

Final Project: ECE 4973 Antennas

Due: May 5th

1 Project Description

For the final project for this course, you will design, simulate, build, and test an antenna for television reception. The website www.tvfool.com or a similar website will be very useful for this project providing information such as power levels from particular stations for your address. Google Earth also provides similar information. The following has more details about each piece of the project.

1.1 Design

Starting with a link budget analysis, pick an antenna that fits the design needs. You will be graded upon the number of stations that you can receive (well) with your antenna. A very useful book for this part of the project will be the ARRL Handbook, which is available in the library. If there are parts that you would like for your antenna, within reason, I will get them ordered for your access. Obviously, you should do this sooner rather than later. I will put in an order request on November 16th and 26th. Beyond that, you are on your own. The design needs to be something that you can easily carry since you will be moving the antenna. An analysis of wind resistance might also be appropriate for a very large antenna.

1.2 Simulate

After picking an antenna design, you will simulate your antenna in FEKO. Report on whether it performs as predicted by the design equations. Some tweaking to the design in simulation may be required. Try to simulate what you actually intend to build. For example, if the metal of your antenna will be flat, then simulate that instead of wires. Note the input impedance of your antenna across frequency and ensure that your feed is designed correctly (e.g. the impedance of your antenna matches the impedance of the feed, there is some semblance of a match as well between the feed transmission line and the coax that you need to plug into the TV, etc.). If your antenna is balanced, remember that you need a balun between your feed and your antenna. The ARRL handbook has an entire section on this. In fact, there is an entire ARRL book on balun design.

1.3 Build

After simulating your antenna, you will actually build it. Some useful building materials will be copper/aluminum tape, cardboard, copper tubing, copper rods (sold at Hobby Lobby), coaxial cable, etc. As a construction tip always electrically connect your metal pieces (e.g.

solder strips of copper tape or copper rods together). The design will work better. You all have card swipe access now to Carson 207 which has solder and soldering irons available.

1.4 Test

A television with a DTV tuner will be available to you in Carson 207. As you will note from google earth or tvfool.com the bulk of the stations are on the Northwest side of the city so point your antennas there. We will have a final test of your antennas during the “Final Exam Period” for this course on December 12th. The location for the test is TBD but if your antenna works in Carson 207 it will work even better at any of the possible locations for the final test. A possible test location is the roof of One Partner’s Place.

2 Recommended Outline

The following is a recommended outline:

- **Introduction** Introduce the topic, outline your analysis, and outline the report in a couple of paragraphs.
- **Body** There should be subsections within the body for each part of the project, namely: design, simulate, build, and test. For each of these sections outline your findings.
- **Conclusion** Summarize your experience with the project (e.g. design equations versus simulation).

You have almost 6 weeks to work on this project. Use your time wisely. This is a large part of your grade. Get started now! If you try to do this the night (or even just a couple of days) before it is due, it will be self-evident and it is unlikely that you will be happy with your grade.

3 Grading Rubric

The grading rubric for the project will be as follows:

- **Clarity - 20%** Understandability of the entire report. Is the report clear and concise? Does it contain any grammatical errors or typos? Appropriate labeling of figures, etc.
- **Design - 25%** Appropriate antenna design chosen based on a logical analysis of the design parameters.
- **Simulate - 15%** Antenna design simulated in FEKO. If tweaking of design was required to improve performance, this was appropriately completed.
- **Build - 15%** Antenna design well-constructed (e.g. a strong gust of wind will not destroy the antenna).
- **Test - 25%** All channels that antenna was designed to receive can be received. The more channels received the higher the score on this section. The following will be the rubric for this individual section:

– Full Credit - 17 Channels

1. 4 - 1,2
2. 5 - 1,2
3. 9 - 1,2
4. 13 - 1,2
5. 14 - 1,2,3,4,5
6. 19
7. 21 - 1,2,3,4
8. 25 - 1,2
9. 30 - 1
10. 31 - 1,2,3,4
11. 34 - 1
12. 36 - 1,2
13. 43 - 1
14. 46 - 1
15. 48 - 1
16. 52 - 1,2
17. 62 - 1,2,3

– For every channel less than 17 channels 2 points will be deducted from the total.