

## **Request for Experimental License Exhibit**

### **Purpose:**

AT&T Laboratories wishes to conduct tests with experimental and proto-type radio systems to evaluate the propagation channels in the 28 GHz and 39 GHz bands for potential 5G communications. We hope to evaluate various characteristics of the channels such as loss, dispersion, MIMO channel rank and interference in a real world suburban/office park outdoor environment over time and various weather conditions. Performance characteristics such as data throughput, latency, error rates, availability and susceptibility to and generation of self and external interference will be investigated.

### **Radio Systems:**

AT&T requests authority to test various experimental and proto-type radios systems. These radio systems will be constructed from various commercially available millimeter wave components and/or modified existing millimeter radios. These radios will be installed and tested by AT&T Laboratories personnel using millimeter wave radio and digital communications test equipment. Each radio unit will consist of a transmitter, a receiver and a directional antenna. The maximum transmitter power of any radio unit will not exceed 23 dBm (0.2 Watts).

### **Antenna Systems:**

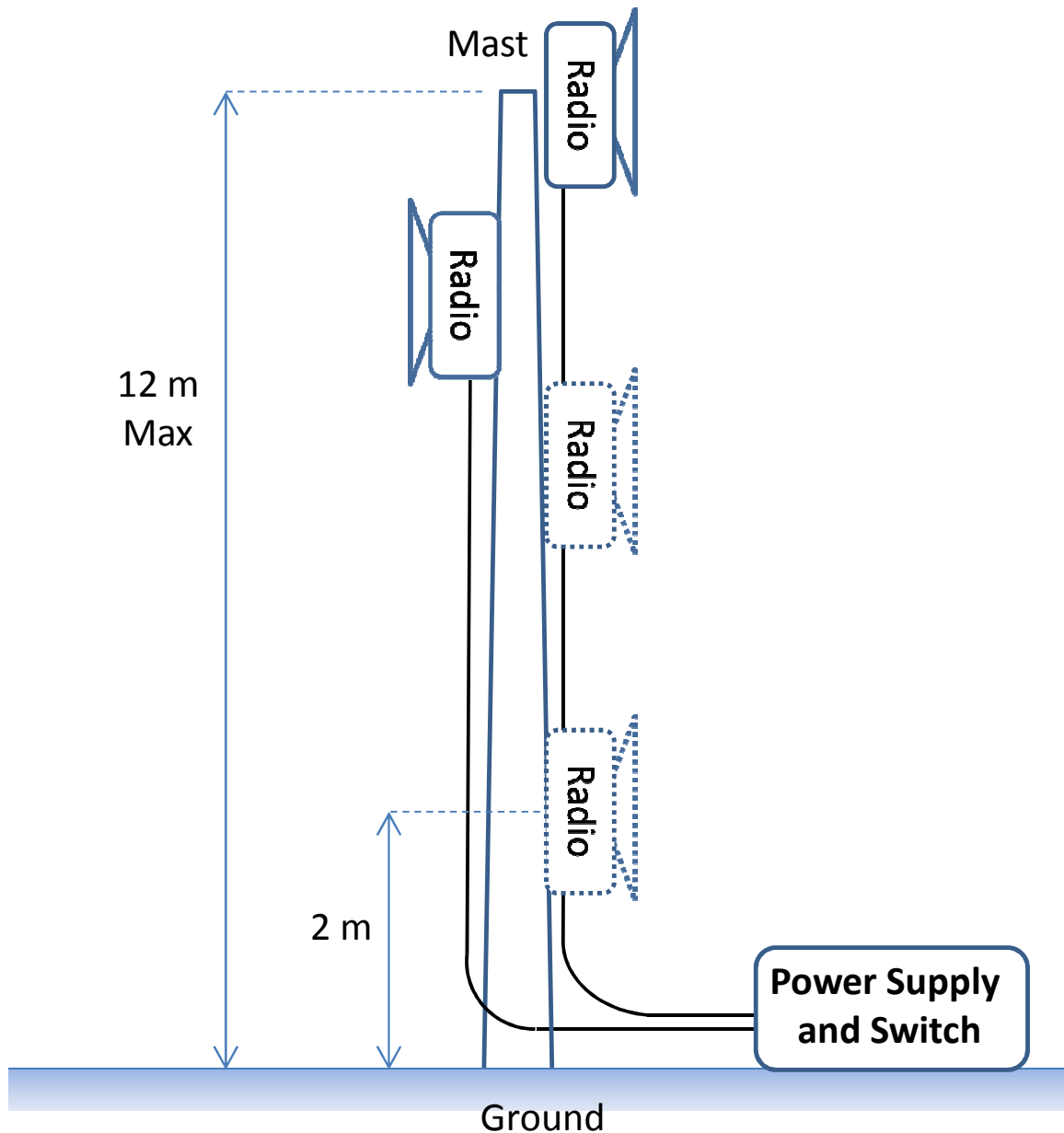
Much of the experimentation will be centered around the evaluation of different antenna and propagation path configurations which may utilize different antennas of various gains and beamwidths. However the maximum gain of any antenna deployed will not exceed 35 dBi and so the beamwidth will be greater than 3 degrees. Additionally the transmit power and antenna gain combination used will never result in an ERP greater than 50 dBm (100 W). Furthermore the main lobe of any antenna deployed will be pointed approximately to the horizon plus or minus 10 degrees. The azimuthal orientation of the main lobe of the antenna may be arbitrary.

### **Equipment Deployment:**

The radio units will be deployed at various outdoor locations around the AT&T Labs office facility located at 200 S. Laurel Ave., Middletown, NJ 07748 in Monmouth County. All transmitters will be within 1.0 Km of 40:23:48.9N 74:08:05.7W NAD83. The ground elevation at the Middletown office facility varies from about 80 feet to 130 feet above mean sea level. No more than 20 radio transmitters will be operated simultaneously. Radios will be mounted on rigid masts not exceeding a height of 12 meters (40 feet) above the ground level or on building rooftops no more than 3 meters (10 feet) above the roof. The roof level of the buildings at the Middletown facility are approximately 21 meters (70 feet) above ground level. See the diagram in Figure 1 for a depiction of the mast deployment. The masts will be located near trees and buildings of similar or taller height. Multiple radios may be located at the same location to investigate MIMO channel characteristics.

### Spectrum Use:

The radio transmitters may occupy spectrum from 27500 MHz to 28350 MHz (28 GHz band) or 37000 MHz to 40000 MHz (39 GHz band). The radios deployed may use frequency hopping in wide band channels (100 MHz to 800 MHz), or digital QAM modulation in narrower band channels (5 MHz to 14 MHz). Different transmitters may use the same or different channels as each other. The total conducted power of any transmitter will not exceed 23 dBm (0.2 Watts) and the maximum ERP of any radio will not exceed 50 dBm (100 Watts).



**Figure 1 - Possible Radio Deployments on Mast**