



File # 0202-EX-CN-2021
Response to FCC RFI
(Received on April 2, 2021)



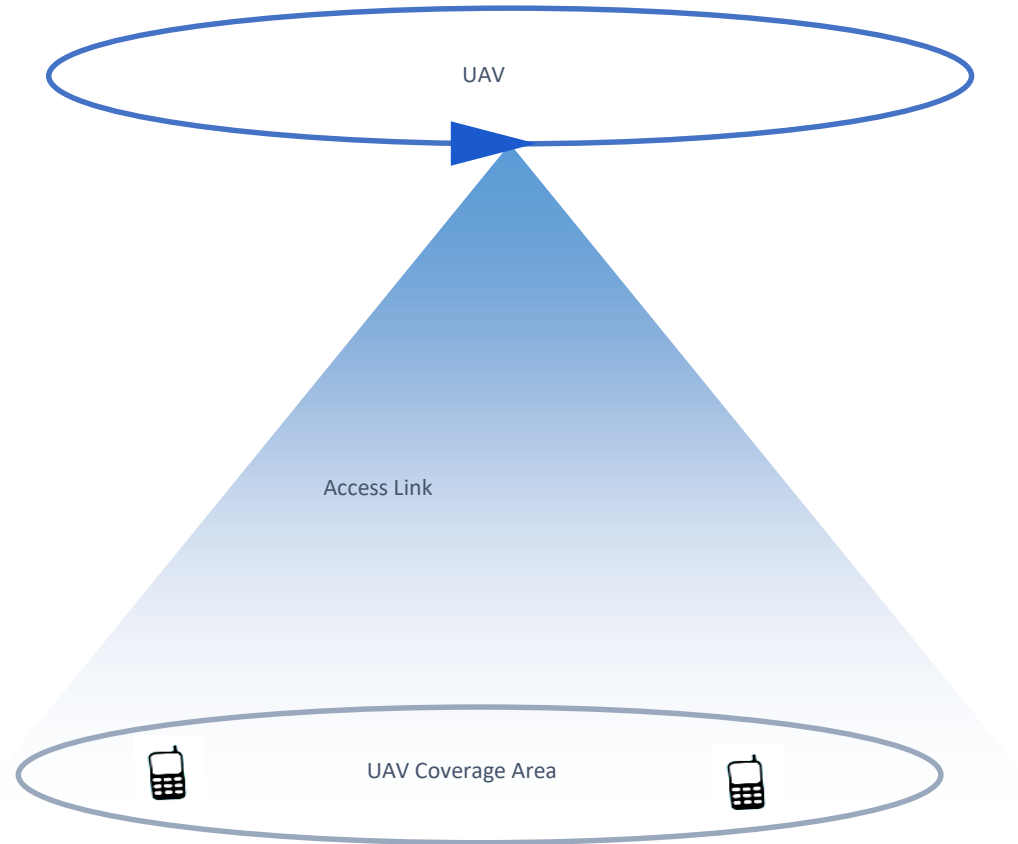
Project Summary

- Implement and evaluate experimental wireless networks, for voice, video & data comms., between UEs (e.g. cell phones) within a defined coverage area, through a node on a UAV.
 - The UAV will fly in a loiter path over an area of approximately 1km diameter, or less, at altitudes of 500m, or less, centered on the test site ground location.
 - Multiple UEs will be deployed within a 1km radius area at the location.
 - Manual and auto-flight operations will be conducted in accordance with FAA guidelines and FAA authorization.
 - Target applications include Private, IoT and Emergency Networks.
- Two network configurations will be evaluated;
 - Configuration 1: A single band transceiver, with e-node B functionality, will be carried in a UAV. 2x2 MIMO directional antennae (6-9 dBi gain) will be fixed to the underside of the UAV in a downward orientation.
 - Configuration 2: A dual band transceiver, for both uplink and downlink communications will be carried in a UAV. e-node B functionality will be located in a ground station. 2x2 MIMO antenna, similar to Configuration 1, will be mounted on the UAV. The ground station antenna will be an upward-pointing MMIMO array, which can track the UAV.
- Network equipment will consist of COTS and vendor-supplied prototypes.
 - Equipment and configurations will be pre-tested in the lab prior to UAV deployment

Project Summary (cont.)

- Prior to flight testing, we will seek permission from licensed users in the area.
- Testing will be done in two remote areas to minimize the potential for user conflicts.
- Both test sites have dedicated runways, launch, landing and operation facilities.
- The maximum duration of each test is expected to be no more than a few hours.
- Potential interference will also be reduced by restricting the coverage area by,
 - Implementing tight loiter flight plans
 - Setting the directionality of the UAV and ground station antennae.
- We will also deploy a base station analyzer at the test site, to monitor any activity in the operating frequency range prior to, and during, testing.
 - If activity is detected prior to flight, we will either migrate our transmission to an unused part of the approved band, or void the experiment.
 - If activity is detected during flight, the transmission will be terminated, by remotely interrupting the electrical power to the transmitter on the UAV.

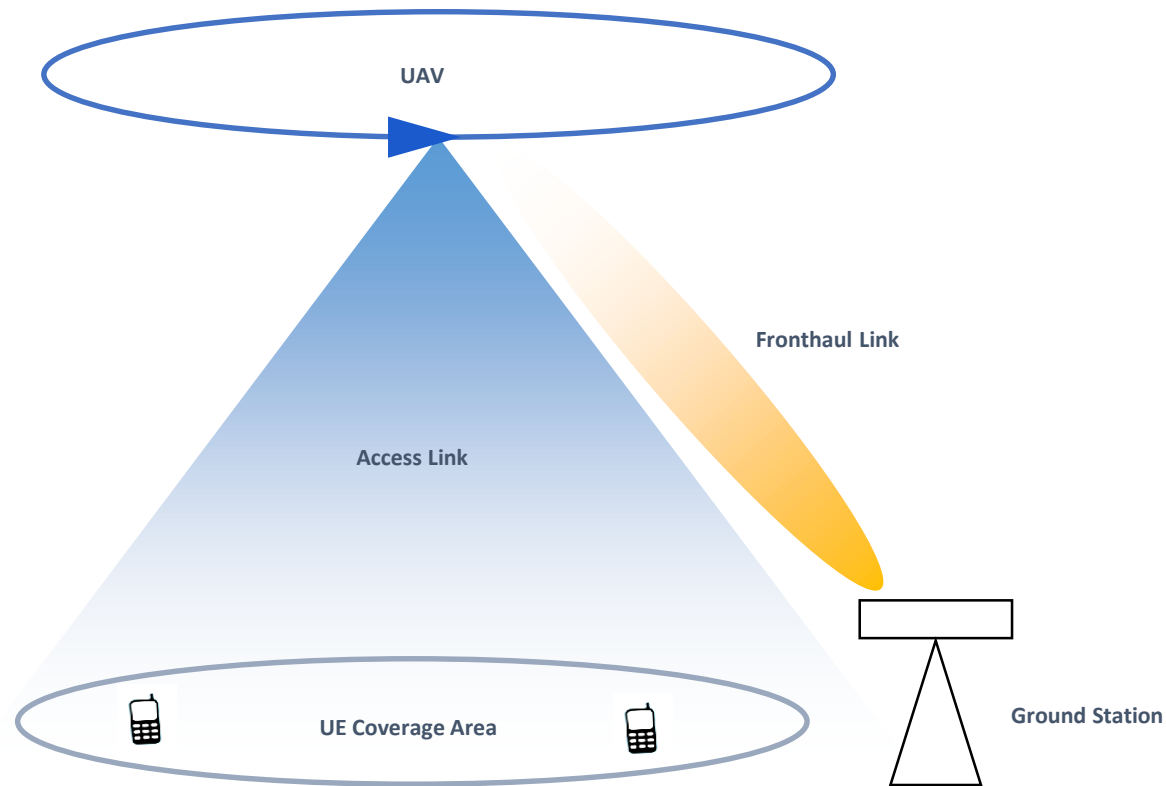
Network Configuration 1



UAV to UE Transmission Frequencies (MHz)

- 716-728 MHz
- 768-788 MHz
- 2620-2690 MHz

Network Configuration 2



Transmission
Frequencies (MHz)

UAV to UE

- 2620-2690

UAV to GS

- 2110-2200 (NM)
- 2100-2200 (CO)

GS to UAV

- 1920-2010

Network Equipment Examples

– Transcievers

- Deltenna: BlackWolf R2 (UAV)
- Prototype Small Cell (UAV)
- Prototype (MMIMO Ground Station)

– Antenna

- Cell-Fi: MIMO panel antenna #A52-X12-100
- L-Com: MIMO panel antenna # HG72708XWPP-NF
- Prototype MIMO (UAV) & MMIMO (ground station)

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Please provide additional detailed information regarding the following:

1. The purpose and detailed prescriptions of the proposed operation.
2. Explanation of how it would coordinate any usage with the AWS, EBS and BRS licensees for the proposed operations.
3. An engineering analysis and explanation of how it would specifically avoid causing harmful interference to incumbent AWS, EBS and BRS operations.
4. Stop buzzer information just in case interference occurs.

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1. The purpose and detailed prescriptions of the proposed operation

- See preceding slides

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2. Explanation of how it would coordinate any usage with the AWS, EBS and BRS licensees for the proposed operations.

- We will request permission in advance from licensees

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3. An engineering analysis and explanation of how it would specifically avoid causing harmful interference to incumbent AWS, EBS and BRS operations.

- Network performance will be modelled to assess the potential for interference.
- Testing will be conducted in remote locations with restricted coverage.
- Testing will be of short duration, and may be scheduled for low traffic periods
- We will employ a JDSU Base Station Analyser, to monitor any activity in the frequency range before, and during, testing. If a conflict is detected, we will migrate to a non-conflicting frequency or terminate the test.

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4. Stop buzzer information just in case interference occurs.

- The avionics on the UAV automatically power down the payloads, if the telemetry and navigation is compromised. The UAV can be pre-programmed to "return to base" if an issue persists.
- A power down signal can also be sent from the on-ground flight control station, for any reason, including potential conflicts with other users, detected on the Base Station Analyzer.