Radio FUNdamentals

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THINGS TO LEARN, PROJECTS TO BUILD, AND GEAR TO USE

A Simple 160 Meter Ferrite Rod Loop For Low Noise Reception

For me 160 meters has always been a problem band. Living in an urban area on a samll lot, surrounded by other homes, the 160 meter QRN level at my QTH is very discouraging. With no effort at all I can hear exotic DX such as light dimmers, TV sweep oscillators, line noise, and other unpleasant sounds. Using my transmitting antenna for reception is a waste of time, as the noise level is many dBs over S9 much of the time.

On the other hand, I am fortunate in that my transceiver has an auxiliary input for a separate receiving antenna. That opens up interesting possibilities as far as using a different antenna for reception than for transmission.

My first experiment was with a loop antenna about 3 feet in diameter, feeding an "Ameco" preamplifier. Signal output of the loop was low, so the amplifier's additional gain was required in order to have readable signals.

This setup worked well. Results were interesting. The loop had a broad figure-8 signal pattern (fig. 1) with deep nulls off the face of the loop. The nulls were quite sharp. In operation I would peak up the noise with the preamplifier and then rotate the loop for minimum noise.

What's Wrong With Bozeman, Montana?

Over a period of time I found that most loud static crashes came from the northeast, almost in a line from San Francisco to Bozeman, Montana. Aiming the loop null at Bozeman dropped the summer static noise up to 20 to 30 dB.

I still had to contend with local noise. Since I was surrounded by noise makers, I had no clue as to where to aim the loop. Experiments showed that I could achieve an impressive noise reduction when the loop was properly oriented. The direction of maximum noise rejection was easy to determine, and it probably had something to do with the electric wiring inside the house.

In any event, during the winter DX months Bozeman didn't cause any problem, static was low, so I could adjust the loop for maximum local noise rejection.

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Finally—Results!

I played SWL for several weeks, listening to the big boys working 160 meter DX around sunrise. With my big antenna I could not hear the juicy stations they were working. Nulling out the QRN and other racket with the receiving loop, I could hear down to a basic noise level, which was about S3 on the meter. Switching back and forth between the loop and the big antenna made a believer out of me! I could clearly hear SSB signals in a roundtable in Australia, many JA signals on CW, plus an occasional UAØ in Siberia. In most cases, when a DXer worked an exotic station I could hear it. (Working it was another matter!)

How About A Ferrite Rod Loop?

Yes, how about it? The conventional loop I was using was too big. It sat on a little platform beside my operating desk, and I could rotate it by hand. But it was a nuisance, and top-heavy to boot. Many times it fell over when I was fiddling with it.

I've read descriptions of ferrite rod loops in various publications, but never had the urge to try one until I had to face the decision: If I wanted a noise-rejecting antenna, it had to be a loop, and that loop had to be small enough to go on the operating table.

I was moved off dead-center by a simplified ferrite-rod loop design described in the November 1994 issue of *Radio Communication* (a monthly publication of the RSGB). This is a construction article by Richard Marris, G2BZQ, covering the assembly of a small ferrite-rod loop antenna for the top band.

This simple gadget consists of a tuned circuit and coupling link on a ferrite rod. It covers the 160 meter band. The tuned circuit is balanced to ground and resonated by a two-gang variable capacitor. What could be simpler (fig. 2)?

G2BZQ reports that a long, thin ferrite rod with a center winding produces sharp, deep nulls required for noise reduction. His rod consists of two short nickel-zinc ferrites, epoxied end to end to form an 8 inch rod. The rod is Q2 material, having a permeability of 125. The rods are 0.25 inch diameter.

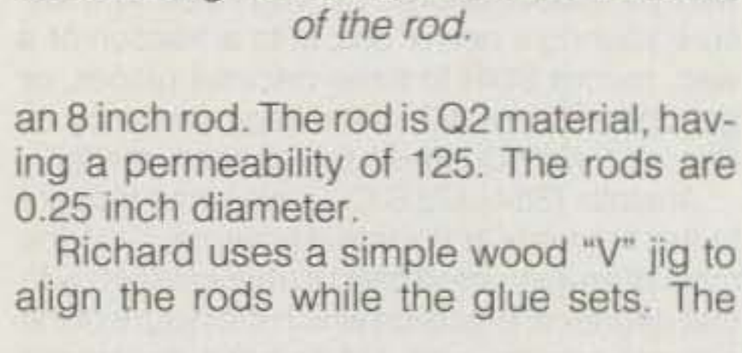

Fig. 1– Pattern of small loop antenna showing sharp nulls off face of loop. Large loop (quad) has nulls off ends. When using ferrite rod, nulls are off ends of the rod.

Richard uses a simple wood "V" jig to align the rods while the glue sets. The

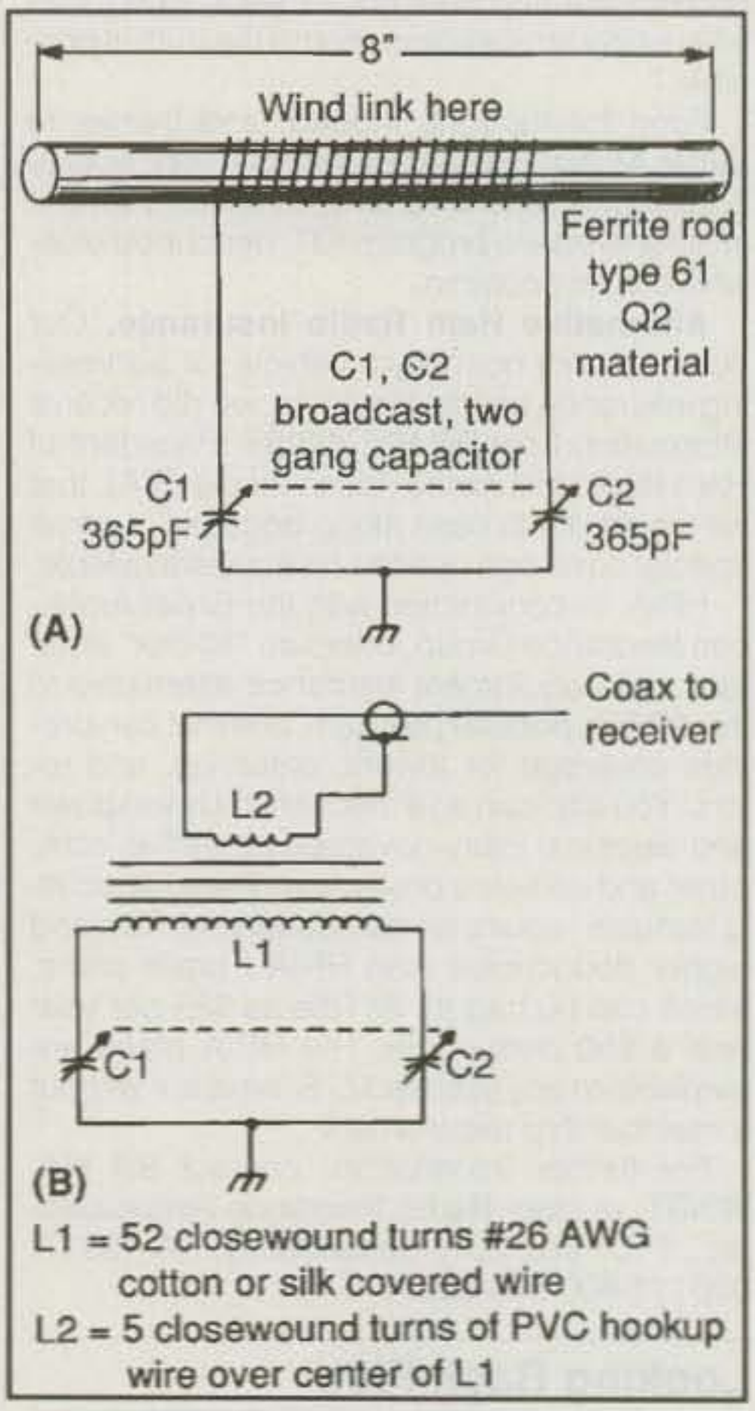

Fig. 2– The layout and schematic of the ferrite rod loop.

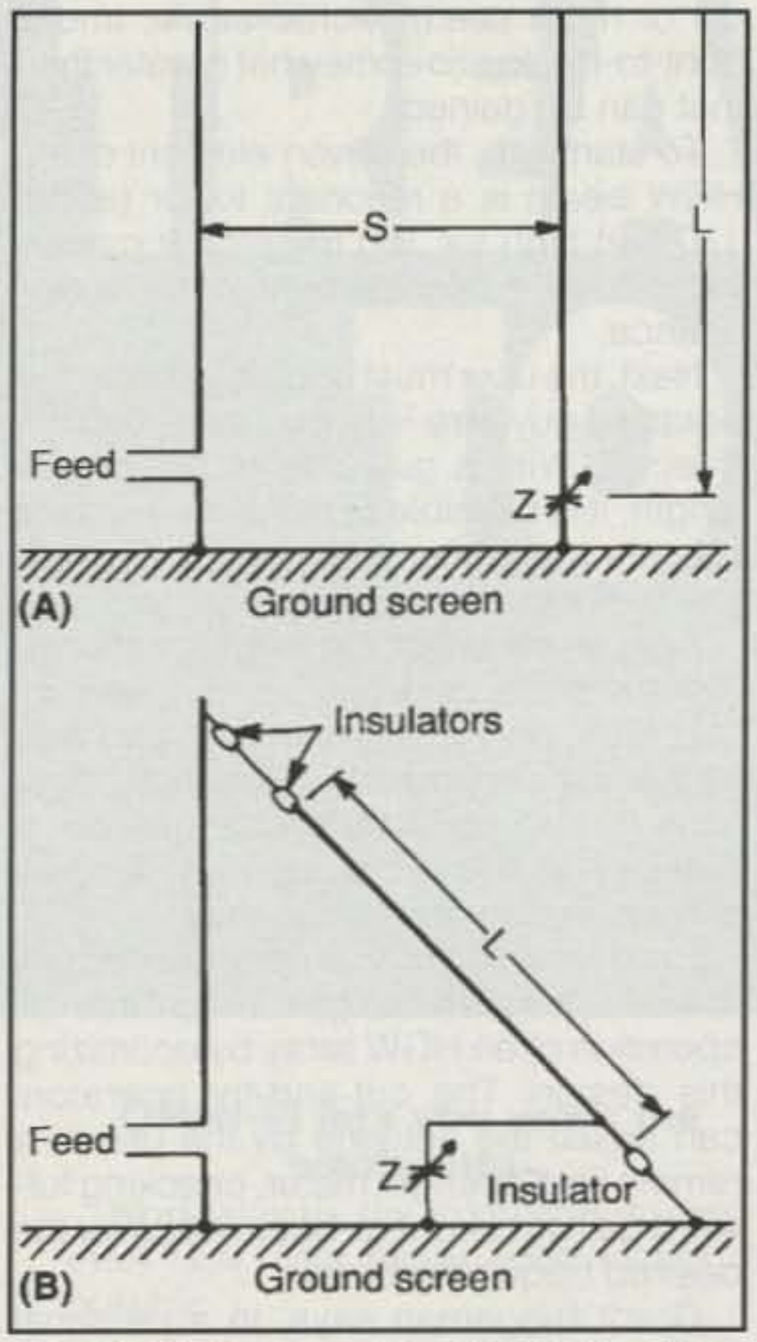

Fig. 3– Derivation of the HGW directional antenna.

rods are then pushed inside a length of 5/16 inch outside diameter polycarbonate plastic tubing, available from Aquarist shops. Aquarist shops? An English-American dictionary told me this is equivalent to a pet store, or an aquarium shop for exotic fish, fish tanks, heaters, etc.

G2BSQ then places a short layer of masking tape over the tubing and winds the coil over the center of the tube-covered rod. Double cotton-covered or plastic-covered wire is used to slightly space the coil turns. Total coil length is about 1.5 inches. The pickup coil is 5 turns of hookup wire, with the ends twisted together for connection to the feedline.

Loop Assembly and Testing

A copper-clad circuit board is used for assembly. The two-gang broadcast-type tuning capacitor is mounted to the board, with a short extension shaft for the dial to reduce hand capacity. The rod is mounted above the capacitor.

Two surplus ceramic insulators plus nylon cable clamps hold the ferrite rod firmly in position, and an extra cable clamp affixes the end of the RG-58 coupling cable to the baseboard.

You can test the antenna on local noise, or use a nearby signal generator with a short antenna on it as a signal source. When you hit resonance, you'll observe a sharp increase in signal level.

Loop directivity is very broad, but the signal nulls are deep and sharp. Swinging the loop about will locate a position where the signal is at a maximum and the noise a minimum. I placed the little antennna on a "lazy susan" from the kitchen.

You'll notice that signal output from the loop is very low. Many transceivers don't have enough RF gain to provide a comfortable signal level. Then a preamplifier (sometimes called a preselector) between the loop and the transceiver is necessary. There are several units on the market which will do the job.

A final note: A preselector should be protected during transmission periods. You may need a relay that will break the coax between loop and preselector to prevent overload damage to the input circuitry of the preselector.

A More Exotic Ferrite Loop Antenna

My good friend Doug DeMaw, W1FB, has spent plenty of time and effort designing and working with 160 meter loop antennas. The performance of the basic G2BZQ loop design can be enhanced by following some of the pointers outlined by Doug in the *ARRL Antenna Book* and in his article "Beat the Noise With A Scoop Loop" (*QST*, July 1977, pages 30–34).

mis-tune the wire half way between director and reflector operation, you will get a peanut-shaped pattern with high current and voltage stresses, poor bandwidth, poor stability, etc. So you might find your antenna beams East at one frequency, West at another frequency, and both directions at some middle frequency. . . . "

Explicit construction and tuning information is not available, as it depends upon the characteristics of the particular tower in question, length of the parasite guy, and the ground screen. This is not a how-to-do-it article, but it is supposed to start you thinking about how to use this scheme in your own installation.

It would seem logical that two guys could be used as director and reflector, giving additional gain, but this has not been tried. And as I said before, installations of this type have been done by commercial engineers on specific antennas, so little amateur-type data is at hand.

Spooky Signals Galore

Now that wide-range receivers (200 kHz to 29.7 MHz) are a part of many new transceivers, more and more amateurs are finding exciting listening outside the amateur bands.

In the "good old days" that traditional approach to amateur radio was via short-wave listening. SWL to amateur was the road to a ticket. Not so today. Amateurs seem to be created with little knowledge of the world outside the amateurs bands—that is, until they start tuning around with their spiffy new transceiver.

The fun of listening to the BBC, VOA, Radio Moscow, and HCJB often gives way to close attention to other mysterious signals on the air, a mess of illegal and covert radio transmissions coming from where?

You'll hear the mysterious "numbers stations," a male or female voice that continually broadcasts a string of numbers: 04107, 08076, 56745, 35988, and so on. What do they mean? Who listens to these goofy signals? The number strings may be broadcast in Russian, Bulgarian, German, English, or Spanish, and sometimes a mixture of languages.

Some listeners have attempted to locate these stations by direction-finding. Some broadcasts originate in the United States, some in Cuba, Honduras, and points in the Pacific. The mystery remains.

"Charlie-India-Oscar" stations abound on HF; the "KKN" group of signals, marker signals, "beeps," "rasps," "foghorns," and other unusual sounds appear and vanish.

All manner of strange signals have frustrated listeners for years. None of the stations are listed in frequency directories or callbooks. However, the *Underground Frequency Guide*, written by Donald Schimmel, is an in-depth analysis of the unusual signals you can hear and the meaning and reason for many of these specialized transmissions.

There's thorough coverage of specialized transmission methods, such as packet and piccolo used by underground stations, as well as a discussion of single-letter HF beacons and dope smuggler communications. You would be amazed at what is going on every day in the HF region!

This book is good stuff. It is the third edition and really covers the field of specialized transmissions. The *Underground Frequency Guide* contains 224 pages in a 6 by 9 inch softcover format (ISBN 1-878707-17-5) and is avaliable at your radio distributor or on order from HighText Publications, Suite 110, Solano Beach, CA 92075. Price is $14.95 plus $3 shipping. Check it out!

And Many Thanks!

My thanks and 73 to the following who have commented on my column. I really appreciate hearing from you! W6PUO, WB2YVY, GØIXC, N1QVQ, OZ7SM, W6AD, N2ZOA, KI1JX, K1JZZ, PY2SFI, NV7K, G4ZU, and WB4HFL.

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