RAN-R18-WS-non-eMBB-Samsung - Version 0.0.6
RAN

3GPP TSG RAN Rel-18 workshop RWS-210593

Electronic Meeting, June 28 - July 2, 2021

Agenda Item: 4.2

Source: Samsung

Title: Email discussion summary for [RAN-R18-WS-non-eMBB-Samsung]

1 Introduction

This NWM document is intended to capture the comments and questions from interested companies on the proposals from Samsung for non-eMBB in 5G-Advanced. According to the guideline from the RAN chair, the following timeline is to be followed.

Round 1 Q&A: Questions: June 14 08:00 UTC – June 17 8:00 UTC; Answers: June 17 8:00 UTC – June 18 23:59 UTC

Round 2 Q&A: Questions: June 21 08:00 UTC – June 23 8:00 UTC; Answers: June 23 8:00 UTC – June 24 18:00 UTC

Before June 25 18:00 UTC, email discussion summary is to be uploaded

1.1 Related documents

This email discussion summary covers the following document:

- RWS-210186 NTN enhancement for 5G Advanced

2 Technical item: NTN Enhancement in RWS-210186

In Rel-17 NTN, specification is being designed with assumption of transparent payload for satellites and active GNSS capability for UEs. Also, it is assumed that the entire LEO constellation is already available.

RWS-210186 suggests the following enhancements on NTN support in Rel-18 to enlarge the application areas that can take benefit of NTN.

- Regenerative payload

- Inter-satellite link (ISL)

- Multi-connectivity

- UE without GNSS capability

3 Q&A on NTN Enhancement (RWS-210186)

Please use section 3 to provide any comments and questions on the proposals from Samsung on NTN enhancement for 5G-Advanced.

3.1 Round 1 Questions

Feedback Form 1: Round 1 Questions

1 – Asia Pacific Telecom co. Ltd We share the same view. However, for Multi-connectivity, we wonder how to synchronize multiple satellites considering different propagation delay.
2 – Intelsat We generally agree with the listed enhancements. ISL may not be as important as the others.
3 – Spreadtrum Communications For regenerative payload, the timing enhancement in R17 may be completely reusable. What are Samsung's specific considerations for timing enhancements in the scenario of regenerative payload?
4 – Lenovo (Beijing) Ltd Regarding timing relationship enhancement for regenerative payload, we share similar concern as Spreadtrum on the spec impact. Regarding DC/CA between GEO and LEO, we are wondering whether there is large difference between uplink Tx power for GEO and LEO?
5 – ESA We support all of them.
6 – Intel Corporation (UK) Ltd Enabling NR NTN without GNSS at the UE will lead to decreased system performance due to larger PRACH reception window (especially for GEO) and frequent PRACH transmission (especially for LEO). Do you expect that significant part of connections will correspond to low-cost UEs without GNSS considering that almost all the devices (e.g. smarthphones) have GNSS?
7 – CATT We're almost aligned in regenerative payload,ISL, CA/DC operation. Due to the limit of time in Rel-18, it seems not possible to do everything in this release. Maybe we could focus on the regenerative architecture with full gNBs on board, the CU-DU split architecture and IAB like topology could be low prioritized or postpone to the future release.Base on this, the ISL is a kind of transport

layer which is out of 3GPP, we just need to focus on the Xn or the other interface (e.g. NG) carried on the ISL.

What do you think of that?

8 – LG Electronics France

We have same view. However, we are afraid if UE without GNSS capability will bring too much work load in Rel-18 because some mechanisms being discussed in Rel-17 assumes that the UE knows its location information. If the UE does not know its GNSS location information, the mechanisms may need to be re-discussed. (e.g. location-based CHO)

9 – THALES

Before considering UE without GNSS capability, should be discuss about the need to define **Network based UE location service** (LCS) to address some regulated servive requirements in terms of accuracy&reliability/trust (e.g. for emergency call)

As per multi connectivity, do you consider asynchronous DC combined with CA between satellites to improve performance or between NTN-TN to improve TN & NTN ?

As per regenerative payload, what architecture would you prioritised among gNB on board, gNB-DU on board, IAB node on board and why ?

10 – Apple GmbH

We are inline with these proposals. What are your views on the TN-NTN possibilities going forward with re-generative mode.

3.2 Round 1 Answers

3.2.1 Response to Asia Pacific Telecom

Even though multi-connectivity is applied, we think a UE will transmit for only one satellite at a given time. Due to the limit of UE power, simultaneous transmission could not be possible. With this application, the UE can apply UL time/frequency synchronization (i.e., TA and freq. offset compensation) for the target satellite.

Similar to LTE-NR dual connectivity, a UE can be connected to a GEO satellite for one traffic type and a LEO satellite for another traffic type. Synchronization can thus be independent for different types of NTN platforms.

3.2.2 Response to Intelsat

We think that regenerative payload and ISL are one set to be supported, where regenerative payload is a pre-requisite for ISL. In our view, regenerative without ISL is possible, but this cannot change any deployment of GW compared to transparent mode, i.e., regenerative payload without ISL should have a gateway on the ground within its coverage. So, we think, without ISL, full advantage of regenerative payload cannot be utilized and the actual coverage of a satellite constellation is not extended compared to transparent payload.

Once the architecture for regenerative payload is decided, the interface for ISL can be done with non-3GPP solution or with reusing Xn interface as much as possible.

The combination of ISL and regenerative payload is critical to cover certain geographically unserved areas

such as parts of oceans; otherwise, ubiquitous/global connectivity is not achievable.

3.2.3 Response to Spreadtrum Communications

Yes, the timing relation defined in Rel-17 NTN can be reused. It is because transparent payload is the worst case compared to regenerative payload in PHY perspective. Our proposal is to check and study the possibility to optimize the timing relationship and procedure. We think it could be dependent on the architecture of regenerative payload.

3.2.4 Response to Lenovo

Yes, as we explained above, the timing relation defined in Rel-17 NTN can be reused. It is because transparent payload is the worst case compared to regenerative payload in PHY perspective. Our proposal is to check and study the possibility to optimize the timing relationship and procedure. We think it could be dependent on the architecture of regenerative payload.

For DC/CA-like multi-connectivity, of course, there will be a difference of UE power for GEO and LEO. But, we think, due to the limit of UE power, simultaneous transmission could not be possible so that the UE will transmit for only one satellite at a given time. Then, the transmission power could be set to the target satellite at the time.

3.2.5 Response to ESA

Thank you for your support. We see regenerative payload with ISL as coverage enhancement of NTN system, multi-connectivity as mobility enhancement, and UE without GNSS as extended use cases. Of course, the work scope could be determined based on TU and time frame.

3.2.6 Response to Intel

We agree your analysis on the performance. But this feature is for better-than-nothing when a UE does not have GNSS. Most of the recent smartphones has GNSS, but this is not the main target of this feature. Low-cost UE could be IoT devices and reduced capability UEs.

One other aspect that can be seen in other companies' proposal is for the case that the received signal power from GNSS is much weaker than that from LEO satellites (especially, with mega-constellation). This could be possible even though this needs to be further studied whether this case is practical or not.

3.2.7 Response to CATT

We think the work scope could be determined based on TU and time frame. For the architecture of regenerative payload, we are very much open for now to discuss on which architecture will be adopted in Rel-18. This will be determined based on the time frame of the release and applicability of the architecture.

3.2.8 Response to LG Electronics

The work scope and prioritization of the feature could be determined based on TU and time frame. As done during SI, UL timing synchronization and PRACH format might need to be discussed and that work load could be big actually. But, we believe it is worth to discuss from what have been done in SI to enlarge the applicability of NTN to many devices.

3.2.9 Response to THALES

For network based UE location service, we think it depends on the devices. For example, if we consider a smartphone, LCS should be supported due to regulatory issue as you explained. How to support/address this issue is up to further discussion.

We are open to utilizing DC between NTN and TN for mobility enhancement and throughput enhancement. For supporting higher data rate, we need to first clarify the use cases of NTN for the higher data rate. With the motivation of mobility management, we also see multi-connectivity between GEO and LEO. The case between two adjacent LEO satellites might be considered as well. This can be also applied to the case of TN&NTN, where NTN becomes the main anchor and the TN becomes the secondary when the terrestrial cells are very distributed without continuity. For spec impact perspective, the required features could be similar for GEO/LEO, LEO/LEO, and NTN/TN.

We are open for the architecture option with the following advantages.

1) gNB at sat: adaptation may be needed in NG.

2) gNB-DU at sat: adaptation may be needed in F1

3) IAB-like sat: possible to support multi-hop routing with largest spec impact to consider.

3.2.10 Response to Apple

TN-NTN handover (or multi-connectivity) can be done even with transparent payload. We can consider its optimization with respect to regenerative payload. How to optimize depends on the architecture of the regenerative payload, i.e., whether it is based on gNB at sat, gNB-DU at sat, or IAB-like sat.

3.3 Round 2 Questions

Please leave the comments and questions during June 21 08:00 UTC – June 23 8:00 UTC.

Feedback Form 2: Round 2 Questions

1 – Omnispace
We support your proposals.

3.4 Round 2 Answers

3.4.1 Response to Omnispace

Thank you for your support.

We believe Rel-18 enhancement of NTN could offer truly global coverage with flexibility of deployment.

4 Summary

During Q&A rounds on NTN enhancement via NWM, questions and comments from 11 companies and corresponding responses were provided and summarized in this contribution.

For the detailed discussion phase, it is suggested that TSG-RAN continues discussing NTN enhancements including regenerative payload (e.g., gNB on board, gNB-DU on board, or IAB node on board) with inter-satellite link (ISL), multi-connectivity, and UE without GNSS capability.