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ATTIC LOOP ANTENNA by Bill Farmer (W3CSW)

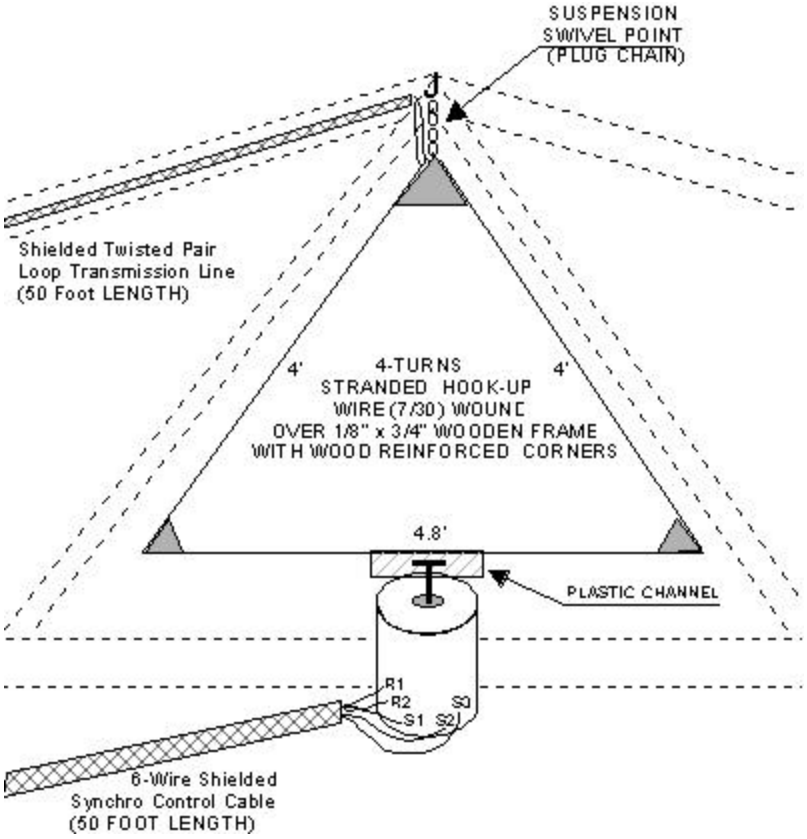
This article describes a 4-turn loop antenna configured in a triangular shape to permit easy installation in a typical attic crawl space. The loop is fabricated on a lightweight wooden frame that can be (optionally) rotated in azimuth using a light duty synchro motor, and is remotely tuned using a capacitance decade box paralleled across the receiver's antenna input. A 50 foot length of shielded twisted-pair cable connects the attic loop to the receiver.

This project started out as an experiment to receiver the USN VLF MSK submarine broadcast transmission on 24.0 kHz. The idea was to replicate the SID receiver system described by Eric Vogel in Richardson, Texas <www.flash.net/~evogel>. After running the transmission line from the attic to the shack, and waiting for the required 600 foot of wire to arrive for Eric's loop design, I decided to try an interim 5-turn loop made up of a 65 foot length of plastic jacketed AWG 18 stranded wire that I had on hand.

This temporary 5-turn loop sparked the idea of building a tunable loop that could be used over the entire 20 kHz to 500 kHz spectrum. The 5-turn loop (including its 50-foot transmission line) turned out to be self-resonant at about 250 kHz. The 50-foot length of shielded twisted pair used is Hosfelt P/N 36-395, which consists of two, AGW 18 wires in a foil shield with drain wire. It was discovered that it could be tuned lower in frequency by simply adding capacitance at the receiver input, but was somewhat desensitized for signals above it's self resonant frequency. Accordingly, I removed one turn from the 5-turn loop and this caused the self-resonant point to move up to about 400 kHz.

The loop is now tunable from 18 kHz (using about .8 μF) up to 400 kHz by incrementally decreasing the added capacitance of the capacitor decade box. The total inductance of the loop, including the feedline is 67 nH as measured at the shack/receiver end. My local NDB signal "GAI", located about 5 miles away at the Gaithersburg Airpark, and operating on 385 kHz, required a mere 100 pF, for an optimum signal strength measured at –53 dBm on a RYCOM Model 6041 Selective Level Meter. It was also found that signals in the AM broadcast band were sufficiently strong to be well received in spite of the 400 kHz self resonant point.

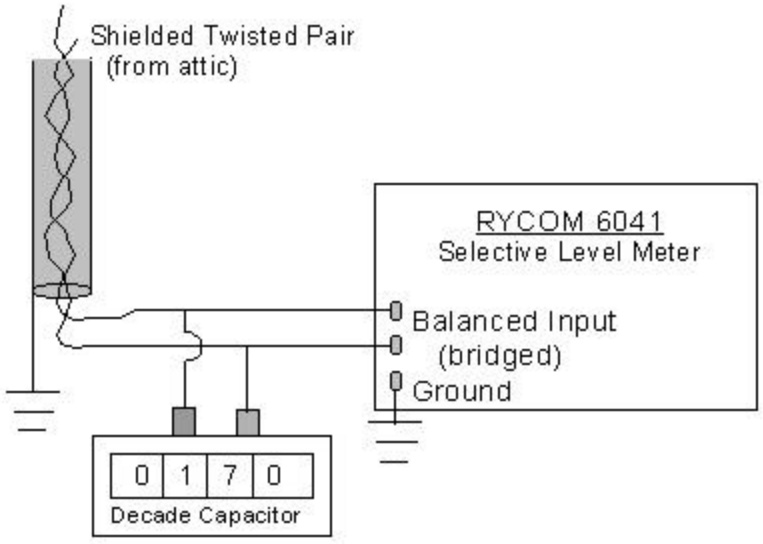
The loop was initially constructed as a fixed structure suspended between the rafters in the attic crawl space. Fitting it with a pair of synchro motors to allow rotation, proved to be a lot more work than originally anticipated in terms of pivot point alignment, azimuthal drift, etc., but was well worth the extra effort.



No doubt, one of the best features of this attic loop is the ability to rotate it so as to null out any received local noise sources. Nulls of about 30 dB appear to be very common. Another obvious benefit is having a weather proof, out of the way structure that should require minimum maintenance.

I initially used an old HEATH Model IN-27 Decade Capacitor box switchable over a 100 pF to .1 µF range to get this project started. However, later I found the IET Labs Model CS-300, to be a more ideal experimenter's tool. It spans a range of 100 pF up to 99.999 µF in a small (2" x 3" x 4.5") and easy to use box available from <www.metersandinstruments.com> on

the Internet. Another ideal candidate is the HP-4440B Decade Capacitor (40 pF to 1.2 μF) that can be found at hamfests or on used equipment lists for less than $100, depending your bargaining skills.



Properly coupling the attic loop to other types of receivers will require some additional experimentation due to the fact that a 50Ω, balanced input (as found on the RYCOM) is not normally found on the typical VLF/LF receiver. Preliminary tests show that direct connection of the shielded twisted pair feedline to either the normal 50Ω unbalanced input or the 600Ω balanced input of receivers such as the NRD-535D or AOR-3030 is less than optimum in terms of both noise performance and signal strength.

Performance of this attic loop has thus far exceeded all other types of active or passive LF antennas used at my QTH over the past 20 years. Using this attic loop with .017 μF, I routinely hear the AMRAD beacon on 136.75 kHz with about an 18dB Signal-to-Noise level. An abundance of NDB signals, some as far away as Puerto Rico, Texas, Kansas, and Canada, are routinely heard during the evening and early morning hours. Likewise, the USN MSK submarine broadcasts from Lueluelai, Hawaii operating on 21.4 kHz can be heard using about .7 μF.