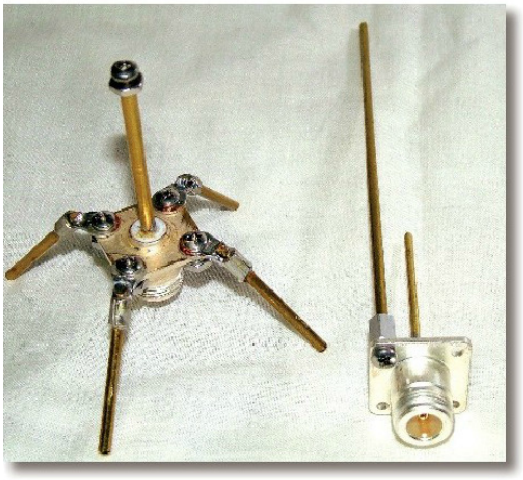

Two Simple Antennas for 1200 MHz

Get started on this interesting band by building these antennas.

Don Dorward, VA3DDN

Not long after getting interested in the 1200 MHz (23 centimeter) amateur band I realized there were not a lot of commercial antennas available for the band and few plans if you wanted to build your own.

In my area just outside of Toronto, Ontario, Canada, there is only one repeater within range (1286 MHz) and it was obvious that using the flexible antenna that came with my 1 W handheld was not good enough, particularly while operating mobile. I also needed some kind of reasonable but simple outside antenna even while using my 10 W transceiver from the home base.

The Designs

So I experimented with several straightforward antenna designs for 1200 MHz, two of which I will describe here. They are shown in the lead photo above, and as may be evident, both are constructed on a chassis mount female Type N connector using brass rod for the elements. Brass rod is a handy material for V/UHF antenna experimenters and it is readily available from most hobby shops and online. One source is K&S Precision Metals (**www.ksmetals.com**).

The one shown on the left is the classic ¼ wave ground plane with drooping radials. The one shown on the right is a mini J pole. Either of these antennas can be easily mounted on top of a length of 1 inch diameter PVC electrical conduit, with a male Type N plug on top and the coax, RG-213, LMR-400 or equivalent running down the center. Figures 1 and 2 show examples of this technique. If used outside, the top of the PVC conduit and the shell of the male Type N plug should be moisture sealed with a silicone sealant. For mobile use, a magnetic mount with a Type N socket and a male-to-male Type N adapter works well.

Construction Details

I made the ¼ wave ground plane antenna first. I used a ⅛ inch outside diameter brass tube, tapped with female #6-32 threads on the top end. This allows some change to the physical length through adjustment of a ½ inch #6-32 screw and a nut to lock it in place. In this case the inside diameter of this tube fits nicely over the center pin of the Type N socket making soldering easy. An alternative is to use 3/32 inch outside diameter solid brass rod, which fits *inside* the center pin of the Type N socket, again making soldering easy. In this case you should make it a bit longer than needed, and then trim for tuning with wire cutters. Shortening the antenna will increase the resonant frequency. Figure 3 shows some of the construction details.

Figure 1 — Close up of the ¼ wave drooping ground plane for the 1200 MHz band.

Some Construction Tips

At 1200 MHz, ¼ wavelength is only about 2.2 inches, or 56 mm long. For improved accuracy in measuring and cutting elements, I prefer to use the metric values. Even so, a change of only 1 mm (0.04 inch) in element length can change the resonant frequency by as much as 20 MHz, so care must be taken in the measuring and trimming steps. At this frequency other factors that may affect resonance come into play, such as type of hardware, proximity to nearby conductors, and the diameter of the radiating elements.

Construction Notes

I recommend using only good quality Type N connectors and low loss coax

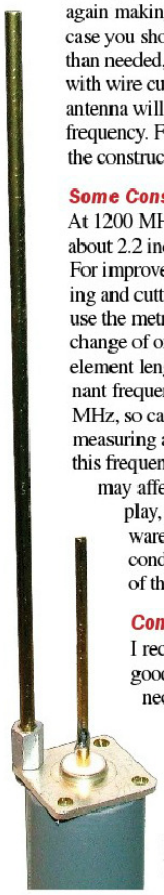

Figure 2 — Close up of the simple J pole for the 1200 MHz band.

Effect of Element Diameter on Resonant Frequency

At lower frequencies, such as at HF, the old standby equation of *L*(feet) = 468/f for a ½ wave or *L* = 234/f for ¼ wave is usually pretty accurate. These formulations include a correction factor for typical wire diameters, a "K" assumed 0.95 — appropriate for HF antennas. For example a ½ wave 40 meter dipole at 65.5 feet is more than 12,281 times as long as #14 AWG wire (0.064 inch diameter).

In these designs, we are using a radiator of either 0.093 or 0.125 inch in diameter. The ratio of the half wave length to conductor diameter in these — and most V/UHF antennas — is considerably smaller. The ratio is about 50 for the 0.093 inch radiator and 36 for the 0.125 inch diameter radiator. This means that the K factor will become smaller too, making the antenna elements shorter as well.

In these designs I have estimated K values from data in ***The ARRL Antenna Book***, as approximately 0.925, for the *L/d* ratio of 50.[1] This section in the *Antenna Book* has a good discussion of the effects of conductor diameter on resonant length.

The equation I used to calculate the ¼ wavelength elements is *L*(mm) = (2952 × 25.4 × 0.925)/f, where f is my repeater input frequency, 1274 MHz. For the ¾ wave section of the J pole, "B" in Figure 3, the equation is *L*(mm) = (8858 × 25.4 × 0.925)/f, with my f again at 1274 MHz.

Using these formulas for 1274 MHz, I have calculated the "A" lengths as 54.4 mm, and the "B" length as 163.3 mm.

[1]*The ARRL Antenna Book*, 22nd Edition, Figure 2-8. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 6948. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.

such as LMR-400 or RG-213. LMR-240 is a good choice for short runs. I suggest cutting the elements 1 or 2 mm longer than calculated and then trim for the lowest SWR. I was able to get a flat match with the ¼ wave antenna and less than 1.8:1 on the J pole.

I used #6-32 stainless-steel hardware, which meant having to drill out the socket mounting holes slightly. One could use #4-40 instead, to avoid drilling, but the #6-32 seems to give either structure somewhat more rigidity.

Note that in the construction of the ¼ wavelength version, the radial length is measured from the center conductor of the Type N connector.

If you choose to use the ⅛ inch brass tube in place of the 0.093 inch brass rod, the effect of the lower *L/d* ratio will be to further shorten the radiator resonant length.

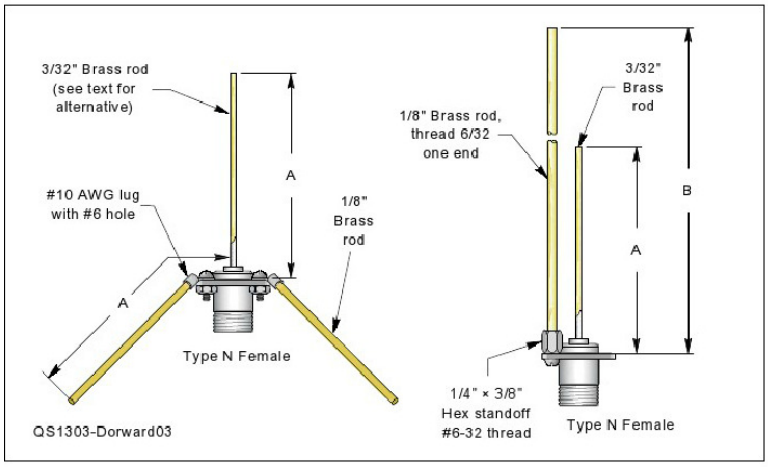

Figure 3 — Dimensioned drawing of the two antennas. For author's 1274 MHz repeater, A is 54.4 mm, B is 163.3 mm. For other frequencies, use formulas as shown in the sidebar.

ARRL International Member Don Dorward, VA3DDN, is an electronics technology graduate licensed since 2002 with basic and advanced certification. He retired in 2006 following a career in engineering management in multiple fields including the development of passive motion machines for orthopedic rehabilitation. He shares in two patent awards, is a Life Member of the IEEE and a member of the Radio Amateurs of Canada as well as the ARRL. You can reach Don at 1363 Brands Ct, Pickering, Ontario, Canada L1V 2T2 or at **ddorward@sympatico.ca**.

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