



**CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY**

Name(s) Tarang Luthra	Project Number S0709
Project Title Reducing Interference in High Speed Home Networking using Signal Processing	
Objectives/Goals The IEEE 802.11b (Wi-Fi) is currently the most commonly used technology for high-speed wireless home networking to connect various electronic devices. Both, noise and the unwanted sources interfere with wireless communication by adding errors in the received information. The purpose of this project is to show how to use multiple antennae and advanced signal processing to significantly reduce the interference. Also, I want to find out what the relation between the number of antennae elements and the amount of reduction in the interference is. This would allow me to figure out roughly how many elements one should use in a practical system.	
Abstract Methods/Materials I used the mathematical models of antennae array, electromagnetic waves captured by the array, noise being added to signal, radiation from an unwanted source and the signal processing to be done by the array in wireless home networking environment. First, I wrote a C++ program which measures the effect of number of antennae on signal to noise ratio. Then, I moved the interfering source around to study how the angular distance from the wanted source impacts the capability of my antennae to reject the unwanted signal. My third program deals with the effect of number of antennae on signal to interference ratio. I collected and plotted the data to see the effect of number of elements on the interference reduction. Lastly, by properly phase shifting the signals at each antennae element, before adding them up, I was able to automatically scan and find the direction of the source.	
Results see (graphs)	
Conclusions/Discussion My hypothesis that the noise will reduce N times by using N antennae elements was correct. It can be concluded that in an 802.11b system about five antennae elements should be used to reduce noise by about 80%. However, my hypothesis that the strength of the undesired signal will also reduce N times by using N antennae elements was not correct. It can be concluded that to significantly reduce the interference from the unwanted source at an angle of twenty degrees or larger, away from the signal source, five antennae elements should be used. Based on this work I also conclude that as, in a typical home networking environment, the unwanted sources are generally farther away than twenty degrees and 80% noise reduction is a good target, a five	
Summary Statement I processed signals coming from multiple antennae, in a receiver, together to reduce interference in a wireless home networking environment	
Help Received Advisor helped with ideas; Mother helped with the board	