K3MT
presents . . .

Mike Villard's
Magic Anti-Jamming
antenna
for shortwave reception

September, 2000

Here's a neat little antenna for receiving on shortwave - that is, HF - frequencies. It's the brainchild of Mike (aka Dr. O. G.) Villard, Professor Emeritus of Stanford, founding father of SRI Inc, and one of the most wonderful colleagues with which it has been my sheer pleasure to be associated.

Mike had been asked by the Chief of U.S. Information Agency, the parent of Voice of America, if there might be some way to counter Soviet jamming of VOA broadcasts. His mind set to work: he made a *pile* of different antennas that seemed to show some promise, and presented a proposal to USIA to produce two different anti-jam antennas that would be effective. I was at VOA engineering. His proposal became a contract: by the best of luck, engineering thrust *me* into the role of "ARCO" - authorized rep of the contracting officer (all other government agencies call this "COTR," but USIA is, well, *different!*)

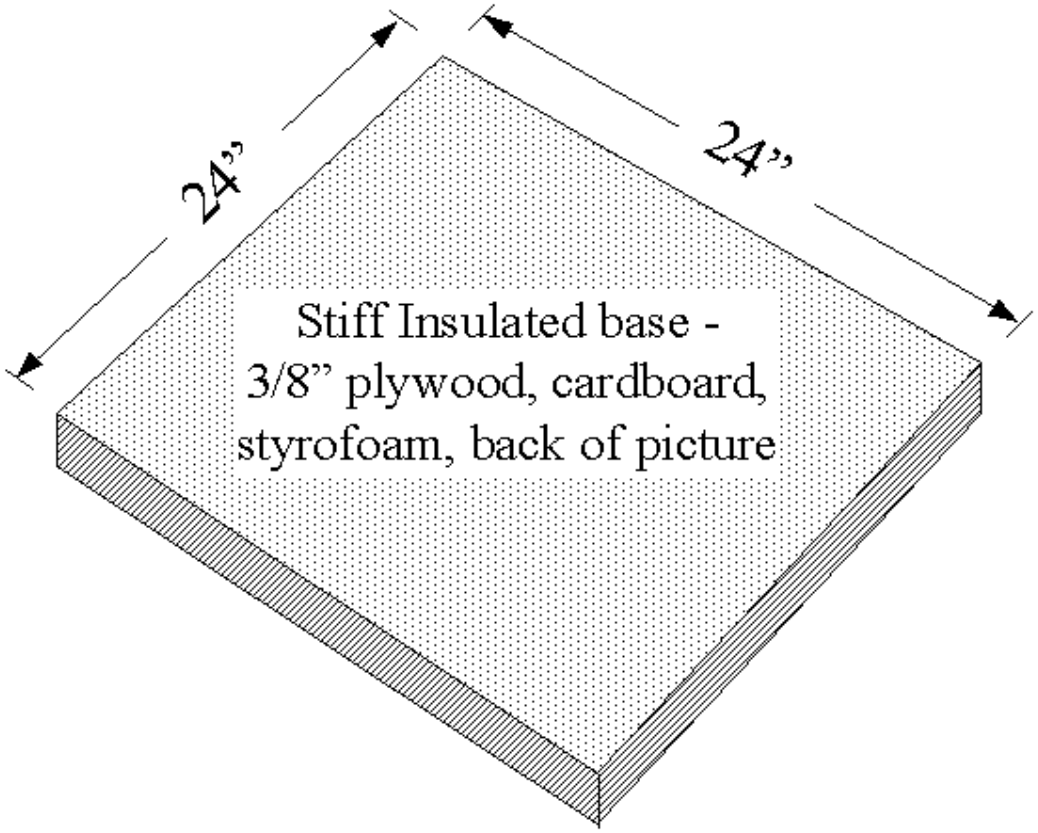
Mike showed me myriad designs that filled his pool house to the max! We selected two promising ones, and spent the rest of the year studying them, improving them, and producing a *really neat* end product. One counters jamming via sky wave, where the jammer propagates by ordinary HF propagation. The other counters *ground wave* jammers - noise transmitters located near the receiver, usually on the outskirts of the city being jammed.

Ground wave jamming is exactly similar to arcing power lines or other locally produced noise from appliances and the like - even from lightning.

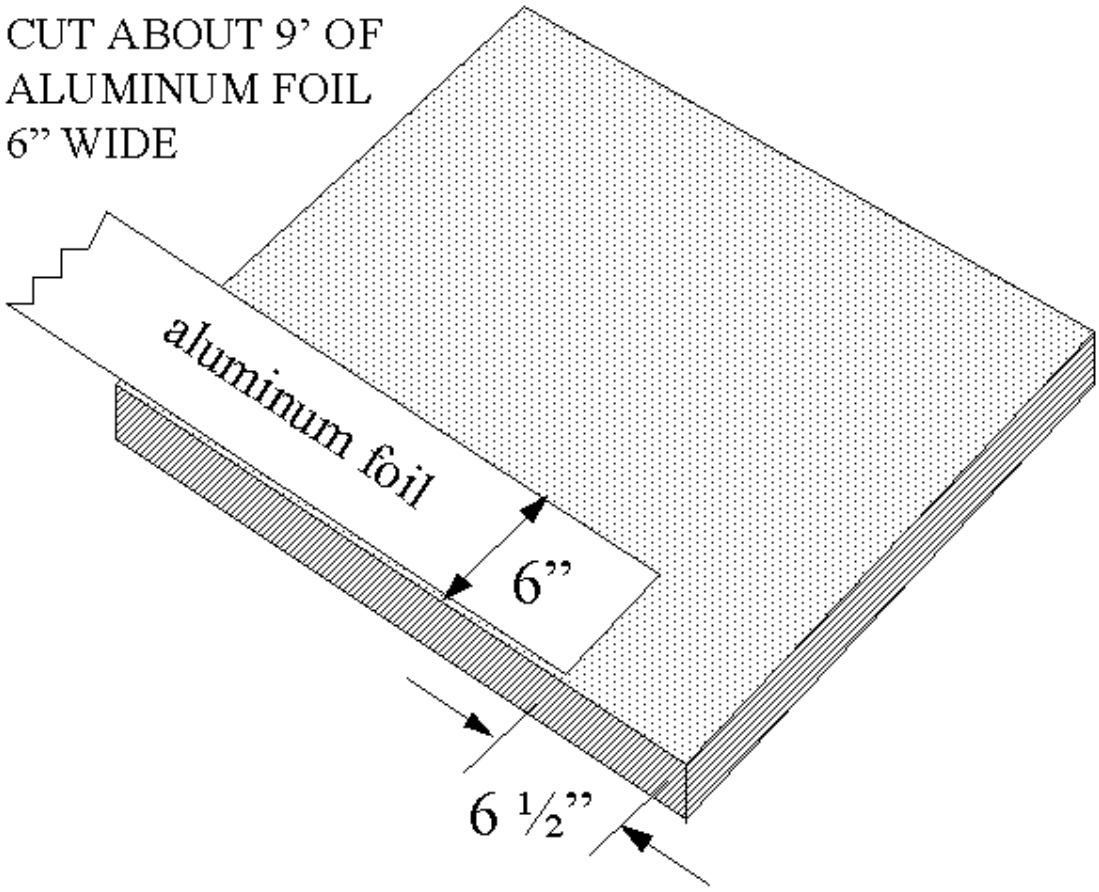
So, without further delay, I present, in picture form, . . .

The HLA
Villard's Noise Rejecting
Horizontal Loop Antenna

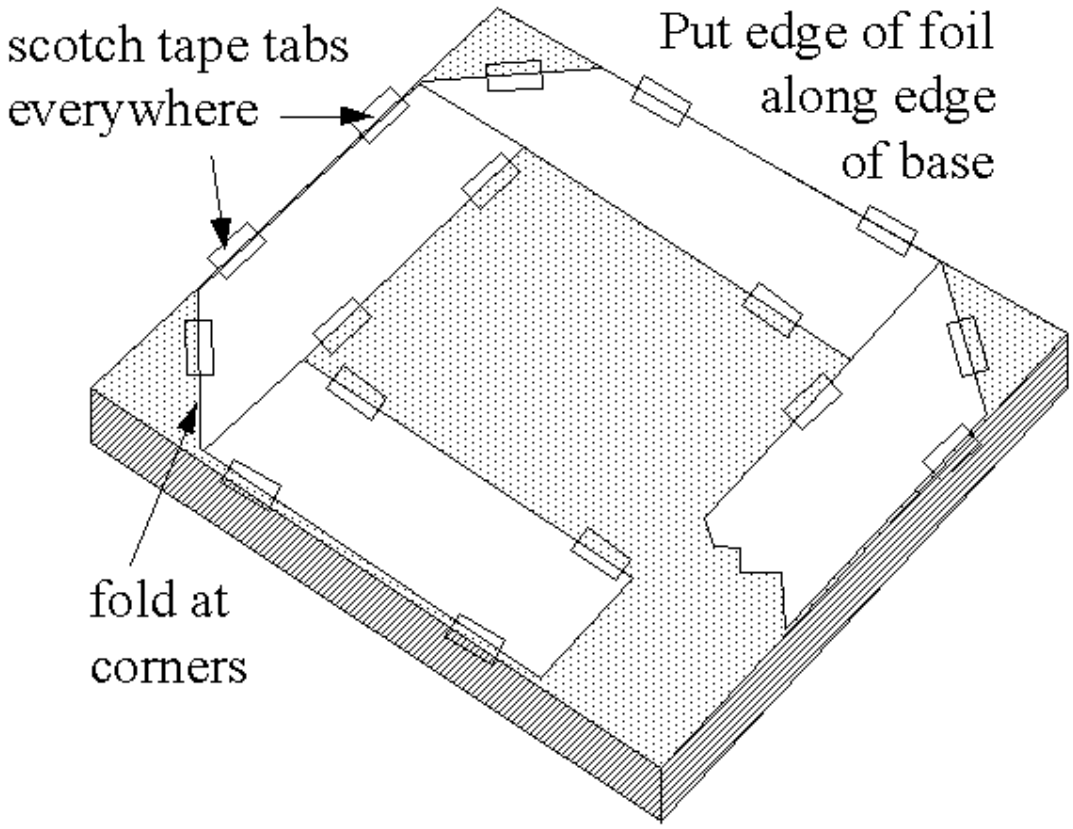
Get a 2' x 2' base - plywood, cardboard, stiff foam plastic, even the back of a wall-hung picture.



Cut a 6" wide piece of aluminum foil. Lay it on the base, with its edge along the edge of the base. Note the 6 1/2" gap where the foil begins.

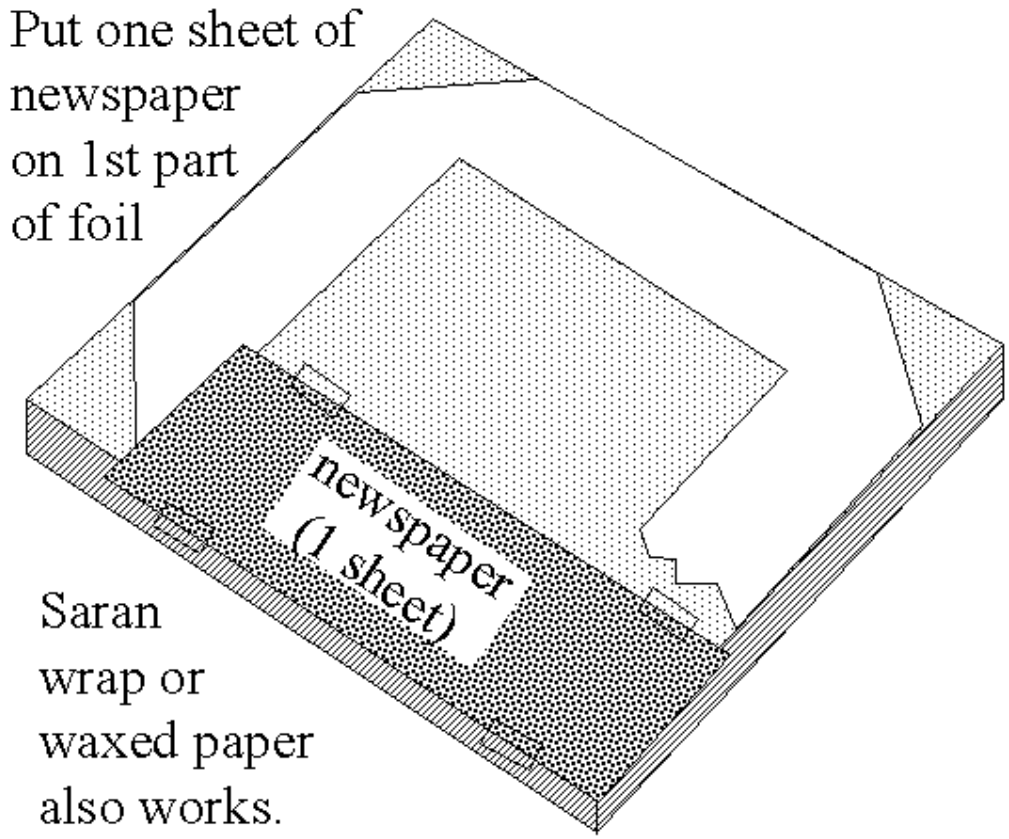


Fold the foil over itself as shown. Use tabs of scotch tape to hold the foil in place. Continue taping it down on three, and part of the fourth, side:

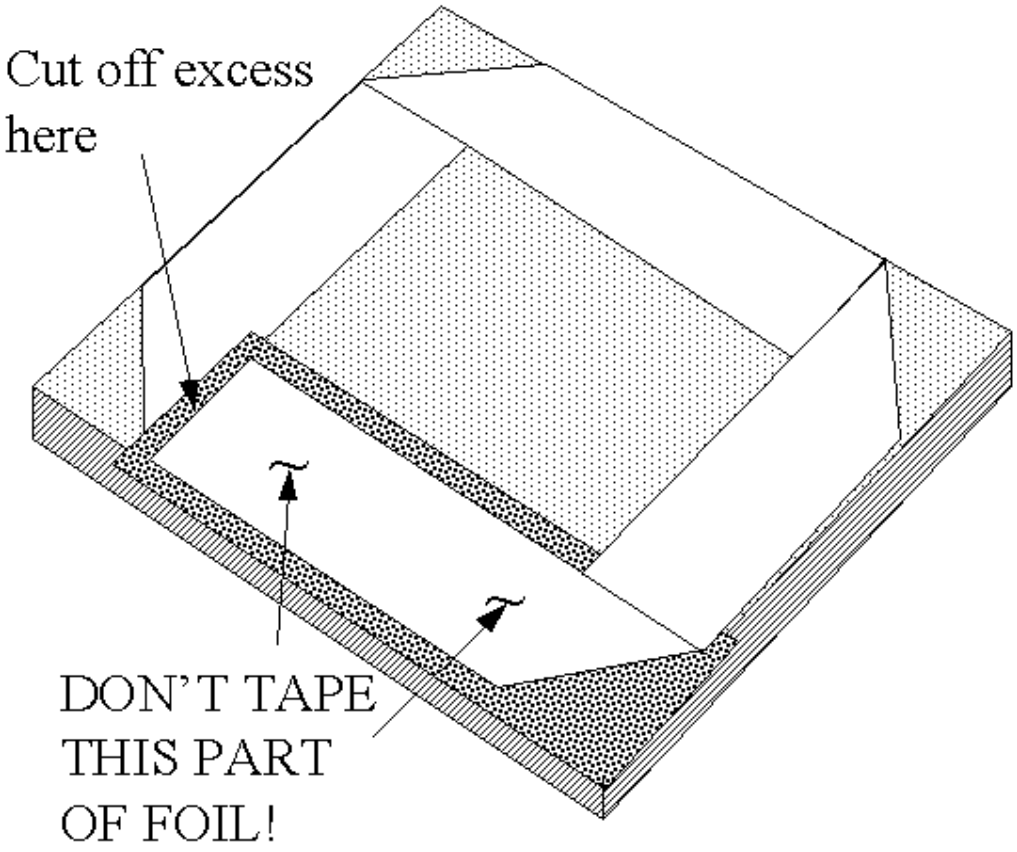


Cut a piece of newspaper 7" wide and 12" long. You can use saran wrap, waxed paper, or lots of other thin, insulated material for this - even a handkerchief! But thick insulation could prevent tuning the antenna to low HF frequencies.

Put the insulating sheet over the first part of the foil and tape it in place, per the drawing.



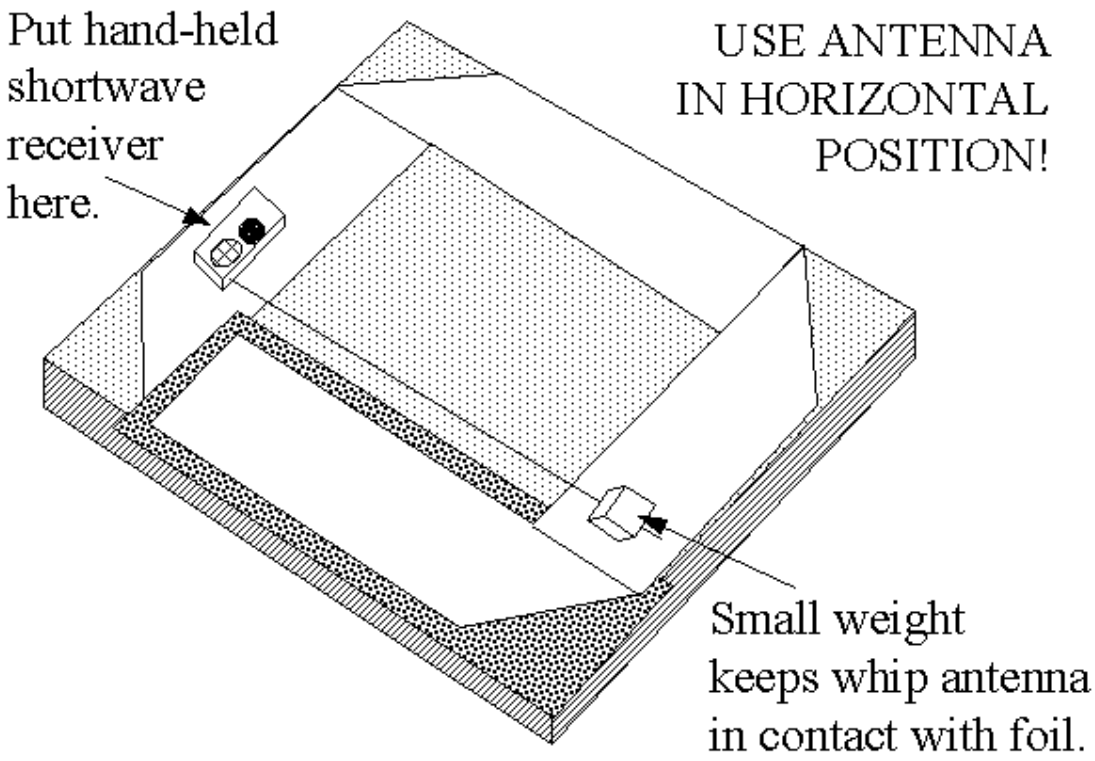
Leave the fifth flap of foil loose, so it can be lifted up when necessary. Cut off excess foil so it does not short circuit against the foil beneath the newspaper.



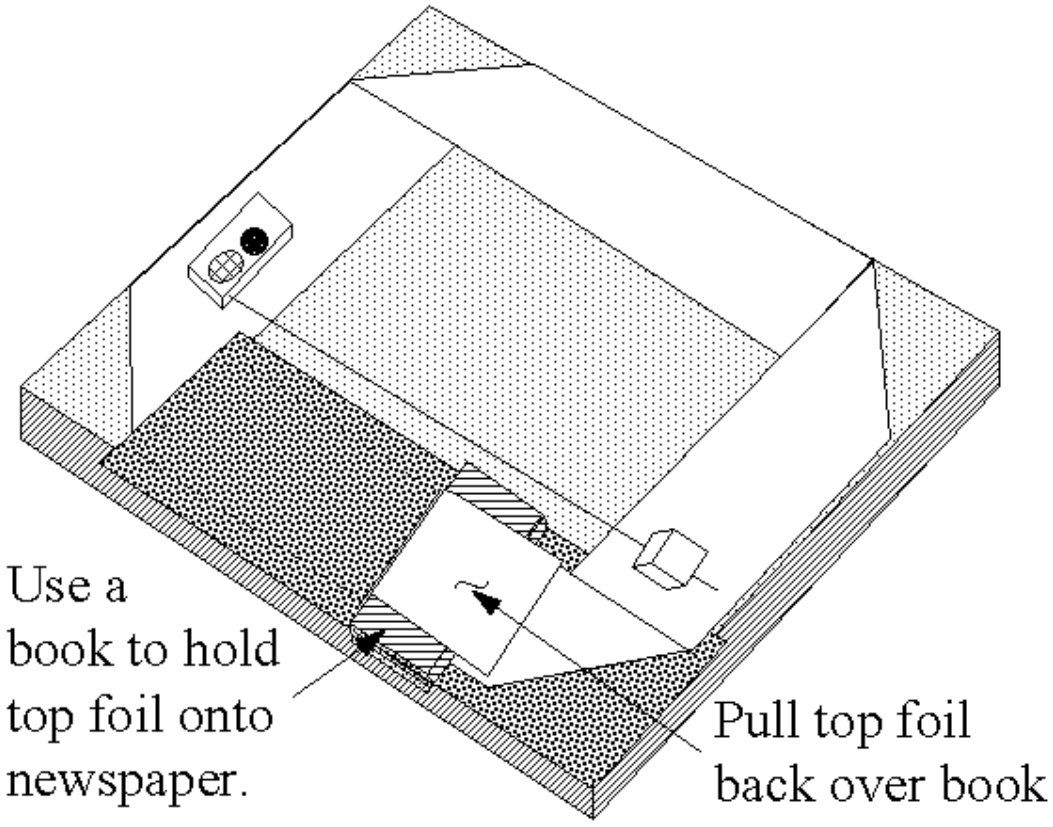
When using a battery-operated, pocket size shortwave receiver, set the antenna on a table, couch, bed, or on the floor. Keep it hoizontal.

Put the receiver on the foil as shown. Don't worry about electrical connection: the capacity between the receiver and the foil will do the trick nicely.

Pull the whip antenna out, and lay it on the other side of the foil loop. Use a small weight to make sure the whip contacts the foil.

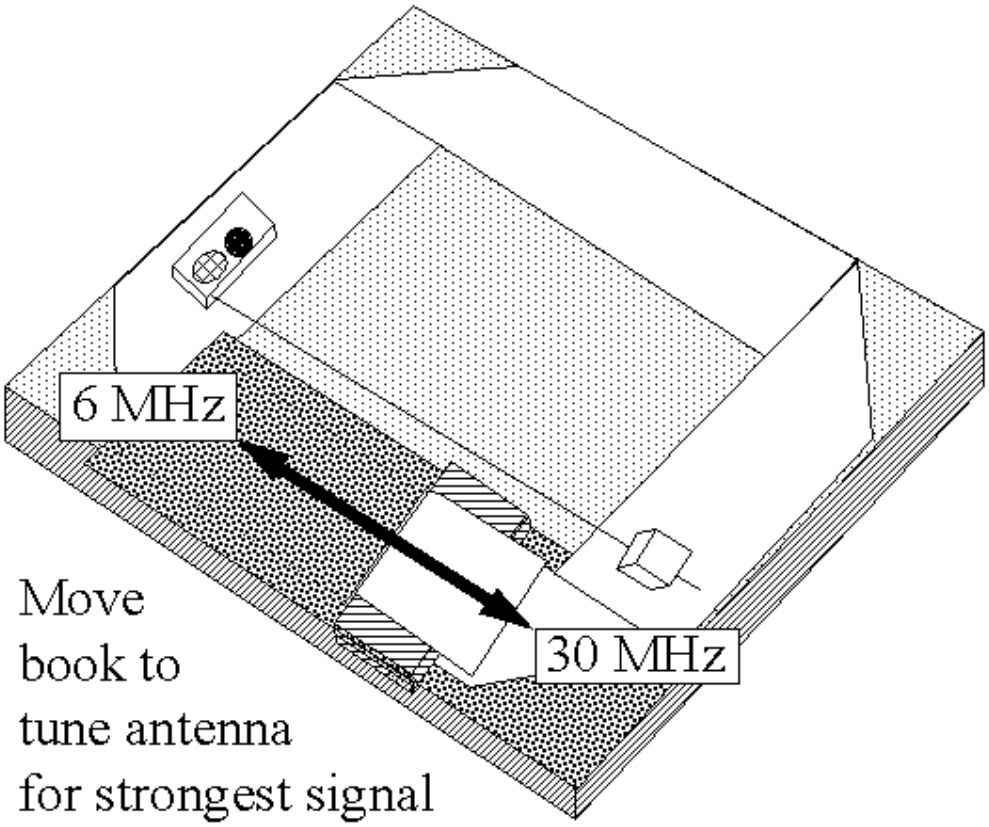


Use a book to press the loose foil flap down against the newspaper. Pull excess foil up and back over the book. The book will be the antenna tuner.



Tune the antenna to the right frequency by sliding the book back and forth while keeping excess foil up and over the book.

To tune the antenna, set the receiver about the middle of the desired band, with the volume control fairly high. Tune for strongest signal, or strong increase in noise from the receiver.

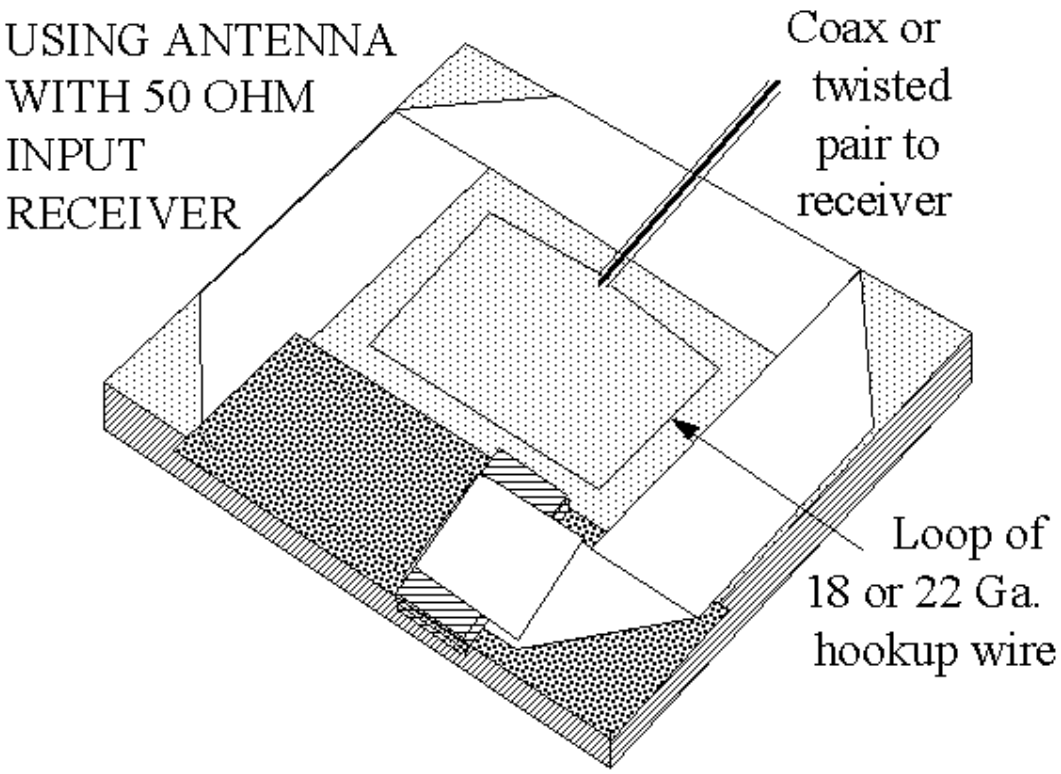


If you use a table model receiver (or an amateur transceiver,) make a single turn loop of about #18 insulated hookup wire by taping the wire in place one inch inside the foil loop. Bring the wire away from the antenna on the middle of the side opposite the tuner. Don't connect this loop to the foil - it isn't necessary.

The pickup loop can be brought to the receiver by twisted pair or by RG-58 or similar coaxial cable.

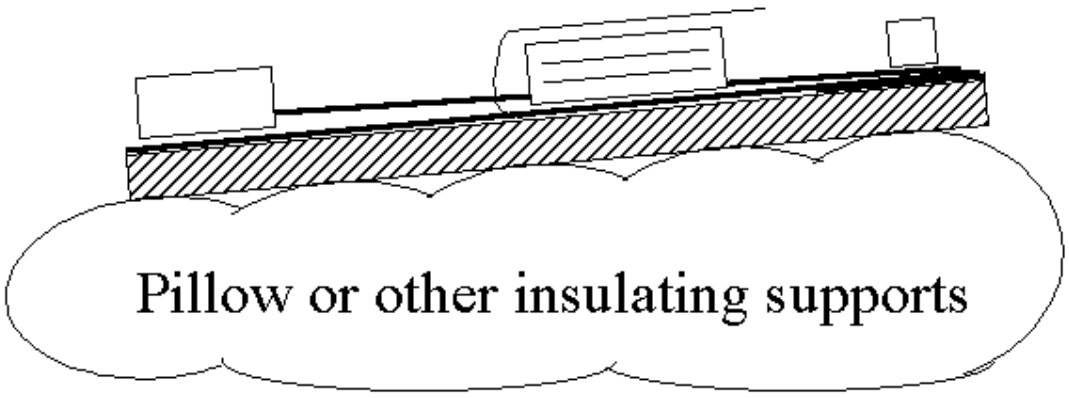
CAUTION

THIS ANTENNA IS <u>NOT</u> DESIGNED FOR TRANSMITTING!!



Now here's the *really neat* part of Mike's design - how to cancel noise. Put the antenna on some insulating support so it can be tipped up on one side or corner. One of the early investigators working with us (Cheryl Hagn) pointed out that a pillow serves very well for this support!

While listening to the interfering noise, tip the antenna a bit to reduce the noise. Many times, with just a minute or so of adjusting, the noise from power lines, nearby TV sets, etc. can be reduced 20 dB, and further noise canceling can be obtained with a bit more care.



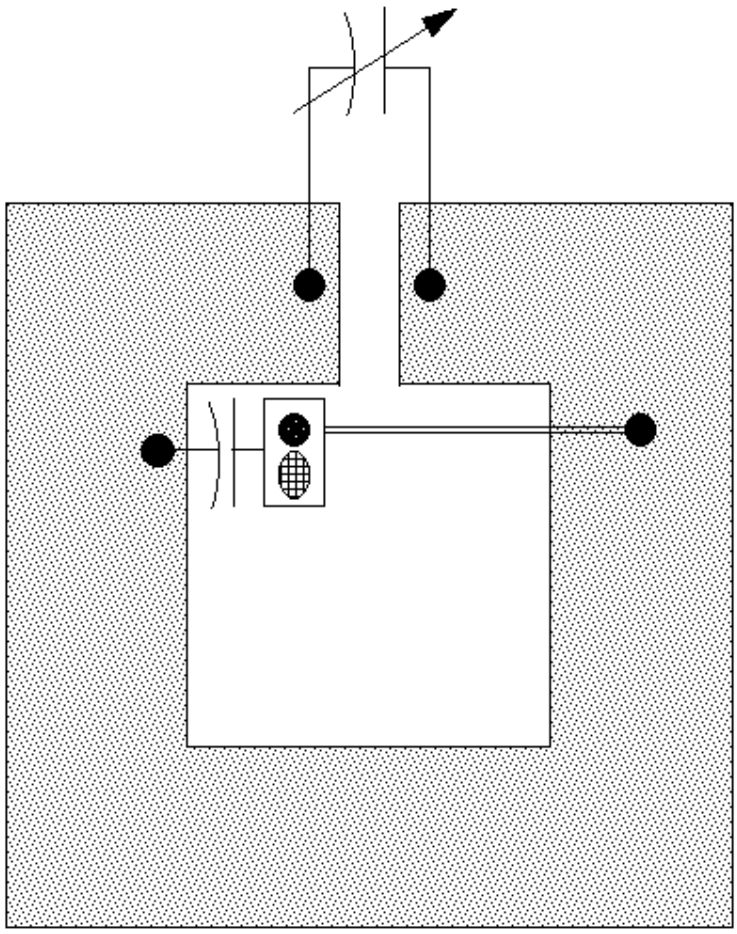
TILT SLIGHTLY AS NECESSARY
TO CANCEL LOCAL NOISE

Great! You now own the "HLA" antenna for noise canceling. I finish with a simple schematic diagram showing what you built.

The newspaper and two foil flaps make a capacitor. The book allows you to vary the amount of overlap of foil, so you made a variable capacitor which is attached to the ends of a single turn loop, made of a very wide, flat conductor.

The receiver, sitting on the foil, has a good deal of capacity between its internal circuit board (or chassis) to one end of the loop. Its whip antenna is connected to the other end, so the voltage developed across the loop is injected into the receiver.

Tuning the loop causes the voltage at one frequency to be maximized. This causes the increase in signal strength.



THE TUNED WIDE STRIP LOOP

HOW DOES THE ANTENNA REJECT NOISE?

Noise from local sources - arcing power lines, fluorescent tubes, TV sets, etc - travels to your receiver along the ground. Its *horizontally* polarized components are attenuated very rapidly, so only its *vertically* polarized part gets through.

Mike's HLA is horizontally polarized. Therefore it doesn't respond to the noise. But skywave signals arrive at your receiver *randomly* polarized, so their horizontal part enters the antenna. As their polarization varies, though, the signal will "fade." But this happens with *any* shortwave

receiving antenna. So Mike's HLA suffers from fading no more than any other. It's forte is noise cancellation.

SOME ADDITIONAL THOUGHTS

There's really nothing magic about the dimensions shown. HLA antennas can be made both larger and smaller, with foil that is wider or narrower. The tuning range will vary if the size is changed. What I've shown has been built in my lab and works from 6 to 30 MHz.

If you decide to make a bigger HLA, just keep in mind that the total circumference of the outside edge of conductor should be kept to well under one-third wavelength. Otherwise, the result will no longer be a small, horizontal loop above ground, but will have other (maybe even interesting) properties.

We've made HLA's from material other than aluminum foil. Sheet aluminum, sheet steel, window screen wire (but not fiberglass, which was the reason for my first failure to get one to work!) or lots of other conducting material will work fine. When using strips of metal, Cheryl discovered you don't need to electrically bond the pieces together. She just put weights at the corners, and the capacity through the oxide layers was essentially a very good connection at RF frequencies.

The HLA was designed to cancel vertically polarized noise. To do so, it was engineered to be kept within about a tenth of a wavelength above ground - not elevated much at all. You can, of course, put them up much higher, but I offer no data on performance when the loop is elevated - other people can attest to the qualities of elevated, horizontal loop antennas.

I hope you find this antenna interesting and useful. Some time ago, I had built one and was using it for reception on 15 meters, while using a grasswire for transmitting. In contact with a ham in Europe, I noticed the lights blinking on and off slightly. When I quit with the QSO, I went upstairs to ask my XYL what the heck she was doing - only to find myself in the middle of a raging thunderstorm! The grasswire, being rather impervious to lightning, and the HLA cancelling QRN from the lightning, kept me from realizing that a storm was even in progress!

For more unusual antennas, visit my web page.

And check out my Books

73

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