistic impairments (e.g. Doppler, time variation, phase distortion)
- Specify necessary signalling, if needed
- Update RF requirements accordingly if needed
- The orthogonal cover codes are across OFDM symbols and/or within an OFDM symbol.

- Notes for this objective:
  - The enhancement is not targeting improvements of MU-MIMO capability
  - Enhancements to PRACH are not in scope
  - This feature may be applicable for UEs operating in terrestrial networks based on a common design

Feedback Form 6: Is the objective acceptable?

1 – NTT DOCOMO INC.

For PUSCH part, generally fine and Demod requirements update may be necessary.

For this topic, **capacity enhancement on common PUCCH resources** is essential. Although capacity of dedicated PUCCH resources may be enough in the existing spec, we believe that capacity of common PUCCH resources is quite low. In legacy spec, only 16 resources are available per cell. Then, R18 NR NTN introduced max 8 repetitions. That is, only 16 resources are available per cell per 8 slots.

2 – THALES

We agree with the proposed text from the moderator

3 – Fujitsu Limited..

Fine with this proposal. Also OK for the proposal by DOCOMO (capacity enhancement on common PUCCH resources)

4 – OQTEC

We agree with the proposed text. We also agree with NTT's comments pertaining to enhancement of common PUCCH resources.

5 – HUGHES Network Systems Ltd

We agree with the proposed text from the moderator

6 – Apple Distribution Intl Ltd

We think the objective text is acceptable in general.

Since the similar objective is in discussion for Rel-19 IoT NTN, we think some mechanism should be taken to avoid duplicated work in NR NTN and IoT NTN. One possibility is to delay the start of this objective to a later stage of Rel-19, so that the design of uplink capacity in IoT NTN could be largely reused for NR NTN.

7 – Gilat

Agreed

8 – ZTE Corporation

1. We share the with DCM to add ”**capacity enhancement on common PUCCH resources**”.
2. We prefer to generalize the scheme for Code-based approach instead of directly mentioning the OCC. OCC is just one option for code-based.

9 – Airbus

Airbus agrees with the proposed text from the moderator

10 – China Mobile Group Device Co.

Agree with the proposed text from the moderator

11 – NEC Corporation

It is acceptable.

12 – Guangdong OPPO Mobile Telecom.

We should try to avoid impact legacy MU-MIMO feature

13 – Spreadtrum Communications

We shared the similar views with apple.

14 – Qualcomm Incorporated

Generally OK, with a couple of minor comments:

- The part on “applicable for UEs operating in TN” could be treated in UE features discussion and not before that. We would like to avoid having to run simulations for both TN and NTN scenarios during the work item.

- On the main bullet, maybe we could clarify “including initial access and SDT”

15 – CATT

1. Maximum user number should be evaluated due to Doppler and gNb complexity.
2. For initial access, the PRACH and PUSCH should be sent together. No new procedure is expected.

16 – Lenovo (Beijing) Ltd

Lenovo:

We are fine with the objective to improve UL capacity by OCC. This objective can be prioritized for RAN1's study.

17 – Transsion Holdings

Agree with these obectives.

18 – Beijing Xiaomi Mobile Software

We are fine with the objectives.

19 – Omnispace

we agree

20 – PANASONIC R&D Center Germany

Support. In addition, common PUCCH capacity enhancement could be added.

21 – NOVAMINT

We agree with the proposed text from the moderator.

22 – Inmarsat

We agree with the proposed text, however we don't think the text "if beneficial" is required, as it is already clear to the vast majority of companies that some enhancements are required.

In addition, we agree with comments/amendments proposed by DOCOMO, ZTE and Qualcomm.

We think this is a very critical item that will directly impact upcoming deployments of NR NTN, so we support RAN1 prioritizing this work.

23 – HUAWEI TECHNOLOGIES Co. Ltd.

For downlink coverage enhancement, it is related to the cost of the network deployment and hence directly impact network deployment. For uplink capacity/throughput enhancement, it is optimization. So in our view the priority of uplink capacity/throughput enhancement is general lower than downlink coverage enhancement.

24 – SHARP Corporation Support. We are open to add common PUCCH capacity enhancement.
25 – Nokia France PDCCH capacity should also be considered, as there is no point to increase the PUSCH capacity if the bottleneck is PDCCH.
26 – Dell Technologies we are fine with that
27 – Samsung Research America In general, when considering specific solutions, it should also be justified what would be the capacity enhancement for the applicable scenarios. For example, it is unclear whether there is a PUSCH capacity shortage for initial access (e.g. how many coverage limited UEs perform IA at the same time?).

3.4 Mobility enhancements

3.4.1 NR NTN/NTN mobility enhancements

The proposals relevant to NR NTN/NTN mobility enhancements are the following:

1. Subsequent CHO
2. DAPS
3. LTM
4. Enhancements for discontinuous coverage
5. Group handover for signaling overhead reduction
6. SMTC only update in connected mode
7. Soft switch of PCI unchanged enhancement of SSB collisions
8. CHO enhancement for unchanged PCI
9. Multi-connectivity
10. Enhancements of UE measurements that allows more detections of the satellites within the PCI unchanged area for soft satellite switching without PCI change in quasi-earth fixed cell case
11. Reduce handover failure rates in DG RACH-less HO
12. Procedure for supporting enhanced relaxed measurement, e.g. time base and/or location based relaxed measurement criterion
13. Broadcasting common configuration for (C)HO in SIB

https://nwm-trial.etsi.org/#/documents/8746

It is the moderator's understanding that proposals in bullets 1, 5, and 13 were discussed in Rel-18 and not adopted, and the proposals in bullet 7 may be considered as a leftover for Rel-18 maintenance, and that bullet 9 may already be completed in Rel-18.

Feedback Form 7: Is any of the above proposals necessary and acceptable for Rel-19?

1 – CATT

Support 10) and 13) if any is in.

For 10), due to the lack of time, unchanged PCI procedure in the soft-satellite-switch scenario was concluded in hurry, adopting an over-simplified procedure which for the progress ignored a couple of important factors (e.g. variation of link quality, TA variation, etc. between source and target satellites) and may thus yield poor performance and (highly) likely lead to the switching failure. To make unchanged PCI design in soft-Sat.-switch practical for real deployment, we think enhancements are needed.

For better clarity, we suggest rewording for 10), e.g. "**Enhancement on soft satellite switching without PCI change, by taking into account link quality of source/target satellites, aiming at more reliable switching with lower failure occurrence**".

For 13), also due to the lack of time in Rel-18, RAN2 failed to discuss this aspect in detail. With the gain we foresee based on our analyses and also confirmed by a majority of companies in Rel-18, it is worth further pursuing this objective in Rel-19 as a Rel-18 leftover.

For the other options, what we want to highlight is that we need to take RAN chair's guidance into account and consider only enhancements promising for practical deployment in Rel-19 (e.g. with reasonable complexity, with real use case, with clear benefits, etc.).

2 – NTT DOCOMO INC.

Unnecessary.

Our understanding is that R18 NTN had quite good progress on mobility enhancement and thus motivation of further enhancement is low.

3 – THALES

We would recommend to address in priority 1), 2) and 3) requesting mostly RAN2 work.

1) "subsequent CHO" should have clear objectives in the WID e.g. combination with satellite switch with-resync.

2) Dual Active Protocol Stack (DAPS) hand-over: should consider in priority Earth fixed cell in FR2 especially for VSAT to minimize further the interruption associated to service link switch (i.e. change of the serving NTN payload) and feeder link switchover. This technique could also be useful to optimize the service interruption during hand-over for Earth moving cell NTN scenarios

3) LTM based hand-over: It prevents L3 mobility procedure for cell switching.

Moreover, we have sympathy for 5) but it was dropped from Rel-18 because the overhead reduction benefits was not obvious.

4 – Fujitsu Limited..

Basically, we don't think it is a good idea to introduce NTN specific mobility functionalities. The enhancements should be common for TN and NTN. In this sence, we think nothing from the list needs to be included in Rel-19 NTN.

If we have to do something in Rel-19, leftover from Rel-18 (i.e. 7 and 10) could be a candidate.

5 – Apple Distribution Intl Ltd

The proposals in bullets 1) 5) 13) were proposed in Rel-18, but RAN2 has no time left to discuss it.

Because these solutions can bring benefits in signaling overhead reduction, we could discuss them in Rel-19 time frame.

1) Subsequent CHO

5) Group handover

13) Broadcasting common configuration for (C)HO in SIB

6 – NEC Corporation

In R17 and R18, we focused on mobility and incorporated the most necessary enhancements into the specification. Additionally, we can discuss certain items such as 1) in the mobility enhancement work item.

However, if the technical understanding is available, we can consider items with clear benefits and less complexity that have not yet been discussed, such as 12) Procedure for supporting enhanced relaxed measurement, e.g. time base and/or location based relaxed measurement criterion.

Currently, we have only implemented measurement initiation based on time and location. However, the previous relaxed measurement protocol is still in place for cases where the UE is at the cell edge or has low mobility and is based solely on the RSRP criterion. We could introduce a criterion based on location and speed for more precise measurements.

7 – China Mobile Group Device Co.

Support the following ehancements:

5. Group handover for signaling overhead reduction

7. Soft switch of PCI unchanged enhancement of SSB collisions

10. Enhancements of UE measurements that allows more detections of the satellites within the PCI

unchanged area for soft satellite switching without PCI change in quasi-earth fixed cell case

13. Broadcasting common configuration for (C)HO in SIB

8 – Guangdong OPPO Mobile Telecom.

We prefer to have the folloiwng enhancements in the scope:

Subsequent CHO

Enhancements for discontinuous coverage

Procedure for supporting enhanced relaxed measurement, e.g. time base and/or location based relaxed measurement criterion

Broadcasting common configuration for (C)HO in SIB

9 – Spreadtrum Communications

No. We do not see strong motivation to introduce extra NTN/NTN mobility enhancements beyond that which already supported in Rel-18.

10 – vivo Communication Technology

RAN2 has specified many solutions to improve TN-NTN/NTN-NTN mobility performance. We think there is no critical issue for Rel-19, and should de-prioritize this topic

11 – Qualcomm Incorporated

Support 1, 4, 5 and 6. We are also fine to work on 13 together with 5. Although 1 and 5 and 13 were discussed in Rel-18, our understanding is that the main reason was time-management and not lack of interest.

12 – Lenovo (Beijing) Ltd

Lenovo:

Support 2 and 9 for TN-NTN service continuity and further integration.

13 – Transsion Holdings

We prefer below for fuhter discussion:

1□Subsequent CHO

5□Group handover for signaling overhead reduction

8□CHO enhancement for unchanged PCI

14 – Beijing Xiaomi Mobile Software

We think the items which were discussed in the Rel-18 but not were specified should be considered with high priority, thus bullet 1, 5 and 13 should be included in Rel-19 NTN.

15 – ZTE Corporation

We understand that R18 NTN had quite good progress on mobility enhancement and thus motivation of further enhancement is low.

16 – NOVAMINT We support 1 & 4. On 4 (Enhancements for discontinuous coverage), we believe it would be beneficial to address this topic in Rel-19 as work has already been conducted in RAN for IoT NTN in Rel-17 & 18 and in SA2 for IoT NTN and NR NTN in Rel-18 which can be leveraged. This feature would be extremely beneficial to provide flexibility to ramp up constellations.
17 – LG Electronics France We think important: 4, 11. We see it some beneficial: 6, 12 (but motivation of 6 needs further clarification) We see it marginally beneficial or non-urgent: 1, 8, 10 We prefer least: 2, 3, 5, 7, 9, 13,
18 – SHARP Corporation We see no urgency on the above-listed topics, as NTN-NTN mobility has been well developed already.
19 – Nokia France These items should not be included.
20 – Eutelsat Group 9 - Multi-connectivity is of interest to Eutelsat Group.
21 – Dell Technologies we see those items as NOT urgent
22 – Samsung Research America Generally agree with the moderator's understanding.

3.4.2 Intra-RAT TN/NTN mobility enhancements

The proposals relevant to Intra-RAT TN/NTN mobility enhancements are the following:

1. TN-NTN reselection and satellite switch with re-sync
2. Seamless mobility between TN and NTN in both directions for vehicle UEs
3. Reduce unnecessary measurement (e.g. SIB19, frequency measurements) for UE in TN
4. Cell reselection and handover enhancements
5. Soft switching handover
6. Enhancements for RRC_INACTIVE

https://nwm-trial.etsi.org/#/documents/8746

7. Improve paging integration between NTN-TN (e.g., a UE paged on one network type can be directed to another network type)
8. Support QoS-based network selection based on access cause
9. Improve user experience based on QoS requirement

In the moderator's view, many of the proposals are too generic to provide enough focus for Rel-19.

Feedback Form 8: Is any of the above proposals necessary and acceptable for Rel-19?

1 – CATT From RAN2 perspective, we did not find showstopper to support the TN/NTN mobility in either inter-RAT or intra-RAT scenarios by Rel-17/18 NR NTN. So we are not sure about the need for above listed enhancements from RAN2 perspective.
2 – NTT DOCOMO INC. Unnecessary. Our understanding is that R18 NTN had quite good progress on mobility enhancement and thus motivation of further enhancement is low.
3 – THALES We believe that this could be de-prioritized in the context of Rel-19
4 – Fujitsu Limited.. We don't see the strong necessity to do something for TN/NTN mobility.
5 – Apple Distribution Intl Ltd We already support and improve the TN-NTN mobility based on coverage in Rel-18. So further optimization in Rel-19 (if supported) should be improved from user experience improvement perspective. So we think we should consider the proposal in bullets 9) in Rel-19 scope. 9) Improve user experience based on QoS requirement
6 – NEC Corporation TN-NTN mobility is thoroughly discussed and defined in Rel-18, and we do not currently see a significant need for further improvements. However, we are open to any additional justification or suggestions.

7 – Guangdong OPPO Mobile Telecom.

we prefer to have:

Seamless mobility between TN and NTN in both directions for vehicle UEs

8 – Spreadtrum Communications

No. We do not see strong motivation to introduce extra intra TN/NTN mobility enhancements beyond that which already supported in Rel-18.

9 – Lenovo (Beijing) Ltd

Lenovo:

We prefer to focus on 3.4.1 to narrow down the scope of mobility enhancements.

10 – Transsion Holdings

We prefer below items for firther enhancement:

1□TN-NTN reselection and satellite switch with re-sync

11 – Beijing Xiaomi Mobile Software

RAN2 mainly focused on the NTN-NTN and TNT-TN mobility in the previous releases, the TN-NTN mobility enhancements should be included in the Rel-19 NTN, thus at least bullet 3 should be included in the Rel-19 NTN.

12 – ZTE Corporation

We understand that R18 NTN had quite good progress on mobility enhancement and thus motivation of further enhancement is low.

13 – NOVAMINT

not necessary in Rel-19

14 – LG Electronics France

Support: 2

Neutral: 1 (scope is a abit unclear), 3

Not support: 7,8

Scope is quite unclear: 4, 5, 6, 9

https://nwm-trial.etsi.org/#/documents/8746

15 – SHARP Corporation Cell selection/reselection improvements for IDLE UEs has been well developed until Rel-18. For TN/NTN mobility for CONNECTED UEs, we consider seamless mobility between TN and NTN as very important, especially for automotive use cases. However, compared with other features such as DL coverage and UL capacity, TN/NTN mobility for CONNECTED UEs may not be very critical for Rel-19.
16 – Eutelsat Group Not a high priority - may not be required.
17 – Nokia France These are all either low priority or unclear what needs to be done (or both).
18 – Samsung Research America A few of the proposals may be considered with lower priority based on available TUs.

3.4.3 Inter-RAT TN/NTN mobility enhancements

The proposals relevant to Inter-RAT TN/NTN mobility enhancements are the following:

1. Inter-RAT satellite information (E-UTRA TN providing NR NTN satellite info)
2. Mobility from E-UTRAN TN to NR NTN
3. Mobility from NR NTN to IoT NTN
4. TN-NTN mobility with QoS adaptation (e.g. PDB relax due to long RTT)
5. E-UTRAN TN to NR NTN idle/inactive/connected mode mobility

Feedback Form 9: Is any of the above proposals necessary and acceptable for Rel-19?

1 – CATT From RAN2 perspective, we did not find showstopper to support the TN/NTN mobility in either inter-RAT or intra-RAT scenarios by Rel-17/18 NR NTN. So we are not sure about the need for above listed enhancements from RAN2 perspective.
2 – NTT DOCOMO INC. Mobility between LTE TN and NR NTN (i.e., f/g/j) may be considerable. For the remaining, no need to work on them.

3 – THALES

We believe that this could be de-prioritized in the context of Rel-19

4 – Fujitsu Limited..

We don't see the strong necessity to do something for TN/NTN mobility.

5 – Fraunhofer IIS

We agree with NTT Docomo to adress mobility between LTE TN and NR NTN in Rel-19.

6 – Apple Distribution Intl Ltd

We have no strong view on this enhancement.

Before discussing the enhancement, we need to first understand whether the corresponding scenario exists.

7 – Guangdong OPPO Mobile Telecom.

We dont see the urgency of the enhancements, thus not prefer to have the enhancements in the scope in this release

8 – Spreadtrum Communications

No. We think it is not needed to consider E-UTRAN TN to NR NTN mobility.

9 – Qualcomm Incorporated

In our view, the missing piece of specification is point 1. It is unclear what is needed to enable 2. For 3, this is not even supported for TN, so we don't think it is necessary to implement it for NTN at this stage.

10 – Lenovo (Beijing) Ltd

Lenovo:

We prefer to focus on 3.4.1 to narrow down the scop of mobility enhancements.

11 – Transsion Holdings

We prefer to depriorizate iRAN TN/NTN mobility.

12 – Beijing Xiaomi Mobile Software

We think the inter-RAT TN/NTN mobility enhancements should be considered with low priority.

13 – ZTE Corporation We understand that R18 NTN had quite good progress on mobility enhancement and thus motivation of further enhancement is low.
14 – NOVAMINT Not necessary for Rel-19
15 – LG Electronics France Not necessary for Rel-19
16 – HUAWEI TECHNOLOGIES Co. Ltd. It is not clear the scenario for inter-RAT TN/NTN and why it impact all RRC states (IDLE/Inactive/CONNECTED)
17 – Nokia France These are all either low priority or unclear what needs to be done (or both).

3.5 Enhanced GNSS Operation

Proposed justification text:

Increase the robustness of NTN operation in conditions where GNSS accuracy and GNSS service availability may be temporarily degraded. There is a need to increase the robustness of uplink time and frequency synchronization in NTN based access against of GNSS temporarily degraded performance to accommodate the actual GNSS service performance. This will also allow the NR-NTN to be less subject to GNSS jamming (leading to denial of service) and spoofing (leading to incorrect location reporting and potentially denial of service) which may occur on a temporary basis. Additionally, it may also increase NR-NTN robustness against natural phenomena, such as solar radiation bursts, which can affect large parts of the earth surface for 10 to 20 minutes.

Feedback Form 10: Is the justification text acceptable?

1 – NTT DOCOMO INC. From our perspective, motivation of this topic is lower than the other important topics. Whether this topic is included in R19 NR NTN WI or not should be carefully discussed with WI scope vs available TU budgets.
2 – THALES We agree with the proposed text from the moderator

3 – OQTEC

We agree with the proposed text from the moderator. We feel that a study on enhanced GNSS is essential.

4 – HUGHES Network Systems Ltd

We agree with the proposed text from the moderator

5 – Apple Distribution Intl Ltd

We are fine with the justification text.

6 – ZTE Corporation

In our view, the necessity for this enhancement is much lower compared to others. Firstly, for NR UE, the simultaneous operation between GNSS and normal DL/UL operation is always supported, which is different from the IoT-NTN (So, the ”same” motivation is not valid yet). Second, regarding the ”availability” of GNSS, since the existing solution for NR-NTN is based on an assumption with GNSS, such an assumption should be always held. Otherwise, other aspects except for UL synchronization will be impacted seriously.

7 – Airbus

Airbus agrees with the proposed text from the moderator

8 – China Mobile Group Device Co.

Agree with the proposed text from the moderator

9 – NEC Corporation

It is acceptable.

10 – Guangdong OPPO Mobile Telecom.

In general we are fine with the justification text

11 – CATT

The GNSS accuracy degradation should be provided with a proof.

Secondly if GNSS is not available, whether any impact to ephemeris information accuracy?

12 – Lenovo (Beijing) Ltd

Lenovo:

Yes

13 – Transsion Holdings

Agree.

14 – Beijing Xiaomi Mobile Software

We are fine with the justification.

15 – PANASONIC R&D Center Germany

We agree.

16 – LG Electronics France

AGree

17 – HUAWEI TECHNOLOGIES Co. Ltd.

the scenario is not very clear. If solar radiation bursts are the problem to address, can proponent explain how often solar radiation bursts happens and affects GNSS operation? Also would be good the get more information whether only GNSS is impacted by solar radiation bursts or whether typical data transmission will be impacted together?

18 – SHARP Corporation

We think the described use case is valid and support the proposed justification.

19 – Eutelsat Group

Agree with moderator text.

This is a high priority, especially for FR2, where existing requirements are very tight. R17/18 Considered GNSS accuracy but not availability or integrity. R19 should consider these aspects.

A question has been asked about space weather (as this is one factor, in addition to man-made sources of 'interference'). There are many reliable sources (including the UK Scientific Report - *Satellite-derived Time and Position: A Study of Critical Dependencies* - referenced in the Draft WID). Further example: https://www.swpc.noaa.gov/impacts/space-weather-and-gps-systems .

LEO satellites receiving GNSS signals (used as an input to realtime ephemeris) are above the ionosphere and, in any event, can use high performance, multi-band, GNSS receivers. Note, systems in bands >10 GHz are not so affected by ionospheric disturbances as L-Band.

20 – Nokia France

In connected mode, TA is available, so it is not clear what needs to be done here.

21 – Dell Technologies

yes, that is fine

https://nwm-trial.etsi.org/#/documents/8746

22 – Samsung Research America

Agree with Huawei. It is unclear what happens to control/data communication due to solar radiation bursts and why only GNSS is impacted by them. Also, the impact of GNSS absence to ephemeris information accuracy is unclear. Given the other possible items for NTN in Rel-19 and that 1 TU (or so) is available in RAN1, this aspect can be at least deprioritized for now.

Proposed objective:

Increase the robustness of uplink time and frequency synchronization in NTN-based access against GNSS temporarily degraded performance for connected mode and for initial access. [RAN1, RAN2]

- PRACH transmission (initial access, connected mode): Study potential enhancements for the UE pre-compensation for UL time and frequency synchronization in case GNSS availability and/or accuracy is reduced, and specify if needed.
    - The UL time and frequency synchronization enhancements shall accommodate a UE GNSS « relaxed » position accuracy better than [300] meters (i.e. 3D error of 6 x 50 meters) for FR1-NTN UE and better than [90] meters (i.e. 3D error of 6 x 15 meters) for FR2-NTN UE.
- Connected mode: Study potential enhancements (e.g. enhanced closed loop) for the UE pre-compensation for UL time and frequency synchronization during long connection times in case GNSS availability and/or accuracy is reduced, and specify if needed.
    - A UE in pre-established RRC connected state shall be able to maintain its connectivity during up to 14.4 minutes corresponding to a temporary GNSS performance degradation.
- Notes for this objective:
    - It applies to NTN systems operating in FR1-NTN or in FR2-NTN
    - consider both static UE and in-motion UE at speed up to ~1000 km/h
    - UE has GNSS capability
    - simultaneous GNSS and NR-NTN operation is supported
    - Enhancements on PRACH signal is not in scope of this topic

Feedback Form 11: Is the objective acceptable? Can the square brackets around [300] meters and [90] meters be removed?

1 – NTT DOCOMO INC.

Basically fine, if this topic is in R19 NR NTN scope. One minor comment is that UE speed up to 1000 km/h may be too high for this topic. For easy/realistic discussion, lower value may be better for the max speed.

2 – THALES

Overall, we agree with the proposed text from the moderator, however we propose to remove "during long connection times"

The square brackets can be removed

3 – OQTEC

We agree with the proposed text from the moderator.

4 – Apple Distribution Intl Ltd

We think the objective text is acceptable in general.

We think the following assumptions are for both PRACH transmission and connected mode.

"The UL time and frequency synchronization enhancements shall accommodate a UE GNSS « relaxed » position accuracy better than [300] meters (i.e. 3D error of 6 x 50 meters) for FR1-NTN UE and better than [90] meters (i.e. 3D error of 6 x 15 meters) for FR2-NTN UE."

5 – ZTE Corporation

As mentioned before for Q10, the assumption on the availability of GNSS should always be held. So, the bullet "A UE in pre-established RRC connected state shall be able to maintain its connectivity during up to 14.4 minutes corresponding to a temporary GNSS performance degradation." is not reasonable, especially for LEO with limited service time.

If the intention is to capture potential objectives for the enhancement due to the degraded accuracy of GNSS, the same assumption will be applied for both initial and RRC connected mode, then, the following updated version can be considered:

#==

Study potential enhancements for the UE pre-compensation for UL time and frequency synchronization for initial access and RRC-connected mode in case GNSS ~~availability and/or~~ accuracy is reduced, and specify if needed.

· The UL time and frequency synchronization enhancements shall accommodate a UE GNSS « relaxed » position accuracy better than [300] meters (i.e. 3D error of 6 x 50 meters) for FR1-NTN UE and better than [90] meters (i.e. 3D error of 6 x 15 meters) for FR2-NTN UE.

#===

6 – Airbus

Airbus agrees with the proposed text from the moderator. Square brackets can be removed

7 – China Mobile Group Device Co.

Agree with the proposed text from the moderator

8 – NEC Corporation

The objective is acceptable. However, we cannot remove the bracket in the sub-bullet of the first bullet without a clear and mutually agreed-upon rule on how to obtain these figures.

9 – Guangdong OPPO Mobile Telecom.

Somehow we're not sure whether UE is feasible to declare if the GNSS performance is reduced to a certain accuracy, thus would be good to restrict the scope to the case when UE's GNSS is not available, thus we prefer to update the text as follows:

Increase the robustness of uplink time and frequency synchronization in NTN-based access against GNSS temporarily unavailable ~~degraded performance~~ for connected mode and for initial access. [RAN1, RAN2]

· PRACH transmission (initial access, connected mode): Study potential enhancements for the UE pre-compensation for UL time and frequency synchronization in case GNSS availability ~~and/or accuracy~~ is reduced, and specify if needed.

o The UL time and frequency synchronization enhancements shall accommodate a UE with temporarily unavailable GNSS ~~« relaxed » position accuracy better than [300] meters (i.e. 3D error of 6 x 50 meters) for FR1-NTN UE and better than [90] meters (i.e. 3D error of 6 x 15 meters) for FR2-NTN UE~~.

· Connected mode: Study potential enhancements (e.g. enhanced closed loop) for the UE pre-compensation for UL time and frequency synchronization during long connection times in case GNSS availability ~~and/or accuracy is reduced~~, and specify if needed.

o A UE in pre-established RRC connected state shall be able to maintain its connectivity during up to 14.4 minutes corresponding to a temporary GNSS performance degradation.

· Notes for this objective:

o It applies to NTN systems operating in FR1-NTN or in FR2-NTN

o consider both static UE and in-motion UE at speed up to ~1000 km/h

o UE has GNSS capability

o simultaneous GNSS and NR-NTN operation is supported

o Enhancements on PRACH signal is not in scope of this topic

10 – Qualcomm Incorporated

For the IDLE mode part, the PRACH actually supports large TA errors, so one simple way to achieve the objective for IDLE mode would be to relax the timing requirement in RAN4 (which is unnecessarily tight for PRACH) and allow negative TAC in msg2.

11 – CATT

1) The upper limit should be clarified, e.g at most 200 meters. For FR2, it is high risky to support GNSS accuracy degradation due to very short CP. Suggest to remove it in Rel-19

2) For 1000km/h UE, it is not justified without necessary evaluation.

3) Do we consider inter-cell even inter-satellite handover case for such long duration, e.g 14 minters?

12 – Lenovo (Beijing) Ltd

Lenovo:

The objectives are not that clear to us e.g., what is the potential impact and possible work in each WG?

13 – Transsion Holdings

Briefly agree.

14 – PANASONIC R&D Center Germany

Generally fine. For connected mode enhancement, where "14.4 minutes" come from?

15 – NOVAMINT

We agree with the proposed text from the moderator. Brackets can be removed

16 – HUAWEI TECHNOLOGIES Co. Ltd.

a temporary GNSS performance degradation of up to 14.4 minutes. We understand 14.4 minutes is calculated based on 1% outage of the day. However is 14.4 minutes is a sum of multiple outage of a day or is it one outage? It is important to understand/define the distribution of the outage time, otherwise working group will find it difficult to study.

17 – SHARP Corporation

Fine with the proposed objective.

18 – Eutelsat Group

Agree with the text (subject to further discussion on how WG will take into account GNSS availability and integrity).

The FR2 case is important. Operation of VSAT on commercial airline in mid-flight (circa. 900 - 1000 km/h) is an important use case (see RP-233789).

19 – Nokia France

This seems lower priority in view of the need to match the overall scope to the available TUs.

20 – Samsung Research America

Agree with the comments from CATT and Huawei.

3.6 Regenerative Architecture

Proposed justification text:

https://nwm-trial.etsi.org/#/documents/8746

Support non-terrestrial network architecture with 5G system functions on board the NTN vehicle (i.e. regenerative payloads). For the support of real time connectivity between 2 UEs and between network and UE via the space segment with/without ISL, a regenerative payload (5G system functions on board satellite) is required.

Feedback Form 12: Is the justification text acceptable?

1 – CATT

Some rewordings are proposed below□new added/modified texts are in **Bold**.

"Support non-terrestrial network architecture with 5G system functions on board the NTN vehicle (i.e. regenerative payloads) **provides new architecture option(s) besides the transparent payload as specified in Rel-17 and Rel-18, which makes the deployment of non-terrestrial network more flexible. Support of regenerative payload brings some benefits on radio resource handling in Uu, and radio resource coordination between the gNBs via the ISL**. ~~For the~~ **To** support of real time connectivity between 2 UEs and between network and UE via the space segment with/without ISL, a regenerative payload (5G system functions on board satellite) is **also** required."

2 – NTT DOCOMO INC.

OK

3 – THALES

we agree with the proposed text from the moderator

4 – Fraunhofer IIS

We agree with the proposed text.

5 – OQTEC

We agree with the proposed text from the moderator. We also support the comments from CATT.

6 – HUGHES Network Systems Ltd

We agree with the proposed text from the moderator

7 – Apple Distribution Intl Ltd

In general, the justification text is acceptable.

One comment is the justification text implies several ways of supporting different on-board functionalities, such as DU only, DU+CU, DU+CU+CN. For example, real time connectivity between 2 UE(s) can only

be achieved by a full stack network with CN. However, the tentative objectives below seems only cover DU only and DU+CU. It would be better to make the justification and objectives aligned.

8 – ZTE Corporation

In general, the justification seems acceptable.

9 – Airbus

We agree with the justifcation text proposal

10 – China Mobile Group Device Co.

Agree with the proposed text from the moderator

11 – NEC Corporation

It is acceptable.

12 – Guangdong OPPO Mobile Telecom.

Yes, but we are not sure whether the part “For the support of real time connectivity between 2 UEs and between network and UE via the space segment with/without ISL” is related to SA2 or not.

13 – Spreadtrum Communications

OK.

14 – Lenovo (Beijing) Ltd

Lenovo:

Yes

15 – Transsion Holdings

Good to go with this justification.

16 – Beijing Xiaomi Mobile Software

We agree with the justification.

17 – Omnispace

we agree

18 – NOVAMINT

We agree with the proposed text from the moderator.

19 – Samsung Research America

OK with the suggested justification text.

Proposed objective:

Support of regenerative payload [RAN3, RAN2]

- Specify the support of gNB on board in TS 38.300 and define, if needed, any necessary enhancements related to NG protocol to address the feeder link switchover issue.
- Evaluate and specify, if needed, any necessary enhancements related to the intra and inter-gNB mobility, especially for Xn interface over feeder link or over ISL.
- FFS Specify the support of DU on board with possible enhancements of at least F1

Feedback Form 13: Is the objective acceptable focusing on the first 2 bullet points?

1 – CATT

For the first 2 bullets, we are ok with them. Some potential enhancements to the network interfaces, if any, could be further checked and specified, no big impact is foreseen.

For the 3rd bullet, either way is fine with us, remove the bullet from the scope, or make it as 2nd priority, only consider it when the work for full gNB on board is completed.

2 – NTT DOCOMO INC.

OK

3 – THALES

We would prefer to keep the possibility of Specify the support of DU on board with possible enhancements of at least F1

4 – Fraunhofer IIS

We prefer to keep the possibility to specify support of DU onboard, and to specify enhancements for F1-U and F1-C.

5 – Fujitsu Limited..

Fine with the proposal

6 – OQTEC

We prefer to keep the possibility for the specification of DU on board with enhancements to at least F1.

7 – Apple Distribution Intl Ltd

See our comments above. We would like to clarify if CN can also be on-board.

8 – ZTE Corporation

1. For the 1st bullet point, the latter part can be removed since the feeder link switching is up to implementation, e.g., hard/soft switching and out of the scope for 3GPP. Then, the basic assumption should be that the ideal feeder link should be always available for NG-interface.

2. For the 2nd one, the necessity for enhancement is questionable and can be removed. BTW, the terminology, i.e., evaluate can be replaced by study.

3. No need to introduce additional discussion on DU on board without clear benefits.

9 – Gilat

We believe that DU onboard is an important option, with the relevant enhancement required on the F1 interface.

10 – Airbus

We would like to keep the possibility to specify support the split DU onboard and CU on ground. Thus we should at least specify enhancements for F1-U and F1-C.

11 – China Mobile Group Device Co.

Support full gNB on board with first priority and DU only on board de-prioritized

12 – NEC Corporation

It is acceptable to focus on the first 2 bullets.

13 – Guangdong OPPO Mobile Telecom.

Yes

14 – Spreadtrum Communications

OK for the first two bullet. For the 3rg bullet, we would like to include it in the WID and make it second priority.

15 – Lenovo (Beijing) Ltd

Lenovo:

Support for the first 2 bullets focusing on gNB onboard.

16 – Transsion Holdings Agree.
17 – Beijing Xiaomi Mobile Software We are fine to focus on the first 2 bullets.
18 – NOVAMINT Agree to prioritize the 2 first bullets. For the 3rd bullet, we would like to keep the possibility for the specification of DU on board with enhancements to at least F1 so to keep as a second priority if time permits
19 – Eutelsat Group We would prefer to specify the support of DU onboard with possible enhancements of at least the F1 interface.
20 – Nokia France OK. In the interests of controlling the overall scope, the last bullet can be dropped, so as to focus on making full gNB on board work well.
21 – Dell Technologies agree to prioritize the first two items
22 – Samsung Research America OK with the first two bullets. The third bullet may be considered subject to available time.

3.7 MBS/broadcast via NTN

Proposed justification text:

Terrestrial MBS features are equally available for NR NTN in the 5G specifications, but for cases where a cell coverage is overlapping two countries while the service area is expected to reach one of those 2 countries, some enhancements need to be done on the SIB to notify the service area of a Multicast or Broadcast service.

Feedback Form 14: Is the justification text acceptable?

1 – CATT Yes, propose to add one more sentence in the beginning, as below: “MBS feature provides an important add-value for NR NTN system, leveraging the large coverage of the NTN compared to TN.”

2 – NTT DOCOMO INC.

Unnecessary.

What kind of enhancement beyond R17 MBS is necessary is unclear for us.

3 – THALES

agree with CATT

4 – SES S.A.

we agree with CATT

5 – OQTEC

We do not see the necessity.

6 – Fraunhofer IIS

agree with CATT

7 – HUGHES Network Systems Ltd

We agree with the proposed update from CATT

8 – Apple Distribution Intl Ltd

We don't see the motivation to support MBS over NTN network. And we haven't seen any requirement from SA either. So we do not think it should be in Rel-19 scope.

9 – Gilat

Agree with CATT

10 – Airbus

Airbus agrees with the additional sentence proposed by CATT

11 – China Mobile Group Device Co.

Agree with CATT

12 – NEC Corporation

The beam for multicast/broadcast can limit the service area further. Thus, no need for further enhancement of MBS.

13 – Guangdong OPPO Mobile Telecom.

No strong view, would be ok to drop

https://nwm-trial.etsi.org/#/documents/8746

14 – Spreadtrum Communications No. MBS is already supported by Rel-17/Rel-18 NTN.
15 – Lenovo (Beijing) Ltd **Lenovo:** Yes
16 – Transsion Holdings No strong view with this.
17 – NOVAMINT Yes - this is important and we agree with the suggestion from CATT to add the sentence proposed
18 – LG Electronics France We see this as low priority obj.
19 – Ligado Networks Agree with CATT above.
20 – Eutelsat Group Agree with CATT. For satellite operators broadcast and multicast is an important service.
21 – Nokia France Not needed
22 – Dell Technologies agree with CATT on the text addition
23 – Samsung Research America Agree with Apple. In our opinion, this objective is unnecessary.

Proposed objective:

Specify SIB signaling to limit the service area of a Multicast or Broadcast service within the intended country in case the satellite footprint overlaps with multiple countries. [RAN2]

https://nwm-trial.etsi.org/#/documents/8746

Feedback Form 15: Is the objective acceptable?

1 – CATT Yes, at least broadcasting over NTN should be supported in Rel-19, which could be considered as a low-hanging fruit with very limit specification impact.
2 – NTT DOCOMO INC. Unnecessary. What kind of enhancement beyond R17 MBS is necessary is unclear for us.
3 – THALES we agree with the proposed text from the moderator
4 – Fujitsu Limited.. Question for clarification: Is only one country intended for broadcasting service? Then, no broadcast service is provided for other countries in the coverage. Is this correct understanding? Also, will no UE behaviour be defined in RAN2 and RAN1 upon receiption of this SIB? If so, how can the service area be limited?
5 – SES S.A. we agree with the proposed objective
6 – Fraunhofer IIS we agree with the proposed text from the moderator
7 – HUGHES Network Systems Ltd We agree with the proposed objective from the moderator
8 – Apple Distribution Intl Ltd We do not need to discuss the details until SA provides the requirement in this aspect.
9 – Airbus Airbus agrees with the proposed text from the moderator
10 – China Mobile Group Device Co. Agree with the proposed text from the moderator

11 – NEC Corporation

The beam for multicast/broadcast can limit the service area further. Thus, no need for further enhancement of MBS.

12 – Qualcomm Incorporated

Although this item is not in our priority, the scope as presented above is well contained and limited to signaling. We would like to understand from the proponents whether the system aspects are planned to be done in SA WGs.

13 – Lenovo (Beijing) Ltd

Lenovo:

Yes. We think it is a scenario worth of study and enhancement.

14 – NOVAMINT

Yes this is important and we agree with the proposed text from the moderator.

15 – LG Electronics France

We see this as low priority obj. But in case this is included, the objective seems fine.

16 – Inmarsat

We think it's important for MBS to be addressed as part of Rel-19, even if it's concluded that not much or any work is required at RAN level, it's important to make sure that MBS can work well in all NTN scenarios. It's a very low-hanging fruit with scope limited to possibly RAN2 only or minor aspects in RAN3.

Probably we should at least add considerations on timer impacts for Multicast transmission due to RTT, in RAN2

17 – Samsung Research America

In our opinion the objective is unnecessary and the need is unclear.

Feedback Form 16: Please provide your views on the necessity of additional optimizations for NR MBS over NTN: HARQ-ACK Feedback Management for NTN MBS, Packet level service continuity (lossless mobility), management of PTP-PTM switch for NTN MBS, Management RRC Inactive/RRC Idle in MBS NTN, Packet level service continuity (lossless mobility).

1 – Lenovo (Beijing) Ltd

Lenovo:

Some minor specification work may be needed for HARQ-ACK Feedback Management considering that there are different rules for NTN per HARQ process and for MBS per TBs, e.g., mapping between MBS TBs and HARQ processes with feedback enabled/disabled could be specified.

2 – Inmarsat

Yes, there could be some minor enhancements needed, particularly to times due to the long RTT.

3 – Samsung Research America

No need for more HARQ-ACK related optimizations despite some differences between NTN and MBS. Rel-18 specifications support NTN/MBS co-existence.

3.8 RedCap UE support with NTN

Proposed justification text:

The support of RedCap devices (e.g. handheld and IoT) operating in FR1 band NR-NTN networks can offer enhanced service capabilities (wideband/broadband) compared to IoT-NTN while ensuring low-complexity devices. Global coverage would clearly benefit RedCap devices for use cases like cameras monitoring for forest fires. RF and RRM requirements were defined for RedCap devices only for terrestrial networks in Releases 17 and 18.

Feedback Form 17: Is the justification text acceptable?

1 – NTT DOCOMO INC.

OK

2 – THALES

we agree with the proposed text from the moderator

3 – OQTEC

We agree with the proposed text from the moderator. In particular application to IoT should be considered.

4 – HUGHES Network Systems Ltd

We agree with the proposed text from the moderator

5 – NEC Corporation OK
6 – Guangdong OPPO Mobile Telecom. no strong view, would be ok to drop
7 – Transsion Holdings No strong view with this.
8 – NOVAMINT We agree with the proposed text from the moderator. We could add as well the case of smart grid which are often in areas not covered by TN.
9 – LG Electronics France We see this as low priority.
10 – CATT We are ok with the justification.
11 – Inmarsat We think this is a lower priority item, but we don't have strong views. Focus should be on Industrial IoT use cases and considerations should be taken on UE performance impact on link budget and system capacity.
12 – HUAWEI TECHNOLOGIES Co. Ltd. According to our analysis on the possible Redcap NTN data rate, Redcap NTN cannot support video services. So we suggest to remove cameras monitoring in the justification. Redcap can be studied in RAN after service requirements are clarified and defined.
13 – Nokia France yes
14 – Samsung Research America Service requirements should first be identified before RAN considers use of NTN for RedCap UEs.

Proposed objective:

Support of RedCap UEs with NR NTN [RAN4, RAN1]

- Define the RF performance for RedCAP UE operating in satellite service allocated bands in FR1 with 5 MHz channel bandwidth. Update the RRM requirements as required [RAN4].
- Study the impact of applying existing Rel-18 NTN to RedCap 1 RX devices (including half duplex),

including seamless NTN-NTN mobility, and identify (define if relevant) any useful potential simplifications from device-cost perspective, e.g. in the following areas [RAN1]:

- Updates to HD collision rules
- Number of HARQ processes
- Simultaneous operation with GNSS
- Number of transmit and receive antennas – with minimum requirement of 2RX at least for UE with linear polarized antenna.

- Notes for this objective:
  - RedCAP UE operating with NTN implement a GNSS receiver.
  - Consider 1 Rx UE
  - FFS: Whether 2 Rx UE should be only considered to avoid network capacity impact.

Feedback Form 18: Is the objective acceptable? Should it be limited to RAN4 aspects in Rel-19?

1 – NTT DOCOMO INC. RAN4 work may be considerable, but we do not see any urgency to promote additional RAN1 work on a specific RedCap UE type.
2 – THALES we agree with the proposed objective from the moderator. In order to downscope, we suggest to only consider 1 Rx UE
3 – Fujitsu Limited.. We are not supportive for this objective. If the covreage and capacity is important for NTN, then why does the UE need to be RedCap? We should use more capable UE.
4 – OQTEC We agreed with the proposed text from the moderator.
5 – Fraunhofer IIS We agree with Thales to consider 1 Rx UE. Despite of the 5 MHz bandwidth, leveraging the Rel-18 Work item to support NR with less than 5 MHz could be beneficial for satellite applications.

6 – Apple Distribution Intl Ltd

We are not sure all the sub-bullets under the second bullet need to be listed here. For example, it is unclear why the number of HARQ processes has impact on supporting RedCap in NTN.

7 – NEC Corporation

This should be limited to RAN4 aspects in Rel-19.

8 – Qualcomm Incorporated

Although we think that NTN Redcap is already defined in RAN1 for the most part, the treatment of HD collision rules is missing (which is different than in TN due to the large TA). From our perspective, simultaneous GNSS & Number of HARQ processes have a lower interest.

9 – Beijing Xiaomi Mobile Software

We think RedCap should be limited to RAN4 aspects in Rel-19. No essential issues identified in RAN1 from our perspective.

10 – PANASONIC R&D Center Germany

Above work in RAN1 may be too much considering other items. RAN4 work only would be ok.

11 – NOVAMINT

We agree with the proposed text from the moderator.

12 – CATT

I suppose the proposed objectives are the core part objective, so for the first bullet, suggest modifying the wording to: "Define the RF ~~performance~~ and RRM requirements for RedCAP UE operating in satellite service allocated bands in FR1 ~~with 5 MHz channel bandwidth. Update the RRM requirements as required~~ [RAN4]."

And we think the 2Rx UE can also be considered.

For the performance objectives, suggest adding the following:

"Specify RF conformance requirements for RedCAP UE operating in satellite service allocated bands in FR1.

Specify RRM performance requirements for RedCAP UE operating in satellite service allocated bands in FR1. "

13 – Inmarsat

We have some concerns with RedCap UE for similar reasons as shared by Fujitsu.

If RedCap is specified, support for both 5 MHz and less-than-5 MHz should be included.

We don't think limiting to 1RX will help reduce the scope, and will have potentially significant impact on system capacity, therefore we think 2RX focus should be kept.

RAN1 work should be postponed for now, we should focus on RAN4 only.

14 – HUAWEI TECHNOLOGIES Co. Ltd.

With RAN4 requirement update, Redcap UEs without HD-FDD constraint can be made to support NTN. Then for Redcap UEs with HD-FDD constraint, we see no strong need to address specific RAN1 enhancement for it.

15 – Nokia France

It is valuable to enable RedCap UEs to support NTN.

The work should include RAN4 requirements.

The RAN1-led objectives should be studied to identify what needs to be done to facilitate NTN support on RedCap devices.

16 – Samsung Research America

Agree with Fujitsu. In general, it is premature for RAN to have a WI that includes support of RedCap for NTN.

3.9 High Power UE support with NTN

Proposed justification text:

Offer optimized performance addressing handset terminals with enhanced Tx power and antenna characteristics. Increasing the UE maximum transmit power will enable to improve UL performance in terms of coverage, availability and throughput performance, to meet the market demands associated with fixed wireless, public safety and automotive usage. However the transmission enhancement for NTN high power UE, e.g. duty cycle enhancement is subject to SAR restriction. Such higher power UE are not yet specified for NTN bands.

Feedback Form 19: Is the justification text acceptable?

1 – NTT DOCOMO INC.

OK for HP-UE.

Additional justification is necessary for Msg5 PUSCH repetition. For example,

"Besides, although UL coverage enhancements have been specified in R17 TN CovEnh WI and R18 NTN WI, 'Msg5' PUSCH coverage after Msg4 HARQ-ACK transmission is not enough due to non-support of repetition."

2 – THALES we agree with the proposed text from the moderator
3 – OQTEC We agree with the proposed text from the moderator.
4 – Fraunhofer IIS Unclear in the proposed text, if FR1 and/or FR2 are meant here in the text. => ”Increase the UE maximum transmit power in FR1 will enable...”.
5 – HUGHES Network Systems Ltd We agree with the proposed text from the moderator
6 – Airbus We agree with the proposed justification text
7 – China Mobile Group Device Co. Agree with the proposed text from the moderator
8 – NEC Corporation OK
9 – Guangdong OPPO Mobile Telecom. Yes
10 – Transsion Holdings Agree.
11 – Beijing Xiaomi Mobile Software We agree with the justification.
12 – Omnispace We agree
13 – NOVAMINT We agree with the proposed text from the moderator.
14 – CATT We agree with the proposed text from the moderator.

https://nwm-trial.etsi.org/#/documents/8746

15 – Inmarsat Agree with the proposed text.
16 – Ligado Networks We agree with the proposed text.
17 – Dell Technologies agree, we certainly support it.
18 – Samsung Research America Agree with the justification.

Proposed objective:

Support of High-Power UEs with PC2 (+26 dBm), PC1.5 (+29 dBm) and PC1 (+31 dBm) for NR NTN FR1 bands (i.e. n256, n255, n254 and Extended L-band (UL: 1668-1675 MHz, DL: 1518-1525 MHz) [RAN4]

- Note: PC1 and PC1.5 are not targeted for smartphones
- Update, if needed, coexistence analysis based on TR 38.863 defined methodology
- Specify RF and RRM aspects of the targeted UE
- Specify transmission enhancement for NTN high power UE, e.g. duty cycle enhancement subject to Specific Absorption Rate restriction [RAN1, RAN2]
- Study and specify if needed new power classes for VSAT antenna mounted on vehicle
- FFS: Whether Msg5/PUSCH repetition or legacy packet segmentation shall be defined (if not included in NR enh as part of Rel-19).
- FFS: Whether a study is required prior to normative work

Feedback Form 20: Is the objective acceptable? Can the objective be reduced to RAN4 only? Can the FFS points be removed?

1 – NTT DOCOMO INC. For HP-UE, we do not see any necessity on at least RAN1 efforts. For UL coverage, Msg5 PUSCH repetition is essential and legacy packet segmentation is not the solution since so many HARQ-based retransmissions will be needed and thereby the latency performance is never practical.
2 – THALES we agree with the proposed objective from the moderator. We prefer keep RAN1/2 work

FFS points can be removed

3 – Fujitsu Limited..

Fine with HPUE. For the SAR issue, our understanding is that the UE will anyway resolve the issue my using UE implementation approach (P-MPR). The duty cycle solution may unnnecessary elliminate the benefit of HPUE. At least, this scope should be ”study and specify, if necessary,”

Fine with including Msg5 PUSCH repetition.

4 – OQTEC

We agree with the proposed text from the moderator, we would like to see an emphasis on RAN1/RAN2 work. The FFS can be deprioritized or removed.

5 – Fraunhofer IIS

We support HPUE for FR1 to increase UL throughput, e.g. for automotive scenarios.

The LS by 5GAA in RP-232733 requests 26 dBm to be supported.

6 – HUGHES Network Systems Ltd

We agree with the proposed text from the moderator, but remove FFS

7 – Airbus

We agree with the proposed text. FFS point could be removed. As Fraunhofer IIS mentioned, it is important to take into account 5GAA LS (RP-232733)

8 – China Mobile Group Device Co.

Support RF requirements for PC2 NTN FR1 bands (n255 and n256) and IoT NTN bands (255 and 256)

9 – NEC Corporation

This should be limited to RAN4 only in Rel-19.

10 – Qualcomm Incorporated

We would like to remove the sentence “Note: PC1 and PC1.5 are not targeted for smartphones” since it imposes an unnecessary limitation on the applicability of this feature.

11 – Beijing Xiaomi Mobile Software

We prefer to reduce the objectives to RAN4 only.

12 – NOVAMINT

We agree with the proposed text from the moderator and removing FFS

13 – CATT

We would like to start from PC2.

Anyway, this topic could be left to RAN4 for further discussion in the next quarter.

14 – Inmarsat

We are ok with general text proposed by the Moderator.

- We think keeping PC2, PC1.5 and PC1 in scope at this point is important, and we agree with Qualcomm's comment that probably removing the note "Note: PC1 and PC1.5 are not targeted for smartphones" is better to avoid posing unnecessary restrictions prematurely. We don't have strong views on whether to keep it RAN4 only, but we think SAR/duty cycle issues must be addressed without relying on MPR, which defeats the link budget advantage, and we think some level of signalling will be required in RAN2, so maybe best to keep the RAN1/2 scope for now. Happy to further discuss.

- We think MSg5 PUCCH enhancement should be kept as some potentially significant gaps have been identified that may have been missed in Rel-18. This is the right opportunity to fix it.

One note, not directly covered in this summary, there is a typo in the summary regarding HPUE for automotive VSAT, the target EIRP values are not in dBm, but in dBW!

15 – Ligado Networks

We agree with the proposed text but would like to remove the note "Note: PC1 and PC1.5 are not targeted for smartphones"

16 – Nokia France

Yes, this is a RAN4 objective.

17 – Dell Technologies

yes

18 – Samsung Research America

Yes. It should be limited to RAN4 in Rel-19.

3.10 Miscellaneous proposals

No proposals are provided for the time-being, but companies are invited to provide their views on the other companies' proposals below.

https://nwm-trial.etsi.org/#/documents/8746

Feedback Form 21: Any comment/views on Rel-19 work on supporting bandwidth less than 5 MHz for NR NTN, including 3 MHz channel bandwidth in FR1, and better support of fragmented spectrum?

1 – NTT DOCOMO INC.

We do not see strong motivation. If needed, RAN4 spec impact may be considerable.

2 – THALES

This RAN4 centric item is also of interest. To limit scope, only the channel bandwidth defined for TN should be considered in the context of NTN

3 – Fujitsu Limited..

We are fine if the impact is limted to RAN4.

4 – Fraunhofer IIS

We agree with Thales. Supporting of less than 5 MHz for NTN is beneficial to support more deployment scenarios.

5 – HUGHES Network Systems Ltd

We agree this should be part of RAN4 Rel-19

6 – Airbus

Airbus agrees with this item. Considering the less than 5MHz bandwidth defined for TN could also help NTN to ease NR NTN deployments, as mentioned by Thales and Fraunhofer IIS

7 – Transsion Holdings

No strong view with this.

8 – NOVAMINT

We agree this should be part of RAN4 Rel-19 as it is important for verticals using NTN

9 – CATT

No strong view about this.

And we understand it's a RAN4 centric topic, to be further dissed and decided later.

10 – Inmarsat

We think this is a crucial item to help speeding up deployments of NR NTN.

Current Rel-18 TN spec should be the baseline, one key aspect that we should look at is to allow deployment of 12 PRB SSB/CORESET within a larger system/channel BW where other services may exist, to address spectrum fragmentation and give operators more flexibility.

Since some PBCH link budget may be degraded, if time available, we should consider techniques to recover PBCH performance loss.

11 – Inmarsat

We think this is a crucial item to help speeding up deployments of NR NTN.

Current Rel-18 TN spec should be the baseline, one key aspect that we should look at is to allow deployment of 12 PRB SSB/CORESET within a larger system/channel BW where other services may exist, to address spectrum fragmentation and give operators more flexibility.

Since some PBCH link budget may be degraded, if time available, we should consider techniques to recover PBCH performance loss.

12 – Inmarsat

We think this is a crucial item to help speeding up deployments of NR NTN.

Current Rel-18 TN spec should be the baseline, one key aspect that we should look at is to allow deployment of 12 PRB SSB/CORESET within a larger system/channel BW where other services may exist, to address spectrum fragmentation and give operators more flexibility.

Since some PBCH link budget may be degraded, if time available, we should consider techniques to recover PBCH performance loss.

13 – Ligado Networks

We agree with Inmarsat's comment above that this is crucial to enable faster deployment of NTN in existing satellite bands.

Feedback Form 22: Any comment/views on Rel-19 work on network-verified UE location with multiple satellites?

1 – NTT DOCOMO INC.

We do not see strong motivation

2 – THALES

We believe that the work associated to this, may be limited and could be handled via a TEI

3 – China Mobile Group Device Co.

Support MULTIPEL satellites for network verified UE location

In R18, regarding network verified UE location, we focus on single satellite and existing LCS framework for verification.

For R19, we could further consider multiple satellites case to purse more accurate UE positioning calculation considering the positioning inaccuracy issue due to long propagation delay in single satellite case of NTN system.

4 – Guangdong OPPO Mobile Telecom.

This topic is not urgent to be treated in R19. We understand that single satellite based network verified UE location can already provide accurate solution to address the issue.

5 – Lenovo (Beijing) Ltd

Lenovo:

Completing the multiple satellite makes sense and the expected work may be minimal based on simulation results of Rel-18 with some further check for possible enhancements.

6 – Transsion Holdings

No strong view with this.

7 – NOVAMINT

No urgency - a TEI should be possible

8 – CATT

UE location verification with multiple satellites in view should be easier than what we've done in Rel-18. Maybe the existing design could also be applied. The expected work is limited, it could be considered in TEI, if agreeable.

9 – Eutelsat Group

Agree with Thales / CATT (subject to scoping the work as suitable for TEI).

Feedback Form 23: Any comment/views on Rel-19 work on Flexible and Relaxed QoS (FRQ) to offer diverse services with suitable QoS via the NTN without increasing the number of 5Qis, where NTN QoS Parameter Value= X* TN QoS Parameter Value?

https://nwm-trial.etsi.org/#/documents/8746

1 – THALES May be this should be addressed first in SA2
2 – OQTEC Agree with Thales.
3 – Fraunhofer IIS Agree with Thales.
4 – Apple Distribution Intl Ltd This might be discussed in SA?
5 – Airbus Aligned with Thales comment
6 – NOVAMINT It may require alignment with SA2 first
7 – CATT Same view with Thales, this should be considered in SA2 first, RAN just make alignment if necessary.
8 – Samsung Research America Agree with Thales.

Feedback Form 24: Any comment/views on Rel-19 work/study on TE-emulated Channel Model for UE testing, and analysis required on OTA test methodologies for frequencies between 7 and 24 GHz (or at least Ka and Ku bands) on top of the assigned work for other features to be added to NR NTN domain?

1 – THALES We strongly support this RAN4 centric activity which is crucial for the certification of UE for both GSO/NGSO. Ideally the work could be carried out in coordination with Rel-19 new SID on Study on channel modelling enhancements for 7-24GHz for NR.
2 – HUGHES Network Systems Ltd Agree with Thales proposal.

https://nwm-trial.etsi.org/#/documents/8746

3 – Airbus

We think that this item is really important for UE certification.

4 – China Mobile Group Device Co.

Support work/study on TE-emulated Channel Model for UE testing

5 – NOVAMINT

This is indeed very important/critical to support this - similar should be done in IoT NTN

6 – CATT

For TE-emulated Channel Model for UE testing, we are fine to further study in Rel-19, but we think it should be limited to the frequencies that we have finished e.g., FR1 and Ka band.

7 – Inmarsat

We agree with this, we think it's going to be quite important. In terms of RAN4 items, there will also be some work to be done in capturing ETSI/ECC/CEPT requirements in the NTN band specifications, since for now this has not been fully addressed in the individual band specifications.

This has been already discussed in RAN4 new band work items.

3.11 Last question: check consistency of the moderator's summary

If any of the companies' views are incorrectly captured (sorry if that is the case), please indicate it below and I will correct it in a revision of this document.

Feedback Form 25: Does any view represented in section 2 of RP-233107 need to be corrected?

1 – NTT DOCOMO INC.

For the beginning part of the object section, "implicit compatibility to support HAPS and ATG scenarios" should be captured as in R17/18 NR NTN WID. We do not see any reason to remove from R19 NR NTN WID.

2 – THALES

It seems that the question "Question: Please provide your views on the necessity of additional optimizations for NR MBS over NTN: HARQ-ACK Feedback Management for NTN MBS, Packet level service continuity (lossless mobility), management of PTP-PTM switch for NTN MBS, Management RRC Inactive/RRC Idle in MBS NTN." has not been captured under MBS/Broadcast.

In response to this question, we would recommend to consider in priority broadcast service over NTN and therefore the study of possible NR/NG-RAN impact related to "Packet level service continuity (lossless mobility)" should be added

Multicast could be considered and therefore the following additional topics could also be studied and if needed specified:

1) HARQ-ACK Feedback Management for NTN MBS

2) Management RRC Inactive/RRC Idle in MBS NTN

3) Management of PTP-PTM switch for NTN MBS

3 – SES S.A.

As mentioned by Thales, the question "Please provide your views on the necessity of additional optimizations for NR MBS over NTN: HARQ-ACK Feedback Management for NTN MBS. Packet Level service continuity (lossless mobility) management of PTP-PTM switch for NTN MBS, Management RRC Inactive/RRC Idle in MBS NTN" has not been captured under the section MBS/broadcast via NTN.

Our view is the following: We shall take advantage from the satellite transmission where the coverage over geographical area is quite large compared to TN to address multicast/broadcast services.

How the procedures are defined today are more adapted for TN use cases and not optimal for NTN. In the sense, that if we want to offer a multicast service to a group of multicast/broadcast UE within a beam, it is worth to save resources as much as possible where the switch between different mode (HARQ Feedback Mode, PTP-PTM switch mostly after handover for service continuity, RRC States) can be well controlled (taking advantage of the predictability movement of the satellite even the predictability of the environment being covered: for e.g. dense forest) avoiding ping pong events and unnecessary switching.

This can be well-controlled by using one of these 2 options depending on the use case:

- Network assistance by RRC with the triggering events (UE Location, Time of cell service, RSRP Threshold) and the switching can be initiated by the UE via a MAC CE then it is up to network to decide
- UE assistance by reporting in a secured way its location to the network, the network digest these informations with other informations (environment, antenna gain) and takes the decision to switch to the appropriate mode. The switching is initiated by the network.

4 – HUGHES Network Systems Ltd

Support Thales and SES's views

5 – Qualcomm Incorporated

In 2.3, we do not want to define sub-PRB due to emission issues. However, intra-symbol OCC may be seen as a way to implement a comb structure, which we do support.

6 – NOVAMINT

We agree with SES and Thales

https://nwm-trial.etsi.org/#/documents/8746

7 – Inmarsat

Many thanks to the Moderator for the very detailed summary, it's generally quite accurate, just a few minor comments:

1) Under HPUE discussion, we think there is a typo in the VSAT HPUE proposals for automotive, the EIRP values are not in dBm, they are in dBW (significant difference).

2) For Uplink Capacity Enhancements: We are not fully clear with this sentence "Given the situation and the limited TU budget allocation for RAN1 work on this item, it is suggested to focus the discussion on whether OCC for DFT-s-OFDM PUSCH could in the scope for Rel-19.". We think the general common views are that OCC or in general code-domain multiplexing should be addressed as a minimum. The way the sentence is worded makes it seem that is the controversial item.

3) We support the comments by Thales and SES on MBS, we also think in general some minor enhancements to timers might be needed to deal with increased RTT and satellite movement for Multicast in particular.