3GPP TSG RAN 93-e
September 13th – September 17th 2021

RP-212323
Agenda Item 9.0.2

NTN NR Enhancements

MediaTek Inc.

Introduction

- Release-17 is the first release for NTN NR with minimum essential functionality for a working NTN NR system
- Release 18 should
  - Prioritize the service aspects of NTN NR with minimum additional enhancements to Release-17 NTN NR functionalities as needed: enhancements for VoNR should be studied (due to e.g. UL link budget limitation) and MBS support defined.
  - Enable single device availability to cover all NTN bands (half-duplex FDD)

NTN NR Enhancements
RAN1-led

3GPP TUs (Total w/ 9 meetings)			
RAN1	RAN2	RAN3	RAN4
TBD	TBD	TBD	TBD

SA/CT Dependency: Yes

Increase the viability and versatility of NTN NR access: mobility, coverage, services
Enable single device availability to cover all NTN bands (half-duplex FDD)

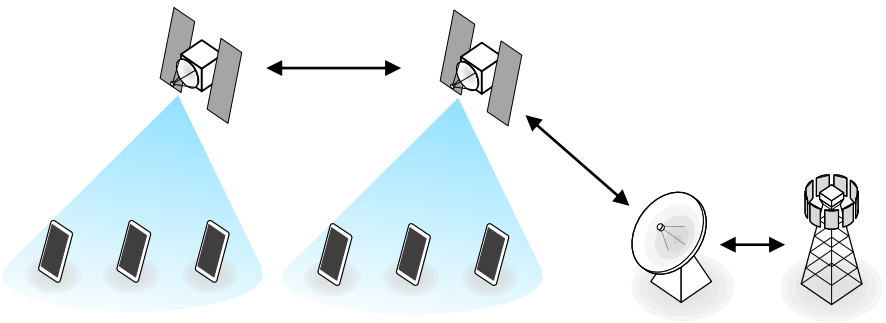
Objective I: Rel-17 Leftovers [RAN1, 2] *[subject to R17 status]*

Objective II: Mobility enhancements [RAN2, 1] *[subject to R17 status]*
- Scope would depend on whether Release-17 NTN NR can significantly benefit from additional enhancements in some scenarios and use cases

Objective III: Regenerative architecture [RAN3, 2]
- Support very dense LEO satellite deployment where the number of LEO satellite greatly outnumbers the number of GateWay stations on the ground, and also where it is not possible to locate GateWay stations – i.e. in the middle of vast oceans

Objective IV: HD-FDD [RAN1, 2]
- Re-use RedCap work but avoiding the corresponding BW/antenna restrictions

Objective V: VoNR Enh., MBS support [RAN1, 2]



NTN NR Enhancements
Selective evolution

- With Rel-17 enabling minimum essential functionality for a working NR NTN system, Rel-18 need to:
- **Prioritize the service aspects** of NTN NR with **minimum additional enhancements** to Release-17 NTN NR functionalities as needed: enhancements for **VoNR** should be studied (due to e.g. UL link budget limitation) and **MBS** support defined.
- Enable **single device availability** to cover all NTN bands (half-duplex FDD)
- We propose **NR NTN prioritizes** the following:
- **Regenerative architecture** to support very dense LEO satellite deployment (LEO satellites greatly outnumbers GateWays on the ground, or no GateWay in the middle of oceans)
- **HD-FDD based on RedCap while avoiding BW/antenna restrictions**
- Support **Voice Over NR with packet interruption mitigation** due to low UL SNR and beam / cell switching for NTN
- Support **(Rel-17) Multicast Broadcast** Service for NTN

HD-FDD support is key to NTN

- Major enabler of NTN due to UE economies of scale in low bands (sub3GHz) (smartphone economics).
- It is very important to enable a single device availability across all NTN bands.
- With Support of HD-FDD, support for NTN is enabled without requiring any additional band-specific duplexers. Deployments in NTN-only bands (i.e. with NO TN equivalent) will likely be jeopardized by lack of availability of duplexers.
- We strongly recommend this topic be in scope of Rel-18 for NTN viability.
- Note that RedCap work can be leveraged (without consideration on Tx/Rx reductions) but additional work is needed to ensure the above.

NTN NR Enhancements
Selective evolution

- We propose the following NOT be included in Rel-18:
  - Support of UE without GNSS would require new RACH and closed-loop frequency correction with numerous RACH transmissions in connected for high-velocity UEs, high impact on RACH capacity
  - Network-based positioning (use GNSS)
  - Beam management and BWP association (in scope of Rel-17)
  - Coverage enhancement with higher slot aggregation / repetitions (up to 32 considered in Rel-17 NR Coverage Enhancements)
  - DL PAPR reduction assuming NR waveform is implementation based technique, new waveform should be out of scope as would require new air interface
  - Discontinuous coverage seems contradictory to mature LEO constellation, regenerative architecture
  - RedCap channel BW reduction < 5 MHz would require new SSN design, proponent of this topic may consider using LTE eMTC