CS 525M – Mobile and Ubiquitous Computing Seminar

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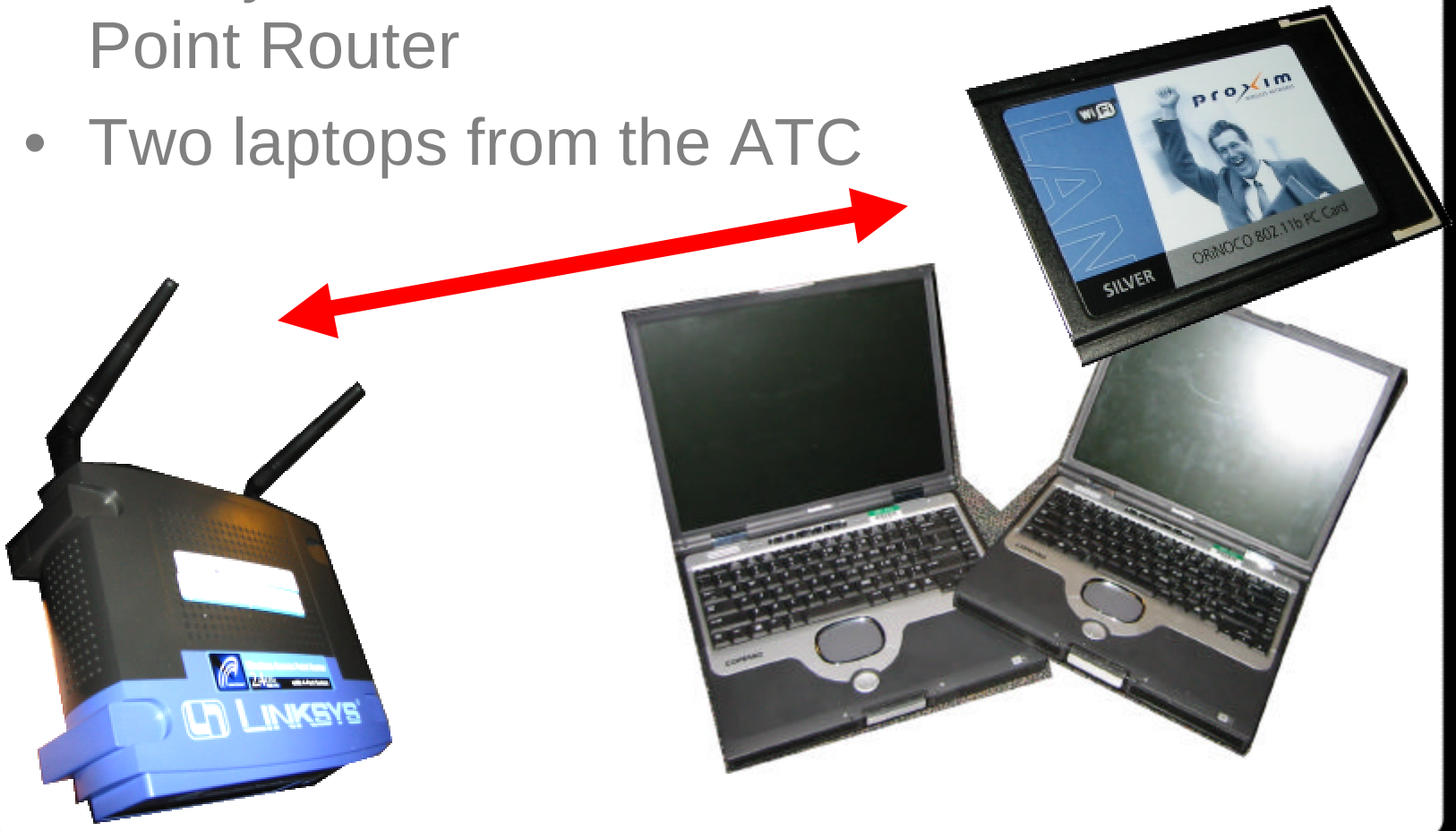
Introduction

- Real-world measurement of 802.11b wireless performance
  - Signal/noise ratio
  - Average bandwidth
- Divided into 4 phases
  - Phase 0 – distance
  - Phase 1 – building materials
  - Phase 2 – environmental effects
  - Phase 3 – interference

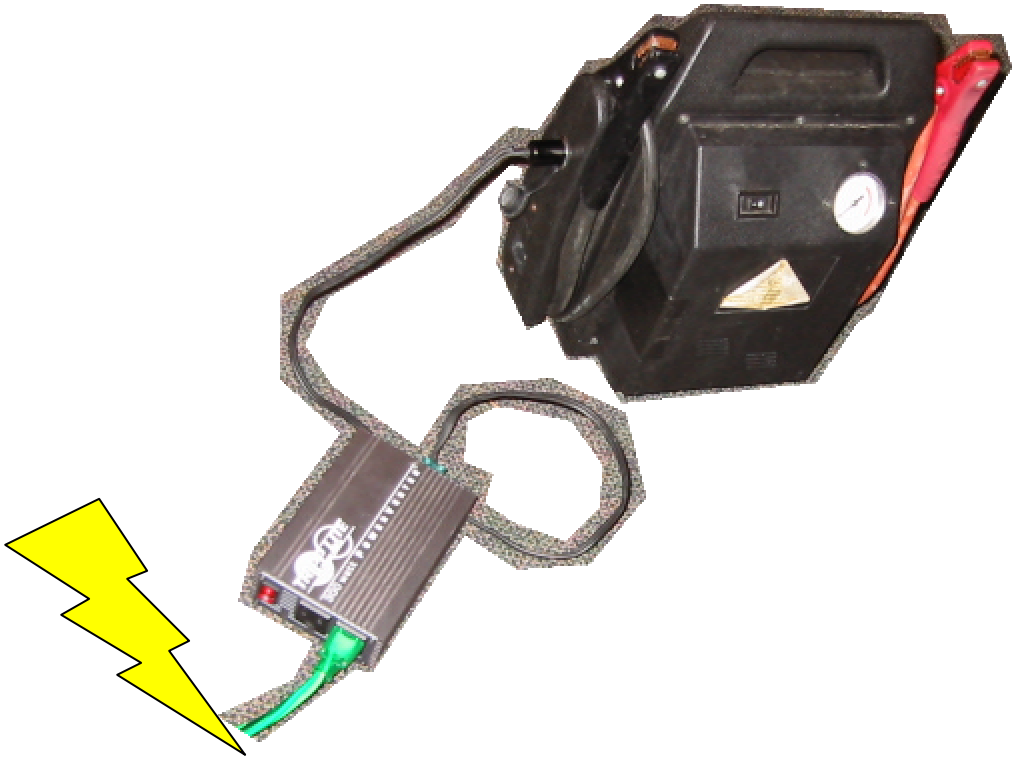
How we tested (equipment)

- Proxim ORiNOCO 802.11b pcmcia card
- Linksys “Instant Wireless” Wireless Access Point Router
- Two laptops from the ATC



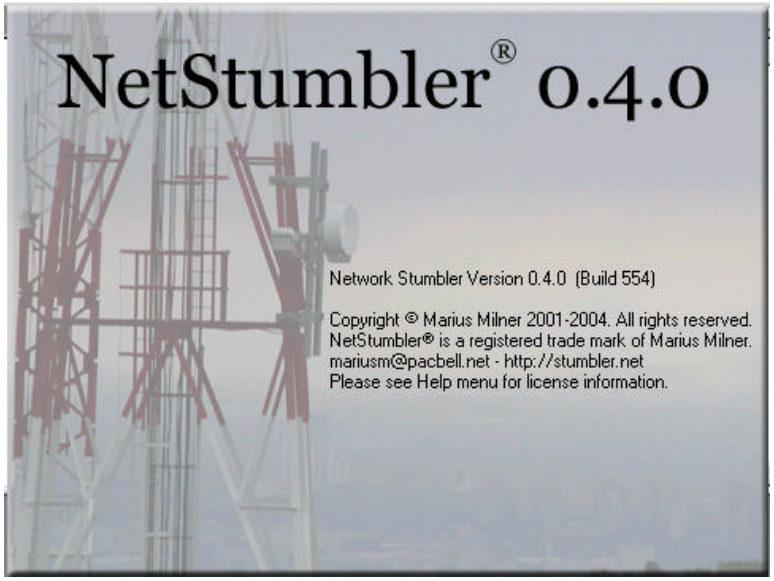
And the power?

- A car starter battery along with a power inverter does wonders!



Software

- 2 measurements taken…
  - Signal/noise with NetStumbler
  - Average bandwidth with QCheck

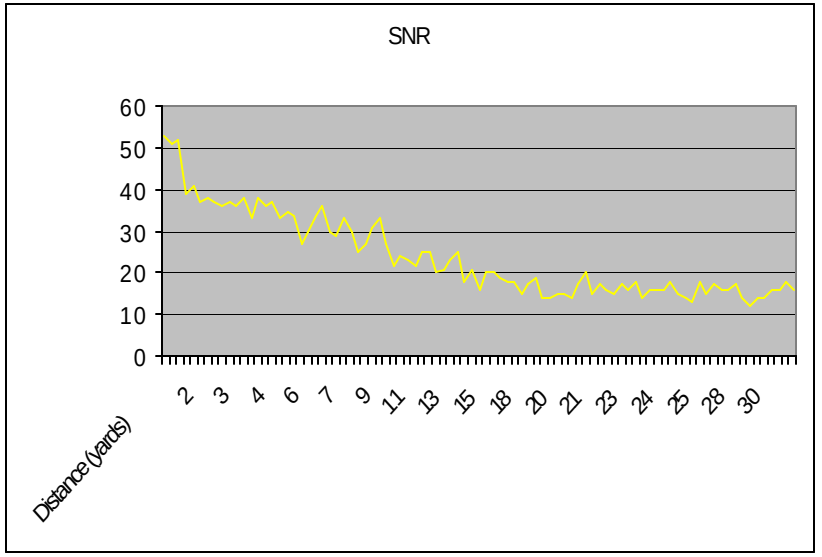


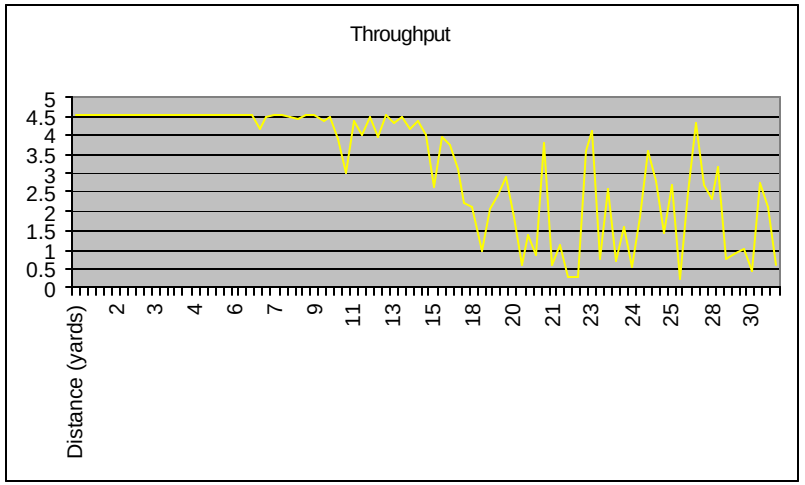
Why?

- NY Stock Exchange
- Short of “ray-tracing” how can you tell what factors are involved in 802.11b performance?
  - Are there any simple rules for planning the design of your home wireless network?

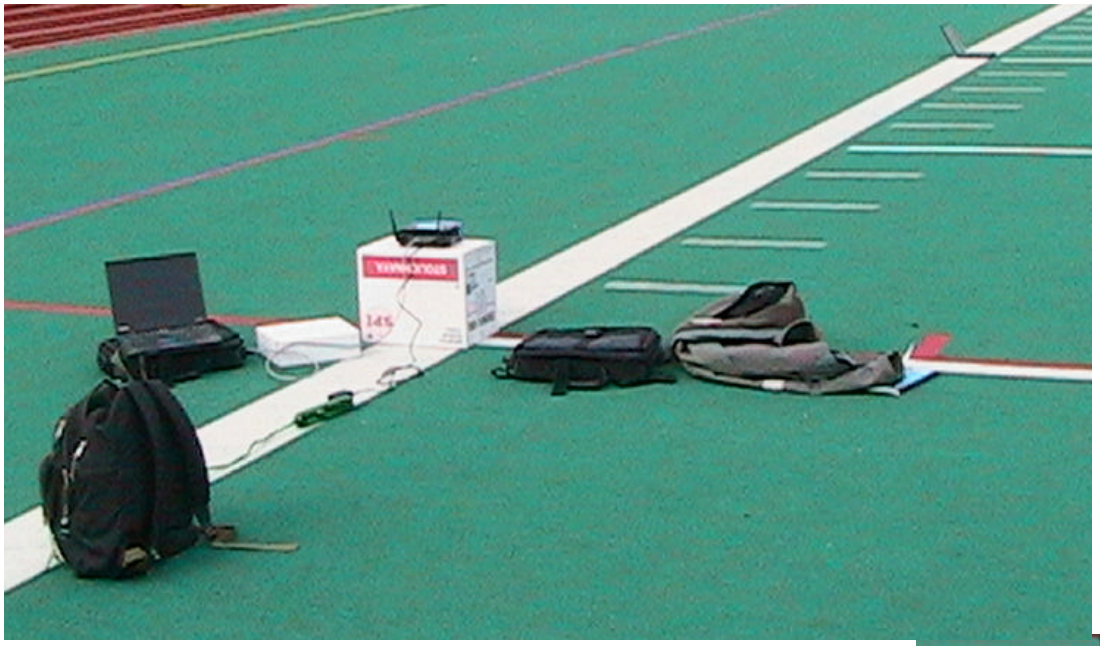
Phase 0 - distance

- First test on the football field
- As expected, SNR drops as distance increases
- At about 15 yards, throughput started to become erratic. By 30 yards, we could not get an accurate measurement.

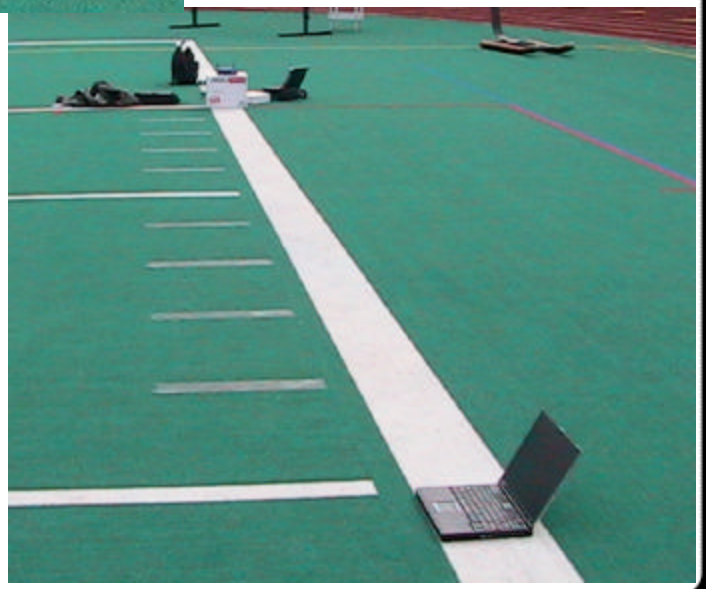




Phase 0 – distance

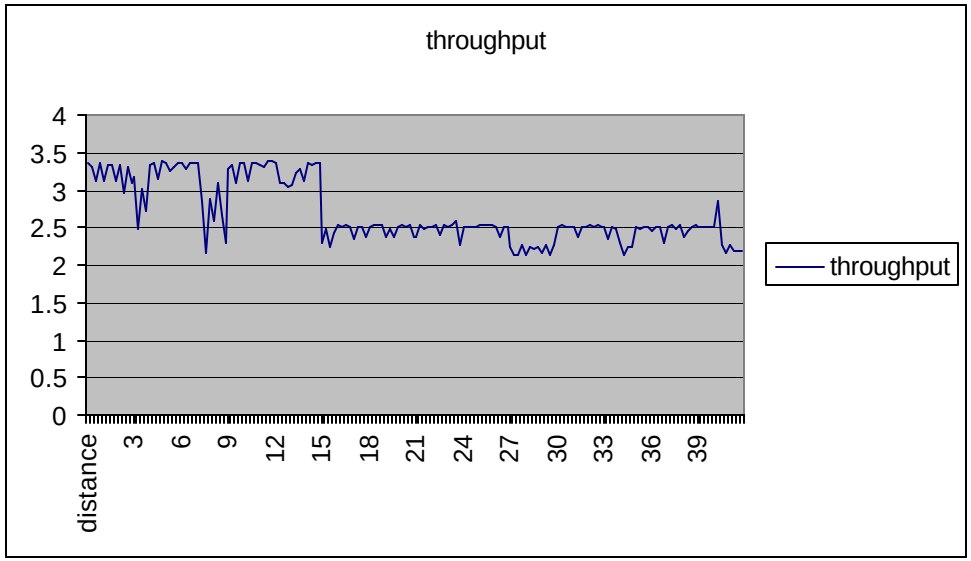


Our setup on the football field



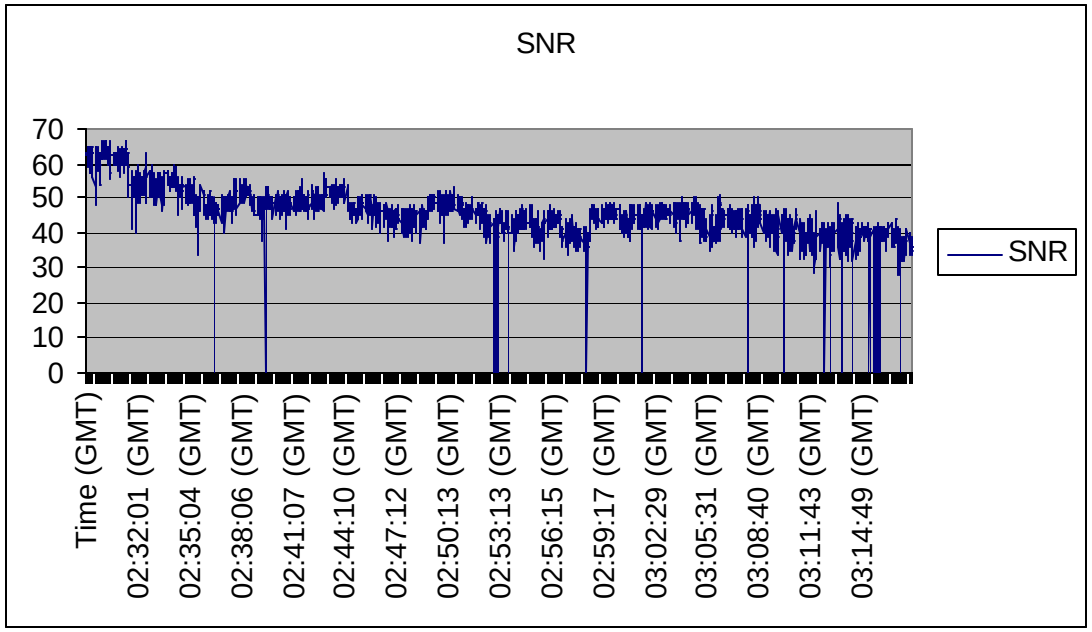
Phase 0 – distance

- Second test in a long hallway in the Campus Center
- Throughput is erratic, but confined to two distinct plateaus



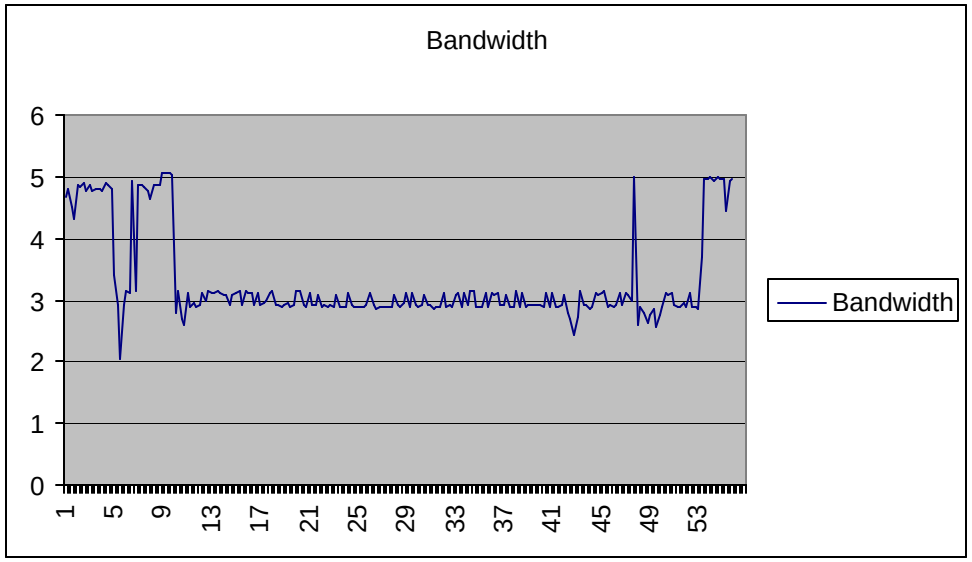
Phase 0 – distance

- Just like in the football-field experiment, the SNR decreases as one would expect with distance…
- At the maximum distance tested which was longer than the distance on the football field, we had 2x the SNR



Phase 0 – distance

- Third test in a large open room (Harrington Auditorium)
- At about 15 yards, bandwidth dropped significantly just like in the previous experiments.
- At 53 yards, it returned to full bandwidth!
  - Shape of the room

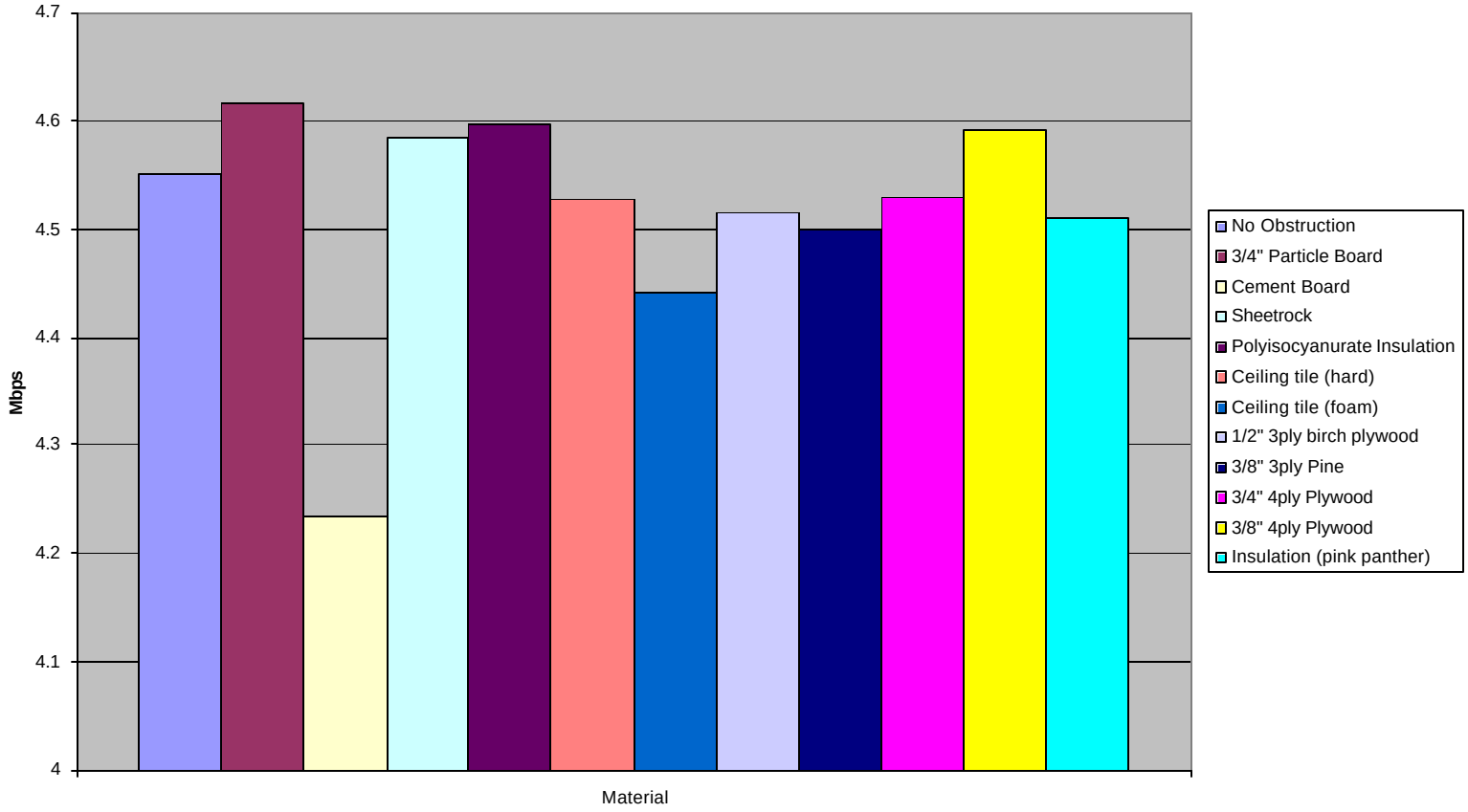


Phase 0 – distance

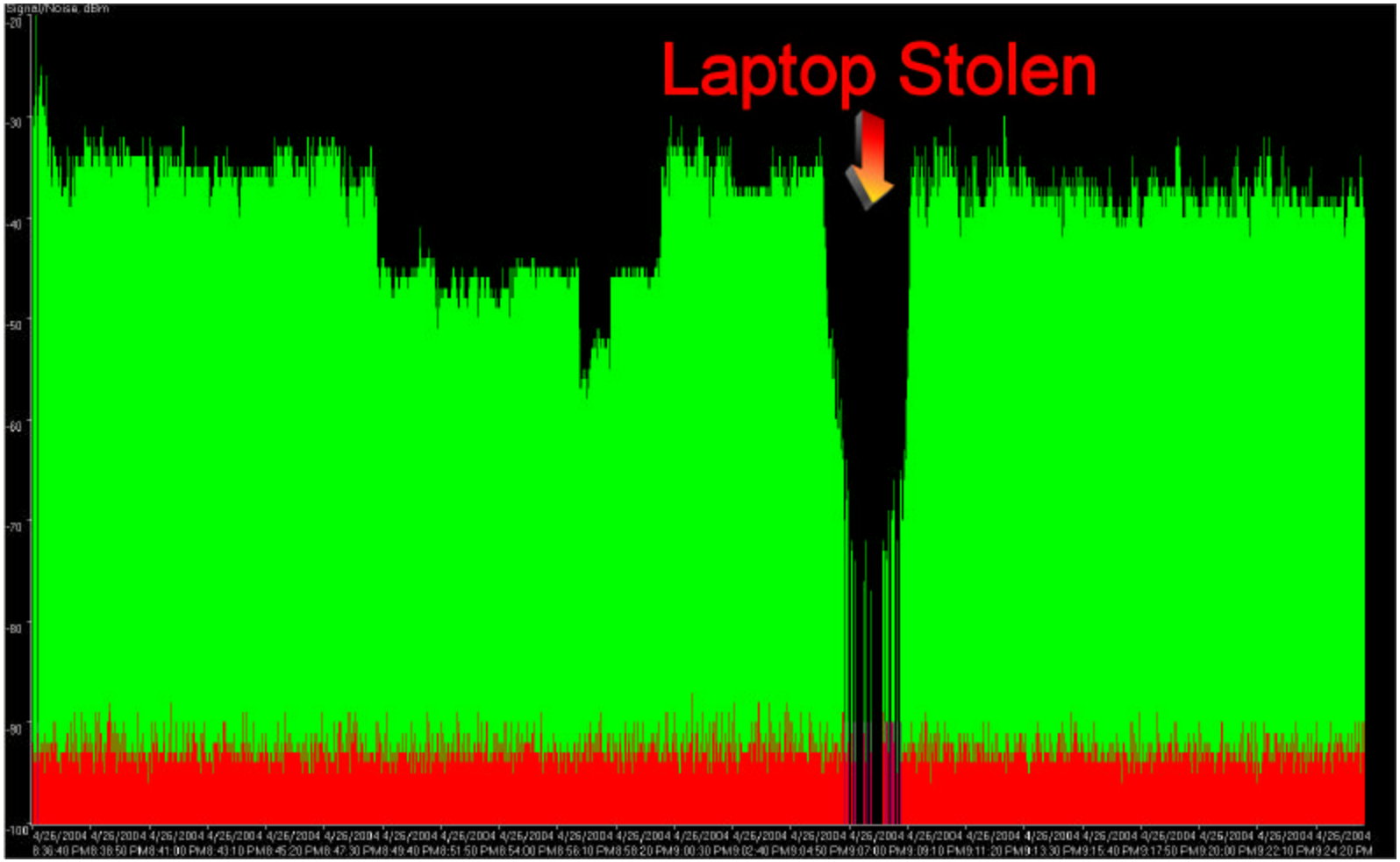
Phase 1 – building materials

- Unfortunately, by the time that we were about to conduct the building materials test, we realized it was ill conceived
- Learned from the distance tests that radio waves are much less line-of-sight than we thought
- We didn’t have the resources to do a better test, so we decided to continue with the test as-is.

Phase 1 – building materials

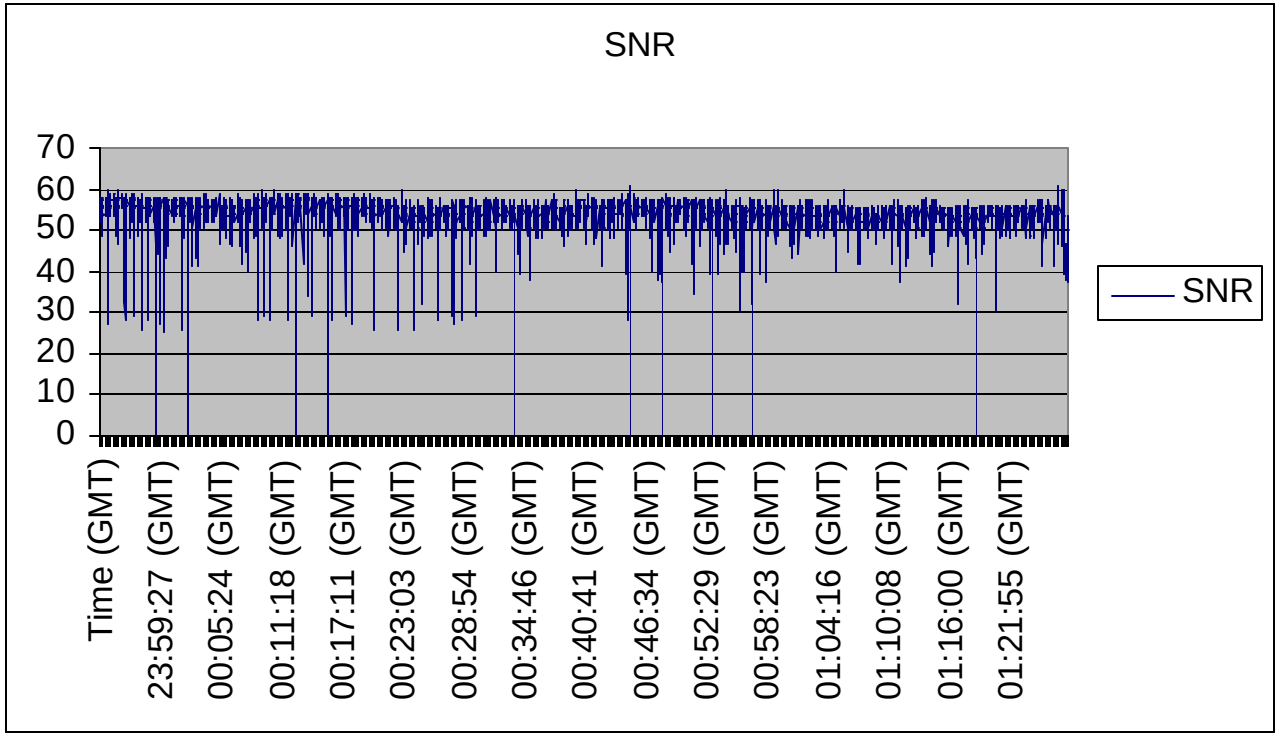


Phase 1 – building materials



Phase 2 – environmental

- What are the effects of humidity on wireless, if any?

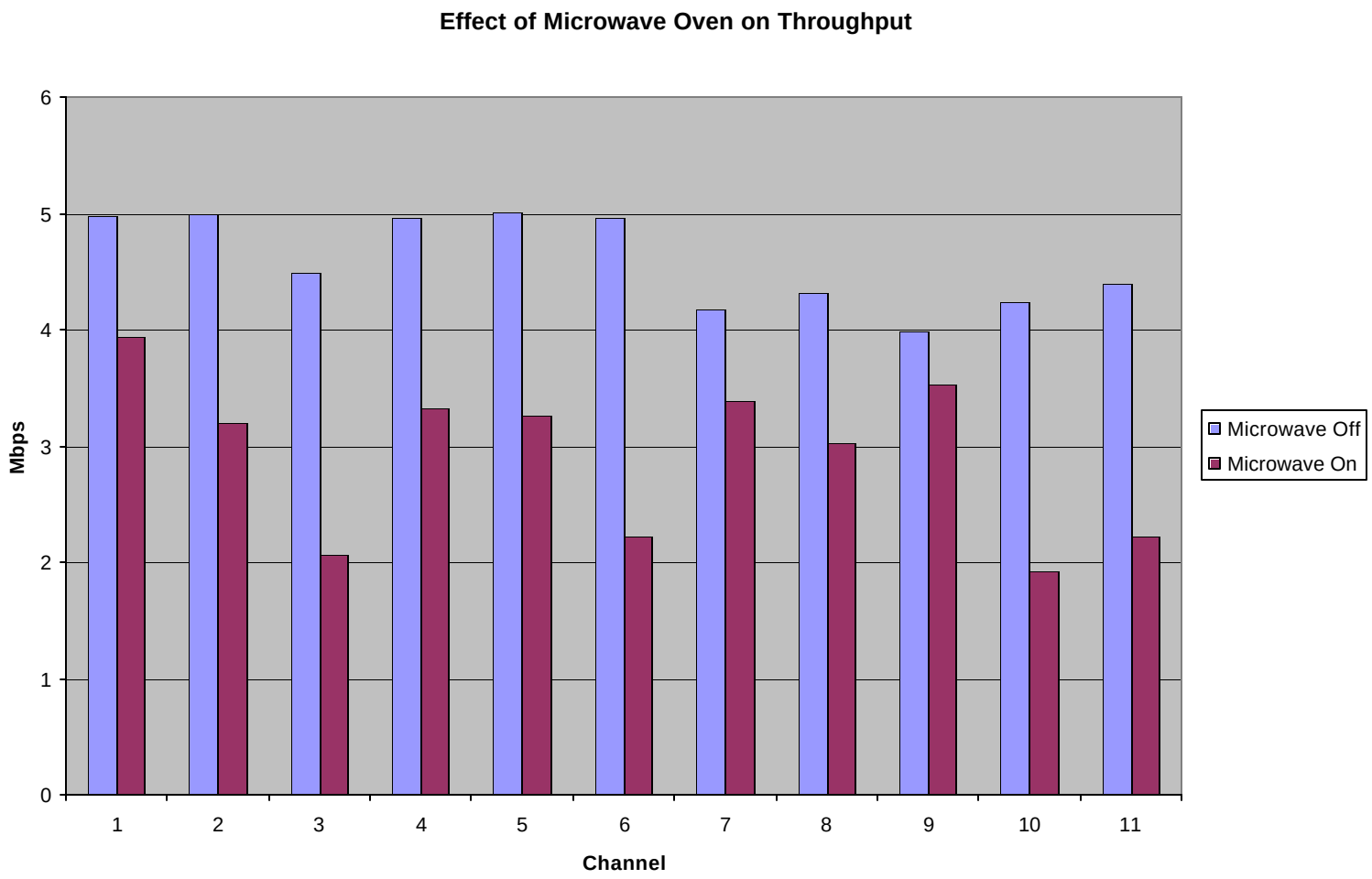


- Very slight downward trend

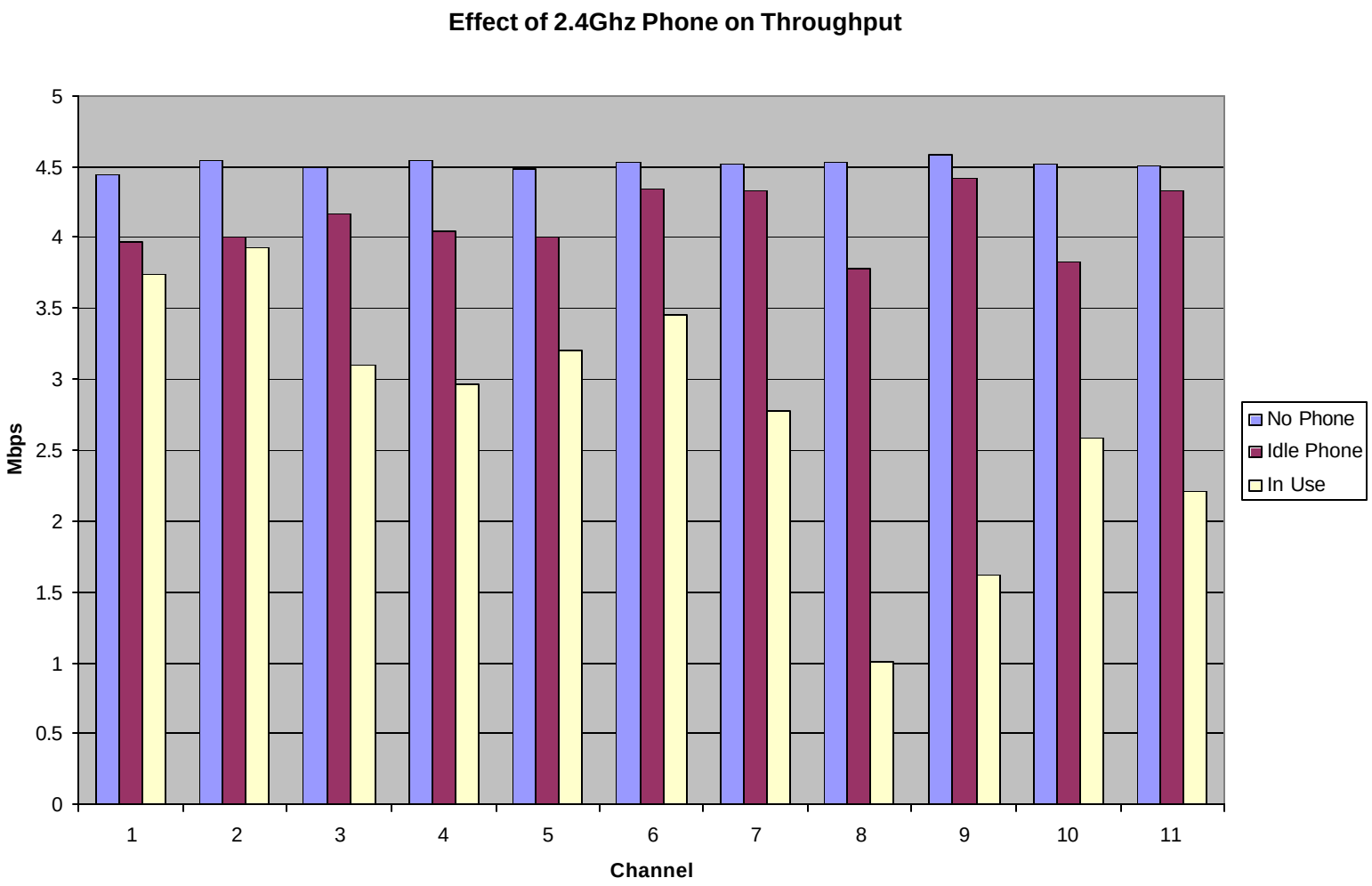
Phase 3 – interference

- Tested with two sources of noise in the 2.4ghz band
  - Microwaves
  - Roommate's phone that *ruins* my wireless headphones

Phase 3 – interference



Phase 3 – interference



Conclusions

- Wireless signals may be too complex to conduct research with based solely on empirical evidence
- Although we did not reach many of out goals, we learned a lot about wireless
  - Line of sight is less important than structures that tend to “focus” radio waves such as the ends of Harrington
  - Without surfaces to bounce off of, 802.11b behaves very poorly as shown by our outdoor test

Conclusions

- Interference with other devices using the same band is a **big** problem
- If you get poor performance, try moving just a little bit – small changes in position or orientation can have huge effects on performance
- Always keep a close watch on your laptop

Questions?