antennas

BY KENT BRITAIN,* WA5VJB

Small Loop Receive Antennas for the Low Bands

Winter is the time of the year when the low bands propagate best, so I wanted to take a look at some low-band antennas that go beyond the dipole or the vertical (photo A). Many low-band DXers do not use the same antenna for transmit and receive, and the lower you go in frequency, the more likely this is to be true.There are many reasons for wanting to use separate antennas. First, a really long wire can pick up an awful lot of RF energy. This can be good, of course, and it's one reason why many low-band operators with space to spare use long receiving antennas, such as the venerable Beverage. On the other hand, there can be too much of a good thing. In one recent case I measured almost a third of a watt coming back down the feedline from nearby broadcast antennas (they were not transmitting at the time). These high RF levels can overwhelm many receivers and lower the performance of even the better rigs. That *big* antenna is great for getting out, but may not be the best thing to use when you are listening. Again, this is especially true on our 160-meter and 80-meter bands.

Small Loop Antennas

There has been a lot written about the low-noise, or noise-reducing, characteristics of small loop antennas. Loop antennas pick up the magnetic portion of the electromagnetic or radio waves. Thus, loop antennas tend to reject local E-Field (electrical) noise.

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Photo A– Receive loop antenna at the Bletchley Park Cryptography Museum in the UK.

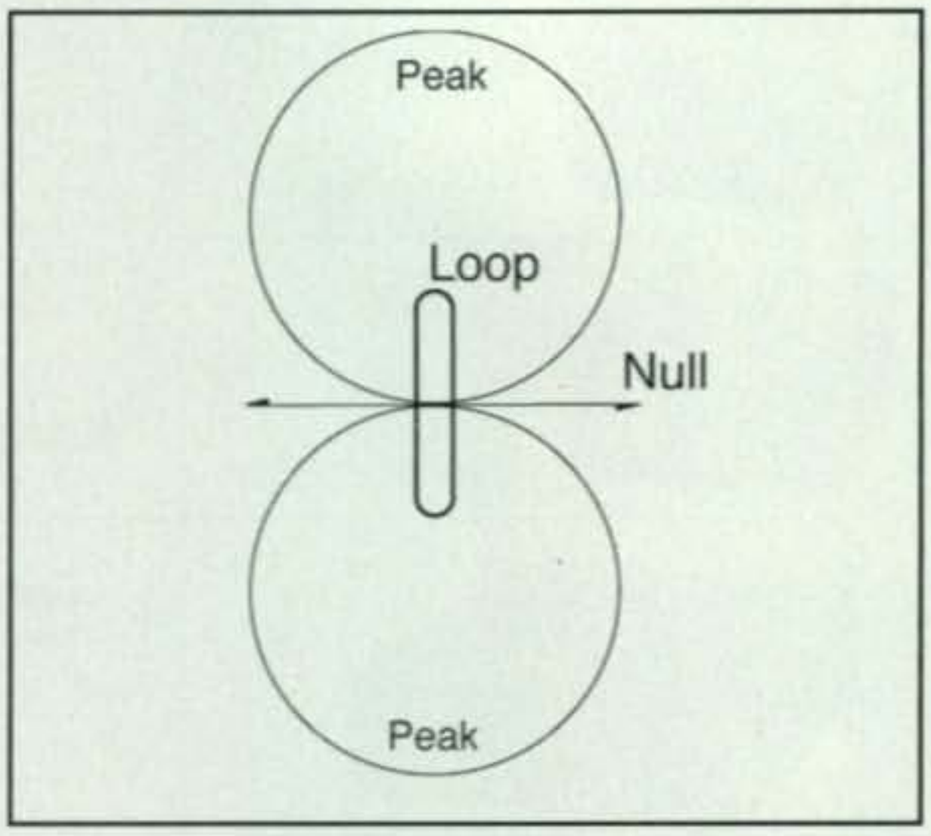

Fig. 1– The loop and its figure-eight pattern.

"But my noise blanker and DSP filters already do that," you may say. Well, yes, but … I can assure you that if you don't pick up a bunch of that noise in the first place, those DSP filters and noise-blanker circuits can do a much better job of cleaning up the leftover noise.

A lot of this E-Field noise is running around on the AC power lines, so it is best to get your loop away from power lines in the house. Sometimes moving a loop just a few feet can really drop the noise floor.

All small loops have a figure-8 pattern with the nulls in the direction of the broad side of the loop, as seen in fig. 1. It is easy enough to test with a small AM radio (photo B). When the ferrite rod is pointed at your local AM station, the loops are broadside to the signal and you get a sharp null or drop in signal strength.

These nulls can be very handy. By turning the loops, you can often put a noise source in the null. Likewise, this can be effective in minimizing QRM from strong stations on adjacent frequencies, or even on your own frequency. Also, if the loop is small enough, you would hardly be the first ham to just set it on top of the rig so you can quickly twist the antenna to a null. I have never tried putting a loop on a small TV rotator, but that is certainly one way to do it. Just twist for best reception.

One subject of endless debate is the best shape for your loop (see fig. 2)—square, diamond, or round? In reality, there is a slight advantage to a round loop, but the differences are microscopic. The important factor is how much area is in the middle of your loop. A big loop catches more signal, but on a noisy band such as VLF or 160 meters,

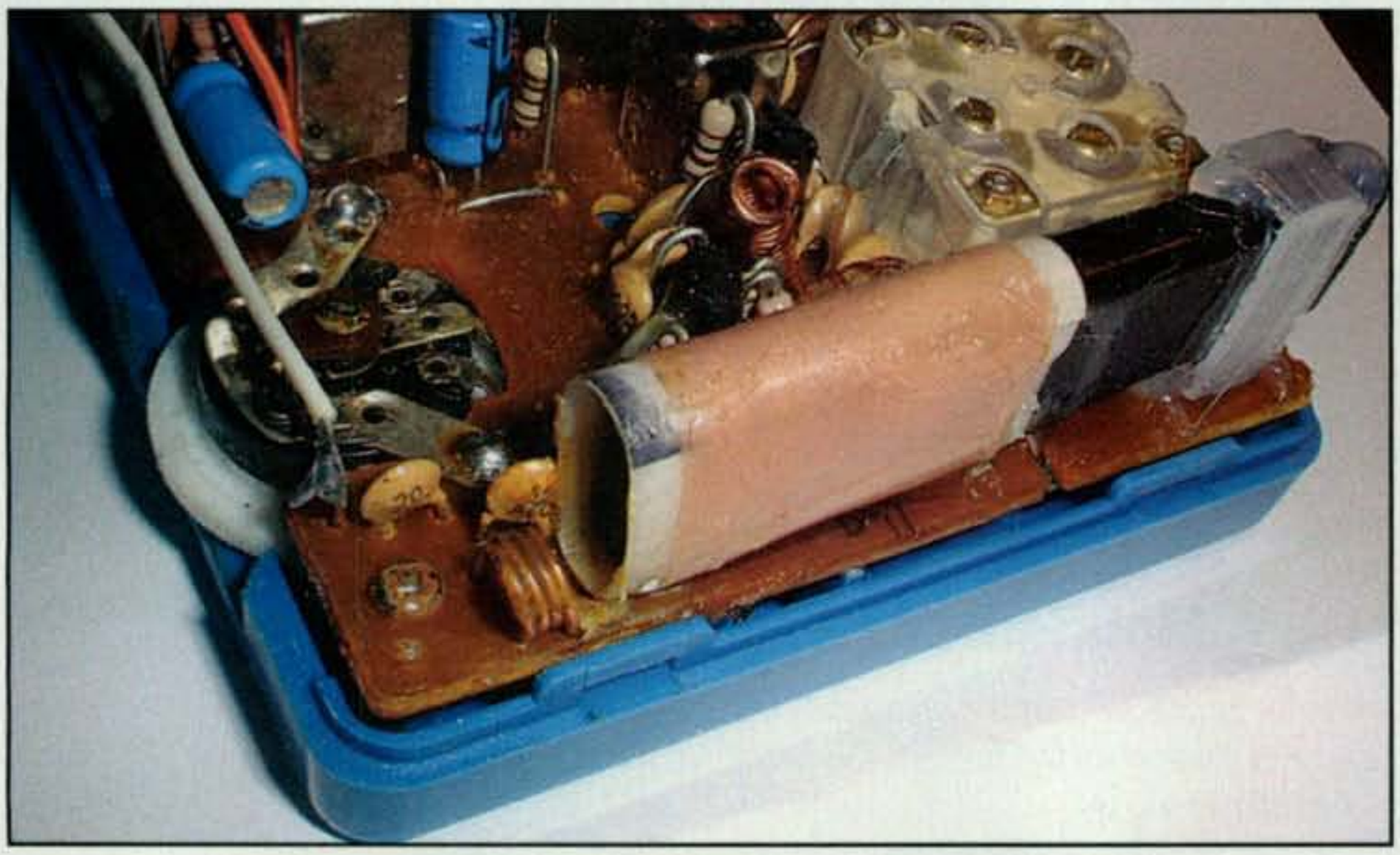

Photo B– The loop antenna in a typical AM broadcast-band radio.

there is no real advantage. It takes a bit more wire, but even a triangle loop would work.

Once your loop is built (I'm still working on the prototypes; watch this space in the May issue), there's nothing complicated about hooking it up and using it. Just connect your receive loop to your HF receiver and start looking for those weak ones. The first thing you're going to notice is that signals are three or four S-units down from what you are used to. This lower signal level is typical, but listen again where there are no signals. Do you notice that the noise floor is down five S-units? Try a few different locations, rotate the loop in a few different directions, and you can probably bring that noise floor down even more. However, more on this after I finish the prototypes.

Station Configurations

There are quite a few ways you can configure your station for separate transmit and receive antennas. First we have the traditional way of doing it, as seen in fig. 3—the Heathkit DX-100 into the transmit antenna, the HQ-180 on the receive antenna. Of course, this can just as easily be an IC-706 on the transmit antenna and an FT-817 on the receive antenna, but you get the idea. This works well, but most operators in the old days rigged up a relay to their speakers or headphones to switch off the speaker when they keyed the transmitter. It saved on the feedback and eardrums.

Fig. 4 shows antenna switching for transceiver use. I kind of cheated and modified my HF rig to have a separate receiver input connector, but on many rigs these days, there is either a jack provided for a receive antenna or there is a software select function. Remember, the goal here is to switch antennas between transmit and receive.

What About Transmitting?

Why can't you use a loop for transmitting? Well, you can, but don't expect to get very far. The high-Q loop will generate

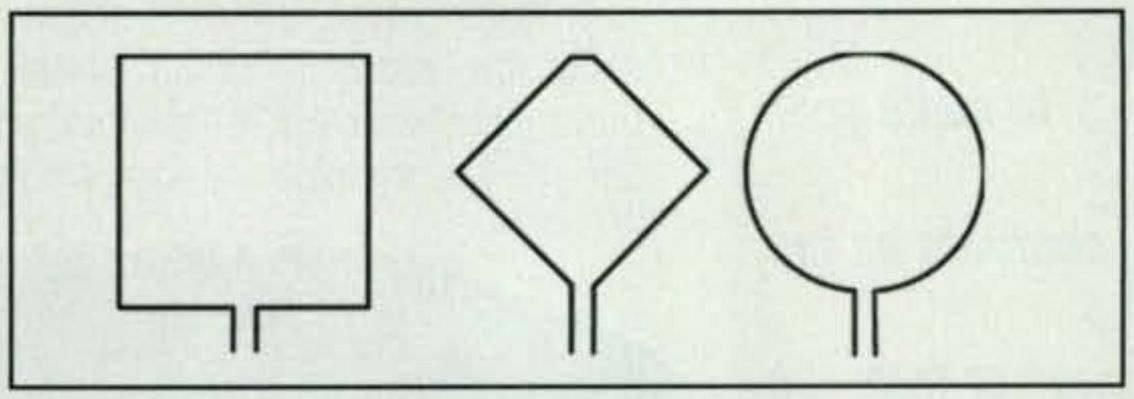

Fig. 2– Which shape is best? Square, diamond, or round? In practice, it doesn't matter.

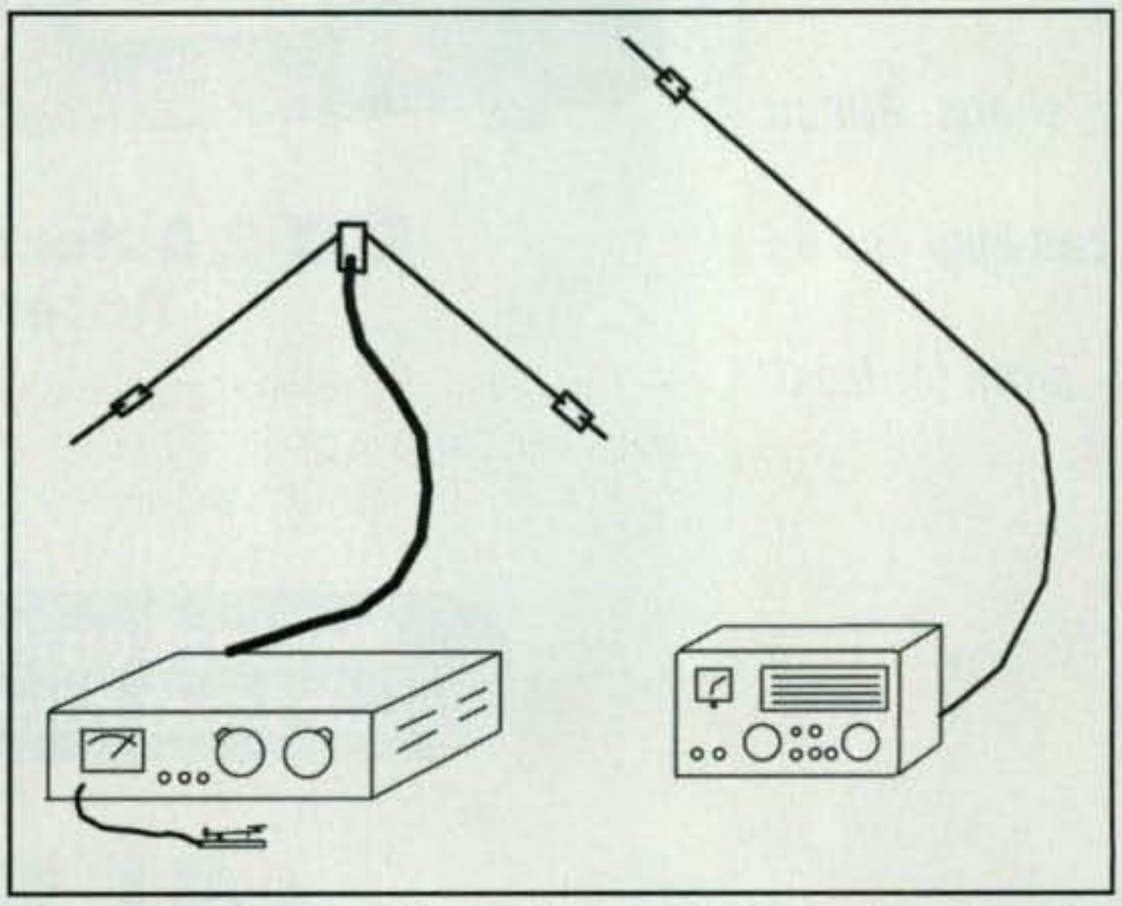

Fig. 3– Traditional station with separate transmit and receive antennas, as well as separate transmitter and receiver.

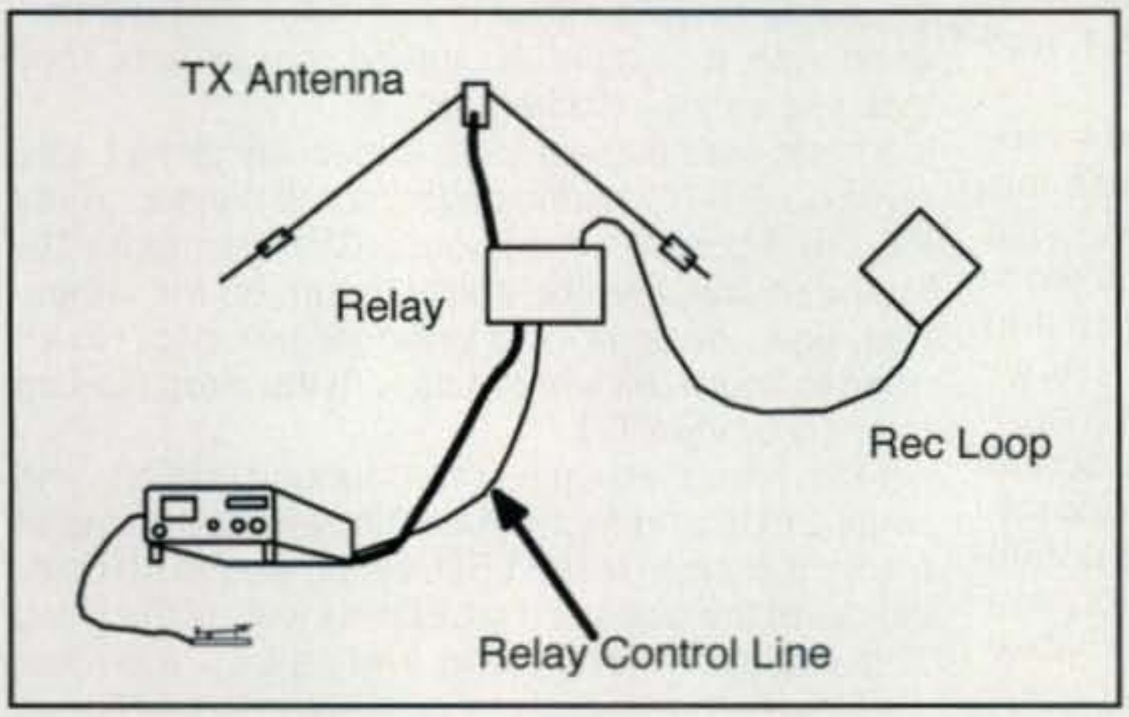

Fig. 4– Switching antennas between transmit and receive

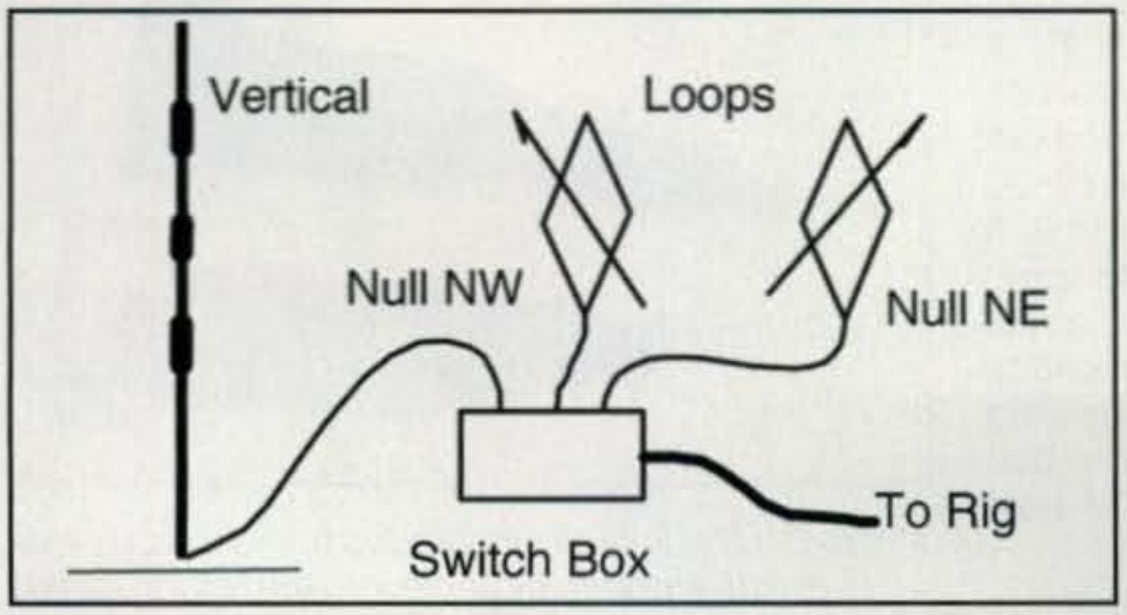

Fig. 5– WA5VJB's 75-meter net-control antenna setup.

some pretty high voltages, and if you run more than a dozen watts or so, the capacitors will usually arc over. Also, if bigger is better, it's going to take a long time to work DXCC with a 2 foot by 2 foot 80-meter antenna!

For a dozen years I was the net control for a 75-meter net. This was a net for VHF and UHF weak-signal operators, so most of them put their efforts into their EME (moonbounce) stations, not their HF stations. In short, there were a lot of puny stations out there trying to check in. My main 75-meter antenna (see fig. 5) is a 35-foot top-loaded vertical with about 400 radials. Four hundred radials? Yep (see my first *CQ* "Antennas" column, back in September 2003), but I also had two loop antennas 90 degrees to each other and a switch. If I was having trouble pulling in a weak one, I would just switch among the three antennas and use the one that was hearing best. Since I was only using the loops on the net frequency, I could just tune them to a single frequency. I didn't have or need the remote tuning back then, but I'm working on that.

Next Time

The plan was for this column to be a construction article. I have a remote tuned loop antenna out on the work bench, but it's not quite ready to become a construction project. Next time, then, look for an electronically tuned low-noise loop antenna that can easily be remote mounted. At a minimum, we'll have a loop antenna for 80 meters, and if Murphy stays away, 160- and 60-meter versions as well.

Just remember, anything in the air works better than that ideal antenna on the drawing board.

73, Kent, WA5VJB