

Fall 2012

# **EE325K Antenna Design Contest**

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Course TA: Mr. Jimmy Li

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# Design Contest Rules

The objective of this design contest is to build an external WiFi antenna for a laptop computer that will give the highest download speed from the Internet signal of a wireless router box.



your  
antenna



DESIGN INFORMATION:

WiFi frequency band = 2.41 – 2.48 GHz

Propagation environment: Indoor, direct line-of-sight (ENS hallway)

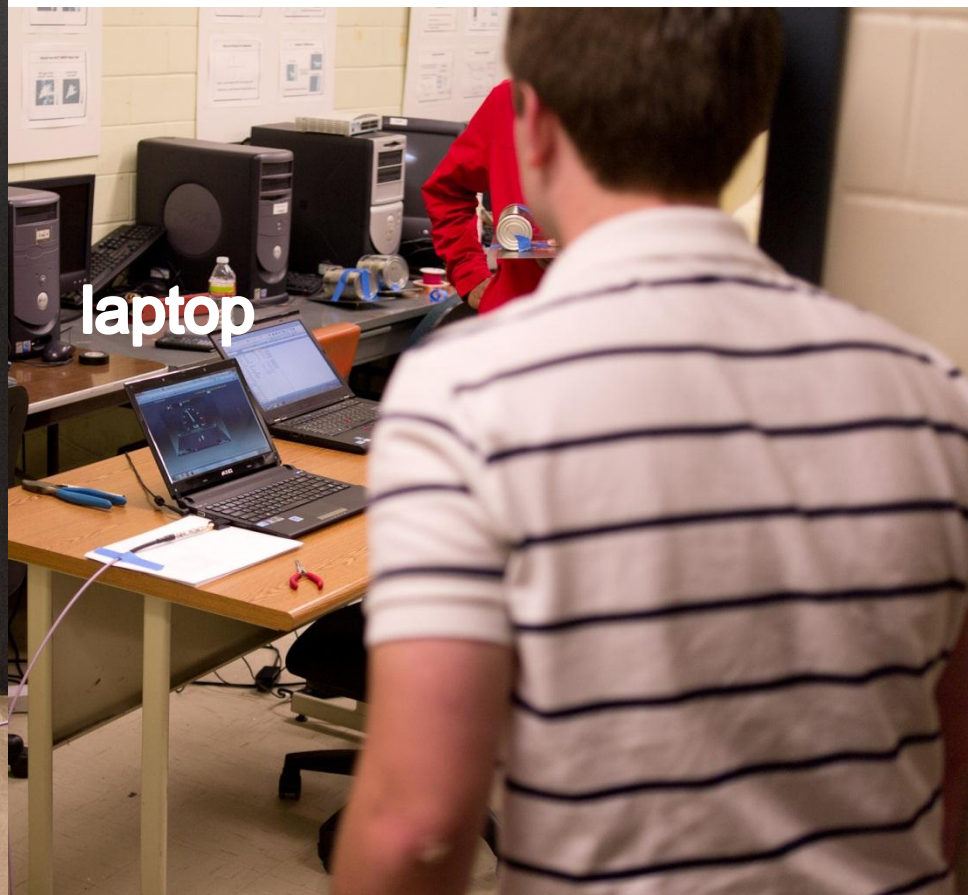
$$\textbf{Scoring Metric} = \frac{\textit{Download speed (in Mbps)}^3}{(\textit{Max dimension of the antenna in mm} + 30)}$$

For example, if you use a monopole of height 3.1 cm and the download speed is 15.0Mbps, your score will be  $15^3 / (31+30)=55.3$ . The download speed is related to the realized gain of your antenna. However, notice that in addition to maximizing the realized gain of your antenna, the scoring metric penalizes for antenna size.

**CONTEST RULES:** During the contest, each contestant will be given 2.5 minutes to mount the antenna and run the speed test. The highest download speed achieved within the allotted time will be used to compute the final scoring metric.



# Setup



# www.speedtest.net

The screenshot displays the Speedtest.net website interface. At the top, the logo "SPEEDTEST.NET" is on the left, and navigation links "CREATE ACCOUNT", "MY RESULTS", and "SUPPORT" are on the right. A promotional banner for Google Chrome is visible, featuring the Chrome logo and the text "Too Slow? Test again with a faster web browser." with a "Download Google Chrome" button.

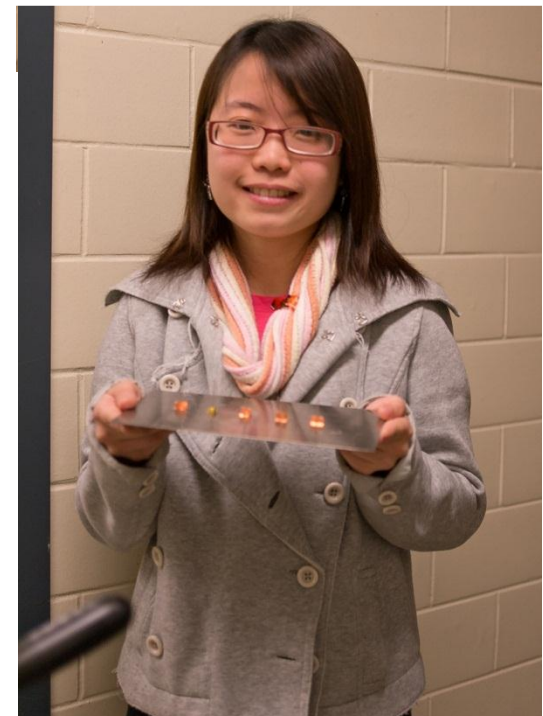
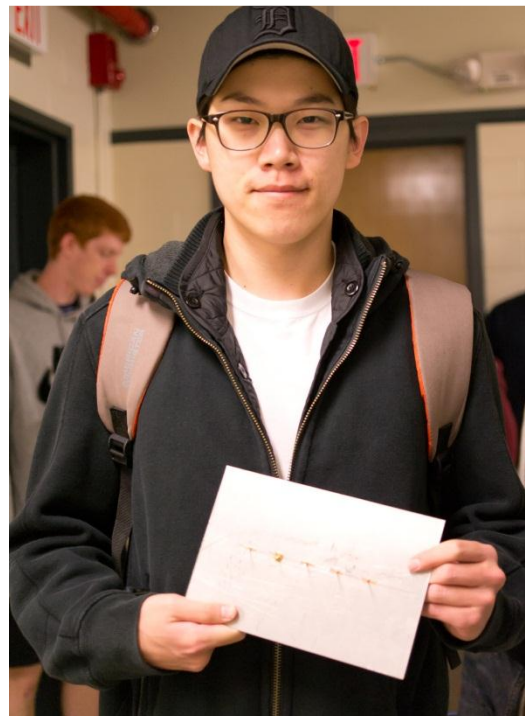
The main content area shows a speed test in progress. The test results are displayed on a futuristic, glowing blue interface. The top section shows three metrics: PING (35 ms), DOWNLOAD SPEED (29.04 Mbps), and UPLOAD SPEED. The download speed is highlighted with a large gauge and a needle pointing to 29.04. Below the gauge is a green line graph showing the speed fluctuation over time. The interface also includes a small figure of a person running, representing the "Road Runner" test server.

At the bottom left, the IP address "72.182.116.74" is shown, along with the text "Road Runner" and a "Rate Your ISP" link. At the bottom right, the location "San Antonio, TX" and the host "Hosted by DoubleHorn Communications" are displayed.

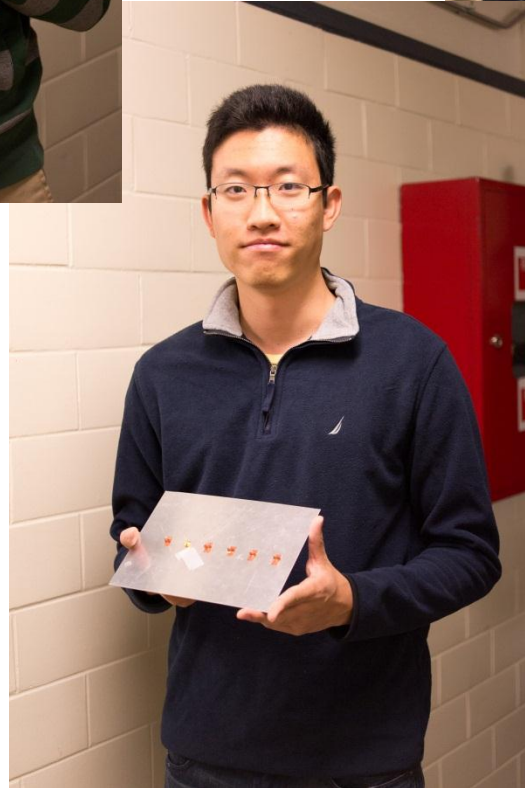
Metric	Value
PING	35 ms
DOWNLOAD SPEED	29.04 Mbps
UPLOAD SPEED	-

# Entries

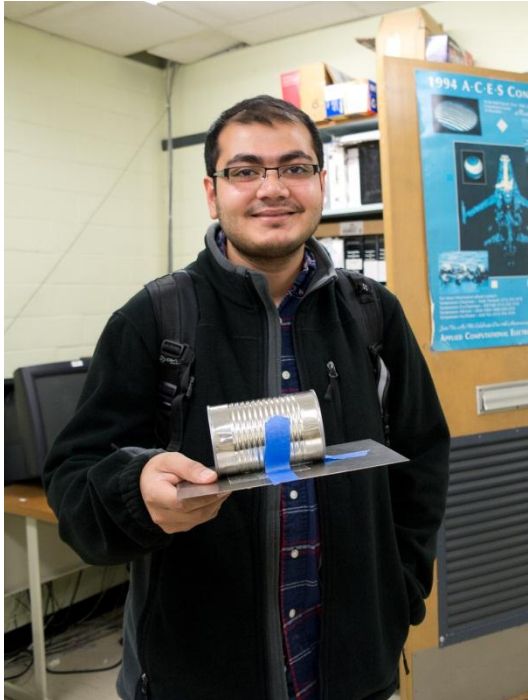
# Yagis



# More Yagis







# Cantennas



# Helices



# Biquads



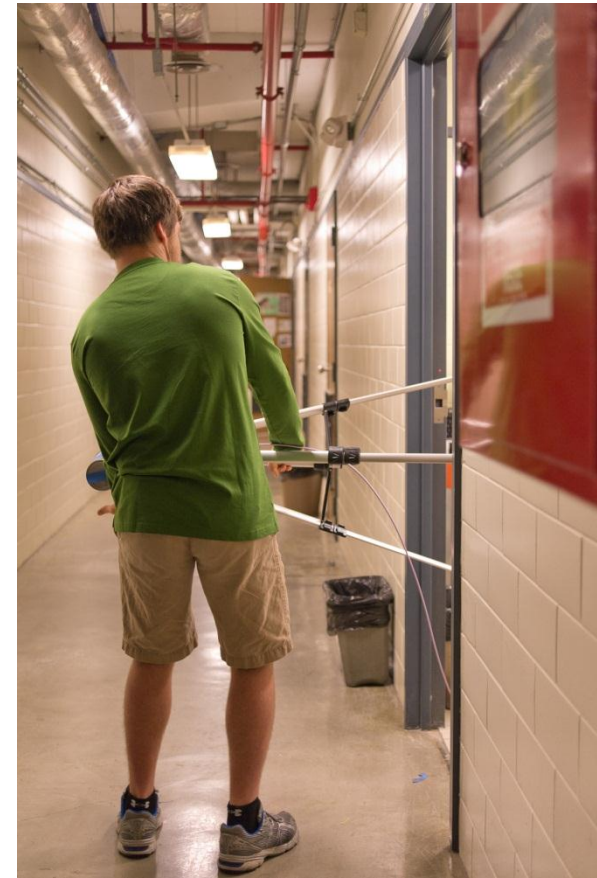
# Monopoles with meander or traps



# Last-Minute Tuning



# Aiming for Max Speed!



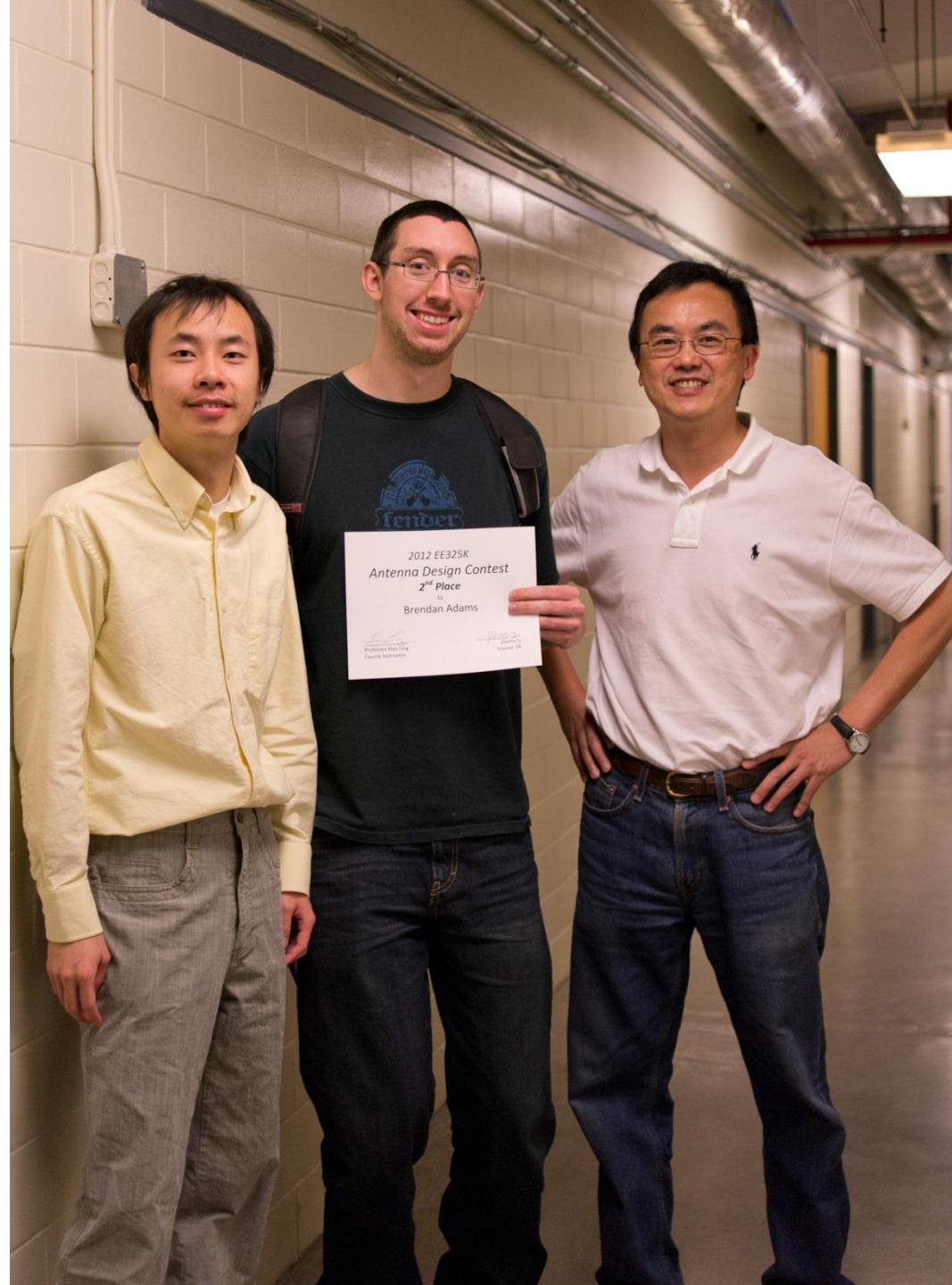
# Results

Antenna Type	Size (cm)	Mbps	Final Score
5-element yagi	12.6	27.0	126.2
biquad	7.6	19.8	73.0
helix	27.5	28.0	72.0
2-element yagi	3.1	16.2	69.7
6-element yagi	15.1	22.7	64.6
cantana	11.6	19.5	50.9
helix	11.1	18.4	44.2
5-element yagi	12.3	18.2	39.2
cantana	11.7	17.9	38.8
4-element yagi	7.4	15.3	34.2
5-element yagi	12.7	17.1	31.8
cantana	14.5	16.0	23.4
5-element yagi	10.0	14.4	22.9
4-element yagi	9.0	13.8	21.6
biquad	4.4	10.5	15.6
cantana	11.2	11.7	11.3
meander monopole	9.0	10.6	9.8
6-element yagi	14.7	12.0	9.6
cantana	12.4	10.9	8.4
cantana	11.0	10.1	7.4
helix	10.4	9.7	6.8
monopole with traps	17.1	8.6	3.2
monopole with traps	12.1	7.2	2.5
6-element yagi	15.1	3.8	0.3

# Second Place

## Brendan Adams

Winning design:  
Biquad antenna

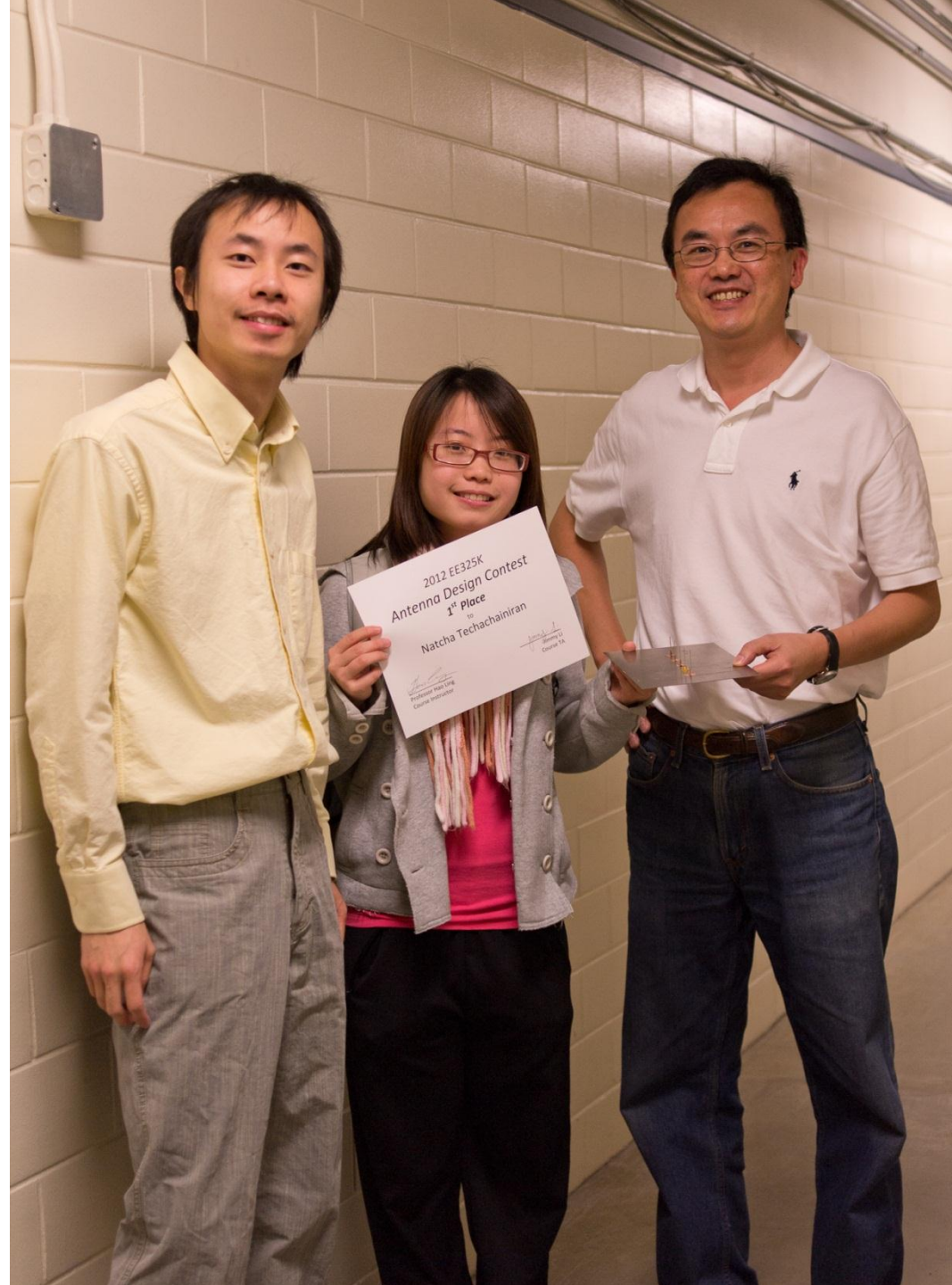
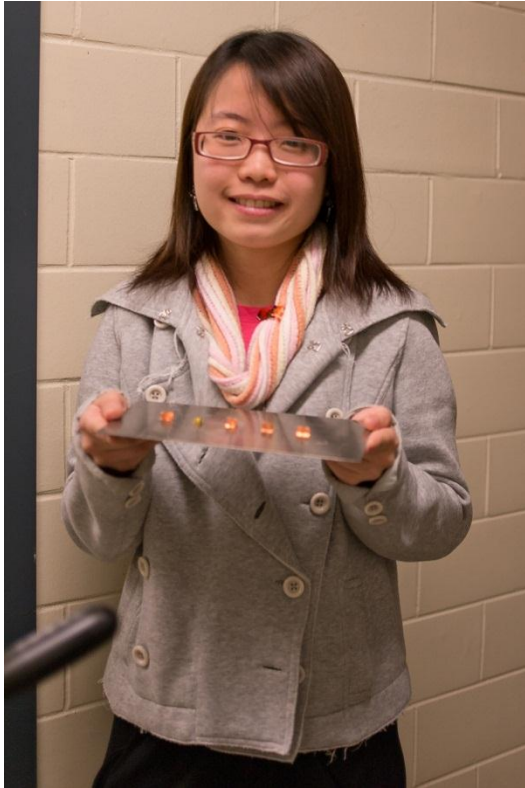




# First Place

## Natcha Techachainiran

Winning design:  
5-element Yagi





# Equipment

- A laptop with wireless internet connection.
- External antenna connection for the laptop via an USB adapter (e.g. Amped Wireless UA150C High Power Wireless-N150 Compact USB Adapter, available at Fry's for \$39.99).
- RF cable (to connect the test antenna to the USB adapter).
- Optional: a wireless router box to serve as the transmitter.
- Optional: RF attenuators to adjust the signal strength.