

3GPP TSG RAN #97-e

RP-222254

E-meeting, September 12th - 16th, 2022

Agenda Item: 9.3.2.7

Document for: Decision

Discussion on coverage enhancement for Rel-18 NR NTN

NTT DOCOMO, INC.

■ WID description (RP-221819)

4.1.1 Coverage enhancement

The Rel-18 NTN objectives are focused on the applicability of the solutions developed by general NR coverage enhancement to NTN, and identifying potential issues and enhancements if necessary, considering the NTN characteristics including large propagation delay and satellite movement. Only NTN-specific characteristics are to be included in this coverage enhancement work, otherwise it should be part of another WI (e.g., UL enhancement of coverage). The work needs to cover the use case of voice and low-data rate services using commercial smartphones with more realistic assumptions on antenna gains instead of 0dBi currently assumed for link budget analysis for non-terrestrial networks. The specific realistic antenna gain assumption will be determined at the working group level. **The evaluation should also take into account any related regulatory requirements, e.g., ITU limitation of power flux density.**

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

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

The following items are shown as examples of areas to consider in the next step of the study. The actual items for study will be based on the evaluation of coverage issues specific to NTN identified above.

- NTN-specific repetitions enhancements beyond techniques covered in Rel-17 CovEnh WI for the relevant channels
- NTN-specific techniques for improved diversity and/or reduced polarization loss
- Improved performance of low-rate codecs in link budget limited situation including reducing RAN protocol overhead for VoNR
 - NOTE: Intent is not to introduce a new codec.

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

■ Update WID according to study phase

- At the last RAN1 meeting, UL channels that have insufficient coverage performance to accommodate smartphone UE were discussed/identified based on companies' simulation evaluations
 - » For PUSCH for VoIP, if DMRS bundling is applicable, performance requirement can be met. At least whether/how DMRS bundling can be applied in LEO scenario should be evaluated further
 - » PUCCH for Msg4 HARQ-ACK is definitely insufficient and hence enhancement is necessary
 - » For PRACH, we do not think PRACH enhancement in this WI is necessary since at least PRACH format 2 can meet the coverage performance requirement, and also Further NR coverage enh WI will enhance PRACH coverage performance
- For DL, although there was no agreed observation/conclusion, it seems that clearly companies' observations are aligned as DL enhancement is unnecessary if satellite transmit power reduction (e.g., due to PFD limitation) is not performed. The key issue is whether such a reduction should be considered or not. Further discussion at WG-level is meaningless for the issue. RAN plenary should conclude whether(/how) to handle this satellite transmit power reduction

Proposal: For coverage enhancement, study PUSCH for VoIP and PUCCH for Msg4 HARQ-ACK

- ***Whether/how DMRS bundling is applied to PUSCH for VoIP***
- ***How PUCCH for Msg4 HARQ-ACK is enhanced***

Proposal: Conclude whether satellite transmit power reduction (e.g., due to PFD limitation) is considered for DL coverage enhancement or not

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