A60-2-1

[redacted]

the irca technical column

Editor: Nick Hall-Patch
1538 Amphion St.
Victoria, B.C. V8R 4Z6
Canada

The following article by W.R. McIntosh first appeared in the April 1984 Lowdown, and is used with the author's permission. The Lowdown is the bulletin of the Longwave Club of America, 45 Wildflower Rd., Levittown, PA 19057; this club has quite a strong emphasis on technical matters, much of it of use to the medium wave experimenter.

SOME ANTENNA EXPERIMENTS — Part 1

If you think the title above sounds as if I'm settling down to a long siege of work, you are correct. Let me explain. Several months ago I had a peculiar idea; what would happen if I took a Longwave loop that contained a lot of wire and used it as a wound-up longwire? For lack of a better name I am referring to the antenna that has resulted as a "helical longwire". If anyone has a better name let's hear it. I'm not that proud of the nomenclature.

DXers have used metal "Slinky" toys (stretched and supported) as antennas with good results. It has been proved that longwire antennas do not have to be strung in a straight line; they may be bent to fit in a given space. My own 120' inverted L antenna is bent in a broad hairpin shape in the attic; it works fine. The important factor seems to be getting as much wire as possible up in the air and not worrying too much about the exact shape as long as it does not double back on itself sharply. What got me going were all of the letters from folks who live in apartments, condos, or restricted housing and who are not allowed to erect an "unsightly" outdoor antenna. Some of them install a short preamplified-whip such as the McKay Dymek DA100, the Radio West KRS, or one of Ralph Burhans' designs and get away with it, possibly by installing them out of sight or in an attic. Running a clip lead to a rain gutter, downspout, window frame, or other metallic part of their home may take advantage of the fact that any large metallic object can become a useful antenna if it is not grounded. A little experimenting with coupling/tuning devices may produce useful signals. Many of us started by using our bed springs or a window screen.

Some years back I heard a few DXers at a SCADS meeting discussing the use of vertical antennas that consisted of wire wound on a long weatherproofed 2 by 4. They seemed to use about 100 to 200 feet of wire, and they reported good results in the BCB and the Shortwave. Such an antenna should be useful in a horizontal position also.

Of the folks using these experimental antennas (and that certainly includes my odd-shaped inverted L) some are using preamplifiers to raise signal levels and some are not. Some use antenna tuners and/or preselectors and some don't. The important points causing such decisions often are the characteristics of the receivers in use. Do the receivers have good sensitivity; do they have bad front-end overload characteristics; and do they need all the help they can get?

The first step after getting the idea of the "helical longwire" was to hit the books and see who had already tried it. I don't claim to be original, but I couldn't find any reference to such an antenna. Only one thing left -- try it!

On hand in the Mc Shack is a tunable loop (Figure 4 page 8 September '83 LOWDOWN) that is 40" by 40", has 22 turns of wire in the tuned loop, contains 293 feet of #26 solid copper wire, and is tuned with a two section variable capacitor of 365 + 140 pf. It covers a frequency range of 150 to 600 KHz and has been extended below 150 KHz by using clip-on fixed padding capacitors in parallel across the variable tuning capacitor. If frequencies above 600 KHz were needed then a switch was made to some other antenna. I don't use tapped windings on loop antennas. A single link turn over the center of the loop winding feeds a length of RG58 coax cable which goes to the receiver.

To try this Longwave loop as a helical longwire I removed the link turn and the tuning capacitor, and used only the loop winding. One end of the loop winding was left floating -- not connected to anything. The other end of the loop was connected via the center conductor of the coax cable to the receiver.

The results with this simple setup were disappointing. The signal strengths were about 20 to 40 db less than those delivered by my DA100 and my inverted L antennas in the Longwave and the BCB. The use of a preamplifier was not tried because the signal-to-noise ratios were bad. Instead I added various antenna tuners and preselectors between the antenna and the receiver. Mixed results were obtained. Things got complicated fast. The antenna tuners on hand are a Grove TUN2, a Grove TUN3, a McKay Dymek DP40, and a homemade pi-section tuner that uses the plug-in coils from a grid dip meter to cover the range from 10 KHz to well over 50 MHz. To summarize quickly my results were as follows:

1. The Grove TUN2 was far more successful than the Grove TUN3. The more versatile and flexible TUN2 allowed me to select antenna tuning and matching combinations that were not available on the TUN3. [Unfortunately, the Grove TUN2 is no longer manufactured and sold by Grove.] Signal strengths and signal-to-noise ratios were delivered to the receiver by the Grove TUN2 which were about the same as those obtained with the DA100 and the 120' inverted L in the frequency range from 10 KHz to 20 MHz. That's right — all the way from the low end of the Longwave up through the Shortwave to about 20 MHz. Above 20 MHz trouble was encountered with the TUN2 which I have not solved yet.

2. The McKay Dymek DP40 did not produce useful signals or signal-to-noise ratios on my receiver in the Longwave, but worked well in the BCB and Shortwave ranges all the way up to 30 MHz.

3. The best results were obtained using the homemade pi-section antenna tuner which produced very good signal strengths and signal-to-noise ratios all the way from 10 KHz through 30 MHz. In fact on many stations tuned the helical longwire and the pi-section tuner produced better results than either the DA100 or the 120' inverted L.

Obviously these are preliminary results and much more work remains to be done. The length of wire in the helical longwire is probably important. 293' of wire produced good results when properly tuned. One of my next projects will be to wind a new loop that contains 500' or more of wire to verify my current best predictions. Then I plan to try a long skinny winding of about 300 to 500 feet of wire on a 2 by 4 or a cardboard tube. That may wind up installed in the attic. Maybe the 293' loop would work better up in the attic. For the time being I will keep the loop in the shack so I can check directional effects.

No antenna tuners or preselectors were used on the DA100 or the 120' inverted L antennas so far in this experimentation. These two antennas have been my "reference antennas" for about ten years.

The receiver used was a Drake DSR2 Laboratory Receiver. It has a 1000 ohm input impedance for the range of 10 to 500 KHz and a 50 ohm input impedance for 0.5 to 30 MHz. This receiver has a large, well-damped, signal strength meter calibrated from 0 to 100 db signal levels. Checking with a calibrated signal generator has showed that this signal strength meter is accurate to ±1 db. Anyone interested in experimental antenna work may have problems if their receiver has a small, bouncing, S-meter calibrated in S-Units. Various manufacturers set each S-Unit as equal to anything from 3 db to 6 db. There is a good fix for this which can turn almost any reasonable all-wave receiver into a better laboratory instrument. That is to install a high impedance VTVM or FET meter on the receiver's AGC (AVC) line as an S-meter. This will result in a definite improvement for several reasons. First, the high impedance meter probably has switchable decibel scales which can furnish very fine readings. Second, the VTVM or FET meter probably will have a larger, more stable meter movement. Third, the high impedance meter will be in parallel with the receiver's own internal S-meter and can serve to calibrate it better for future use. I have been known to use a Heathkit VTVM permanently wired into a receiver as an S-meter for careful experimental work. Adding the high impedance meter to the AGC line should not interfere with the receiver's alignment if the leads used are short. Keep the AGC line lead and the ground lead well separated to prevent capacitative loading of the AGC line.

One important thing noticed along the way was that while the 293' loop of wire when used as a tuned Longwave loop was quite directional and produced good nulls, the helical longwire idea destroyed most of the directional properties and only very small nulls were obtained.

A61-2-2

This whole project is not a copyrighted personal trip. Everyone is invited to join in. In fact, to put it bluntly, I would welcome some help. You never know where your next good idea is going to originate. I used #26 solid copper wire merely because I lucked into a quantity of it a few years back. Larger gauge wire, particularly larger gauge Litz wire, might produce even better results. It is suggested that wire as small as #30 is usable, if that is what you have available. The math found in various books has led me to think that the more wire the better. I doubt that a litle BCB loop would contain enough wire to work very well as a helical longwire. Anyone want to prove me wrong?

This whole project started as an attempt to design/develop a low cost indoor antenna that would be useful over a large frequency range (10 KHz to 30 MHz). So far the necessity for a good versatile antenna tuner has increased the cost and complexity considerably. However, the design so far is useful over the required large frequency range and can be operated indoors. There is still a lot of work to be done. It seems that only the surface has been scratched. In particular I would like to hear from anyone who does experimental work of their own, or can find anything in the literature about such an antenna design. I would like to get Xerox copies of any such literature. Keeping the Windom antenna and other off-center fed antennas in mind it might be worth while connecting the feed point for the antenna somewhere besides at one end. It also seems obvious that such an antenna could be used as an auxiliary loading coil for another antenna which could be attached at the free end of the wire coil.

One word of caution -- if your receiver is in a plastic case instead of being <u>totally</u> shielded by a metallic case, be careful about using any antenna too close to the receiver. RF radiation from a receiver oscillator or synthesizer can cause noise problems. Don't get your antenna near an operating computer or hand calculator. Either of these can be worse than an old black and white TV set or as bad as a cheap light dimmer. This microcomputer word processor which I am using gave me quite a bit of trouble on radio and TV reception until I moved the computer to the far end of the house and positioned it to use the large mass of metal around the disc drive as a shield between the rest of the computer and the RF receiving equipment.

One preliminary observation which I cannot explain is that the 293' coil of wire seemed to work very well as an antenna even without any antenna tuner when it was used in the higher frequency bands of the Shortwave. Have I missed something somewhere? Signal levels and signal-to-noise ratios were as good as those with the DA100 and/or the 120' inverted L.

It is planned to continue with these experiments as time allows. I would value hearing from anyone who tries some of these ideas or anything else that may occur to them. I'm certain that there are many possibilities which have not occurred to me.

W. R. McIntosh
PO Box 33188
Granada Hills, CA 91344-0019

* * * * * *