REVIEW

ISOTRON SOLUTION FOR THE 160-METER BAND

Since the opening of the 160-meter band to amateur use, the 1.8-band-selector position on my FT-102 has been gathering dust. Like a number of hams, I simply do not have space to put up a 252-foot-plus wire antenna for 160 meters. Even if space was available I doubt if I would consider a wire antenna because of the difficulty I had in getting permission to put up my 5-band vertical at my apartment. It would be nice if there was a zero-space antenna for the 160-meter band!

Baltimore, Maryland, is approximately 500 miles from my QTH, and my contact with WB3GBF on 40 meters opened my eyes to the signal power of the Bilal Isotron antenna. My RST using a 5-band vertical was 5–9 while WB3GBF's RST, using an Isotron 40-meter antenna, was 5–20 dB over 9. And to top this, he was using it inside his apartment.

As an ARRL Assistant Technical coordinator for North Carolina, N4BTK asked me to help him with his 20-meter-antenna problems in a local Senior Citizen retirement apartment complex. John lives on the 12th floor and had been using a coil-loaded window antenna but for some reason, 20 meters, even at the altitude of a 12-story building, was very weak. I suggested an Isotron 20-meter antenna as a better solution since the management would not permit a vertical or beam to be mounted on the roof. John's Isotron 40 was mounted 3 feet from the apartment's windowsill on an offset 1″-mast section. By comparison, it out-performs my 5-band vertical on 20 meters.

Impressed with the two-band performance of the Isotron antennas, I contacted Ralph Bilal WD0EJA about his 160-meter antenna and proposed that I work with it to obtain details for an article. My thought was that perhaps only an Isotron could give me 160-meter operation in my apartment complex, and this was an opportunity for me to see what it could do.

The Isotron antennas come in a kit form that can be fully assembled in less than an hour using only a screwdriver and 7/16″ socket wrench (Photo A). They are definitely unique in that no frequency model occupies more than an area of 1.5′ x 2′ x 2.5′, and most frequencies even less. Technically speaking, they defy the accepted antenna theorem of voltage and current distribution on a dipole antenna. One cannot help being impressed when seeing an Isotron in operation.

Assembly begins by attaching a formed aluminum plate to the insulated top support member. In my assembly of the 160-meter antenna, I first installed the mast clamp, U bolts in the end of the insulated bar and attached it to a mast section. This method supports the insulated bar while you attach the formed metal plates.

I followed the same method to mount the square metal lower support section to the mast for attaching the lower formed metal plate. Since the top and bottom plates are aluminum and will quickly oxidize, I spread a thin film of No-Ox over the surfaces that would overlap when bolted to the support bar.

No-Ox is a common non-oxidizing compound used to prevent aluminum oxidization of electrical wiring and is usually available at most electrical supply houses. After attaching the top and bottom formed plates, my antenna looked like bird wings, one above the other (Photo B).

The rather large antenna coil is attached between the top and bottom support bars by adjustable bolts inserted in the top and bottom sections of the coil. I inserted both bolts and loosely positioned their lock nuts so that final centering of the coil could be accomplished with minimum effort. I attached the top of the coil to the top insulated support bar first and ran the coil's bottom bolt through the bottom support without attaching the securing nut. This was to permit attachment of the two plastic side panels without first adjusting the position of the lower support bar attached to the assembly mast.

At this point of the antenna's assembly, only the 1/4–20 bolts holding the formed metal plates to their respective support bars had been tightened securely.

There are two transparent plastic side panels to be attached to the top and bottom formed plates. One plastic plate contains a terminal. After loosely attaching the top ends of the two side plastic plates to the top plates, loosen the bottom support bar mast clamp and gently raise or lower the bar until the side plate holes line up with the bottom plate's holes. Insert the 1/4–20 bolts. At this point, all 1/4–20 bolts joining metal to metal may be tightened securely.

Those 1/4–20 bolts connecting the side plastic plates to the metal of the top and bottom plates should be tightened with less force than the metal-to-metal bolts to prevent shattering of the plastic. These bolts may be finger-tightened if used in connection with locktite or other thread-locking compounds.

Centering the coil between the top and bottom plates is not difficult. Merely measure the distance between the bottom and top ends of the coil to their respective metal plates—not the support bars. There should be some tension put on the top and bottom formed plates by the coil's bolts that will pull the formed plates in slightly. This increases the rigidity of the plates to eliminate wind flutter and subsequent detuning of the antenna. (See Photo C.)

Pre-soldered wires with closed terminal ends connect the PL-259 antenna cable connector to the coil's top-end winding and the top formed plates. A second closed terminal from the PL-259 connector connects to the coil's bottom-end winding and to the bottom formed plates (see Photo D). The resulting electrical circuit is a simple LC series circuit with the top and bottom plates forming the plates of a capacitor connected in series to the coil.

The final assembly consists of two threaded L-shaped rods on which two small rectangular aluminum plates are attached (Photo B). It would be advisable to round all edges of these plates with a file, including each corner, before attaching to the bolt. This will reduce rf-energy discharge into the atmosphere.

The actual antenna assembly is basically an easy push-in-a-bolt-attach-a-nut operation. At worst, it takes no more than an hour. The hard part comes in the final tuning of the antenna. This is done by moving the tuning plates on the L-bolts until the lowest swr ratio has been reached.

This will be a trial-and-error approach where you select your transmit frequency, and, at the transmitters lowest power level, tune the finals to resonance and note the swr indication. Now turn off the transmitter and make a very slight change in the positions of both tuning plates. Turn on the transmitter and recheck your swr. This procedure is repeated until the swr lowers to between 1:1.5 and 1:2.0.

The Isotron 160-meter antenna produces such a strong rf field at 100-Watts input that it is unsafe for indoor use. It is best used outdoors at a height above ground where no one walking by could possibly reach it and suffer rf burns or shock.

The advantages of the Isotron antennas are small physical size, no ground-plane radials required, and minimal parts, for trouble-free operation. Its radiation patterns are typical of ground-mounted vertical antennas when it is connected to ground by an 8-foot-copperclad ground rod. The only disadvantages are tuning it and a somewhat narrow bandwidth.

I believe that a remote tuning system, using plastic components and nylon or monofilament control lines, could be added to the tuning L-bolts that would enable the antenna to be remotely tuned under power to eliminate the present difficulties when frequencies outside of the antenna's bandwidth are wanted.

I visualize connecting the two L-bolts together with a small plastic rod which could be moved forward or backward by the movement of the line in the manner that a pointer on a radio-tuning dial is moved by the dial cord. Another approach would be to use two control lines so that each tuning plate's bolt could be moved independently by a dual-cord system.

I do not know if atmospherics or lack of 1.8 MHz activity in my area was the reason I made no 1.8 MHz contacts in the period I had access to the antenna. I do know that it boosted the background noise level from zilch to S-9 on my FT-102.

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USER'S REPORT

Ralph Bilal gives you a complete set of instructions for tuning his antennas, and the 160-meter version is no exception. I placed the antenna on a seven-foot mast at ground level and began the preliminary tuning procedure using an MFJ antenna-noise bridge and the station receiver. The antenna is designed to be resonant, as received, just above 2.0 MHz, and Ralph recommends that you try it out under low power to check your swr at a frequency just below the top band edge.

The antenna environment at ground level will make a difference in your results because of antenna capacity to ground and to nearby objects. I supported it temporarily with one of those umbrella tables with a hole in the center. This one was aluminum, and I knew that it would affect the antenna resonance point somewhat. Sure enough, it resonated a bit above 2.0 MHz, but I was able to add the small tuning rods provided and achieve resonance at about 1950 kHz.

There are two rods, one mounted on each side of the antenna at the top plate. Bringing them down from the vertical to the horizontal by simply rotating them on their mounting hardware and retightening them, lowered the resonance to below 1900 kHz. I reasoned that this was close enough for now, and that by mounting the antenna on the roof I would be able to lower the resonant frequency still further.

Incidentally, it would be good to point out that *any* antenna which is only a small fraction of a wavelength in size and consists of "lumped" values of inductance and capacitance, will necessarily have a limited-frequency bandwidth, so I did not expect to be able to cover the entire band with one setting. As it turned out, I was able to cover only 25 kHz either side of resonance without retuning the antenna, but that's getting ahead of the story.

So far, things were going according to plan, and the moment of truth had arrived; it was time to install the Isotron 160 on my chimney mount, up in the clear and away from surrounding objects—or at least as far as possible considering that my "antenna farm" is a hole in the midst of trees, with the nearest being about 25 feet away.

Another point: I prefer antennas that are tuned to resonance at the antenna and not in the shack by means of a coupler or antenna tuner. In other words, I like to bring the coax directly to the transceiver and not have to go through any sort of matching device to make it work. This requires that the antenna itself be properly tuned.

It took only a few minutes to mount the antenna to the chimney bracket and secure it for testing. Since I happened to have RG-59/U available (instead of the RG-58/U which I prefer) I used that, and connected it to the chassis-type connector on the antenna. Tuning up the rig was easy, and the antenna accepted power readily at 1900 kHz—but not at 1850 where I wanted to center it. Back up to the roof again to adjust the tuning rods; down the ladder to the check and another tune-up. After about three trips, I got the antenna to resonate at 1860 kHz—close enough for government work, as they say.

And Now, For The Test

It was necessary only to wait until dark now to test the antenna—a time when I knew that there would be stations available for contacts. As it turned out, I could have done my on-the-air tests right away because there was a contest in full swing! Nevertheless, I did wait until about 2130Z, and began to tune the band.

There was plenty of activity. Normally, I prefer CW operation, but in testing this antenna I reasoned that SSB should be a more difficult evaluation mode because the antenna would really have to put out a good signal to compete with the stations using full-size antennas for this top band.

Tuning, tuning. \ .oops, here's one: *"CQ Contest, CQ contest, from VE1ASJ, VE1ASJ, Contest, K."* Frequency 1823 kHz. Quick, now.

"VEQASJ, VE1ASJ from W1XU, W1XU, New Hampshire. Over"

"W1XU from VE1ASJ; five nine of hive, QSL?

"VE1ASJ from W1XU; QSL and thanks, OM. Five nine oh five. Good luck in the contest." Wow, the antenna worked into the Maritimes!

In quick succession, I worked VE3OME (Ontario) and VE2DVI (Quebec) with 5/9 signal reports. Then, I happened upon K2LXN and KA1W; Connie in Parish, New York, and Dave in Bridgeport Connecticut, having a nice QSO Calling KA1W, Dave came back with a *"Five nine plus 10 dB, here in Bridgeport OM. Nice signal; how do you copy W1XU, Connie? K2LXN from KA1W."*

"W1XU, with KA1W, here is K2LXN. Nice signal OM in Parish, New York. Five and nine on a noisy band. How do you read me? Over."

"Thanks lot, gentlemen. This is an experimental antenna, and I really appreciate the reports. You're both doing well here through a lot of QRN, and both well above S9. Good chatting with you, and so long from Peterborough, NH. Name is Jim, and I'll be looking for you on 160 again. Seventy three."

Great stuff, this antenna really seems to get out. Frequency was . . . hmm, let me see . . . 1850 kHz. Not bad at all. A little later I heard W3GFR calling CQ at exactly 1850 kHz. There—he's signing.

"W3GFU, W3GFU, W3GFU, here is W1XU, W1XU, Whiskey One X-Ray Uniform in Peterborough, New Hampshire. Over."

"Roger, Roger. W1XU from W3GFU right back. Thanks for the call. Name here is Jim and the GTH is Churchville, PA near Philadelphia. Your signal is five by nine here, with some QSB. How do you read me? W1XU from W3GFU, over."

W3GFU from W1XU. Hi, Jim, good to hear you. My name is Jim, too, and you're coming through just great; also five by nine here in Peterborough, New Hampshire. I'm running about 100 Watts to an experimental antenna, and would like to see how it goes for a few minutes."

These exchanges lasted for 45 minutes, and during this time I learned that Jim was transmitting on an inverted vee dipole at 40 feet and had a TS-830S (I was using my TS-820S) at about the same power output. His receiving antenna was a coaxial loop, about five feet on a side and rotatable. Although the received signal strength was down a bit on the loop antenna, Jim reported the signal-to-noise *ratio* was better, and he planned to install an amplifier to improve the signal.

When I described my own antenna, Jim was enthusiastic and wanted to know more. He remarked that it ought to be ideal for an apartment dweller, a condo owner, or someone in a travel trailer—virtually anywhere a full-sized antenna couldn't be used. Naturally (with great satisfaction) I agreed.

During the course of the conversation, Jim said: *"100% copy; really amazing! Really hard to believe that it works that well. You're doing a job—and as good as many of the signals I hear from guys running the same or even more power on big, outside antennas. The guy who designed that antenna must be a pretty smart cookie."*

And so it went. Other contacts have been as rewarding, too. On CW and phone, the Bilal Isotron antenna performs very well, indeed—perhaps much better than I had any right to expect. I've had fun with it, but can't claim that under all conditions it will out-perform a big antenna. That would be ridiculous. However, I can recommend it for the ham who needs to operate 160 meters but can't put up a larger one.

Make no mistake, it is a bit fussy to tune, and you're going to have to be patient and take your time with it. The bandwidth in my case is about 50 kHz either side of resonance between the 2:1 VSWR points. Ralph's antenna, which is at 40 feet and tuned to perfection, gives about 100 kHz between the 2:1 vswr points on either side of resonance.

As a last measure, I went up on he roof and painted all of the criti- :al connections with weather- ɔroofing—because I plan to leave t up this winter and enjoy 160!

By the way, I did hear some DX coming through—faintly, but it was there. No hope, of course, to contact it with the Isotron . . . or is there?

Jim Gray
~73 Staff