



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Andrew B. Nazareth	Project Number S1014
Project Title Cell Phone Radiation: Watts Worse, Voice or Data Transmissions? A Comparison of Electromagnetic Field Strength	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this study is to determine which source of cell phone transmission- voice or data - emits more non-ionizing electromagnetic radiation, to determine if the data supports the inverse square law and to seek ways for users to reduce their EMF exposure</p> <p>Methods/Materials The EMF radiation from different smartphones (LG-4S and iPhone-SE) and accessories (a virtual reality headset and blue tooth), was measured using an RF detector (Tenmars TM-195 3 Axis RF Field Strength EMF Meter) under different operating conditions (voice, video, mobile games, and a 3d virtual reality app). The distance from the phones was varied (from 0 cms to 15 cms) to see how this affected the EMF exposure. Readings were taken (every 30 seconds) over a 150 second interval for each test. In addition to distance, alternative approaches to reduce EMF radiation exposure were considered, including the use of a Bluetooth device, and a homemade Faraday cage (made from aluminum foil). A total of 140 trials were completed.</p> <p>Results Total averaged EMF readings tested at 0 cms showed voice transmission to be 42% higher than averaged data transmission (including You Tube, Clash Royale Video Game and Virtual Reality video). 97% drop in EMF exposure for data (You Tube) and 63% drop in voice (Phone Call) from 0 cms to 15 cms. 77% drop in EMF exposure between Bluetooth and voice readings at 0 cms.</p> <p>Conclusions/Discussion The data from this experiment proved my hypothesis wrong as Voice calls had a higher EMF exposure than Data usage (including You Tube, video downloaded through Virtual Reality and Video Games). Downloading You Tube videos or playing video games has lower EMF exposure than watching videos/movies using a Virtual Reality headset. Blue tooth is a safer solution than texting or using a shield. Talking emits more radiation than receiving a call. Results from this experiment supports the inverse square law for both voice and data transmissions where EMF exposure reduces with an increase in distance between the phone and the user's head- which is the most effective and inexpensive way to shield users from radiation.</p>	
Summary Statement Over 140 trials, I proved that cell phone voice transmissions have a higher EMF exposure than data transmissions, the results support the inverse square law and blue tooth usage and distance away from the user's head reduces EMF exposure.	
Help Received Erik Perkins from Kirby School was my project advisor. I worked with Mr. Williams to understand the physical concepts involved in this experiment.	