97e-22-R18-NR-NTN - Version 0.0.3
RAN

3GPP TSG RAN Meeting #97-e

RP-222582

Electronic Meeting, September 12 - 16, 2022

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

Source: Thales (moderator)

Title: Moderator's summary of discussion [97e-22-R18-NR-NTN]

Document Type: Report

Document for: Information & Decision

The discussion in this thread covers the topic # [97e-22-R18-NR-NTN]

We should focus on concluding the study phase on coverage enhancement for NTN and getting a consolidated revision of the WID for approval by the end of the email discussion period.

Deadlines and NWM organization is based on the guidelines provided by the RAN Chair in its mail "[97e-01-Organizational] Set of email threads » of 8th September 2022.

1 Initial round

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

- RP-222081 discussion Discussion on NR NTN coverage enhancement LG Electronics Polska
- RP-222096 discussion Discussion on Rel-18 NTN Coverage enhancement Beijing Xiaomi Mobile Software
- RP-222151 discussion Discussions on NR NTN coverage enhancements vivo
- RP-222206 discussion Views on NTN coverage enhancements Qualcomm Incorporated
- RP-222234 discussion On the work scope of Rel-18 NR NTN enhancements Samsung
- RP-222254 discussion Discussion on coverage enhancement for Rel-18 NR NTN NTT DOCOMO, INC.
- RP-222301 discussion Discussion on direction for NTN enhancement SK Telecom
- RP-222305 discussion On the need for NTN-specific coverage enhancements in Rel-18 Ericsson
- RP-222316 discussion Views on the coverage enhancements in Rel-18 for non-terrestrial networks Huawei, HiSilicon

- RP-222319 discussion Coverage enhancements for NTN THALES
- RP-222342 discussion Discussion on potential scope for Rel-18 NR NTN Coverage Enhancements MediaTek Inc.
- RP-222439 discussion Discusssion on NR-NTN in Rel-18 ZTE, Sanechips
- RP-222485 discussion Discussion on Rel-18 NR NTN Coverage Enhancement Apple Inc., Lockheed Martin, Inmarsat, OPPO

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

1.1 Collection of company views

1.1.1 Coverage enhancements - reference scenario

Companies should provide comments in the each associated feedback forms.

Proposal 1.1.1/ The following reference scenario is considered for the definition of coverage enhancements for NTN: parameter set-1 for LEO-1200 satellite operating at Line of Sight (LOS) and commercial smartphones with -5dBi antenna gain and 3 dB polarisation loss. It is assumed that potential enhancements for LEO can also apply to GEO and MEO.

The targeted services are VoIP using AMR 4.75 kbps and Low data rate of 3 kbps

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

Feedback Form 1: Cov enh reference scenario

1 – NTT DOCOMO INC. [DCM] OK. Although RAN4 agreed UE antenna gain as '-5.5dBi', observation/conclusion would not be changed.
2 – Guangdong OPPO Mobile Telecom. We agree. We are also fine to use -5.5dBi as a target antenna gain to take into account RAN4's feedback.
3 – LG Electronics France [LGE] We are fine with the proposal

4 – ZTE Corporation

It seems that the intention of this proposal is to conclude the target scenario for coverage enhancement, if so, we are fine to take the LEO-1200 set-2 as the baseline with proper assumption on UE antenna gain, polarization, and corresponding traffic assumption.

Regarding the last sentence, we are confused about the intention since based on RAN1's discussion, a much larger performance gain is expected for MEO and GEO cases. It means that with the applied solution, the service via MEO and GEO is not available. However, by the current description, it seems that we may still need to work on the enhancement for these cases and also conduct the RAN4-related works. So, we prefer to remove it.

5 – T-Mobile USA Inc.

no objection

6 – vivo Communication Technology

Ok, although RAN4 agreed to assume -5.5dBi as the antenna gain. 0.5dB difference would not change the conclusions already made in last RAN1 meeting.

7 – CATT

We support this proposal.

8 – Lockheed Martin

We support this proposal.

9 – Apple GmbH

We have one clarification question here. Whether the satellite EIRP density in parameter set 1 is per satellite or per satellite beam? If it is per satellite beam, then we think it needs to be re-checked. In our view, if a satellite serves multiple beams simultaneously, then its power is split and the satellite EIRP density per beam is smaller than 40 dBW/MHz for LEO-1200.

10 – Panasonic Corporation

We agree as it is aligned with RAN1 agreement. One point we may need to clarify is whether the 3dB polarization loss can be recovered by antenna combining (i.e. 2Rx) at the network.

11 – InterDigital

We support the proposal

12 – Beijing Xiaomi Mobile Software

Support, although RAN4 agreed antenna gain as -5.5dBi, the 0.5dB difference does not change RAN1's observations and conclusions.

13 – HUGHES Network Systems Ltd

We support the proposal

14 – Ligado Networks

We would like to modify the note "***It is assumed that potential enhancements for LEO can also apply to GEO and MEO"*** *to* ***"All potential enhancements shall also be applicable to MEO and GEO scenarios."***

15 – HUAWEI TECHNOLOGIES Co. Ltd.

Agree with the proposal. The scenario is agreed in RAN1 and it would be good to update the WID with description of the targeting scenario, as proposed. We are also fine to use -5.5dBi antenna gain as indicated in the RAN4 LS.

16 – Classon Consulting

[for FUTUREWEI] ok

17 – MediaTek Inc.

We support the proposal. It is fine to use -5.5 dBi antenna as it was agreed in RAN4.

18 – NOVAMINT

We support the proposal

19 – Intel Corporation SAS

We are fine with the proposal. Also, -5.5 dBi antenna gain can be used according to RAN4.

20 – TURKCELL

We support the proposal. We can use a -5.5 dBi antenna as was agreed in RAN4.

21 – Spreadtrum Communications

We support the proposal.

22 – ESA

We support the proposal.

23 – Nokia France

We support this proposal. Regarding Apple's question, Table 6.1.1.1-1 in 38.821 is clear that "All these satellite parameters are applied per beam"; we do not see any need to revisit the parameters agreed in 38.821.

24 – THALES

We are supportive of the proposal. We suggest to adopt the -5.5 dBi antenna gain as suggested by RAN4

We propose to clarify that 3 dB polarisation loss is due to the assumption of 1 Rx antenna on board

We propose to replace "***It is assumed that potential enhancements for LEO can also apply to GEO and MEO.***" by "***Note: The enhancements defined for LEO may also apply to GEO and MEO scenarios as appropriate.***"

We propose to clarify the sentence as follow "***The targeted services are VoIP using AMR 4.75 kbps and data transmission services with Low data rate of 3 kbps"***

25 – Lenovo (Beijing) Ltd

Lenovo:

We support the proposal. Although RAN4 feedback is -5.5dBi, we don't think it will change RAN1 conclusion.

26 – Samsung Electronics Romania

Although we are fine with this proposal, we think that this proposal is already captured as part of RAN1 agreements/conclusions.

27 – Baicells Technologies Co. Ltd

We support the proposal. It is agreed by RAN1.

28 – Baicells Technologies Co. Ltd

We support the proposal. It is agreed by RAN1.

29 – Baicells Technologies Co. Ltd

We support the proposal. It is agreed by RAN1.

30 – Baicells Technologies Co. Ltd

We support the proposal. It is agreed by RAN1.

31 – Inmarsat

We agree with the proposal, but as other companies have suggested:

- we propose to use -5.5 dBi antenna gain as identified by RAN4

- we agree with Panasonic's view that the possibility of using 2RX H+V polarization combining to compensate the 3dB polarization loss should be considered

- we also propose to adopt Ligado's proposed alternative wording: "***All potential enhancements shall also be applicable to MEO and GEO scenarios."*** since it should be clear that coverage enhancements are not orbit-specific and are in fact applicable to all orbits including GEO, even though LEO-1200 Set 1 is used as a reference scenario.

32 – Ericsson LM The UE antenna gain of -5 dBi should be aligned with the recommended value from RAN4 of -5.5 dBi (see reply LS R4-2214968). The VoNR AMR 4.75 data rate will exceed 3 kbps with margin, so we suggest to drop the low data rate from the list of targeted services.
33 – Sony Europe B.V. Basically fine with the proposal. However, we have similar understanding as Panasonic that the 3dB polarization can be considered to be enhanced by having dual polarized antenna combining.
34 – Eutelsat S.A. OK with the proposal, suggest to amend the UE antenna gain to -5.5 dBi I.A.W. RAN4. .

1.1.2 Coverage enhancements - objectives

Companies should provide comments in the each associated feedback forms.

Proposal 1.2.1/ The objectives are to specify for NTN:

• enhancements to PUCCH for Msg4 HARQ-ACK enhancements [RAN1, RAN4]

• to enable DMRS bundling for PUSCH with VoIP [RAN1]

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

Feedback Form 2: Cov enh objectives - 1

1 – NTT DOCOMO INC. [DCM] OK for PUCCH of Msg4 HARQ-ACK. For PUSCH with VoIP, our understanding is that we firstly need to see exact issue of DMRS bundling in NTN and whether enhancement is necessary. Then, if necessary, enhancement can be specified. In that sense, ’to specify’ should be updated as ’to study’ for DMRS bundling in this stage.
2 – Guangdong OPPO Mobile Telecom. agree with the proposal. We think the wording ’to enable’ already resolves Docomo’s concern. It naturally

requests working group to study if the current specification can enable the functioning of DMRS bundling. Thus, we think the proposed wording is fine.

3 – LG Electronics France

[LGE] We agree with enhancing Msg4 PUCCH. For DM-RS bundling for VoIP, we think the necessity is not proven sufficiently at this stage.

4 – ZTE Corporation

We are fine with the PUCCH for Msg-4 since it's RAN1's consensus. For the PUSCH with VoIP, in our view, it's also necessary to check the feasibility and performance of DM-RS bundling considering the lower SINR and time-variant channel, also the impacts of pre-compensation.

5 – T-Mobile USA Inc.

We agree

6 – vivo Communication Technology

Support the proposal

7 – CATT

Support PUCCH enhancement for Msg-4.

For DMRS bundling, we share same view with other companies. Using "study" rather than "specify" in this stage is preferred.

8 – Apple GmbH

We think this proposal is related to other proposals below. Right now, without any observations and conclusions on downlink channels, it is too early to finalize only the uplink channels to be enhanced for coverage.

For the sake of progress, we can only accept the enhancement of PUCCH enhancements for Msg 4 since it seems to have least objection.

9 – Lockheed Martin

We agree with Apple

10 – Qualcomm Incorporated

For PUCCH, we are OK.

For PUSCH, as discussed in the RAN1 meeting and in the RAN GTW call, RAN1/RAN4 need to work on the specific details on how DMRS bundling and time-frequency pre-compensation work together. For instance, in NTN IOT the time-frequency precompensation loop is "frozen" during a segment, but another option would be to do continuous correction.

Therefore, we would propose to adjust the wording as **Specify DMRS bundling for PUSCH with time-frequency pre-compensation [RAN1,RAN4]**

11 – Panasonic Corporation

On Msg4 PUCCH, we agree. As an editorial modification, the second "enhancement" in the first bullet should be removed. "***enhancements to PUCCH for Msg4 HARQ-ACK ~~enhancements~~ [RAN1, RAN4]***"

On PUSCH with VoIP, DMRS bundling is already possible in Rel.17. The issue would be how many bundled slots (time domain window) can be feasible in NTN LEO scenarios considering the time and frequency pre-compensation.

12 – Samsung Electronics Co.

(As RAN1 Chair)

I would like to remind everyone that Rel-18 NR-NTN is a 0.5 TU work item. We need to seriously consider this aspect. While I understand that some companies prefer to have a larger scope for NTN coverage enhancement, I think we need to be practical. The scope should be focused enough so that we can be confident of completing the WI in the next 12 months (6 RAN1 meetings).

13 – Beijing Xiaomi Mobile Software

Support this proposal.

14 – InterDigital

Support the proposal

15 – HUGHES Network Systems Ltd

We support PUCCH enhancement for Msg-4.

For DMRS bundling, using "study" rather than "specify" at this stage is preferred.

16 – HUAWEI TECHNOLOGIES Co. Ltd.

Support the proposal in general. Just some revision to make it clearer and more focus

The objectives are ~~to specify~~ for NTN:

- **To specify coverage** enhancements to PUCCH for Msg4 HARQ-ACK ~~enhancements~~, e.g. repetition of PUCCH format 1 [RAN1, RAN4]

- **To study, if beneficial for coverage, specify~~to enable~~ NTN-specific** DMRS bundling for PUSCH with VoIP [RAN1]

17 – Classon Consulting

[for FUTUREWEI] ok, but if only one of these will fit then prefer PUCCH for Msg 4 HARQ-ACK

18 – MediaTek Inc.

Support proposal. DM-RS bundling for PUSCH is already supported in Rel-17. For NR-NTN, some enhancements for DM RS bundling may be needed when using it with time-and-frequency pre-compensation . DM RS bundling will improve significantly channel estimation at low SNR.

19 – NOVAMINT

We support the proposal in general. We support the suggestion from Huawei and revision as a way forward

20 – Intel Corporation SAS

We agree enhancements to both enhancements PUCCH for Msg4 HARQ-ACK and PUSCH for VoIP are to be specified. Thus, we agree the proposal.

21 – TURKCELL

We agree with Qualcomm

22 – ESA

We support the initial proposal. To compromise, Huawei revision is fine.

23 – Nokia France

We support the first bullet. The second bullet needs further study first.

The proposal from Huawei is therefore good for us, with the addition of a missing ”and” in the second bullet:

The objectives are ~~to specify~~ for NTN:

- **To specify coverage** enhancements to PUCCH for Msg4 HARQ-ACK ~~enhancements~~, e.g. repetition of PUCCH format 1 [RAN1, RAN4]

- **To study, and, if beneficial for coverage, specify~~to enable~~ NTN-specific** DMRS bundling for PUSCH with VoIP [RAN1]

24 – THALES

We agree with the proposal. We propose to clarify the objectives wrt uplink channels as follow:

The objectives are ~~to specify for NTN~~:

- ***to specify enhancements to PUCCH for Msg4 HARQ-ACK enhancements [RAN1, RAN4]***
- ***to enable DMRS bundling for PUSCH with time-frequency pre-compensation~~VoIP~~ [RAN1]***

25 – Lenovo (Beijing) Ltd

Lenovo:

We are fine with the first bullet. For the second bullet, we prefer Qualcomm's version with time-frequency pre-compensation.

26 – Samsung Electronics Romania

On the second bullet, we think that applicability of Rel-17 DM-RS bundling feature to NTN scenario needs to be checked before considering to specify something. We suggest to rephrase the proposal as "Support Rel-17 DM-RS bundling feature for NTN scenario, and specify necessary changes, if any identified".

27 – Baicells Technologies Co. Ltd

Support PUCCH enhancement for Msg-4. DMRS bundling for PUSCH with VoIP can be further studied.

28 – Inmarsat

We are ok with the proposals.

29 – Ericsson LM

We are fine with these two objectives. The scope of enhancements to PUCCH for Msg.4 HARQ-ACK should be limited to enabling PUCCH repetitions for this case.

30 – Sony Europe B.V.

Support the proposal

We also support the update from Nokia:

The objectives are ~~to specify~~ for NTN:

- **To specify coverage** enhancements to PUCCH for Msg4 HARQ-ACK ~~enhancements~~, e.g. repetition of PUCCH format 1 [RAN1, RAN4]

- **To study, and, if beneficial for coverage, specify~~to enable~~ NTN-specific** DMRS bundling for PUSCH with VoIP [RAN1]

31 – Eutelsat S.A.

Agree with Thales suggested text.

32 – TTP plc

Support the proposal

Proposal 1.2.2/ Coverage enhancements for PRACH format B4 should be discussed as part of the NR coverage enhancement WI by considering NTN reference scenario and other specifics (i.e. 15kHz SCS,

NTN-TDL-C channel model in TR 38.811 and SNR target of -18.4dB)

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

Feedback Form 3: Cov enh objectives - 2

1 – NTT DOCOMO INC. [DCM] OK with this direction. The WI should handle PRACH and we (NR NTN WI) should avoid discussion on the overlapped topic.
2 – Guangdong OPPO Mobile Telecom. In last RAN1 meeting, there were discussions on the number of received antenna assumption. It is important to let NR coverage enhancement WI group know what the assumption is, e.g. whether 2 Rx antennas or 1 Rx antenna.
3 – LG Electronics France [LGE] We agree PRACH enhancement should be within general coverage enhancement item.
4 – ZTE Corporation Regarding the PRACH enhancement, it's still preferred by us to conduct the discussion in NTN WI considering the different scenarios and assumptions. For example, due to the changes of channel and pre-compensation for UL transmission, it's not proper to enable the RACH detection via the combination cross multiple transmission, and it will lead to unnecessary restriction or over-design for TN network.
5 – T-Mobile USA Inc. We agree this should be in coverage
6 – vivo Communication Technology These details can be discussed in RAN1 later when PRACH repetition is specified in Rel-18 coverage enhancement topic, there's no need in RAN plenary to define the target SNR to determine maximum number of repetitions for NTN now.
7 – CATT Generally it is ok for us. But the NTN specific issue should be addressed, for example, fast variation of timing and frequency within multiple repetitions in LEO case. In addition, exact SNR target is not proper to define it.
8 – Apple GmbH Before discussing the coverage enhancements for PRACH format B4 in NTN, we need to see the necessity of enhancing it. Based on RAN1 observation, majority companies think PRACH format 2 can meet the performance requirement. Considering that, the necessity of enhancing PRACH format B4 is unclear.

On the other hand, we think the potential enhancement on PRACH format B4 in NR coverage enhancement WI can also apply to NR NTN scenario.

9 – Lockheed Martin

We believe PRACH should be considered, it is acceptable to consider PRACH format B4 in the NR coverage enhancement WI.

10 – Qualcomm Incorporated

We agree that PRACH enhancements should be done in the general coverage enhancement work item. Regarding the format, we think it should not be restricted to B4, since the other formats have a very small margin (or cannot meet the requirements, depending on the company simulation assumptions)

11 – Panasonic Corporation

We agree.

12 – Beijing Xiaomi Mobile Software

To avoid overlapping with Coverage enhancement WI, we are okay with this proposal.

13 – HUGHES Network Systems Ltd

We agree that PRACH enhancements should be done in the NR coverage enhancement work item

14 – China Telecomunication Corp.

We agree that PRACH enhancement should be handled in NR coverage enhancement WI to avoid overlapping discussion. We think the simulation assumptions should be determined fisrt. We don't think it is a good way to discuss the simulation assumptions during the NR coverage enhancment WI considering the limited TU.

15 – HUAWEI TECHNOLOGIES Co. Ltd.

It is observed in RAN1 that For "PRACH format B4 with parameter set-1 for LEO-1200 operating at LOS, ten sources observed that the existing specification cannot meet the performance requirement". At the same time, short PRACH format (most likely format B4) will be enhanced in Rel-18 coverage enhancement work item. In order to avoid parallel discussion in two work items and also to maximize the value of one work, (as one of the proponents) we agree with the proposal to update Rel-18 coverage enhancement WID, taking NTN coverage enhancement requirements for PRACH format B4 into account.

16 – Classon Consulting

[for FUTUREWEI] ok

17 – MediaTek Inc.

Support proposal. RACH enhancements can first be discussed in the further NR coverage enhancements WI

18 – Intel Corporation SAS

We agree with the proposal.

19 – TURKCELL

We support PRACH enhancement.

20 – ESA

We support PRACH format B4 enhancements. We agree to not duplicate the work and this can be discussed in the NR coverage enhancements WI.

21 – Nokia France

PRACH enhancements should proceed in the coverage enhancements WI.When the Coverage Enhancements WI has completed its work on PRACH, the PRACH can be reviewed again for NTN-specific scenarios.

22 – THALES

We support this proposal.

We would suggest that as part of NR coverage enhancement WI which is already considering enhancements for PRACH, a complementary normative work be carried out to take into account NTN specifics.

In terms of PRACH enhancements, we recommend that both PRACH short format B4 and PRACH format 0 (as the coverage gap is around 2dB) be considered

We therefore propose the following revision of the proposal: "***Coverage enhancements for PRACH format B4 and PRACH format 0 should be discussed as part of the NR coverage enhancement WI by considering NTN reference scenario and other NTN specifics as agreed in RAN1#109-e under AI 9.12.1.***"

23 – Lenovo (Beijing) Ltd

Lenovo:

We agree that PRACH enhancement should be considered and overlap with NR coverage enhancement should be avoided.

24 – Samsung Electronics Romania

Since RAN1 has observed that PRACH format 2 is feasible solution in NTN, there is no need to consider other PRACH formats.

25 – Baicells Technologies Co. Ltd

We agree.

26 – Ericsson LM Considering that RAN1 has observed that PRACH format 2 can meet the performance requirements, we see no need for coverage enhancement of PRACH format B4 for NTN purposes. The coverage enhancement work item already considers enhancements to short PRACH formats, but since these enhancements will be generally available, there is no need to have NTN specific requirements.
27 – Inmarsat We agree with the proposal and ideally we should feed the NTN requirements in the main NR Coverage Enhancements WI to avoid duplication of effort.
28 – NOVAMINT We agree with the proposal.
29 – Sony Europe B.V. Support the proposal. However, is ”i.e.” correct at the end? Are these really the only other specifics that should be considered?? It seems like ”e.g.” would be better than ”i.e.”
30 – TTP plc Agree with the proposal

Proposal 1.2.3/ Without satellite transmit power reduction, there is no need for DL coverage enhancement

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

Feedback Form 4: Cov enh objectives - 3

1 – NTT DOCOMO INC. [DCM] OK for us (though we can guess that only ’without’ might be not OK from some companies).
2 – Guangdong OPPO Mobile Telecom. this proposal may not be needed as the controversial part is whether Tx power reduction should be considered or not. We can focus on the proposal 1.2.4
3 – LG Electronics France [LGE] We agree with the proposal

4 – ZTE Corporation

Based on the current assumption on the satellite's parameter, e.g., fixed EIRP regardless of the supported bandwidth, we are fine with this proposal.

5 – vivo Communication Technology

This is should be the observation from RAN1 study

6 – CATT

It is fine to us.

7 – Apple GmbH

We think this proposal should be discussed together with Proposal 1.1.1. We still have question about the satellite EIRP density value.

8 – Lockheed Martin

We believe it is too early to conclude that there is no need for DL coverage enhancement.

9 – Qualcomm Incorporated

We think this is consistent with the RAN1 observations.

10 – Beijing Xiaomi Mobile Software

Support this proposal.

11 – HUAWEI TECHNOLOGIES Co. Ltd.

Agree, according company contributions in RAN1#110. This proposal can also be discussed together with Proposal 1.2.4.

12 – MediaTek Inc.

Support proposal. This is consistent with evaluation of DL coverage enhancement in RAN1 based on Set 1 and Set 2 parameters in TR 38.821.

13 – Panasonic Corporation

Agree with the proposal.

14 – ESA

We agree and it's consistent with the RAN1 simulations/observations.

15 – Nokia France

OK

16 – THALES

Agree

17 – Lenovo (Beijing) Ltd

Lenovo:

Fine with the proposal.

18 – Lenovo (Beijing) Ltd

Lenovo:

Fine with the proposal.

19 – Samsung Electronics Romania

Although we are fine with this proposal, we think that this is already captured as part of RAN1 conclusions.

20 – Baicells Technologies Co. Ltd

Agree

21 – Ericsson LM

Agree

22 – TURKCELL

We agree with the proposal.

23 – Inmarsat

Isn't this conclusion specific to the LEO-1200 Set1 parameter set? It should be made clear that it is the case.

We should not give the impression that this applies to all parameter sets.

24 – NOVAMINT

We agree with the proposal. ok with point made by Inmarsat

25 – Sony Europe B.V.

Agree. This would be in-line with the observations from RAN1.

26 – Ligado Networks

There is still benefit to DL enhancement even without power reduction, to compensate for (e.g.) body loss and user pointing error.

27 – Eutelsat S.A.

Agree - in line with RAN1.

28 – TTP plc

This should be limited to a specific case i.e. LEO 1200 Km

Proposal 1.2.4/ Coverage enhancements for DL physical channels should be.

Option A/ deprioritized in Rel-18

Option B/ further studied until RAN#98-e as part of Rel-18 for selected physical channels(e.g. at least PDCCH and PDSCH for Msg2/Msg4) provided that a clear guidance is defined on the maximum power reduction to be considered

Option C/ else

You are expected below to select the appropriate option (with comments/suggestions) with respect to the above proposal

Feedback Form 5: Cov enh objectives - 4

1 – NTT DOCOMO INC.

[DCM] Important thing from our perspective is to conclude this topic (whether power reduction is considered or not) at this RAN plenary meeting since the conclusion is independent to WG-level observation. Further WG-level discussion is meaningless. From this perspective, Option B is quite unclear; conclude that power reduction is considered? the conclusion is pending till RAN98? If the 2nd one is the intention, we never agree the direction.

Considering that the allocated TU is not large and NW verified UE location would be a large topic, Option A might be reasonable as the conclusion.

2 – Guangdong OPPO Mobile Telecom.

Technically speaking, RAN1 has not officially provided input on the DL coverage performance evaluation due to the blocking issue whether the Tx power reduction is applied and how to apply it. Thus, RAN plenary should rather focus on the guidance to let WG to complete the previously assigned task. For this reason, we

suggest that the discussion can focus on whether and how the power reduction is applied. Regarding how to apply power reduction, Xiaomi has provided different options in their contribution RP-222096 and this can be used for further discussion. Once the guideline is clear, WG can straightforwardly draw conclusions and RAN plenary can decide to update the WID scope in RANP#98 meeting.

With the above reasoning, we suggest a revised proposal:

[REVISED-OPPO] Proposal 1.2.4/ WG to provide DL coverage evaluation until RAN Plenary#98 meeting by,

Option A: without considering Tx power reduction

Option B: Considering Tx power reduction with respect to

- ***option 1: ITU regulation - Table 5-2 (Rev.WRC-19)***
- ***option 2: ITU regulation - Table 21-4 (Rev.WRC-19)***
- ***option 3: ITU regulation - Annex to Resolution 212 (Rev.WRC-19)***

Note: down selection among option A and Option B should be down in RAN plenary#97

3 – ZTE Corporation

Before we have further discussion on this proposal, it's more important to align the views on PFD (power flux density) for satellites based on ITU regulatory assumptions since different understandings and positions are shared by companies on this aspect. (BTW: It should be the PFD instead of power reduction since there are many aspects including implementation for the latter one)

So, the following revised proposal is more preferred:

[REVISED-ZTE] Proposal 1.2.4 RAN#97 concludes that:

Option A: The impact of PFD is not considered for NR-NTN in Rel-18

Option B: One of the following assumptions of PFD is considered for NR-NTN in Rel-18 with down-selection in RAN#97

- ***option 1: ITU regulation - Table 5-2 (Rev.WRC-19)***
- ***option 2: ITU regulation - Table 21-4 (Rev.WRC-19)***
- ***option 3: ITU regulation - Annex to Resolution 212 (Rev.WRC-19)***

  Note: If it's failed to down-select it in this meeting, an LS to ITU-R is preferred for clarification.

4 – CATT

Based on RAN1 discussion, option A is preferred.

Regarding the ITU regulation, currently no clear consensus is reached. And more importantly, the complete evaluation of DL channel and detailed discussion of enhanced schemes will need more TUs than expectation. It is hard to finish it with Rel-18 timeline.

5 – Apple GmbH

We support Option B and have strong concern on Option A.

RAN1 has not discussed extensively on the amount of DL power reduction, and hence we think it is unfair that DL physical channels coverage enhancement is deprioritized in Rel-18 at this moment. In case of the lack of the quantity of DL power reduction, we should continue to discuss it either in this RAN plenary meeting or potentially in the following RAN1 meeting(s).

6 – Lockheed Martin

We do not believe that PFD and power reduction are mutually exclusive. Downlink power reduction should be considered for coverage enhancement.

7 – Apple GmbH

To avoid any ambiguity and controversial discussions on PFD limitation, we think RAN1 discussion should focus on the downlink transmit power reduction due to power split among multiple satellite beams or cells. Below is our potential proposal for the group to consider:

Considering a possible downlink power reduction, for example, due to power split between multiple beams or cells, coverage enhancements for DL physical channels should be further studied until RAN#98-e as part of Rel-18 for selected physical channels (e.g. PDCCH and PDSCH for Msg2/Msg4)

Note: existing SSB design is not expected to be impacted

8 – Qualcomm Incorporated

Before concluding anything, it would be important for RAN plenary to conclude on the amount of power reduction RAN1 should consider. Based on this limit, RAN1 could finalize the observations.

Note that this process would essentially mean extending the study phase, so we would also be OK with down prioritizing DL coverage in this release.

9 – Beijing Xiaomi Mobile Software

From our perspective, the PFD issue, i.e., whether and how PFD is applied in NTN should be clarified in RAN#97 meeting. For the power reduction for DL due to other aspects, e.g., multi-beam deployment can be further studied.

10 – vivo Communication Technology

We are open to discuss multiple satellite beams or cells, considered in the typical deployments, satellite operators can clarify whether power is split or not, including what is the typical number of beams or cells can be transmitted simultaneously, which may depend on antenna/PA architecture.

11 – HUGHES Network Systems Ltd

We are open to discuss DL enhancement due to power reduction as a results of multiple satellite beams/cells in a typical deployment.

Need to first clarify EIRP density in Set 1 and Set 2 parameter of Table 6.1.1.1-1 and 6.1.1.1-2 if it refers to per satellite or per beam. In NOTE 3: All these satellite parameters are applied per beam).

We are also open to discuss DL enhancement due to other impairments or issues.

12 – HUGHES Network Systems Ltd

RAN1 should not associate possible power reductions or impairments with PFD limit based on ITU regulations

13 – Ligado Networks

We support Option C. There is significant value and need to enhance the DL as well as the UL.

14 – Classon Consulting

[for FUTUREWEI] open to B, but if not then A.

15 – HUAWEI TECHNOLOGIES Co. Ltd.

Option C discuss and conclude in RAN#97e: If companies can discuss and reach a common understanding regarding the needed power reduction (due to PFD or due to Tx power split) in RAN#97e, then RAN may be able to conclude which downlink channel(s) need enhancements, together with simulation results submitted to RAN1#110. We suggest to try with this direction.

16 – MediaTek Inc.

Option A. We are also fine with Option C proposed by Huawei. We also share HUGUES view that RAN1 should not associate possible power reductions or impairments with PFD limit based on ITU regulations. We have same understanding on the Set 1 and Set with ”NOTE 3 All these satellite parameters are applied per beam” in TR 38.821.

17 – Nokia France

We agree with Qualcomm that it is not possible to continue discussions on DL coverage enhancement in RAN1 without agreement on any level of power reduction to be considered. It seems that there is now consensus that regulatory PFD reductions will not be considered. We also do not see it being possible to agree on a power reduction value arising from splitting power among multiple beams, as this is purely an implementation matter; moreover, it is an addition to the existing WI, and we understood that additions would not be treated at RAN#97e. Therefore it seems that the only feasible course for Rel-18 is not to give further consideration to the downlink in this work item.

18 – THALES

We support the extension of a study phase for DL channels enhancements (e.g. PDCCH and PDSCH for Msg2/Msg4) to take into account possible usage of downlink power, for example, due to power split between multiple beams or cells. In any case, we recommend that the downlink power scenarios prevent the need to revise the SSB design (This gives a boundary on the DL power to be taken into account compared to the targeted reference scenarios).

19 – Lenovo (Beijing) Ltd

Lenovo:

We are fine the study the issue and impact of multiple satellite beams including whether there is power split.

20 – Samsung Electronics Romania

We are open to further study the impact of power reduction on DL channel coverage once the power reduction requirements are well understood. This can be done in a next release. Thus, we prefer Option A.

21 – Baicells Technologies Co. Ltd

The key issue is whether and how PFD is applied. We prefer Option B.

22 – Ericsson LM

We support option A. The PFD reduction is agreed by ITU-R as a last resort to avoid or reduce interference towards terrestrial networks. To enhance the DL coverage under these circumstances is likely to contradict the intention of the PFD reduction, and instead increase interference to neighboring terrestrial networks. Without further justification we cannot agree to option B.

23 – TURKCELL

Before the decision on Option A or Option B, we need to consider the amount of power reduction in RAN1.

24 – Inmarsat

B, regardless of power reduction, DL coverage enhancements are likely needed for other scenarios outside of LEO-1200 Set1. Since this is not the only configuration possible, the coverage enhancements for DL are still beneficial even if there is no power reduction.

In parallel, further clarifications on PFD limits and constraints can be discussed.

25 – Sony Europe B.V.

Option B.

While we basically agree with the proposal, we think that RAN1 can consider the amount of power reduction to be considered (i.e. the "*provided that a clear guidance is defined on the maximum power reduction to be considered*" text should be deleted.

26 – NOVAMINT

We tend to support option B but are open for C.

27 – TTP plc

Option B

28 – TTP plc Option B

Proposal 1.2.5/ High power UE (e.g. 26 dBm Tx power) can be considered for NTN FDD bands to enhance the coverage

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

Feedback Form 6: Cov enh objectives - 5

1 – NTT DOCOMO INC. [DCM] We think that baseline should be normal UE (i.e. 23 dBm); otherwise, handheld UE for NTN shall be capable of high power TX. Of course high power UE can be accommodated in NTN.
2 – Guangdong OPPO Mobile Telecom. RAN4 needs to study the feasibility for HPUE in NTN bands and leave RAN4 to decide.
3 – ZTE Corporation This aspect can be left to RAN4's discussion for high-power UE and whether can be extended to the NTN case is determined by the need to support the operation over the NTN band.
4 – T-Mobile USA Inc. We think this is something that we will need to consider carefully. I believe that most all of the coexistence studies have assumed 23dBm UL for UEs and doubling the power could have effects that we have yet to be seen revealed in these studies. RAN4 needs to take a look at this and possibly have a discussion with ITU.
5 – vivo Communication Technology HPUE discussions should be discussed in TN, if agreed it can be used in NTN directly. There's no need to introduce different UE power between NTN and TN except that we assume more realistic antenna gains, given that smart phones are assumed to be same as TN in this WI.
6 – CATT Technically it is promising for NTN coverage enhancement if using larger Tx power. RAN4 evaluation for this assumption should be conducted.

7 – Qualcomm Incorporated

We would be open to specifying PC2 for NTN bands. RAN4 would need to take a careful look at all the issues, like coexistence.

8 – Panasonic Corporation

High power UE should be supported in NTN, but the design of coverage enhancement for NTN should not rely on this.

9 – Beijing Xiaomi Mobile Software

Support this proposal and high power UE should be supported in NTN.

10 – HUGHES Network Systems Ltd

We are open to specifying High power UE such as PC2 for NTN.

11 – Ligado Networks

We support consideration of other NTN UE factors (.e.g. HPUE) as part of RAN4.

12 – HUAWEI TECHNOLOGIES Co. Ltd.

According to RAN1 study, uplink is bottleneck for NTN coverage. An efficient way to improve uplink coverage is to increase the transmission power on UE side. Support for high power UE has been specified for n1 and n3 FDD bands in Rel-17. Therefore, we support the proposal to introduce high power UE on NTN bands for smartphone. In our understanding, this would only need to involve RAN4.

13 – Classon Consulting

[for FUTUREWEI] ok

14 – MediaTek Inc.

High power UE PC2 is already supported in legacy specifications. We are open to support of PC2 in NTN bands. This can be discussed in RAN4.

15 – NTT DOCOMO INC.

[DCM2] After seeing companies' inputs, we understand the intention; this proposal is intended only for RAN4. Our previous comment was for coverage enhancement perspective involved with RAN1.

16 – ESA

Ok. It's important to support UE PC2 in NTN bands.

17 – THALES

We believe that High power UE (e.g. 26 dBm Tx power) may be considered for NTN FDD bands to enhance the coverage as part of a separate RAN4 led new work item.

18 – Lenovo (Beijing) Ltd

Lenovo:

We prefer RAN4 to discuss the related issue.

19 – Baicells Technologies Co. Ltd

We agree with the proposal. High power UE (e.g. 26 dBm Tx power) is important for NTN, should be discussed by RAN4.

20 – Samsung Electronics Romania

In Rel-17 NTN, RAN4 specifies requirements for FR1 NTN bands (L and S band) with PC3 assumption. Introducing PC2 (26dBm) requires additional RAN4 co-existence study which will increase RAN4 workload and TU budget. Note that in current TN specifications, no PC2 is introduced for similar frequency ranges as L and S bands, and Rel-18 HPUE spectrum WI for TN is still discussed in this RAN-P. It's better to wait for conclusions for TN, and then consider how to proceed for NTN.

21 – Ericsson LM

Coexistence work for introducing 23 dBm NTN UE was recently completed. Strong justification for now introducing higher power UE is needed, and if this will require new coexistence studies in RAN4.

22 – TURKCELL

We need RAN4 coexistence studies before to decide the support of the High power UE (e.g. 26 dBm Tx power).

23 – Nokia France

High power UEs for NTN could be studied in RAN4; if so, this would need to include coexistence evaluations.

24 – Inmarsat

We agree, HP UE should be considered

25 – Sony Europe B.V.

Agree

26 – NOVAMINT

We agree with the proposal

27 – TTP plc

We agree with the proposal

Proposal 1.2.6/ No need to have higher layer enhancements for NTN coverage as PHY techniques can already provide sufficient coverage for PUSCH

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

Feedback Form 7: Cov enh objectives - 6

1 – NTT DOCOMO INC. [DCM] As commented above, enhancement for PUSCH with VoIP might be necessary, might not. We are not sure this proposal ('as PHY ~') is correct.
2 – Guangdong OPPO Mobile Telecom. The proposal needs to be more specific. The current wording seems to suggest no RAN2 enhancement in R18, which may not be the case.
3 – ZTE Corporation We are in general fine with this proposal. We should focus on the PHY-level enhancement including the potential improvement in RAN4 as highlighted in ***Proposal 1.2.5*** .
4 – vivo Communication Technology Support the proposal
5 – CATT Support this proposal. PHY enhancement should be focused.
6 – Apple GmbH We are generally fine with the proposal. Physical layer enhancement should be the focus of this objective. Also, we think the PUSCH discussed here is mainly for VoIP, as RAN1 already concluded the enhancement is unnecessary for PUSCH for Msg3 and PUSCH for 3kbps. Finally, the necessity of enhancing PUSCH for VoIP is unclear to us.
7 – Lockheed Martin We believe PHY level enhancement should be the focus.

8 – Qualcomm Incorporated

We are a bit surprised about this proposal.

First, we showed the importance of reducing the protocol overhead in our RAN1 contribution (by application layer bundling).

Second, the work item clearly states that the protocol overhead reduction study is to be finalized in the next quarter:

[Quote from WID]: RAN to determine by RAN#97 (for RAN1 items) and **RAN#98 (for RAN2 items)** whether the study phase has identified any need for NTN-specific coverage enhancements in Rel-18.

Third and last: unlike for other channels, where repetitions may be used to close the coverage gap, VoNR requires a constant cadence of packets every 20ms, therefore limiting the amount of repetitions for every individual packet. Therefore, the PHY enhancements can only provide gain up to a point. For low rate codecs, we are observing that a large % of the payload (even with ROHC) is due to protocol overhead, and therefore reducing the overhead will result in a direct improvement of the physical layer performance.

9 – Beijing Xiaomi Mobile Software

Support this proposal.

10 – HUAWEI TECHNOLOGIES Co. Ltd.

Agree with companies expressed view earlier that PHY-related enhancements should be the main focus for NTN-specific coverage enhancement.

According to the evaluation results provided by companies in RAN1, most of the companies who observed coverage gap for PUSCH with VoIP have the results of around 3dB gap. By considering the above PHY layer related solutions, we believe the coverage gap of PUSCH with VoIP can already be compensated.

From another aspect, NTN WID says "RAN to determine by RAN#97 (for RAN1 items) and RAN#98 (for RAN2 items) whether the study phase has identified any need for NTN-specific coverage enhancements in Rel-18." RAN2 can continue further study until RAN#98. While we would also suggest that the necessity of RAN2 enhancement should be discussed taking into account PHY enhancements agreed in RAN#97e. Therefore we suggest the following WID revision:

RAN to determine by ~~**RAN#97 (for RAN1 items) and**~~RAN#98 (for RAN2 items) whether the study phase has identified any need for NTN-specific coverage enhancements in Rel-18**, taking PHY enhancements into account**.

11 – Classon Consulting

[for FUTUREWEI] ok

12 – Intel Corporation SAS

Agree. If it can be confirmed by RAN1 or RAN plenary that PHY techniques can already provide sufficient coverage for PUSCH, it would be good to exclude higher layer enhancements for this coverage enhancement purpose.

13 – MediaTek Inc.

We think this proposal is not needed in RAN#97 since higher layer enhancements for protocol overhead reduction is still for discussion in RAN2. The RAN2 objective can be discussed and concluded in RAN#98. We would be fine with the revision proposed by Huawei.

14 – MediaTek Inc.

We think this proposal is not needed in RAN#97 since higher layer enhancements for protocol overhead reduction is still for discussion in RAN2. The RAN2 objective can be discussed and concluded in RAN#98. We would be fine with the revision proposed by Huawei.

15 – Panasonic Corporation

As mentioned by some companies, according to the WID description ”RAN to determine by RAN#97 (for RAN1 items) and RAN#98 (for RAN2 items) whether the study phase has identified any need for NTN-specific coverage enhancements in Rel-18.”, it would be premature coming to such a conclusion at this point of time already. Further discussion on phy techniques for PUSCH VoIP (proposal 1.2.1) would be needed, as well.

16 – ESA

We agree with QCOM and MediaTek, since the overhead reduction can be beneficial. The RAN2 discussion is not started yet, therefore we support a revision (as proposed by Huawei) to wait for RAN#98.

17 – THALES

Agree

18 – Lenovo (Beijing) Ltd

Lenovo:

We are OK to focus on PHY first, but think it could be too early to preclude any higher layer enhancements. The proposal shall be more specific.

19 – Baicells Technologies Co. Ltd

We think the proposal is not necessary. We can still follow the NTN WID: “RAN to determine by RAN#97 (for RAN1 items) and RAN#98 (for RAN2 items) whether the study phase has identified any need for NTN-specific coverage enhancements in Rel-18.”

20 – Samsung Electronics Romania Agree with this proposal.
21 – Ericsson LM Agree
22 – Nokia France We agree with the comment from Mediatek. RAN2 can continue its study until RAN#98e, as per the WID.
23 – TURKCELL We agree with the comment from Qualcomm and Mediatek. The revision proposed by Huawei is ok. It's early to decide.
24 – Inmarsat Disagree with proposal. We agree with comments made by Qualcomm, Mediatek and other companies, protocol overhead reduction is already being discussed, so it seems unnecessary to specify this proposal.
25 – Sony Europe B.V. Do not agree. We should revisit at RAN#98 after RAN2 have completed their study. We are also OK with the Huawei update: *"RAN to determine by* ***~~RAN#97 (for RAN1 items) and~~****RAN#98 (for RAN2 items) whether the study phase has identified any need for NTN-specific coverage enhancements in Rel-18****, taking PHY enhancements into account"****.*
26 – NOVAMINT We agree with Qualcomm and MediaTek and we support the revision proposed by Huawei to wait for RAN#98 as RAN2 discussion has not started yet
27 – TTP plc Agree with Qualcomm and MediaTek

1.1.3 Other topics

Proposal 1.3.1/ In RP-222301, there are two general proposals

- ***« Proposal 1 Supporting high data rate should be considered for NR NTN enhancements.***

– ***Proposal 2 Discussion for NR-NTN deployment in above 10 GHz bands should be completed in Rel.18, or at least the allowable spectrum for NR-NTN in FR2 should be included in the specification. »***

You are expected below to provide your views on whether these proposals need to be discussed

Feedback Form 8: Other topics - 1

1 – NTT DOCOMO INC.

[DCM] Discussion would be unnecessary if we understand correctly. Proposal 1-related aspect was already discussed at RAN1 and 3kbps was agreed for evaluations since higher data rate is not realistic assumption. Proposal 2 would be done by RAN4.

2 – Guangdong OPPO Mobile Telecom.

For proposal 1: RAN1 has already agreed the target data rate.

For proposal 2: WID has captured the objectives for RAN4.

We don't see the need for these two proposals.

3 – ZTE Corporation

The intention of this proposal is unclear.

For proposal 1, the target scenario and traffic are already set. Anything beyond this target is only the best effort.

For proposal 2, the discussion on the spectrum-related issue should be decided in RAN4 as we concluded in the previous plenary meeting. It may not be proper to set some "RAN-level" suggestions.

4 – vivo Communication Technology

Not necessary to discuss higher data rate as it was agreed (see below agreements) to focus on 3kbps data and 4.75kbps VoNR in last RAN1 meeting.

Agreement

For NR-NTN coverage enhancement in Rel-18, link budget of parameter set-1 for LEO-1200 operating at LOS is considered as the target to evaluate whether each channel/signal with the existing specification needs to be enhanced or not. The targeted performances are used to evaluate the following services:

· VoIP using AMR 4.75 kbps.

· Low data rate of 3 kbps.

· Potential enhancements for deployments with parameter set-1 can also apply for deployments for parameter set-2

For >10GHz band, this is a separate topic compared to coverage enhancement topic for NTN, and it can be further discussed in RAN4 instead of in RAN plenary. No conclusion on >10GHz for NTN in this plenary is necessary.

5 – CATT

Proposal 1 is unreasonable since the target data rate is relatively low for the smart phone.

Proposal 2 seems to be one RAN4 specific topic.

6 – Lockheed Martin

We do not see the need for these proposals. We support Proposal 2 but this should already be understood to be a part of the WI.

7 – Panasonic Corporation

Intention of proposal 1 is not clear. Proposal 2 is already covered in the current WID in our understanding.

8 – HUGHES Network Systems Ltd

Proposal 2 is already understood in the WID and and should be covered in RAN4.

9 – HUAWEI TECHNOLOGIES Co. Ltd.

For Proposal 1: according to our understanding data rate for coverage enhancement has been agreed in RAN1. So no additional agreement/proposal is needed.

For Proposal 2, the work for above 10 GHz band is already part of Rel-18, RAN is expected to carry out the work according to the agreed WID, and seems no additional agreement/proposal is needed. Regarding NTN band and FR2 band, we would like to point out that WID states ”Definition of NTN band(s) above 10 GHz does not change the current FR1/FR2 definition, nor automatically apply to future terrestrial bands defined in this frequency region;”

10 – Classon Consulting

[for FUTUREWEI] no need to discuss

11 – MediaTek Inc.

On proposal 1, RAN1 has already discussed and agreed data rates for NTN coverage enhancements.

On proposal 2, it is already a RAN4 objective.

12 – Baicells Technologies Co. Ltd

The two proposals are unnecessary in our view.

For proposal 1: RAN1 has already agreed the target data rate (3kbps and VoIP using AMR 4.75 kbps).

For proposal 2: WID has captured the objectives for RAN4.

13 – THALES

No need to consider the 2nd proposal since it is inherently part of the existing objectives of the WI. As per the 1st proposal, the targeted service rate are being defined in TS 22.261 that could be considered as baseline.

14 – Lenovo (Beijing) Ltd

Lenovo:

There is clear agreement in RAN1 regarding the date rate. We don't think further discussion is necessary.

15 – Nokia France

For proposal 1, we understand that additions to existing Rel-18 items would not be considered at RAN#97e. Proposal 2 is addressed by the ongoing WI.

16 – Samsung Electronics Romania

Agree with DOCOMO and OPPO's views.

17 – Ericsson LM

Proposal 1: For the NR NTN coverage enhancements study, the data rate target has already been agreed to be 3 kbps. Only S-band is in the agreed scope for NR NTN coverage enhancements. The "NR NTN deployment in above 10 GHz bands" objective does not include data rate enhancements.

Proposal 2: The agreed Rel-18 WID includes definition of band above 10GHz. Like all WIDs, it is already agreed to attempt to complete the objectives of the WID within the rel-18 timescale. So in our understanding this is already agreed and does not need additional discussion / agreements.

18 – TURKCELL

We don't support both Proposal 1 and Proposal 2. No need to discuss them.

Proposal 1: The data rate target has already been agreed to be three kbps in RAN1.

Proposal 2: Rel-18 NTN WID covers above 10 GHz bands in RAN4.

19 – Sony Europe B.V.

Do not agree with proposal 1. RAN1 has already agreed to focus on 3kbps data and 4.75kbps VoNR.

20 – NOVAMINT

No need for those proposals in our view

21 – SK Telecom Thanks for valuable feedbacks for our proposals. For the proposal 1, it could be not the right time to discuss. However, we expect that high data rate with NTN system would be one of major factors to provide advanced services in the well terrestrial network deployed countries. For the proposal 2, as many companies mentioned, we aware that WI objective covers our proposal 2. We want to make consensus that discussions about FR2 for NTN should be completed in Rel.18, which was not complested in Rel.17. Thanks again.
22 – TTP plc Generally agree with Proposal 1 as future service would require higher data rate, details to be considered at a later date

Proposal 1.3.2/ Any other topic to be discussed ?

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

Feedback Form 9: Other topics - 2

1.2 Moderator Summary and recommendation for further discussion

More than 30 companies have responded to the 1st set of questions and their feedback are appreciated.

Hereunder are, the analysis of the feedbacks per questions

1/ Reference scenarios : Overall, there is a consensus on the definition of the reference scenarios however some clarifications would be beneficial. Companies support the adoption of the -5.5 dBi antenna gain value as suggested by RAN4 (see reply LS R4-2214968). One company was confused by the statement « ***It is assumed***

that potential enhancements for LEO can also apply to GEO and MEO. « and therefore there is a need to clarify that the defined enhancements may apply to other scenarios as appropriate. In other words, there is no need to take into account MEO and GEO specifics in the normative work. 1 Rx antenna on board should be understood as the baseline. This doesn't prevent dual polarised antenna combining implementation.

- In view of the above the moderator suggests to revise the proposal as follow and update the NR_NTN_enh NWI accordingly

The following reference scenario is considered for the definition of coverage enhancements for NTN: parameter set-1 for LEO-1200 satellite operating at Line of Sight (LOS) and commercial smartphones with -5.5 dBi antenna gain and 3 dB polarisation loss (1 Rx antenna on board).

Note:~~It is assumed that potential~~The enhancements defined for LEO ~~can~~may also apply to GEO and MEO scenarios as appropriate.

The targeted services are VoIP using AMR 4.75 kbps and data transmission services with Low data rate of 3 kbps

2/ Uplink channel enhancements :

There is full consensus for the enhancements of PUCCH for Msg4 HARQ-ACK. However, Ericsson/Sony suggest to limit to enabling PUCCH repetitions

About the enhancements to the DMRS bundling for PUSCH with VoIP, vast majority are interested to work on the topic

- Oppo, TMobile, Vivo, QC, Xiaomi, Futurewei, Mediatek, Huawei, Intel, Turkcell, ESA, Thales, Lenovo, Inmarsat, Ericsson, IDC support the definition of this enhancement may be clarifying the scope (e.g. time and frequency pre compensation)
- NTT Docomo, ZTE, Panasonic, Hughes, Huawei, Nokia, Samsung, Baicell, Sony suggest to study the specific details before specifying the enhancements if needed
- LG, Apple, Lockheed are not convinced about the need of this enhancement

Based on QC, Huawei, Nokia, IDC and Thales suggestions, the moderator proposes a revision of the proposal as follow that would be added in the NR_NTN_enh NWI:

The objectives are ~~to specify~~ for NTN:

- To specify coverage enhancements to PUCCH for Msg4 HARQ-ACK ~~enhancements~~, e.g. repetition of PUCCH format 1 [RAN1, RAN4]

- To study, and, if beneficial for coverage, specify NTN-specific~~to enable~~ DMRS bundling for PUSCH

with time-frequency pre-compensation~~VoIP~~ [RAN1]

3/ PRACH enhancements : There is a general trend to support the proposal but some minority views can be observed :

- Supportive to handle this in NR_cov_enh WI : NTT Docomo, LG, T-Mobile, Vivo, Lockeed, Panasonic, Xiaomi, Hughes, China Telecom, Huawei, Futurewei, Mediatek, Intel, Turkcell, ESA, Nokia, Thales, Lenovo, Inmarsat, Novamint, Sony
- Supportive to handle this in NR_NTN_enh WI : ZTE
- Possible support : Apple
- No need : Samsung, Ericsson

Besides :

- Vivo and CATT recommend not to agree at plenary on a specific SNR target value as this should be discussed in the WG
- QC, Thales suggest that not only format B4 should be enhanced for PRACH

In view of the above, the moderator suggests that as part of the NR_cov_enh WI the PRACH enhancements proceed as planned and then additional enhancements may be considered, if needed, in view of NTN specifics.

- The following should be captured in the NR_cov_enh WI

additional PRACH (at least format B4) enhancements may be consideed, if needed, in view of NTN specifics (agreed at RAN#109, under AI 9.12.1)

4/ No satellite transmit power reduction : All companies agree that without satellite transmit power reduction, there is no need for DL coverage enhancement. This is already reflected in the conclusion of the study phase in RAN1#110 chair's note and doesn't have to be reported in the work item. The discussion on this topic is closed.

5/ Down link channel enhancements :

- Topic to be de prioritised in Rel-18: NTT Docomo, CATT, QC, Nokia, Samsung, Ericsson
- Topic to be further discuss/study : Apple, Lockheed, Xiaomi, Vivo, Hughes, Ligado, Futurewei, Huawei, Mediatek, Thales, Lenovo, Baicell, Sony, Novamint, Inmarsat
    - No PFD limits to be discussed in relation to power reduction : Hughes, Mediatek, Apple, Lockheed, Thales
    - PFD limits may be discussed if needed : Inmarsat, Xiaomi
    - PFD limits shall be discussed to provide guidance to WG on the maximum power reduction: Oppo, ZTE

Several companies advocated that TR 38.821 assumes satellite parameters are applied per beam. Some companies assume that SSB is not be impacted by such DL scenarios

On the basis of the majority of views, the moderator suggests to consider further study on the subject and hence suggests to revise the proposal as follows :

Considering possible usage of downlink power, for example, due to power split between multiple beams or cells (e.g. max 10 beams/cells), coverage enhancements for selected DL physical channels (e.g. PDCCH and PDSCH for Msg2/Msg4) should be further studied until RAN#98-e.

Note: existing SSB design shall not be impacted

6/ high power UE : All companies agree that high power UE would help in the coverage enhancement. This would require RAN4 to study the feasibility for HPUE in NTN bands (i.e. review of coexistence sevaluations) possibly in coordination with ITU-R before defining the appropriate RF performances. This may be discussed in RAN4 possibly leveraging the work in Rel-18 HPUE spectrum WI. However, no impact on the Rel-18 NR_NTN_enh WI is foreseen. The discussion on this topic is closed.

7/ higher layer enhancements :

Most companies recommend to prioritise PHY-related enhancements for NTN-specific coverage.

However some companies advocate that it is too early to rule out possible RAN2 enhancements.

Therefore the moderator suggests to wait for RAN2 study outcomes at RAN#98-e. The discussion on this topic is closed.

Therefore the following correction should be considered for the WID objective:

RAN to determine by ~~RAN#97 (for RAN1 items) and~~ RAN#98 (for RAN2 items) whether the study phase has identified any need for NTN-specific coverage enhancements in Rel-18.

8/ Proposals on high data rate and NR-NTN deployment in above 10 GHz bands : All companies agree that the two proposals are unnecessary. There is no need to impact the NR_NTN_enh objectives. The discussion on this topic is closed.

9/ No other topics were suggested to be discussed

2 Intermediate round

2.1 Collection of company views

A new set of proposals is submitted for your considerations in this intermediate round

Proposal 2.1: Capture in Rel-18 NR_NTN_enh WI

«The following reference scenario is considered for the definition of coverage enhancements for NTN: parameter set-1 for LEO-1200 satellite operating at Line of Sight (LOS) and commercial smartphones with -5.5 dBi antenna gain and 3 dB polarisation loss (1 Rx antenna on board).

Note: The enhancements defined for LEO may also apply to GEO and MEO scenarios as appropriate.

The targeted services are VoIP using AMR 4.75 kbps and data transmission services with Low data rate of 3 kbps"

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

Feedback Form 10: NR_NTN_enh (cov enh ref scenario)

1 – Guangdong OPPO Mobile Telecom. we are fine with the proposal
2 – FirstNet We support the proposal.
3 – Classon Consulting [for FUTUREWEI] OK
4 – Apple GmbH We think this proposal has some connection with Proposal 2.4. Our understanding is that the defined satellite EIRP density per beam for satellite parameter set-1 for LEO-1200 is based on the assumption of one beam per satellite. It is over-optimized assumption for a satellite to support simultaneous multiple beam transmissions, with EIRP density of 40 dBW/MHz for each beam, since the total satellite transmission power is restricted. Hence, we suggest adding a note to this proposal: "Note: The satellite EIRP density per beam in parameter set-1 for LEO-1200 is separately discussed in case of multiple beams per satellite." For the existing note, we suggest the changing of "may" to "shall".
5 – MediaTek Inc. We are fine with the proposal
6 – InterDigital Support the proposal
7 – CATT Support the proposal
8 – NTT DOCOMO INC. OK
9 – HUGHES Network Systems Ltd We are fine with the proposal, and suggest in the Note: to use "shall" instead of "may"

10 – Lockheed Martin

We agree with Apple and Hughes.

11 – Ligado Networks

We agree with Apple, Hughes, and Lockheed that the note should use ”shall” instead of ”may”.

12 – VIVO TECH GmbH

We’re generally fine with the proposal. However ”1 Rx antenna on board” should be removed since the 3dB polarization loss is assumed already in the CNR calcucation as agreed for the evaluations in RAN1.

13 – Baicells Technologies Co. Ltd

Support the proposal

14 – ZTE Corporation

General is fine with the current wording.

15 – Samsung Electronics Romania

We are fine with this proposal.

16 – LG Electronics France

We are fine with the proposal

17 – Eutelsat S.A.

OK with the proposal.

18 – ESA

The proposal is fine.

19 – TURKCELL

We support the proposal. We prefer ’shall’ instead of ’may’.

20 – TURKCELL

We support the proposal. We prefer ’shall’ instead of ’may’.

21 – NOVAMINT

We are fine with the proposal - we agree with Apple, Hughes and Lockheed that the note should use ”shall” instead of ”may”

22 – Nokia France

Support.

23 – HUAWEI TECHNOLOGIES Co. Ltd. *Agree with VIVO comment that "1Rx on board" should be removed as 3dB polarization loss already indicates that. 1Rx on board is redundant and can sometime be interpreted in other ways. We are fine with other parts.*
24 – Inmarsat We agree with the general proposal but with changes as proposed by Apple, Hughes and Lockheed
25 – Intel Corporation SAS Agree with the proposal
26 – Panasonic Corporation OK with the proposal.
27 – Ericsson LM Again, the VoNR AMR 4.75 data rate will exceed 3 kbps with margin and the low data rate should be dropped from the list of targeted services.
28 – Sony Europe B.V. Basically we are OK with this. Can we decouple the "1 RX antenna on board" assumption from the 3dB polarisation loss assumption? The main sentence also almost links the "polarisation loss" with the "commercial smartphone". We suggest the following for the main sentence: *The following reference scenario is considered for the definition of coverage enhancements for NTN: parameter set-1 for LEO-1200 satellite operating at Line of Sight (LOS)**, ~~and~~** commercial smartphones with -5.5 dBi antenna gain**, ~~and~~** 3 dB polarisation loss **and ~~(~~**1 Rx antenna on board t**he satellite~~)~~**.*
29 – HISPASAT SA We are ok with the proposal, including the change agreed by Apple, Hughes and others about modifying the note from "may" to "shall".

Proposal 2.2: Capture in Rel-18 NR_NTN_enh WI «The objectives are for NTN:

- To specify coverage enhancements to PUCCH for Msg4 HARQ-ACK, e.g. repetition of PUCCH format 1 [RAN1, RAN4]

- To study, and, if beneficial for coverage, specify NTN-specific DMRS bundling for PUSCH with

time-frequency pre-compensation [RAN1] »

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

Feedback Form 11: NR_NTN_enh (cov enh UL channels objectives)

1 – Guangdong OPPO Mobile Telecom.

we are not fine with the second bullet. DMRS bundling is already supported in R17 and it should be supported by NTN, which is not conditioned by studying the benefits. The study should be focus on any additional spec impact to enable the DMRS bundling for NTN. We suggest the following rewording

[Revised-OPPO]

- To study, and specify if any, additional specification to enable NTN-specific DMRS bundling for PUSCH with time-frequency pre-compensation [RAN1, RAN4]

2 – Classon Consulting

[for FUTUREWEI] OK, though some rewording of the second objective may be expected

3 – Apple GmbH

We are fine with the first bullet.

For the second bullet, we think RAN1 chair's comments in the first round need to be considered. Based on this, we are still conservative on the second bullet. However, if it is majority companies' preference, we can compromise to study and specify only if beneficial for coverage. Here, we should restrict to PUSCH for VoIP, based on RAN1 conclusion. We propose modification for the second bullet as

"To study, and, if beneficial for coverage, specify DMRS bundling for PUSCH with VoIP with additional enhancement on time-frequency pre-compensation [RAN1]."

4 – MediaTek Inc.

We are mainly fine with the proposal. The "e.g. Repetition of PUCCH format 1" in first bullet is not necessary.

5 – InterDigital

Ok with the proposal

6 – HUGHES Network Systems Ltd

We are OK with the proposal

7 – CATT

We are finw with the proposal.

8 – Qualcomm Incorporated

We are fine with the direction in general. For the DMRS bundling, we do not think there is a need to study if DMRS bundling is beneficial for low SNR (it is clear it is), the objective would be to specify necessary additions on top of Rel-17 DMRS bundling to adapt to the LEO scenario for time-frequency precompensation.

9 – NTT DOCOMO INC.

Same view with OPPO/QC. What to study is whether further NTN-specific enhancement is necessary to use DMRS bundling efficiently. Wording should be updated.

In addition, we have same view with Apple: 'VoIP' should not be removed since for other services. Otherwise, it means that more repetitions can be used instead of DMRS bundling and thus enhancement on DMRS bundling becomes unnecessary. The restriction on 20 repetitions for VoIP would be an important information.

10 – Lockheed Martin

We are ok with the proposal.

11 – VIVO TECH GmbH

Fine.

12 – ZTE Corporation

1. Prefer to remove the "e.g.," for the PUCCH;

2. Regarding the PUSCH for VoIP, it's definitely to consider the enhancement due to the impact of pre-compensation. And prefer to update the proposal to "Specify the DM-RS bundling for PUSCH in NTN with the impact of pre-compensation".

13 – Samsung Electronics Romania

We think that "if beneficial for coverage" seems ambiguous as DM-RS bundling has already been introduced for TN because it is beneficial for coverage. Also the current wording is too specific. Thus, we propose the following:

- Study DM-RS bundling for NTN and, if necessary, specify enhancements to the Rel-17 procedures.

14 – LG Electronics France

We are fine with the proposal

15 – Eutelsat S.A.

OK with the proposal.

16 – ESA

We support the proposal.

17 – TURKCELL

We support the first bullet of the proposal. We can keep VoIP in the second bullet.

18 – NOVAMINT

We are fine with the proposal

19 – Nokia France

For the first bullet, it is not necessary to include the example.

For the second bullet, Oppo's proposal seems to go in the right direction, with addition of "if found beneficial for coverage ":

*To study, and**, if found beneficial for coverage, specify** any additional specification to enable NTN-specific DMRS bundling for PUSCH with time-frequency pre-compensation [RAN1]*

20 – Inmarsat

We are ok with general proposal and agree with OPPO's proposed changes

21 – HUAWEI TECHNOLOGIES Co. Ltd.

For the second bullet, we agree with OPPO/Qualcomm/DOCOMO comment that the objective would be to specify necessary additions on top of Rel-17 DMRS bundling to adapt to the LEO scenario for time-frequency pre-compensation. Some adjustment in wording like that proposed by OPPO would be preferable.

It is unclear to us why HP UE is not included in the objective in this NR NTN Enhancement WI. As WID indicated, the coverage objective of NR NTN Enh WI includes RAN4. Moderator summary for initial round discussion indicates that "All companies agree that high power UE would help in the coverage enhancement". It is unclear to us why the moderator summary concludes "However, no impact on the Rel-18 NR_NTN_enh WI". Is moderator suggesting a separate RAN4-leading item for NTN HP UE□Our understanding is that HP UE is one of the solutions to solve NTN coverage issue, we would suggest to add an objective in NR NTN enh WI, paralle to PUCCH and DMRS bundling, like:

- To verify whether there is coexistence issue for PC2 HPUE and specify PC2 HP UE for NTN band n256 (S-band)

22 – Intel Corporation SAS

In our view there is no need for study phase for NTN-specific DMRS bundling for PUSCH. We prefer initial version, i.e. enable DMRS bundling for PUSCH NTN.

23 – Panasonic Corporation On the 1st bullet, we are OK with the proposal. On the 2nd bullet, we agree with OPPO's modification to clarify the work.
24 – Baicells Technologies Co. Ltd We are fine with the proposal. We also agree with the comment of Huawei on the issue of HPUE.
25 – Ericsson LM PUCCH repetitions are supported in the specification, but currently missing for Msg4 HARQ-ACK. Repetition of PUCCH format 1 should not be an example, but since this is the most straightforward solution it should be the default solution to study. Only if this fails, other enhancements should be considered. Hence, the text "e.g. repetition of PUCCH format 1" should be change to "through repetition of PUCCH for Msg4 HARQ-ACK".
26 – Sony Europe B.V. OK with proposal.
27 – HISPASAT SA OK with the proposal.

Proposal 2.3: Capture in Rel-18 NR_cov_enh WI

« additional PRACH (at least format B4) enhancements may be consideed, if needed, in view of NTN specifics (agreed at RAN#109, under AI 9.12.1) »

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

Feedback Form 12: NR_Cov_enh (ref scenario)

1 – Guangdong OPPO Mobile Telecom. we are fine with this proposal in principle. But does RAN plenary need to give a more clear guidance? or the proposal intents to l leave RAN1 NR_cov_enh WI to decide if this is considered or not? A remark: RAN#109 should be replaced with RAN1#109.
2 – Classon Consulting

[for FUTUREWEI] it would be better to directly do the work ... more time might be spent 'considering' 'if needed' than it would take to just finish the work

3 – Apple GmbH

Although we do not see strong motivation of enhancing PRACH format B4 for NTN since PRACH format 2 can meet the performance requirement, we are fine with the direction that no work in NR NTN WI is conducted for PRACH enhancement. All the PRACH related coverage enhancement should be conducted in NR coverage enhancement WI to avoid duplicate work.

4 – MediaTek Inc.

We are fine with proposal. The proposal can be made more explicit and mention Rel-18 NR coverage enhancements WI" instead of AI 9.12.1.

5 – HUGHES Network Systems Ltd

We are OK with the proposal and agreed with MediaTek to explicitly refer to Rel-18 NR coverage enhancements WI

6 – CATT

We are fine with the proposal, and agree with MediaTek to directly refer to Rel-18 NR coverage enhancements WI.

7 – Qualcomm Incorporated

We agree with MediaTek

8 – NTT DOCOMO INC.

We are not sure 'may be' is good way... If this proposal is agreed, discussion at Rel-18 NR coverage enhancements WI will become complicated on whether NTN perspective is considered or not. Clear guidance is much better; e.g., 'is' instead of 'may be'.

9 – Lockheed Martin

We agree with Mediatek and Hughes.

10 – VIVO TECH GmbH

In our view, PRACH format 2 should be prioritized when it comes to the coverage enhancement in NTN for S band. For FR2, short format is already the target PRACH format to be enhanced in Rel-18 coverage enhancement as B4 is the bottleneck format identified in Rel-17 coverage enhancement topic for terrestrial network. In addition, PRACH repetition to be introduced in NR Rel-18 coverage enhancement topic would be applied to all formats as stated already in the corresponding WID. We do not see the need to restrict the PRACH format to be format B4 in NTN. Therefore, we propose to remove the " (at least format B4)" .

11 – ZTE Corporation

We agree with MTK.

12 – Samsung Electronics Romania

We don't think there is a need for PRACH enhancements for NTN, thus adding additional work in NTN WI or in another WI seems not justified. Techniques that will be specified in Rel-18 NR coverage enhancements will be available for use in NTN. If further PRACH enhancements are needed, that can be considered in the next release.

13 – LG Electronics France

We are fine with the proposal

14 – Eutelsat S.A.

Fine with the proposal and agree MediaTek comment above would be a helpful addition/ clarification.

15 – ESA

We support the proposal with explicit reference to the NR WID.

16 – TURKCELL

We support the proposal with MediaTek wording.

17 – NOVAMINT

We support the proposal with the explicit reference to the NR WID as proposed by MediaTek.

18 – Nokia France

We propose modifying the proposal simply as follows (also taking into account MediaTek's suggestion):

"PRACH enhancements will proceed in the Rel-18 NR coverage enhancements WI."

19 – Inmarsat

We agree with the proposal and with explicit mention of the NR coverage enhancements WID

20 – HUAWEI TECHNOLOGIES Co. Ltd.

According to company response and moderator summary for initial round, there is clear majority view to include PRACH enhancement for NTN in Rel-18 NR coverage enhancement WI. The wording like "may be considered" and "if needed" are not providing clear guidance. We suggest a clearer proposal and decision from RAN plenary as mentioned by few other companies.

21 – Intel Corporation SAS

We prefer more clear guidance from RAN plenary whether to consider NTN-specific assumptions for PRACH enhancements. We suggest to consider NTN-specific assumptions for PRACH enhancement.

22 – Panasonic Corporation Agree with MediaTek.
23 – Ericsson LM We disagree with modifying the Coverage Enhancement WID. There is no need to add NTN-specific requirements as the enhancements will be generally available.
24 – Baicells Technologies Co. Ltd We are OK with the proposal. Progress of NR_cov_enh on PRACH will definitely benefit NTN. There is a typo in the proposal: 'consideed' should be 'considered'.
25 – Sony Europe B.V. OK with proposal. Typo: "consideed" -> "considered" (as also pointed out by other companies).
26 – HISPASAT SA OK with the proposal and agree with Mediatek's suggestion.

Proposal 2.4: Capture in Rel-18 NR_NTN_enh WI

«Considering possible usage of downlink power, for example, due to power split between multiple beams or cells (e.g. max 10 beams/cells), coverage enhancements for selected DL physical channels (e.g. PDCCH and PDSCH for Msg2/Msg4) should be further studied until RAN#98-e.

Note: existing SSB design shall not be impacted »

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

Feedback Form 13: NR_NTN_enh (cov enh DL channels objectives)

1 – Guangdong OPPO Mobile Telecom. From the previous experience of RAN1 discussion. We suggest to make the use case more clear in order to avoid potential non-technical debating in RAN1. For example, the 'possible usage' may lead RAN1 to spend at least one meeting to argue how possible to have this use case. Such kind of debating may impact the RAN1 discussion efficiency. We therefore suggest to remove the word 'possible', which means that RAN1 only needs to discuss this use case, but RAN1 should not further discuss how possible or whether it is possible to have this use case. This should be discussed in RAN plenary instead of RAN1.

2 – Classon Consulting

[for FUTUREWEI] prefer to provide better guidance at this RAN before kicking back to RAN1

3 – Apple GmbH

We support this proposal. We think the transmission power split among multiple beams or cells by a satellite is a typical scenario, which enhances the coverage of satellite. According to the comments from satellite companies in the first round, we think it is more than the implementation issue. Instead, it is a common issue for satellites. Hence, we need to carefully examine a practical situation and come up with a useful solution if any.

We have minor change on the proposal:

"Capture in Rel-18 NR_NTN_enh WI

Considering possible **reduction** of downlink power, …. (e.g., max 10 beams **or** cells)..."

4 – MediaTek Inc.

This proposal needs further discussion. Assuming a 5.5 dBi antenna loss, 3 dB polarisation loss, and additional 10 dB loss in case there are 10 beams, the total SNR loss is 18.5 dB compare to Rel-17 NTN. This is not a reasonable assumption for Rel-18 NTN coverage enhancement. Our understanding on "NOTE 3 All these satellite parameters are applied per beam" in Set 1 and Set 2 parameters in TR 38.821 is that the EIRP figure is per beam. If there are 10 beams, then the total EIRP is increased by 10 dB without TX splitting.

5 – Qualcomm Incorporated

The proposal is still to vague for RAN1 to conduct a proper study. In our view, RAN plenary should:

1) Get feedback from satellite companies on what is the power reduction they expect, and what is the reason (power sharing across multiple beams? PFD limit?)

2) Clearly indicate the SNR / power target to RAN1.

As mentioned in our previous reply, DL enhancements are lower priority for us, given the previous discussions in RAN1.

6 – HUGHES Network Systems Ltd

We support that the need for coverage enhancements for selected DL physical channels should be further studied at leastuntil RAN#98-e.

7 – Lockheed Martin

We support this proposal. We agree with Apple pertaining to the use of multiple beams. We also support the need for coverage enhancements for selected DL channels and believe they should be further studied in RAN#98e.

8 – Ligado Networks

We support this proposal and agree with Lockheed and Apple comments.

9 – NTT DOCOMO INC.

Three comments.

- Regarding power split between beams/cells, we think Note 3 in 38.821 is saying that all these satellite parameters are applied per beam. Why the assumption is changed now (not in Rel-16 study phase before making 38.821) is quite unclear. Clear explanation from satellite companies would be necessary. If the explanation is reasonable, we can consider the issue.

- Even if the above issue is valid, we have concern on TU perspective. TU allocated for NR NTN is small. And an important note is that we need to have discussion on NW verified UE location as well, in this WI. We do not feel both UL and DL can be handled in the current allocated TU. Since UL enh would be more straightforward, UL enh scope would be agreed as above discussed. Then we believe that further scope reduction for DL is necessary if DL is enhanced. For example:

  - Clear assumption on the number of beams (to provide clear SNR without further RAN1 agreement)

  - Clear guidance to focus on one or two channels (e.g., 'only the worst channel is enhanced in Rel-18 NR NTN')

  - Clear guidance to focus on what kind of enhancement is specified

- Note that it is not true that we do not want DL enh. If time is allowed, we are fine to have some enh for DL.

10 – CATT

If allocated TU is sufficient for NTN, DL enhancement can be discussed and evaluated. Currently how many beams are used for power split, and what is realistic assumption for satellite power restriction are unclear. It seems more efforts are needed in order to get a clear understanding for the target and motivation of DL coverage enhancement.

11 – Samsung Electronics Romania

It is a bit surprising to us that the power split has suddenly become an issue, considering also that there was no discussion at the time the WI was created. Given the limited TUs for NR NTN (i.e., 0.5TU/meeting), we suggest to consider to study this topic in the next release.

12 – LG Electronics France

We are skeptical to proceed with DL coverage enhancement unless clear necessity is found, e.g., due to downlink power restriction. We think it is better to make a conclusion or more refined guidance at this meeting

13 – LG Electronics France

We are skeptical to proceed with DL coverage enhancement unless clear necessity is found, e.g., due to downlink power restriction. We think it is better to make a conclusion or more refined guidance at this meeting

14 – ZTE Corporation

Regarding the discussion on DL, it seems that the motivation behind it dramatically changed from the PFD issue to the implementation of satellite, especially to question the basic assumption used for evaluation.

When we discuss the reference parameter in the previous release, it's claimed by the proponent that the corresponding EIRP is defined per beam, and all sets are agreed upon without touching the detailed implementation of the satellite, e.g., the total power for transmission and number of beams, etc. Now, the whole assumption is different, and frankly speaking, it's impossible to achieve a consensus on the exact number of beams and reduced power due to various implementations of satellites since all of these are sensitive and too specific.

For the DL discussion, let's focus on the PFD issue and draw a clear conclusion on this aspect in this meeting.

15 – Eutelsat S.A.

Proposal needs further discussion and clarification. Agree with MediaTek and NTT DoCoMo regarding the reference scenario and notes (generally accepted meaning of Note 3). If any change is to be made we should start by revisiting and agreeing the assumptions.

16 – TURKCELL

We need to discuss the proposal and more clarification. We share the concerns of NTT Docomo.

17 – NOVAMINT

Agree with MediaTek and Qualcomm that it needs further discussion

18 – MediaTek Inc.

MediaTek view in initial round was not captured accurately in moderator summary. We indicated our preference for Option A for DL coverage enhancement Topic to be de-prioritized in Rel-18. We share DoCoMo concern. RAN Plenary should further discuss and conclude to de-prioritize DL enhancements in Rel-18.

19 – Nokia France

We do not agree with this proposal. Table 6.1.1.1-1 in 38.821 is clear that "All these satellite parameters are applied per beam"; there has not been any agreement to revise the parameters agreed in 38.821. There are no agreed assumptions for power splitting between beams, which is anyway purely an implementation matter and which, if valid, would cast serious doubt on the operational feasibility of the whole Rel-17 NTN work. Inclusion of this aspect at this stage would represent a substantial upscoping of the WI, which is not appropriate at this plenary.

20 – ESA

We share the same concern expressed by other companies about the DL enhancements. In addition, with the clear indication that the SSB design shall not be impacted, the minimum supported SNR is somehow already set and it must be aligned with the current expected SSB detection performance. It is really unnecessary to enhance DL physical data/control channels for very low SNR, if the DL synchronization cannot be even reliable.

21 – HUAWEI TECHNOLOGIES Co. Ltd.

Our suggestion in the initial round was to discuss and make decision in plenary, taking inputs from e.g. satellite companies, instead of to kick the discussion back to RAN1 again. We share similar view with few other companies and suggest plenary to discuss whether or how much power reduction is required, otherwise it is impossible for RAN1 to study the enhancement (if any).

22 – Inmarsat

We agree with Apple's view and share ESA's concerns regarding the importance of maintaining consistency between SSB performance and that of other channels.

To clear things up a bit, the concern in regards to actual satellite DL power transmission is very real and the answer is that it BOTH relates to:

- PFD limits that may come both from regulatory constraints, constraints defined by filings (e.g. with FCC) and coordination agreements for non-interference with other services (satellite or otherwise)

- practical engineering limitations with satellite design, which mean that the dBW/MHz figure does not necessarily translate to a per-beam EIRP because the total power budget of the payload is limited

These observations were made by satellite operators (such as us) during the NTN study phase and during the subsequent WI phase (alongside with issues related to power back-off due to PAPR, which also reduces the payload efficiency, leading to lower DL EIRP per-carrier), but were mostly ignored because they had implications in terms of coverage and possible protocol impact (which we understand).

The reality is that probably the Set 1 parameters are a bit optimistic as of now, so it would be wise to consider DL coverage enhancements seriously - in the end, both TN and NTN will benefit from this. Coverage, spectrum and power efficiency are quite important.

We are ok to consider LEO-1200 Set 1 parameters as reference, but we should be ready to consider DL EIRP scaling - otherwise, maybe best taking a slightly worse parameter set.

23 – Panasonic Corporation

Similar view with Qualcomm and DCM. Clearer guidance (e.g. reference EIRP or PFD value) would is necessary if the DL coverage study is continued in RAN1.

24 – Ericsson LM

We do not support this proposal. DL enhancements can be excluded already now with no further need for study. Reduction of TX power due to power splitting between beams is a new aspect that has not been discussed before. It deviates from the agreement in RAN1#109 that satellite parameters from TR38.821 will be reused. It seems we are now changing the assumptions in order to justify DL changes.

25 – Sony Europe B.V.

Basically OK with the proposal.

We would prefer to remove the note. It is unclear what "SSB design" means. While we would not expect the structure of the SSB to change, we think that it might be beneficial to transmit the SSB with different polarisations. It is not clear whether the polarisation aspects are part of the "SSB design", whatever that means.

26 – Sony Europe B.V. Basically OK with the proposal. We would prefer to remove the note. It is unclear what ”SSB design” means. While we would not expect the structure of the SSB to change, we think that it might be beneficial to transmit the SSB with different polarisations. It is not clear whether the polarisation aspects are part of the ”SSB design”, whatever that means.
27 – Baicells Technologies Co. Ltd We understand the concern on the usage of downlink power. But in our view, the assumptions given by RAN1 #109 agreements and the satellite EIRP parameters given by TR38.821 are clear enough; and power splitting is a matter of implementation. In this meeting, maybe it is more urgent to determine the PFD issue.
28 – HISPASAT SA We support the proposal of studying possible enhancements in DL, but requires further discussion based on the concerns from the partners.

Proposal 2.5: Revise in Rel-18 NR_NTN_enh WI, the following sentence :

«RAN to determine by ~~RAN#97 (for RAN1 items) and~~ RAN#98 (for RAN2 items) whether the study phase has identified any need for NTN-specific coverage enhancements in Rel-18. »

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

Feedback Form 14: NR_NTN_enh (RAN2 objectives)

1 – Classon Consulting [for FUTUREWEI] prefer to drop but can accept the proposal
2 – MediaTek Inc. This proposal seems not needed. The WID already mention ”RAN#98 (for RAN2 items) whether the study phase has identified any need for NTN-specific coverage enhancements in Rel-18”.
3 – Qualcomm Incorporated We do not see the need to update the WID, but do not have a strong view.

4 – Lockheed Martin

We do not see a need for this proposal.

5 – NTT DOCOMO INC.

OK with either to agree or drop. Intention would be the same.

6 – VIVO TECH GmbH

Fine.

7 – Samsung Electronics Romania

The proposal is not needed.

8 – ZTE Corporation

This proposal is not needed and we will check the RAN2 as scheduled.

9 – TURKCELL

We don't need this proposal.

10 – NOVAMINT

This proposal doesn't seem to be needed.

11 – ESA

We support, however it seems not needed

12 – Nokia France

Not necessary; normal practice would be to keep the whole text in the WID, which also helps to maintain visibility of what was done. The Status Reports provide the quarterly updates, without needing to update the WID.

13 – Inmarsat

we support, but also agree that it seems redundant

14 – Intel Corporation SAS

Agree with the proposal

We suggest to revise the wording as below:

«RAN to determine by ~~RAN#97 (for RAN1 items) and~~ RAN#98 (for RAN2 items) whether the study phase has identified any need for NTN-specific coverage enhancements in Rel-18 (considering RAN1 evaluation results and conclusions). »

Since the target is to identify the "need for NTN-specific coverage enhancements", in our understanding if PHY techniques can provide sufficient coverage for PUSCH, there is no "need" to pursue higher layer

enhancements. So whether there is a "need" should depend on RAN1 evaluation results and conclusions, e.g., when the DMRS bundling is enabled for PUSCH if there is still a coverage gap.

15 – HUAWEI TECHNOLOGIES Co. Ltd.

Agree with Intel's motivation!

Given RAN1 already conducted simulation and agreed on some area for enhancement, it is reasonable for RAN2 to take these evaluation and agreed enhancement into account so as to avoid developing unnecessary solution(s) or solution(s) that may not work together with the enhancements in physical layer. Slight modification on top of revision from Intel:

RAN to determine by ~~RAN#97 (for RAN1 items) and~~ RAN#98 (for RAN2 items) whether the study phase has identified any need for NTN-specific coverage enhancements in Rel-18 (considering RAN1 evaluation results, conclusions and enhancements)

16 – Ericsson LM

Proposal is fine

17 – Sony Europe B.V.

OK with proposal.

18 – HISPASAT SA

Ok with the proposal.

19 – HISPASAT SA

Ok with the proposal.

20 – Baicells Technologies Co. Ltd

Agree with the modification by Intel and Huawei. "considering RAN1 evaluation results, conclusions and enhancements" should be emphasized.

2.2 Moderator Summary and recommendations for further discussion

About 30 companies have responded to the 2nd set of questions and their feedbacks are appreciated.

Hereunder are, the analysis of the feedbacks per questions

P2.1: Most companies agree but two companies suggests in the Note: to replace “may” by ”shall”.

=> Moderator believes that this would require to consider the MEO and GEO specifics during the normative work. Hence it is preferable to replace “may” by “can”

Vivo/Huawei asked to remove “1 Rx antenna on board” since this is covered by the 3dB polarization loss assumption.

On the basis of the above, the moderato suggests to revise the proposal as follow:

Proposal 2.1bis: Capture in Rel-18 NR_NTN_enh WI

«The following reference scenario is considered for the definition of coverage enhancements for NTN: parameter set-1 for LEO-1200 satellite operating at Line of Sight (LOS) and commercial smartphones with -5.5 dBi antenna gain and 3 dB polarisation loss ~~(1 Rx antenna on board)~~.

Note: It is understood that the enhancements defined for LEO ~~may~~ can also apply to GEO and MEO scenarios as appropriate.

The targeted services are VoIP using AMR 4.75 kbps and data transmission services with Low data rate of 3 kbps”

P2.2: some specific comments have been provided

1st bullet: most companies agree. Mediatek/ZTE suggest to remove the example

2nd bullet (DMRS bundling)

- Oppo/ZTE/Samsung suggest that the study to focus on any additional spec impact to enable the DMRS bundling for NTN taking into account the impact of pre-compensation => Moderator concur that the focus should be clarified
- Apple is not convinced about the coverage benefit while QC/Samsung state that the coverage benefit in case of case of low SNR has been demonstrated => Moderator would agree with QC and Samsung on the basis of the simulations carried out in RAN1
- Apple and Turkcell suggest to restrict the use case of DM-RS bundling to VoIP during the normative work => Moderator believes that there is no need to restrict the enhancements to a specific service

On the basis of the above, the moderator suggests

Proposal 2.2bis: Capture in Rel-18 NR_NTN_enh WI «The objectives are for NTN:

- To specify coverage enhancements to PUCCH for Msg4 HARQ-ACK~~, e.g. repetition of PUCCH format 1~~ [RAN1, RAN4]

- To study~~, and, if beneficial for coverage, specify~~~~NTN-specific~~ DMRS bundling for PUSCH ~~with~~taking into account NTN-specific time-frequency pre-compensation and, if necessary, specify enhancements to the Rel-17 procedures [RAN1] »

P2.3: some specific comments have been provided:

- Oppo suggests to revise to RAN1#109
- Vivo suggests that since the PRACH repetition to be introduced in NR Rel-18 coverage enhancement topic apply to all formats, then there is no need to restrict the enhancements to PRACH format B4 for NTN
- Mediatek, Lockheed, CATT, Hughes, ZTE, Eutelsat, ESA, Novamint ask the AI 9.12.1 to be replaced by the corresponding WI to be explicit
- NTT Docomo/Huawei asked to remove ambiguity of "may be" by "is" so that the guidance on the work in RAN1 is clear on whether NTN perspective is considered or not.

In view of the above, the Moderator suggests to revise the proposal as follow:

Proposal 2.3bis: Capture in Rel-18 NR coverage enhancements WI

« additional PRACH ~~(at least format B4)~~ enhancements is~~may be~~ considered, if needed, in view of NTN specifics (i.e. agreed at RAN1#109, under ~~AI 9.12.1~~NR_NTN_enh WI) »

P2.4: The interest on DL channel enhancements is acknowledged by large number of companies. However the use case is not clear which prevents to provide a clear guidance for RAN1.

There are different views on the use case

- Power split on board: Apple, Lockheed, Ligado, Novamint, Inmarsat
- PFD limits: ZTE, Inmarsat, Baicell

A majority of companies are favorable to continue discussing the topic except Mediatek, Samsung, Nokia, Ericsson which consider the issue unclear.

Moderator recommends to further discuss the issue at RAN1 until RAN#98-e then decide at RAN#98-e, the way forward.

In view of the above, moderator suggest to revise the proposal as follow:

Proposal 2.4bis: Capture in Rel-18 NR_NTN_enh WI

"Start normative phase on uplink channel enhancements after RAN#97-e.

RAN1 discuss further DL enhancements and decide the way forward at RAN#98-e."

P2.5: Most companies don't see the need for such proposal which is then dismissed. Discussion is closed

The following set of proposals are hence submitted for agreement to the plenary during the 2nd GTW session:

Proposal 2.1bis: Capture in Rel-18 NR_NTN_enh WI

«The following reference scenario is considered for the definition of coverage enhancements for NTN: parameter set-1 for LEO-1200 satellite operating at Line of Sight (LOS) and commercial smartphones with -5.5 dBi antenna gain and 3 dB polarisation loss.

Note: It is understood that the enhancements defined for LEO can also apply to GEO and MEO scenarios as appropriate.

The targeted services are VoIP using AMR 4.75 kbps and data transmission services with Low data rate of 3 kbps"

Proposal 2.2bis: Capture in Rel-18 NR_NTN_enh WI «The objectives are for NTN:

- To specify coverage enhancements to PUCCH for Msg4 HARQ-ACK [RAN1, RAN4]

- To study DMRS bundling for PUSCH taking into account NTN-specific time-frequency pre-compensation and, if necessary, specify enhancements to the Rel-17 procedures[RAN1] »

Proposal 2.3bis: Capture in Rel-18 NR coverage enhancements WI

« additional PRACH enhancements is considered, if needed, in view of NTN specifics (i.e. agreed at RAN1#109, under NR_NTN_enh WI) »

Proposal 2.4bis: Capture in Rel-18 NR_NTN_enh WI

"Start normative phase on uplink channel enhancements after RAN#97-e.

RAN1 discuss further DL enhancements and decide the way forward at RAN#98-e."