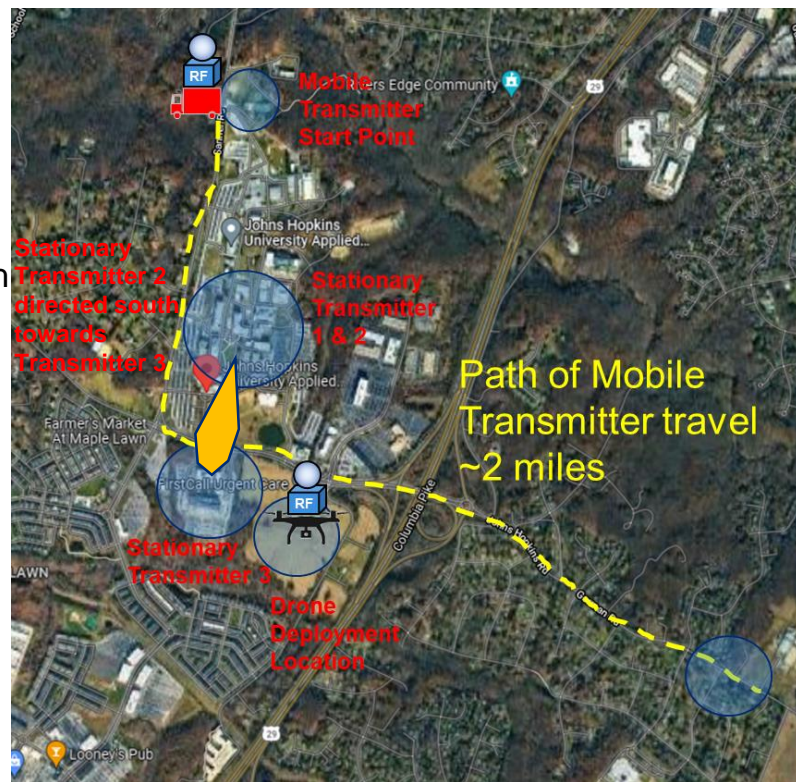


JHU/APL STA Application

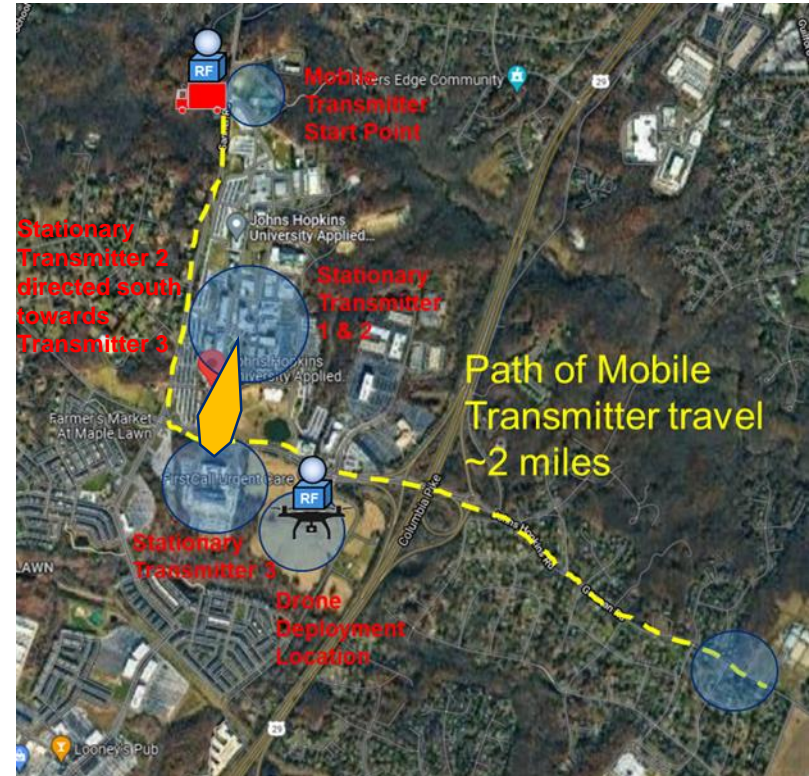
- **Stop Buzzer:** Zachary Geesey 240-584-7432
- **Background:** The Johns Hopkins Applied Physics Laboratory (JHUAPL) is a University Affiliated Research Center (UARC) that conducts basic research for the United States Government (USG)
- **Objective:** Verify the operation of a short-range multi-band communications network utilizing frequency hopping radios with diverse antennas, radios, geometries, and mobile nodes to support ongoing research. Ettus Research SDRs, Silvus Technologies, and signal generators will be used to generate the physical layer of the network.
- **Experiment Description:**
 - APL will be testing an experimental network consisting of 3 fixed nodes, 1 ground mobile node, 1 airborne node
 - Experiments will be located at APL campus and on Johns Hopkins Rd and Sanner Rd in Laurel, MD
 - Experiments will be during working hours during requested license dates
 - A table of emissions and antennas is included in the following documentation
- **Location Details:**
 - 39.164N, 76.899W
 - Mobile platform will travel up to 2 miles from campus along Johns Hopkins Rd.
 - 11100 Johns Hopkins Rd, Laurel MD, 20723
- **Experiment Dates:**
 - Intermittently 04/15/2022 – 10/1/2022
- **Experiment will be conducted on a non-interference basis**
- **Emission and Antenna Details are on the following pages.**



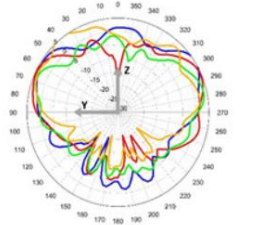
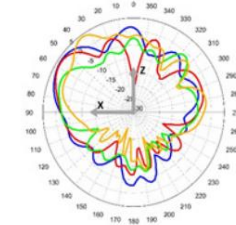
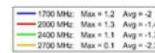
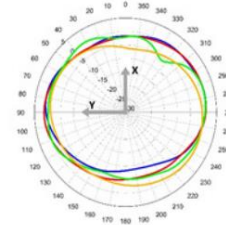
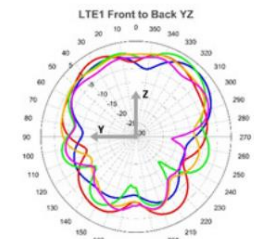
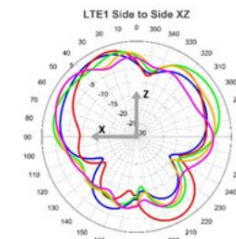
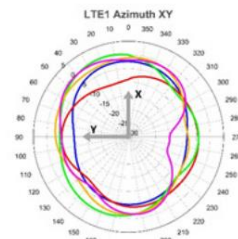
Experiment Setup

Location	Antenna	Emission
Stationary Tx 1	Antenna 1	Waveform A, B
	Antenna 2	Waveform A, B
	Antenna 3	Waveform C, D, E
Stationary Tx 2	Antenna 4	Waveform F, G
	Antenna 5	Waveform H, I
	Antenna 6	Waveform H, I
Stationary Tx 3	Antenna 1	Waveform A, B
	Antenna 2	Waveform A, B
	Antenna 3	Waveform C, D, E
Mobile Tx	Antenna 1	Waveform A, B
	Antenna 2	Waveform A, B
	Antenna 3	Waveform C, D, E
Drone	Antenna 3	Waveform C, D, E

Waveform	Emission Designator
A	40M0F7W
B	40M0G7W
C	20M0F7W
D	10M0F7W
E	5M00F7W
F	155MF7W
G	155MG7W
H	100MF7W
I	100MG7W



Antenna 1 [Stations 1,3, and Mobile Tx]



Description: Dual-band Communications
900 MHz, 2.4 GHz

Antenna 1

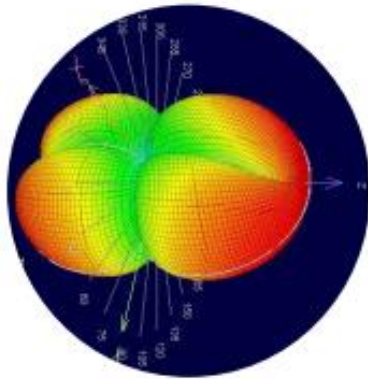
- Antenna >6m above ground? No
- Directional? No
- Manufacturer: RFMAX Antennas
- Model #: RM2
- Polarization: Vertical
- 3-dB Beamwidth: Omni
- Orientation in horizontal plane: NA
- Orientation in vertical plane: NA

Radio Details

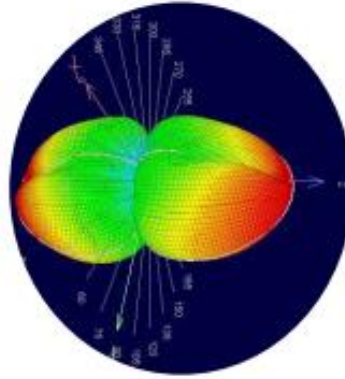
- Manufacturer Ettus Research
- Peak output power: 4W
- Peak ERP: 8W
- Frequency of operation: 805-960 MHz, 2.4-2.5 GHz
- Frequency Tolerance: 2.5 ppm (± 6.25 kHz @ 2.5 GHz)
- Signal Type/description: Digital MIMO. Emission Designators: 40M0F7W and 40M0G7W

Antenna 2 [Stations 1,3, and Mobile Tx]

ANTENNA PATTERNS



7 dBi @ 1800 MHz



7.5 dBi @ 2400 MHz



Description: Dual-band
Communications 900 MHz, 2.4 GHz

Antenna 2 Details

- Antenna >6m above ground? No
- Directional? No
- Manufacturer: ET Industries
- Model #: ET17ODA
- Polarization: Vertical
- 3-dB Beamwidth: Omni
- Orientation in horizontal plane: NA
- Orientation in vertical plane: NA

Radio Details

- Manufacturer: Ettus Research
- Peak output power: 1.4W
- Peak ERP: 8W
- Frequency of operation: 805-960 MHz, 2.4-2.5 GHz
- Frequency Tolerance: 2.5 ppm (± 6.25 kHz @ 2.5 GHz)
- Signal Type/description: Digital MIMO. Emission Designators: 40M0F7W and 40M0G7W

Antenna 3 [Stations 1,3, Mobile Tx, and Drone]

Description: Silvus Radio node

Antenna 3

- Antenna >6m above ground? Yes on drone. Stations 1,3, and the mobile station will be <6m above ground.
- Max Drone Altitude: 200 ft
- Directional? No
- Manufacturer: Silvus Technologies
- Model #: Streamcaster 4200-235
- Polarization: Vertical
- 3-dB Beamwidth: Omni
- Orientation in horizontal plane: NA
- Orientation in vertical plane: NA

Radio Details

- Manufacturer: Silvus Technologies
- Peak output power: 4W
- Peak ERP: 10W
- Frequency of operation: 2.4-2.5 GHz
- Frequency Tolerance: 5 ppm (± 12.5 kHz @ 2.5 GHz)
- Signal Bandwidth: 20/10/5 MHz
- Signal Type/description: Digital Mobile Networked MIMO (MN-MIMO).
Emission Designator: 20M0F7W, 10M0F7W, 5M00F7W



Antenna 4 [Station 2]

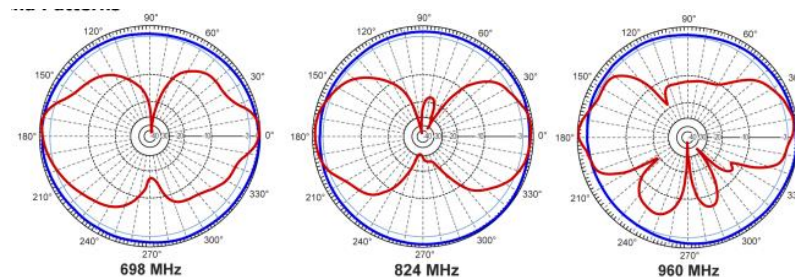
Description: 900 MHz network control and synchronization waveform

Antenna

- Antenna > 6m above ground? No
- Directional: No
- Manufacturer: L-COM
- Model: HG72107U-PRO
- 4 dBi gain in 900 MHz band
- Polarization: Vertical
- 3-dB Beamwidth: N/A

Signal Generation

- Peak output power: 4W
- Peak ERP: 10 W
- Frequency of operation: 805-960 MHz
- Frequency Tolerance: 2.5 ppm
- Signal Bandwidth: Up to 155 MHz
- Signal Type/Description: 155MF7W and 155MG7W



Antenna 5 [Station 2]

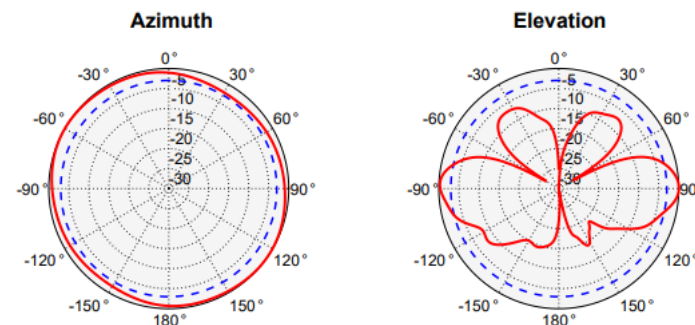
Description: 2.4 GHz network control and synchronization waveform

Antenna

- Antenna > 6m above ground? No
- Directional: No
- Manufacturer: L-COM
- Model: HG2471-04U-NM
- 4 dBi gain in 2.4 GHz band
- Polarization: Vertical
- 3-dB Beamwidth: N/A

Signal Generation

- Peak output power: 4W
- Peak ERP: 10 W
- Frequency of operation: 2.4-2.5 GHz
- Frequency Tolerance: 2.5 ppm
- Signal Bandwidth: Up to 100 MHz
- Signal Type/Description: 100MF7W and 100MG7W



Antenna 6 [Station 2]

Description: 2.4 GHz directional network control and synchronization waveform

Antenna

- Antenna > 6m above ground? No
- Directional: Yes
- Manufacturer: L-COM
- Model: HG2414P-NM
- Polarization: Vertical
- 14 dBi gain in 2.4 GHz band
- 3-dB Beamwidth (horizontal and vertical): 30 degrees
- Orientation in horizontal plane: 180 degrees
- Orientation in vertical plane: 0 degrees

Signal Generation

- Peak output power: 0.4W
- Peak ERP: 10 W
- Frequency of operation: 2.4-2.5 GHz
- Frequency Tolerance: 2.5 ppm
- Signal Bandwidth: Up to 100 MHz
- Signal Type/Description: 100MF7W and 100MG7W

