

## Test with Obstacles

## Lesson 3

### Overview

Students will use the Vex Robotics System in a laboratory setting and conduct scientific inquiry-based experiments to determine the effect of radio control transmitter signal strength relative to an obstructed receiver.

### You Will be Able to:

1. While holding the radio control transmitter at waist height and pointing at the receiver, identify and measure the maximum distance from radio control transmitter to an obstructed receiver at various antenna heights
2. Use a fixed radio control transmitter antenna height and fixed radio control transmitter distance from receiver to discover the optimal angle of the radio control transmitter antenna
3. Collect data from your investigation
4. Apply and describe the various points of experimental procedure:
  - a. Experimental hypothesis
  - b. Measurement technique
  - c. Multiple trials
  - d. Systematic error
  - e. Random error
5. Write a summary describing what you learned in the investigation

### Materials Needed:

- Constructed robotic system (refer to “Background / Resources / Signal Platform Construction”)
- Radio control transmitter
- Yard stick
- Tape measure
- Sheet of paper
- Wood
- Sheet metal
- Lesson 3 datasheet (modified from “Background / Resources / Lesson Datasheet”)

### Testing with Obstacles

1. Place robotic system at a stationary point. Turn on Vex micro controller and radio control transmitter. Make sure to have plenty of table or floor space for this experiment.
2. Stand in front of the robotic system, holding the radio control transmitter at waist height (approximately 2' to 3' from the floor). Tilt the antenna between 45 degrees and vertical as in Figure 2. Extend the antenna 1" from the radio control transmitter to gain minimal reception.
3. Begin the experiment by placing a piece of paper on top of the receiver and the antenna (Figure 3). Make sure the antenna wire is not in the plastic tube and is wrapped around the receiver. Push forward on the joystick of the radio control transmitter to turn on the motor of the robotic system. If you have no signal, and the motor does not turn on, extend the antenna 1" more and move closer to the robotic system. Keeping the radio control transmitter at your waist, and your finger on the joystick, slowly walk away from the robotic system until the motor stops moving. Once the motor has stopped, slowly walk toward the robotic system to

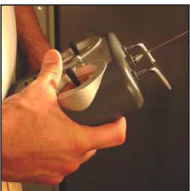


Figure 2



Figure 3

**Test with Obstacles** *continued*

## Lesson 3



Figure 5

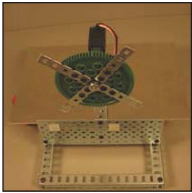


Figure 6

regain the connection. Once you find a consistent signal at a maximum distance, measure from the antenna tip to the receiver antenna. Record the data in your Lesson 3 datasheet.

4. Continue to extend the antenna in 4" increments and measure the distance from antenna tip to the receiver. Record the data at each increment. You will have 8 distances recorded in your Lesson 3 datasheet for the paper obstacle.
5. Next, place a piece of wood on top of the receiver and the antenna (Figure 5). Repeat the same procedure as in steps 3 and 4. Once you find a consistent signal at a maximum distance, measure from the antenna tip to the receiver antenna. Record the data in your Lesson 3 datasheet. You should have 8 distances recorded in your Lesson 3 datasheet for the wood obstacle.
6. Finally, place a piece of sheet metal on top of the receiver and the antenna (Figure 6). Repeat the same procedure as in steps 3 and 4. Once you find a consistent signal at a maximum distance, measure from the antenna tip to the receiver antenna. Record the data in your Lesson 3 datasheet. You should have 8 distances recorded in your Lesson 3 datasheet for the metal obstacle.
7. Compare the graphs of all three experiments. Which material hindered the strength of the radio control transmitter signal the most? Which material had the least effect on the strength of the radio control transmitter signal?