Engineering Student Technology Committee

http://www.engr.colostate.edu/ESTC

College of Engineering

Colorado State University

1. Title of Proposal:
Establishing an RF/Wireless Experiment Workbench within the College for Undergraduate Courses and Student Design Projects.

2. Proposal Participants:

Primary Contact for Proposal

Name: Tom Chen _____E-Mail:chen@engr.colostate.edu _____
Department/Major:Electrical & Computer Engineering, SBME _____
Check One: ___X__ **Faculty** _____ **Staff** _____ **Student**

Additional proposal participants

Name: John Seim _____E-Mail: johnseim@engr.colostate.edu _____
Department/Major:Electrical & Computer Engineering_____
Check One: _____ **Faculty** __X___ **Staff** _____ **Student**

3. Proposal Abstract (limit to 100 words):

RF/wireless technologies are at the forefront of mobile revolution that has had a tremendous impact on our society. There has been a growing emphasis on RF/wireless technologies in undergraduate and graduate education nationally. Availability of RF and wireless experiment workbench will have a positive impact on courses and design projects across the entire college. However, we don't have a single RF/wireless workbench within the college that is accessible by students for courseworks and design projects. This proposal calls for establishing an RF workbench accessible by all students in the college to enable design experiments and measurements that are currently impossible.

4. Proposal Budget

List of items to purchase and cost of each

AT-N5172B EXG X-Series RF Vector Signal Generator:	$21,109
AT-N9010A-526 9kHz-26.5GHz EXA Signal Analyzer:	$26,409
AT-11970U 40-60 GHz waveguide harmonic mixer:	$3,742
Update an existing spectrum analyzer in ECE:	$5,000
Total	$56,260

Dollar or percentage amount requested from ESTC: $56,260

5. Full description of proposal:

RF/wireless technologies are at the forefront of mobile revolution that has had a tremendous impact on our society so far, and will continue to provide greater opportunities for our society in the future. There has been a growing emphasis on RF and wireless technologies in undergraduate

and graduate engineering education to better prepare engineering students for the future at the national level. At CSU, traces of RF and wireless technology education are embedded in many undergraduate and graduate courses within ECE. The courses range from electronic circuit design (ECE202 and ECE332), to communication theory (ECE303, ECE421, ECE516, and ECE524), to integrated circuits design (ECE534, ECE536, and ECE571). There is also a growing demand from students to incorporate RF and wireless technologies into their senior design projects. Unfortunately, we teach RF and wireless communications mainly from a theoretical perspective. A big chuck of hands-on experiments is not included. The College of Engineering does NOT have a single RF/wireless workbench for any RF/wireless related experiments and measurements that are accessible by students. The workbench provides instrumentation needed to demonstrate a variety of signals and communication schemes currently being used in mobile devices today. The workbench also provides interface needed to interact with custom mobile devices such as cellphones and mobile control units design by students to validate their designs and to measure performance. Such a workbench is common in other peer schools to support teaching of undergraduate and graduate programs. This proposal is intended to establish an RF/wireless workbench and experiment station to provide students access to RF/wireless experiment and measurement hardware and signal generations related to their course work and senior design projects.

The availability of an RF/wireless workbench provides many ECE courses an avenue to hands-on demos and lab experiments. These hands-on experiments are invaluable for students to gain insight about how electronics work, say, within a cellphone. Students in sophomore and junior level courses will mainly benefit from live demos to demonstrate how electronic circuits behave in a wireless device such as a cellphone. These live demos link theories taught in classes with practice and cultivate more interests from students in learning engineering and improve our retention rate. Students in senior and graduate level courses can do labs on the workbench. The courses that can benefit from the workbench are listed in the previous paragraph. Based on the enrollment of this academic year, a total of more than 290 ECE students can benefit from the workbench.

In addition to courses, senior design projects from ECE will also benefit from having access to RF/wireless workbench. However, Applications of RF and wireless technologies are not only limited to electrical and computer engineering students. Students from mechanical and civil engineering can also benefit from having access to hardware and software for experimenting with RF/wireless technologies, especially when they are part of a large interdisciplinary team. I have been approached several times by students from ME to incorporate more state-of-the-art electronics into their car designs for national competitions. Projects related to water and environment monitoring from CE are also interested in incorporating wireless technologies into their design project for real-time data collection. Students from CBE and SBME involved in chemical and biological sensors can benefit from the availability of the proposed workbench for experimenting with incorporating wireless sensors in chemical and biological applications.

It is my belief that a modern engineering education program must embrace RF and wireless technologies and incorporate such technologies in the curriculum. Establishing a RF/wireless workbench for our students across the College can have a significant impact on student learning and retention.