

## RF Airplane-Mode On-Off Detector (RF AMOOD) for Arecibo Observatory

**Abstract:** Radio astronomy research often involves the use of antenna to measure radio frequency energy in order to gather scientific insight into space and the upper atmosphere. One inhibiting factor in this research is radio frequency interference, which can derive from cars, powerlines, and cellular phones. This is a known problem at the radio observatory in Arecibo, Puerto Rico. This announcement of opportunity is targeting individuals with experience in both RF engineering and digital signal processing to design, build, and test an RF sensing device to detect the presence of RF interference.

The setup of the problem is as follows. Many people visit Arecibo observatory throughout the year. Many of these people carry cell phones, which are transmitters of unwanted RF signals at the observatory. Thus, visitors are told to turn their phones into Airplane mode. However, typical people don't do that. Unfortunately, these unwanted signals corrupt Arecibo radio data. So, we would like a device to be built to detect whether or not someone has their cell phone turned on airplane mode.

Specifically, airplane mode on is the same as no transmission. Airplane mode off means that a phone is transmitting from its antenna. This is what is desired to be detect: airplane mode on or off. Ideally, the device could be set next to a person with a cellphone, and the device would indicate: "No Cellular Transmission Present" or "Cellular Transmission Present" and it would flash an alarm.

In terms of technical specification, this detector must find (1) signals in the following bands:

Interface	Uplink Frequencies (MHz)
GSM 850	824.2-848.8
GSM 1900 PCS	1850.2-1909.8
UMTS B2 (1900 PCS)	824-849
UMTS B5 (850)	1850-1910
B17 700 BS	704-716

And (2) , be able to detect cellular signals from at most 1 meter away.

In terms of a design of this system, it is essentially an antenna, receiver circuit, and a software defined radio, that will have some detection algorithm written on it.

What is presented in this document are a mandatory set of guidelines (1-2) that must be followed. The verification of this system will be developed during the proposal and design review

phase of the class. A requirements and verification table along with a system block diagram will be the task of the students who choose to take this project as their Senior Design project.

Graduate Assistants Gonzalo Cucho and Benjamin Eng must approve the design of your project before any hardware purchases can be made. Purchases made without consent of the aforementioned people will not be reimbursable.

Candidates who are interested in this project must have taken ECE 310, ECE 350, and ECE 453. ECE 454 and ECE 420 are suggested but not required. Interested applicants should first speak with:

Benjamin Eng - [bceng2@illinois.edu](mailto:bceng2@illinois.edu)

Gonzalo Cucho - [gac3@illinois.edu](mailto:gac3@illinois.edu)

Thanks