China Academy of Telecommunication Technology

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Views on Rel-19 UAV and SL Relay Enhancements

CATT

Introduction

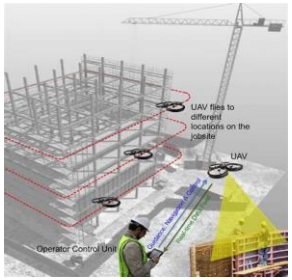
- In this paper, we will further discuss the following additional RAN2-led topics:
  - UAV
  - SL Relay enhancement

UAV

UAV USE CASES

Top UAV use cases:

- Construction
- Agriculture
- Insurance Claims
- Offshore Refining
- Police, Fire, Coast Guard, Border Control
- Journalism, News
- Utilities
- Filmography
- Logistics



Work done in R18 UAV

Enhancements to measurement reporting

- ✓ Height-based Reporting for Aerial UE Communication
- ✓ Height-dependent Configurations for Aerial UE Communication
- ✓ Flight Path Information Reporting for Aerial UE Communication
- ✓ Measurement reporting based on a configured number of cells (i.e. larger than one) fulfilling the triggering criteria simultaneously

Management/regulation related

- ✓ Subscription-based aerial-UE identification
- ✓ The support for UAV identification broadcast (BRID) in NR PC5.
- ✓ The support of DAA using the same framework as BRID without DAA specific enhancements
- ✓ Based on the technical conditions defined for aerial UE usage in ECC Decision (22)07, specify the necessary UE types and additional OOBE requirements for aerial UEs in 1710-1785 MHz, 2500-2570 MHz and 2570-2620 MHz.

RAN tasks in R18 UAV include:

1. **Measurement reporting enhancements.**
2. **Enhancements to fulfill management/regulatory requirements.**

Starting point of R19 UAV

According to the discussion in RAN#101, the following objectives can be further discussed

- ⇨ Starting point of an acceptable objective:
- Mobility enhancements
  - Specifying new CHO triggering events
  - Studying/specifying LTM enhancements for UAV
- No transmit zone (if SA2 will also do work on this)
- Enhancements for RRC_IDLE/RRC_INACTIVE

In our view, the following bullets could be prioritized:

1. **CHO enhancements for UAV**
2. **No-transmit zone**

More justification is needed for:

1. **LTM enhancements for UAV**
2. **Enhancements for RRC_IDLE/RRC_INACTIVE**

R19 UAV objective: mobility enhancements

Improving mobility performance of aerial UEs

✓ **Motivation:**

Flight Path Information Reporting has been supported in R18, which means network can know the UE trajectory that can be used for mobility optimization

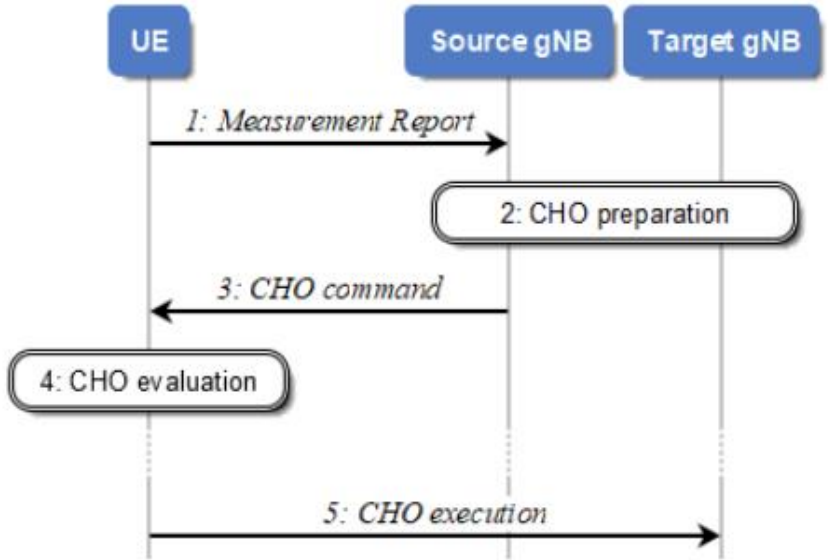
✓**Objective:**

1. CHO considering flight path plan

The potential enhancements with flight path plan can be considered, e.g., CHO triggering events along with flight path

2. CPAC considering flight path plan

The triggering mechanism with flight path can also be applied to CPAC



R19 UAV objective: no-transmit zones

No-transmit zones

✓ **Motivation:**

ECC decision (22)07 on harmonized framework on aerial UE usage in MFCN harmonized bands states "a mechanism is necessary to ensure that aerial UE respect no-transmit zones".
The detail can be found in right-hand side figure.

✓**Objective:**

1. No-transmit zone is defined in RAN, e.g., assistance information is provided by RAN to prohibit aerial UE from transmitting in several bands near DTT receiver, RAS sites and radars.
2. Access/barring mechanisms to block UAV.

A1.2 OPERATIONAL CONDITIONS

The operational conditions to be defined and implemented at national level provide additional measures to the technical conditions in order to protect other services.

703-733 MHz: Protection of DTT receivers and RAS sites

Aerial UE operating in 703-733 MHz should not transmit when less than 30 m above ground level to avoid interference to DTT receivers[1];

Nationally determined no-transmit zones are required around RAS sites operating in 1400-1427 MHz for aerial UE operating in the 703-718 MHz frequency band, as appropriate.

832-837 MHz: Protection of RAS sites

Nationally determined no-transmit zones are required around RAS sites operating in 1660-1670 MHz for aerial UE operating in the 832-837 MHz frequency band, as appropriate.

2500-2570 MHz/2570-2620 MHz: Protection of RAS sites and radars

Nationally determined no-transmit zones are required around RAS sites operating in 2690-2700 MHz for aerial UE operating in the 2500-2570 MHz or 2570-2620 MHz frequency band, as appropriate;

Nationally determined no-transmit zones might be required around radars operating in 2700-2900 MHz for aerial UE operating in the 2500-2570 MHz or 2570-2620 MHz frequency band.

Summary for R19 UAV

The following enhancements can be considered for R19 UAV:

1. Further mobility enhancements to aerial UEs, i.e., to improve the performance of CHO/CPAC by taking advantage of flight path plan, etc.

2. No-transmit zone is defined in RAN to fulfill the regulatory requirement in ECC Decision 22(07), e.g., assistance information is provided by RAN to prohibit aerial UE from transmitting in the corresponding bands around DTT receiver, RAS sites and radars.

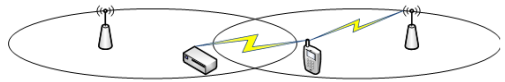
   Note: further refinement of the NTZ objective should take into account progress/request from SA/SA2

SL Relay Enhancements

Multi-hop

Rel-17/18 Background

- ✓ **Rel-17**
  - Single hop U2N Relay
- ✓ **Rel-18**
  - Single hop U2U Relay



Single-hop U2N Relay

Single-hop U2U Relay

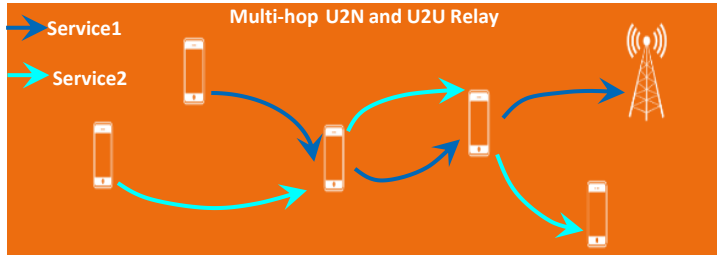
Multi-hop U2U/U2N Relay

- ✓ **TS 22.261**

Scenario	Estimated number of hops
InHome Scenario	2 to 3
Factory Sensors	2 to 3
Smart Metering	2 to 5
Containers	3 to 9
Freight Wagons	10 to 15
Public Safety	2 to 4
Wearables	1 to 2

- ✓ **SP-230521/S1-233364**
  - Multi-hop U2U relay requirement for public safety
  - 2~6 hops of multi-hop U2U relay for public safety

- ✓ **Rel-19 potential enhancements**
  - Multi-hop U2N Relay
  - Multi-hop U2U Relay

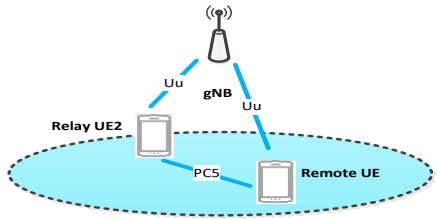


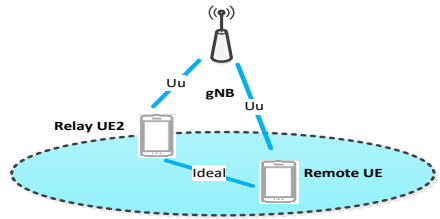
Multi-path enhancements

Rel-18 Background

✓ **Rel-18**

- Only consider intra-gNB
- One direct path + one indirect path
- UE-UE interface can be PC5 or ideal





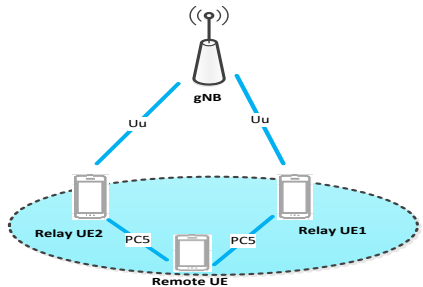
Multi-path enhancements

✓ **TS 22.261 requirements**

The 5G system shall support same traffic flow of a remote UE to be relayed via different indirect network connection paths.
The 5G system shall support different traffic flows of a remote UE to be relayed via different indirect network connection paths.

✓ **Potential enhancements**

- Intra-gNB multi-path with two indirect paths
- Inter-gNB multi-path with one indirect path and one direct path
- Inter-gNB multi-path with two indirect paths



Objectives & prioritization

Potential objectives

- ✓ **Specify potential solutions for multi-hop U2N Relay and U2U Relay [RAN2, RAN3]:**
  - Control plane procedures (e.g., relay discovery, relay (re)selection, relay connection setup and etc)
  - User plane procedures (e.g., QoS split, resource allocation and etc)
- ✓ **Specify mechanisms to enhance multi-path for the following scenarios [RAN2, RAN3]:**
  - Intra-gNB multi-path with two indirect paths
  - Inter-gNB multi-path with one indirect path and one indirect path
  - Inter-gNB multi-path with two indirect paths

* * Note: Support of L3 multi-hop U2N/U2U relay are subject to SA2 progress.

Prioritization consideration

- ✓ **Multi-hop enhancements can be prioritized over multi-path enhancements**
- ✓ **Multi-hop U2U relay can be prioritized over multi-hop U2N relay considering the public safety requirement**

THANK YOU