ham radio TECHNIQUES

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first, the bad news

"How long will we have to wait until the sunspot cycle improves?" More and more Amateurs are migrating to the low frequency bands as the popular, higher-frequency DX bands are becoming more spotty. Ten meters is nearly deserted, except for an occasional north-south opening and some wandering ignition noise. And 15 meters isn't much better! Even 20 meters is a pale imitation of its former robust self.

Predicting when the sunspot minimum arrives and when the new sunspot cycle begins is a chancy business best left to the experts. A good guess indicates that sometime between winter, 1986, and spring, 1987, may be the turning point at which we move on to the next new cycle.

But several months of the new cycle must elapse before the high-frequency bands will come alive. Fall 1987 may be a good time to take the 10-meter beam out of mothballs and get it up in the air. That's two years away!

Meanwhile, there's a migration to the lower frequency bands and hams are turning to dipoles, inverted-Vs, delta loops and slopers. Certainly, some big DX "guns" have full-size 40 and 80 meter beams, but such monster antennas are out of the question for most operators.

now, the good news

Although we can't fool Mother Nature, there's still a lot of DX and good operating pleasure left on the "DC bands." As far as DX goes, many operators have made DXCC and won other juicy awards on both 40 and 80 meters. And I understand that Wal, W8LRL, has over 200 countries to his credit on 160 meters!

One of the better newsletters about 160-meter DX is published by Ivan Payne (VE3INQ). Send two IRCs and a business-sized envelope to Box 276, Station A, Weston, Ontario, Canada M9N 3M7 for this 22-page bulletin that will prove to you that DX is alive and well on 160 meters.

Along this line, Ivan's newsletter describes a simple 160-meter DX antenna, sketched in **fig. 1**, used at VS5RP by Bob Parkes (P29BR). Basically, it's a short, vertical antenna top-loaded by a single wire and inductively coupled by a toroid transformer to a coax line.

Bob recommends using from 25 to 40 radials. In his particular location, taking ground resistance into effect, he estimates the antenna's efficiency to be about 40 percent.

With regard to the radials few Amateurs can lay out 135-foot (40.7-meter) quarter-wavelength, 160-meter radials. The solution is to simply do the best you can. Several ground rods at the antenna feedpoint are useful, as well as a square of 1-inch (2.54 cm) mesh chicken wire laid on the ground. Dennis Peterson, N7CKD, uses a 30-foot square of chicken wire for a 160-meter ground screen plus other random ground connections to a metal fence.

The Canadian Top Band News also points out that long-path openings occur on the 160-meter band, citing the contact between AA1K (Delaware) and YB5AES (Indonesia) at 2205Z in October, 1984, as well as the contact between VE1ZZ (Nova Scotia) and 9M2AX (Malaysia) at 2323Z in January, 1985.

Finally, it should be pointed out that there's a 160-meter net active on Saturdays at 1600Z on 14.260 MHz and also on Tuesdays and Thursdays on 1840 kHz at 0400Z. DX and antennas are the main topics of conversation.

Speaking of antennas. . .

a very compact antenna for 160 meters

You can't get a full-size dipole up on 160 meters? You have a poor ground? You can't make a low resistance ground connection? Join the club! Most Amateurs have one or more of these problems. Unless you live in the middle of a large salt marsh, you're going to have to make compromises in your "top band" antenna system.

Some lucky Amateurs have enough space to squeeze in a large vertical antenna and lay out a number of radials. And others can erect loaded dipoles, or some form of Marconi antenna with a good ground system. But what about the rest of us?

A friend of mine wanted to get on 160 meters. He had about 55 × 25 feet (16.76 × 7.61 meters) in his backyard to work with, and his ground was terrible — rocky, sandy soil.

The only simple solution I saw was to erect a highly-loaded dipole antenna about 50 feet (15.2 meters) long. That would fit in the available space, and the dipole doesn't rely upon a ground connection to function properly. Such an antenna is shown in **fig. 2**.

The design is based upon a readily

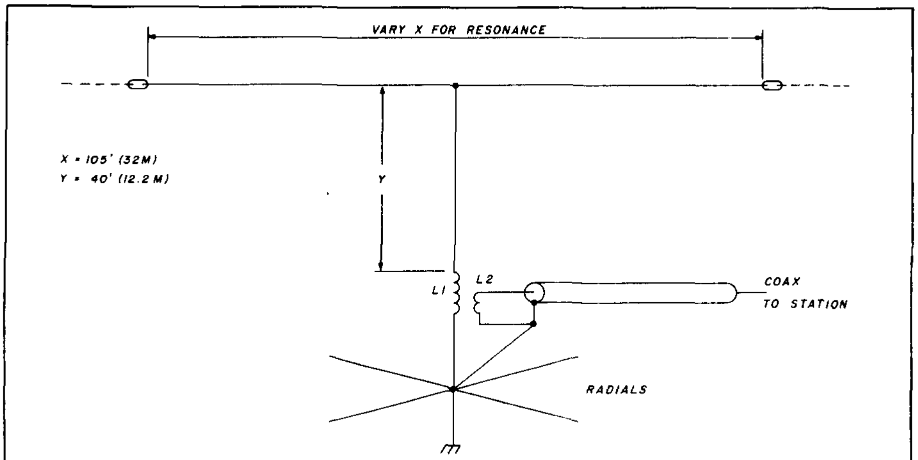

fig. 1. 160-meter antenna at VS5RP. L1, 28 turns No. 14 enamel; L2, 20 turns No. 14 enamel. Both L1 and L2 are wound on a 2-inch (5.08 cm) toroid, μ = 10 (Amidon T-200-2 or equivalent). Vary turns of L2 for best match.

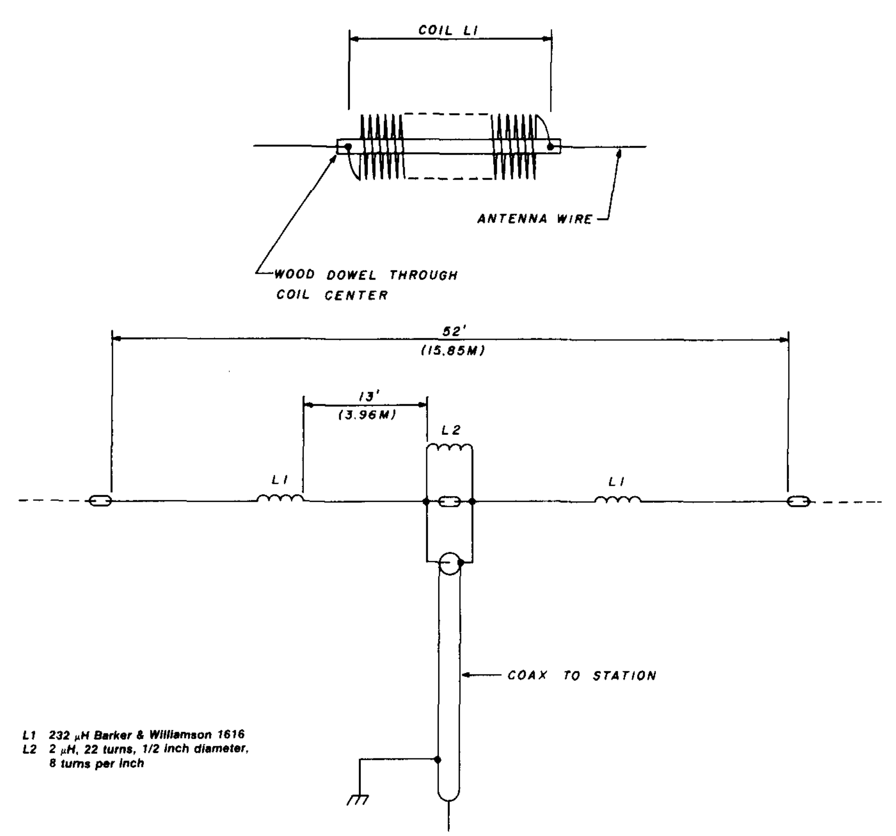

fig. 2. Assembly data for 160-meter "mini-dipole."

available, high efficiency loading coil: the Barker & Williamson* 1616 inductor. This coil is air-wound, 2 inches (5.08 cm) in a diameter and 10 inches (25.4 cm) long. It has 16 turns per inch of tinned copper wire. (It's also available with Formvar® coated wire, which should provide somewhat better efficiency than the tin plating when the coil is used in antenna service.)

Two of these ready-wound coils are used in this antenna, one in the middle of each leg. Since the coils are somewhat fragile, they're supported on an insulator made of a wood dowel rod cut to the same length as the coil. The ends of the antenna wires are passed through small holes drilled in the dowel, removing tension from the concentric coil.

The radiation resistance of the antenna is about 3 ohms, but the feedpoint resistance is close to 20 ohms, due to the loss of the coils. This results in an antenna efficiency of about 13 percent. This may make purists who have experienced little loss in their high-frequency antennas shudder, but the 160-meter band is a different matter and most of the small antennas used by Amateurs on this band exhibit a comparable degree of efficiency. The radiated signal, then, is about 8 dB down from that of a 100 percent efficient antenna (a dipole, for example).

A simple matching coil is placed at the center of the antenna to match it to a 50-ohm coax line. When properly adjusted, the antenna has a bandwidth of about 25 kHz between the 2:1 SWR points on the feedline.

antenna adjustment

The first step after building the antenna is to sling it up between two temporary points, allowing it to sag down until the center feedpoint can be safely reached from the top of a step ladder. The halves of the antenna are shunted with a two or three-turn link coupled to a dip oscillator. The resonant frequency of the antenna is carefully measured (with the aid of a calibrated receiver) and the antenna tip sections trimmed equally, a few inches at a time, until the antenna is resonant at your design frequency. (This one was cut for 1820 kHz.)

The pickup coil is removed and another coil is installed for matching to the coax feedline. The antenna is erected in its final operating position. The number of turns in the matching coil is then adjusted until unity SWR is obtained at some frequency near the design frequency. You'll find that the presence of the coil tends to detune the antenna a bit, and by the time

*Barker & Williamson, 10 Canal Street, Bristol, Pennsylvania 19007.

you've achieved a good match, the resonant frequency of the antenna will have moved.

The final step is to readjust the tip sections equally until the resonant frequency is back where you want it.

The whole process sounds tedious, but it's really not. The experimental antenna was built at an easy pace over one weekend and all adjustments were made during one morning of the following weekend.

And the antenna works fine! Granted, bandwidth of operation is restricted and antenna efficiency is low. However, running 150 watts input, contacts across the continent have been made on the band and, unless attention is drawn to the unusual antenna, most operators "on the other end" will assume you have a full-size dipole, judging from the reports my friend has received with his little antenna.

using an antenna tuner

Smart 160-meter operators know that a narrow-band antenna such as this compact dipole can be "pulled" in frequency by using an antenna tuner at the station end of the coax feedline. The very high off-resonance SWR exhibited by the antenna can be reduced to an acceptable value by the tuner. Experiments have shown that the antenna, with a simple tuner, permits operation over 100 kHz of the 160-meter band., And that's not bad for such a midget!

keep TVI to a minimum!

Two words of caution on this familiar topic: try *not* to run the antenna parallel to the house wiring system. It's easy to couple power from any 160-meter antenna into the house electrical wiring, but doing this can cause TVI, RFI, and other undesired reactions. In addition, since the coil loss of the antenna is high, don't try to run a lot of power into it. A good limiting figure for this antenna is 150 watts, so it will work OK with your exciter, but you'll burn up your antenna coils if you run your linear amplifier into it.

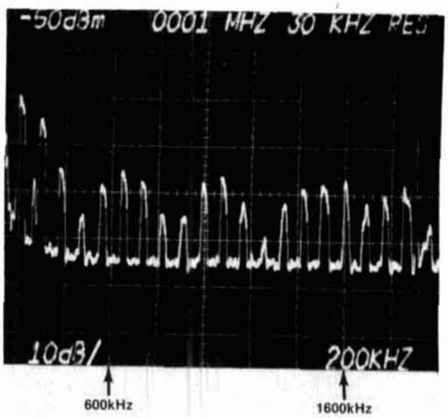

fig. 3. RF lighting device emissions (courtesy *Broadcast Engineering*).

I understand Barker & Williamson can supply coils with LEXAN® insulation instead of cellulose acetate or plexiglass. The extra cost of LEXAN is justified because it's impervious to the ultra-violet radiation from the sun that quickly destroys the plastic supports in the regular coils. A LEXAN-insulated coil wound with Formvar-coated wire sounds like the ideal inductor for any long-life loading coil exposed to the weather.

the RF light bulb

In my June, 1984, column I mentioned the possibility of RFI from the next generation of light bulbs. Although the subject lay dormant for months, the threat is real. In a recent issue of *Broadcast Engineering*, M.C. Rau, of the National Association of Broadcasters, wrote:

The pending introduction of RF lighting technology will significantly cut energy costs, by replacing the ubiquitous incandescent light bulb with RF devices. Unfortunately, many RF lighting devices emit energy at AM broadcast frequencies, both over the air and through the power line [**fig. 3**]. *A current FCC Notice of Inquiry is exploring the issues of lighting, the need for regulation of such equipment, and interference protections to be provided to the AM radio service.*

If RF lighting significantly increases interference over existing devices, NAB should act to ensure that the FCC adopts regulations carefully designed to protect the AM radio service.[1]

Well said! But a glance at the right-hand portion of the plot of **fig. 3** shows that RF emissions continue well above 1600 kHz, into the HF spectrum and probably the 160-meter and 80-meter Amateur bands.

It would be well for some enterprising Radio Amateurs who have appropriate facilities at hand to examine RF light bulbs, to see what problems they produce in the HF spectrum. NAB is doing a good job — as far as they go — but they have little interest above 1600 kHz. A word to the wise. . .

the 2-meter EME directory

I have additional copies of the 16-page 144 MHz EME Directory of active "moonbounce" participants compiled by Lance Collister, WA1JXN. You can obtain a copy by sending four first-class postage stamps (or four IRCs) to me at EIMAC, 301 Industrial Way, San Carlos, California 94070. (Don't send an envelope — we have oversize ones especially for this directory.)

reference

1. Michael A. Rau, "Charting a Course for A.M. Improvement," *Broadcast Engineering*, April, 1985.

ham radio

short circuit

tapered vertical

A misplaced parenthesis in "Calculating the Impedance of a Tapered Vertical" (K3OQF, August 1985, page 25) resulted in an incorrect calculation in **eq. 1**. The corrected equation should read as follows:

$$Z_0 = 60\,\ln\left(\frac{2L}{b}\right) + 60\left(\frac{t}{b-t}\right)\bullet\ln\left(\frac{t}{b}\right)$$

Upon substituting values on page 26, Step 1

$$Z_0 = 60\,\ln\left(\frac{2\bullet 720}{1.5}\right) + 60\left(\frac{0.375}{1.5-0.375}\right)\bullet\ln\left(\frac{0.375}{1.5}\right) = 384.3$$

All the other formulas and evaluations are correct. (TNX N6DH — Ed.)