中国移动
China Mobile

3GPP TSG RAN Rel-18 workshop
Electronic Meeting, June 28 - July 2, 2021

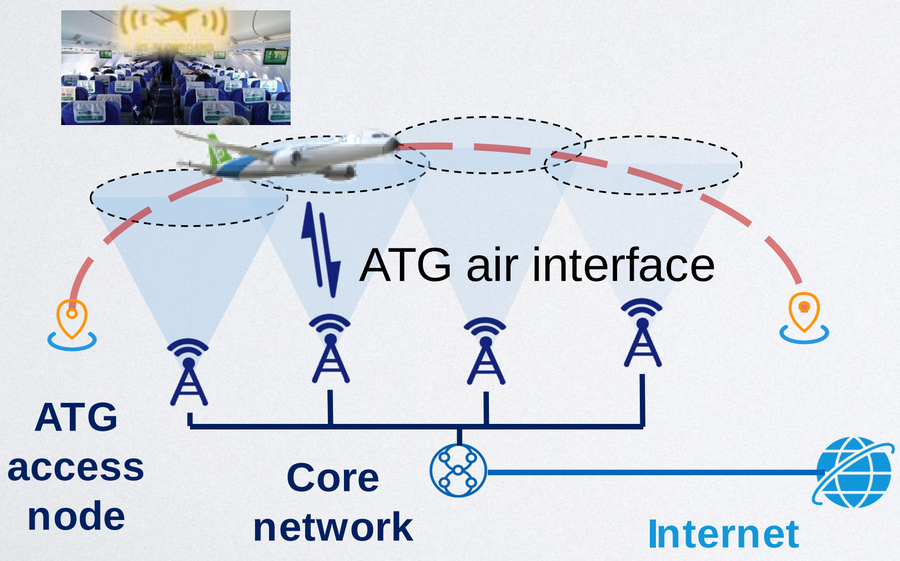
RWS-210337

Motivation for new WI on air-to-ground network for NR

Agenda Item: 4.1
Source: CMCC

BACKGROUND

- Air-to-ground (ATG) network refers to in-flight connectivity technique, using ground-based cell towers that send signals up to an aircraft’ s antenna(s) of onboard ATG terminal. As a plane travels into different sections of airspace, the onboard ATG terminal automatically connects to the cell with strongest received signal power, just as a mobile phone does on the ground



- **Scenario**: to provide broadband access for civil aircrafts
  - ATG gNB deployed on the ground, with antennas pointing upward to form an aerial cell
  - Aircraft as a special UE
  - Aircraft to ATG gNB: 5G air interface
  - Aircraft to passengers: WiFi access

JUSTIFICATION

- There are several regional commercial or trial in-flight networks based on hybrid techniques of ATG and satellite communication, such as Gogo’s commercial network in USA, Inmarsat’s commercial network in Europe, and CMCC’s trial network in China. Regarding the hybrid network, satellite link focus on providing every-where connectivity (e.g., when cross the sea), while ATG link focus on providing high-quality data services for all service available areas (e.g., inland and coastline area).

- In RAN#86 meeting, the Rel-17 WID (RP-193234) solutions for NR to support non-terrestrial networks (NTN) was approved. The NTN work item aims to specify the enhancements identified for NR NTN (non-terrestrial networks) especially LEO and GEO with implicit compatibility to support HAPS (high altitude platform station) and ATG (air to ground) scenarios

JUSTIFICATION

- Considering that ATG has the advantage of high throughput, low propagation delay, and low cost application, some operators and the aircraft industry have a strong request for the deployment of ATG, and it is urgent to start the standardization of ATG, especially for RAN4 requirements which is very important for the coexistence of ATG and IMT
- Although the RAN1/2/3 aspects of standardization work are generally common for satellite, HAPS and ATG, the RAN4 aspects differ very significantly. The node definitions, spectrum considerations and co-existence considerations all differ. In the case of ATG, both base station and UE will be unique types. ATG will operate within existing bands and does not need new bands and band properties to be identified. The NTN WI includes development of generic requirements for RAN4, however in practice the work will be separate and different for Satellite, HAPS and ATG
- The Rel-17 NTN WI does not specify the RF requirements of ATG, in order to avoid confusion and overloading of the NTN WI and the low dependency between RAN1-3 work and RAN4 work for ATG, it is proposed that the ATG RAN4 work is performed within the context of this ATG WI. The proposal to split off RAN4 work is exceptional for the NTN work due to the large and complex scope of covering quite different types of system and low dependency on RAN1-3.
- **Proposal: A separate ATG WI led by RAN4 in Rel-18**

Objectives: ATG scenarios and RF requirements

Specify features to core specifications of RF requirements for coexistence between ATG and IMT terrestrial network [RAN4]

- Identify key characteristics where it is absolutely necessary to differentiate ATG BS and UEs from ground based BS and UEs
  - Aim to reuse existing requirements for BS and UE where possible.
- Study and specify the framework how ATG core requirements are defined.
  - This includes identifying whether the requirements are captured within the existing specifications or new specifications are created.
  - Determine whether conducted, OTA or both types of requirement are required for both the BS and UE
- Identify the FR1 potential band(s) to be used as example for ATG
- Perform FR1 co-existence evaluation for ATG network (e.g. ACLR, ACS)
- Specify new UE/BS type(s) for ATG network if necessary
  - Taking into account identified differences between ATG and ground based systems
- Specify RF requirements for ATG UE/BS
  - Considering the results of co-existence simulations in terms of impact on emissions and RX requirements, cell sizes and link budgets, technology capabilities, likely BS and UE architectures and other relevant aspects.
- Specify test procedures for ATG BS conformance testing
  - Determine at an early phase whether conducted, OTA or both types of testing are needed

Objectives: RRM/Demod requirements

Indentify and specify RRM/Demod requirements for ATG, taking into account the decisions/outcome of Rel-17 NTN work item.

- RRM core requirements for ATG UE. [RAN4]
  - Considering the different nature of ATG UEs and their view of the network, increased cell sizes and other relevant aspects.
- RRM performance requirements and test cases for ATG UE type. [RAN4]
- Demodulation performance requirements and test cases for ATG UE/BS. [RAN4]

Thanks!