DEMONSTRATION 5

Ted W5QJR

This is the fifth in a series of demonstrations to allow the reader to build a very simple and very inexpensive EH Antenna, and experience the excellent performance parameters of this new concept in antenna theory.

This demonstration will display specific designs any Ham should be able to copy and achieve excellent performance. We have included a couple of photographs to help convey the concept of these antennas.

Each of these antennas is my favorite designs, because they are for specific applications, and because I plan to copy them for my fixed and mobile stations. If your application is different, you may want to alter the design to suit your needs. Use the information we have presented as a guide from which you can begin to experiment.

DEMONSTRATION 5: *STAR* antennas for 20, 40 and 80 meters

20-METER ANTENNA. For frequencies above 7 MHz there is no need for high angle radiation, therefore we can use a small cylinder length to diameter ratio for medium and DX ranges. For 20 meters I choose a ratio of 3. The radiation pattern is about the same as a full ¼ wavelength vertical with 120 radials. More pattern gain is available with a larger ratio, but it is not enough to justify the increased size. We choose a diameter of 1 inch and this results in a very wide band antenna for 20 meters. However, if the antenna is smaller, a much larger tuning coil would be required, so this is a good compromise.

This antenna is built on a piece of plastic pipe 1 inch in diameter. The cylinders are made of copper foil. To have a good high Q coil, plastic adaptors are used to allow the coil to have a diameter of approximately 3 inches.

Phasing coil (below upper cylinder) – 2 turns
Tuning coil – 12 ½ turns, tap 2 turns from bottom
Source coil – 5 turns
Bandwidth – +/- 3 dB bandwidth is 540 KHz centered at 14.2 MHz.

It is necessary to spread the turns to tune the antenna exactly.

40-METER ANTENNA. We wanted an antenna with high angle radiation for 40 meters to allow close communications. When mounted vertical, this antenna will compete with a ½ wavelength horizontal Hertz dipole for close range based on high angle radiation, and it is also an excellent DX antenna and covers all ranges in between. To understand this, think of a dipole several wavelengths long. There will be many lobes and nulls in the antenna pattern, including lobes that are close to being parallel to the axis of the wire. This approach is used in the design of Rhombic and other directional wire antennas.

The EH Antenna has the unique property of being able to adjust the antenna pattern by selecting the length to diameter ratio of the cylinders. A large ratio will produce a lobe in the pattern close to the axis of the antenna. This pattern is similar to a very long wire of several wavelengths mounted vertical as described above, except that there are no nulls in the pattern. Therefore, this EH Antenna can communicate close in, mid range and DX.

For my preferred antenna on 40 meters, I use a length to diameter ratio of 12. If you only want to work DX, use a ratio between 3 and 6. If you want more bandwidth, use a larger diameter than 2 inch plastic pipe (2 3/8 inch OD). The length of each cylinder is 30.5 inches, and as for all EH Antennas the spacing is equal to the diameter. The coils are wound on the same diameter pipe.

Phasing coil – 2 turns
Tuning coil – 14 ½ turns, tap 2 turns from bottom
Source coil – 6 turns
Bandwidth –+/-3 dB bandwidth is about 240 KHz centered at 7.15 MHz.

Spread the turns to tune the antenna exactly.

75-METER ANTENNA. The comments made above for 40 meters also apply for 75 meters. We wanted a small vertical that acted like a horizontal dipole for close communications and also acted as a general purpose medium and DX antenna. In fact, the 80 meter antenna was built first, and then the same physical characteristics were duplicated for 40 meters.

It is interesting to note that these antennas were actually designed and constructed for a specific application – communications antennas for an Emergency Communications Van. The local Ham club obtained an old tool truck and equipped it with radios. That was the easy part. What do you do for antennas that must be used in an emergency? You need local communications out to the state emergency center – about 80 miles from here – which dictates high angle radiation on 75 meters. These antennas are the perfect choice. They are made on plastic pipe and stored in the van. The length of the pipe and antenna is approximately 15 feet in length. When the van goes to the site, the antenna of choice (40 meters daytime – 75 meters at night) is inserted into a holder on the rear of the van. The coax feed attaches to a coax connector on the rear of the van. This allows the van to be internally wired, thus requires a minimum effort for set up. Although we have not yet had an emergency in this area that requires the van, we do take it to the local area towns and set it up when they have a festival, and recently used it for a Boy Scout outing. Each time these antennas have offered excellent communications with a 100-watt radio in the van.

Phasing coil – 4 turns
Tuning coil – 32 turns, tap 2 turns from bottom
Source coil – 7 turns
Bandwidth – +/- 3 dB bandwidth is about 130 KHz centered at 3.9 MHz. Our state emergency frequency is 3.975 MHz, so the final setting was on that frequency.

Spread the turns to tune the antenna exactly.

Figure 1 Pedmont Amateur Radio Emergency Service Van

GENERAL COMMENTS:

*) Each of the above antennas was designed for 100 watts. Therefore we used #14 varnish covered magnet wire.

*) For weather protection the coils on each antenna and electrical connections were covered with 3M company Scotchkote. This is a brown liquid that is put on with a brush. Allow it to partially dry then check the tuning on the antenna and spread turns on the tuning coil to be on the desired frequency before it dries. This material is available at any good electrical supply store.

*) The +/- 3 dB for each antenna is presented. The 2:1 VSWR bandwidth is about ½ that value. If it is necessary to use the antenna over the entire +/- 3 dB bandwidth an antenna tuner will be required to keep the transmitter happy.

George and I spent a lot of time building and testing these antennas. Stefano and Marco of ARNO Elettronica in Italy made significant contributions to the development of the *STAR* version of the EH Antenna. All of us hope you enjoy these designs.