Tech Corner – RF detector

Time for a little fun. I just thought it might be neat to show everybody how to build a simple RF detector, that is, a device that can display the presence of a relatively strong radio wave. Since our greatest bands of interest seem to be dictated by our HTs (handheld transceivers), let's create one that will detect a 2 meter signal and another for a 70-cm signal.

The entire construction is for a simple resonant dipole and a detector circuit between the elements. Each element of the 2-meter dipole is calculated as 234 ÷ 146 MHz = 1.6 feet, or 19.23 inches. Multiply by the velocity factor of copper and get 19.23 inches x 0.951 = 18.3 inches. By the same calculation, each element of the 70-cm dipole is 234 ÷ 446 MHz = 0.525 feet, or 6.3 inches. Multiply by the velocity factor of copper to get 6.3 inches x 0.951 = 6.0 inches.

The detector circuit is nothing more than a low-voltage (1.8 V to 2.0 V) LED in parallel with a Schottky barrier diode in reverse polarity. The LED is a diode in its own right, but turns on and off so slowly that for each cycle of the signal, by the time the voltage begins rising, the cycle starts reversing, and so the LED never becomes forward-biased with a high enough voltage to display light. The Schottky barrier diode turns on and off very quickly, allowing the voltage in the signal sufficient time to rise above the LED threshold, sending the pulsating DC to the LED, lighting it.

Parts List

Two 1SS86 Schottky barrier diodes

Two color 5 mm 1.8 V 20 mA LEDs

Two 18.3″ 12 AWG solid copper wires

Two 6.0″ 12 AWG solid copper wires

One 2-meter / 70-cm HT (handheld transceiver)

Optional : 36″ foam poster board

Optional : clear packaging tape

Construction

The longer leg of each LED is the anode, which you'll need to mark or otherwise keep track. Bend the legs of each LED flat-ways 180° away from each other. Wrap the cathode (marked with a stripe) lead of the 1SS86 diode around the LED anode (longer) leg, such that the diode is mounted directly under the LED.

Cut each 12 AWG wire to length, straighten each, then bare about ¼″ from one end of each. Place each identical pair of wires end-to-end, the bare ends about ¼″ from each other. Wrap each diode leg-lead pair around a bared end of one of the 12 AWG wires, then solder each of the three conductors together.

Use some clear packaging tape to mount the two dipoles on the poster board in parallel with each other and about four inches apart. The project is finished...it was that simple!

Testing the RF detector

With both dipoles constructed and mounted parallel to each other, it's easy to see which RF signal is being detected. While holding the HT a few inches away from the poster board and equidistant from the dipoles, tune to 146.520 MHz and key up (don't forget to transmit your call sign!) The LED of the longer dipole should light brightly while the LED of the other dipole should not light at all. Repeat this test using 446.000 MHz, and the LED of the shorter dipole will light instead.

Using this detector, affirm the idea of the inverse-square law by pressing the PTT, then moving the radio antenna closer and farther from the detector. The LED should brighten and dim as the square of the distance, and not linearly, which might be difficult to see precisely because of the voltage threshold sensitivity of the

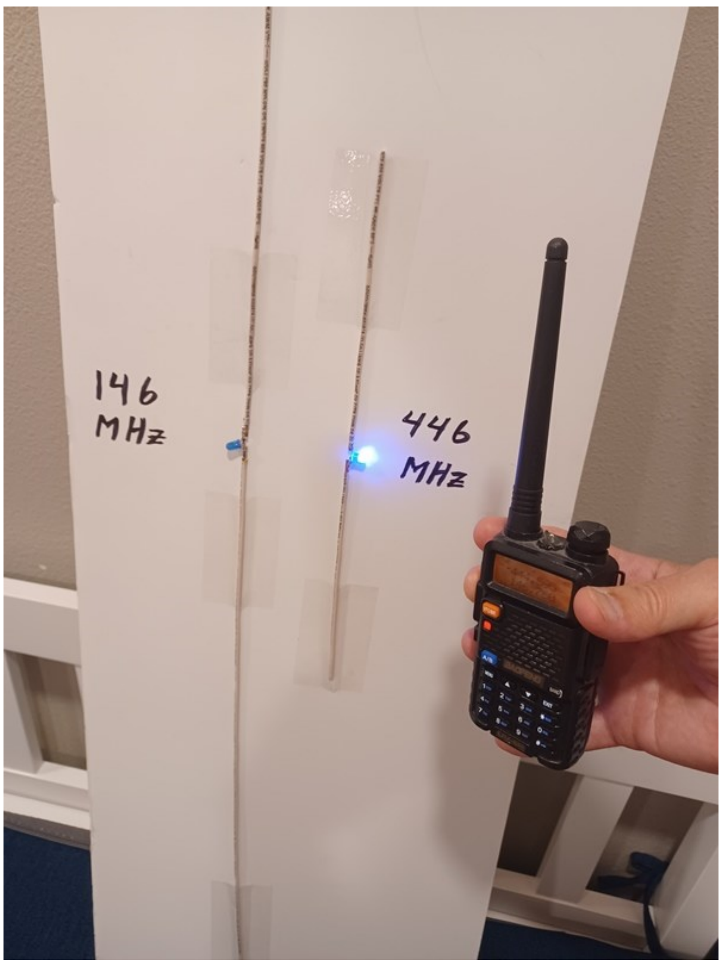
RF detector, cont'd

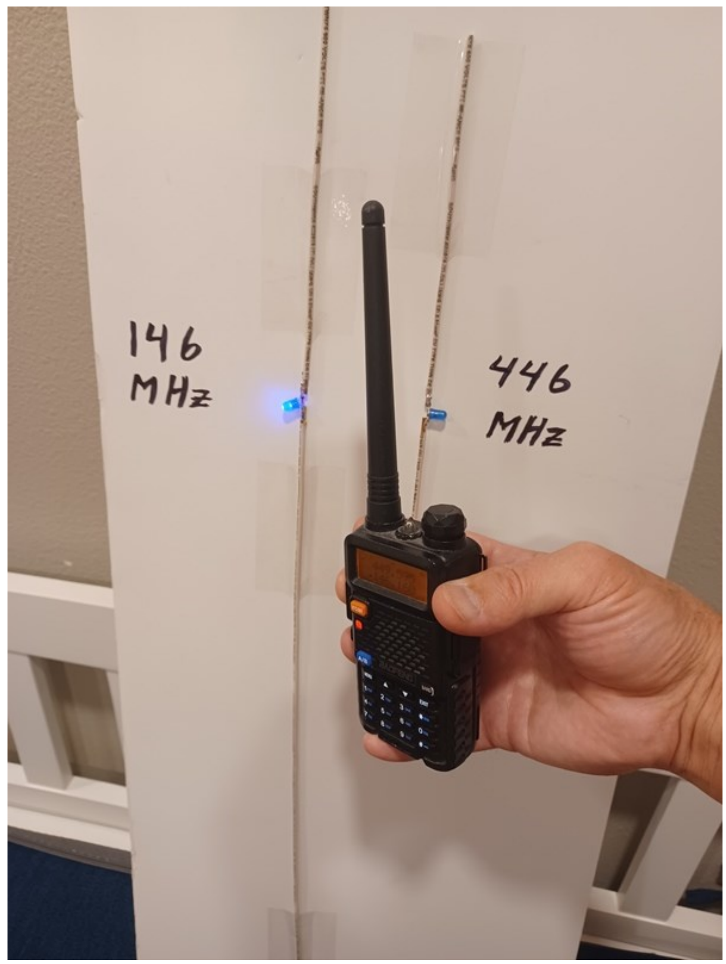
LEDs. But fun anyway. What else can you discover with your detector?

Ever wonder what difference it makes whether you keep your HT antenna pointed upwards or turned sideways? Demonstrate the effect of signal mis-polarization, by pressing the PTT, then rotating the antenna in a plane perpendicular to the detector dipole orientation and back again. How about if you point your HT antenna right at the detector? I'll leave that as an exercise for ***you***.

Extracurricular

Well, this fun little experiment brings up a few questions, like how selective the detector is. If it can detect 2-eter and 70-cm signals, how about 220 MHz signals, or even 6-meter signals? Why not. Just run through the calculations and cut the wires and demo the result.





How about multiple detectors within the same band? For example, can you have one dipole for 144 MHz, another for 145 MHz, another for 146 MHz, and so forth? To be honest, I haven't tested the selectivity of the Schottky diode to that extent, so again I leave that experiment as your exercise, and you can educate ***me***!

Noji Ratzlaff KNØJI