CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
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Project Number
J2205

Project Title
Microwave Emissions of Cellular Phones

Abstract

Objectives/Goals
There is much debate about whether cell phones emit harmful radiation. The electromagnetic wavelengths cell phones use to communicate are called microwaves. Microwaves are non-ionizing radiation between 3kHz and 300GHz. Although microwave communication has been used since 1934, its widespread use in cell phones and the close proximity to the brain make the study of the effects on humans important. I recently received my first cell phone. I wanted to find out how much radiation cell phones emitted and if it was harmful. I hypothesized the amount of radiation emitted by cell phones would be within the FCC standard.

Methods/Materials
I constructed an apparatus to test phones at distances of 2.0, 5.0, and 15.0 centimeters. I used two microwave leakage detectors that measure electromagnetic emissions at 2.45 GHz. I measured emissions from each phone's front, back, left, and right sides during calls and text messages. Each test was repeated five times, and averaged. I performed 1680 tests on 14 different cell phones. The call tests were important because people usually hold the phone to their ear during a call, so the head is absorbing the radiation.

Results
All the phones tested emitted more radiation during a call than when sending a text message. This is because cell phones need more power and better signal strength to make a call than a text message. The phone that emitted the greatest amount of radiation while making a call was the Blackberry 8100, emitting an average of 9.39mW/cm2 at 2 cm. The phone that emitted the least radiation during a call was the Motorola Razr with an average emission of 0.21 mW/cm2 at 2cm. This may be because the blackberry 8100 runs on a faster 3G network, while the Motorola Razr runs on a slower EDGE network.

Conclusions/Discussion
My results showed that while some phones emitted more radiation than others, all of them were within the FCC standard. Radiation emission from cell phones is non-ionizing, but still may have some thermal effects. The cell phone cases could not be tested since they are designed to protect against radiation at 1.9 GHz. My device tested emissions at 2.45 GHz. My device could not test emissions at the 1.88 to 1.95 GHz frequencies, which also contribute to exposure and may have been emitted by the cell phones.

Summary Statement
My project tested 2.45 GHz emissions from various cellular phones at three different distances in four different positions while calling or sending text messages.

Help Received
I would like to thank my father for supervising me while performing some of my procedures. I would also like to thank my science teacher for her guidance and help obtaining the testing devices.