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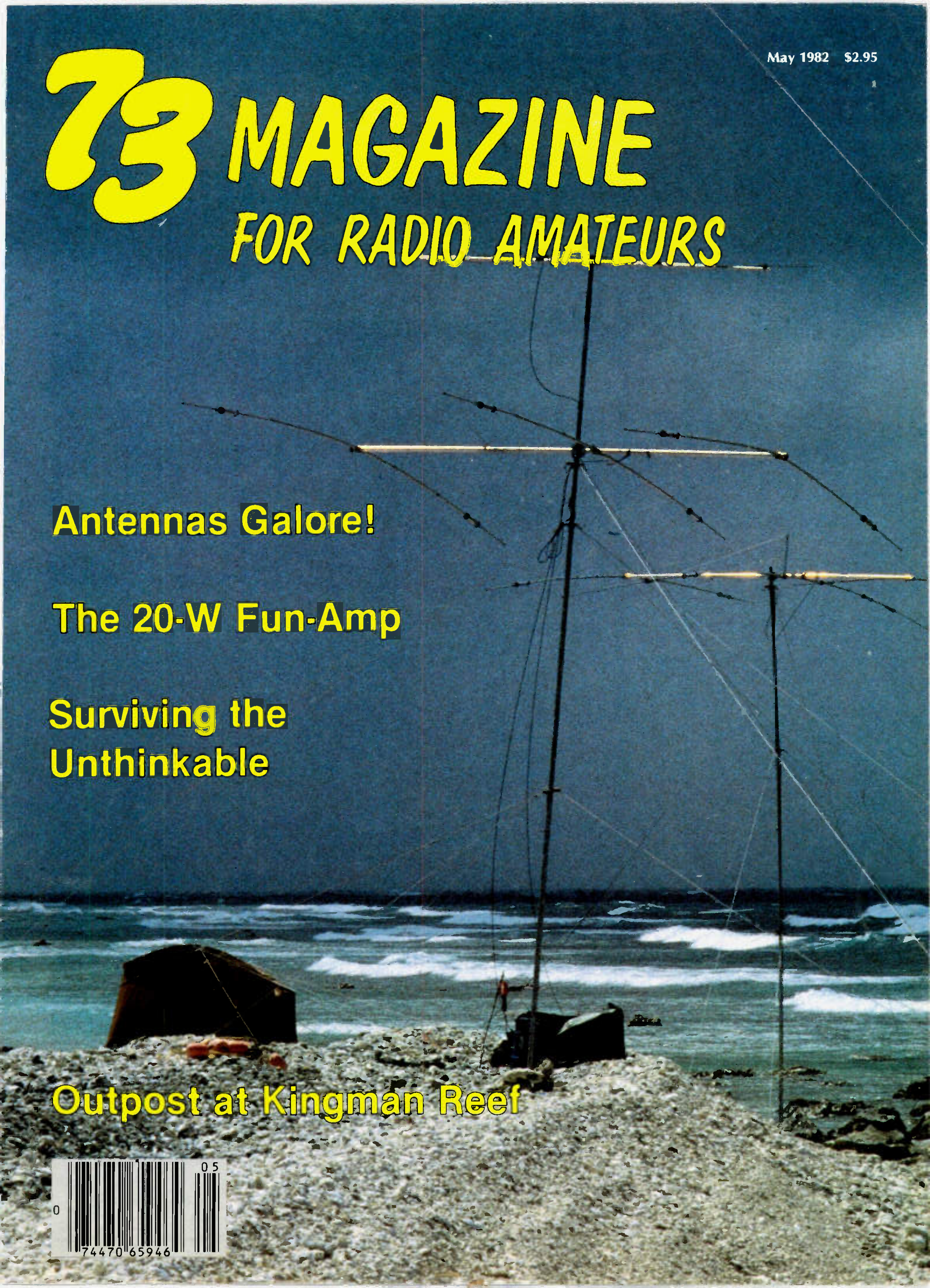
FOR RADIO AMATEURS



Antennas Galore!

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Omni-Gain: A Collinear for 70 and 23 Cm

—coax comes alive

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This antenna is a coaxial collinear with 9 dB gain over a dipole. The pattern is omnidirectional and works well for both ATV and FM service. While building the Mount Wilson ATV repeater, I explored an antenna system that would give omnidirectional coverage and have as much gain as was practicably available. Another consideration was environmental problems such as extremes of temperature and icing.

Commercially-manufactured antennas are available for the 432-MHz band even though their price tags are high. There are no commercially-manufactured gain vertical antennas for the 1241-MHz band. I needed antennas for both the repeater input of 434 MHz and the output of 1241 MHz; since I did not want to spend a bundle on the 432-MHz antenna, I decided to home-brew it.

The antenna is in the collinear family with its elements made of RG-213 coax stacked one on top of the other. The main elements are ½ wavelength and can be calculated from the formula 5904 divided by the frequency in megahertz (equals element length in inches). The next step is to find the velocity factor of the coax that will be used. I chose RG-213 as it has a good tight shield and a constant velocity throughout its length. RG-8A/U can also be used as long as it has a solid dielectric and tight-knit shield.

The last step is to multiply the element length by the velocity factor (.66 for RG-213) to yield the actual length; in this case, 8.9 inches for 434 MHz. This formula can be used for any frequency and coax.

Elements are transpose-connected at the end of the half-wave elements so that the phase of the signal is 180 degrees out of phase from the other end of the element. See Fig. 1. As the signal travels up the elements, less signal reaches the top because of radiation, so more elements are used to get the same gain, as with stacked dipoles but without the complicated phasing harness. A quarter-wave element is used at the top and bottom of the array to match the 52-Ohm feedline at the bottom and the whip at the top of the antenna.

If 6 dB is desired, 8 elements can be used, and 16 are used for 9 dB. A slight downtilt of the pattern can be obtained by cutting the elements three percent shorter. (Downtilt is desirable if the antenna is to be installed on a mountaintop.) Any small amount of vswr can be minimized by the quarter-wave stub and trimmer capacitor in

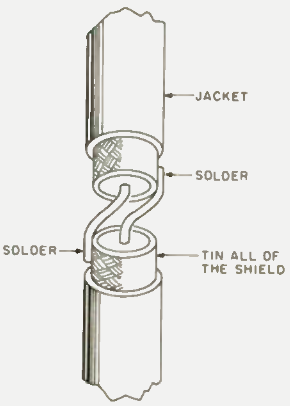
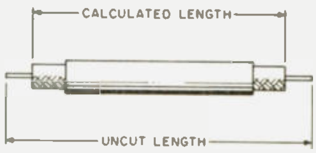


Fig. 1. Coax connection.



Calculated Length

	434 MHz	1250 MHz
¼λ whip	6¾"	2⅓"
¼λ element	4½"	1½
½λ element	8-7/8"	3"

Fig. 2. Coax preparation.

the matching decoupling section.

Construction

Add one half inch to the calculated length to allow for exposing the center conductor so it can be connected to the other element. See Fig. 2. Cut the jacket, shield, and dielectric with one cut. A sharp knife or X-acto® miter saw should be used to make the cut. After all the elements are cut to length, then cut the jacket back three-eighths of an inch and tin both the center conductor and shield using a 25-Watt iron—too much heat will melt the dielectric.

Now that all parts are tinned, solder the parts together with a maximum of one-eighth-inch separation between elements. After completion, check for shorts by visual inspection as the antenna is at dc ground. Excess flux should be scraped off, but do not use any chemical flux remover as it can contaminate the dielectric. The whip on the top is connected to both the center and shield. The matching section is a quarter-wave coax stub shorted at both ends and a piston trimmer capacitor. See Fig. 3.

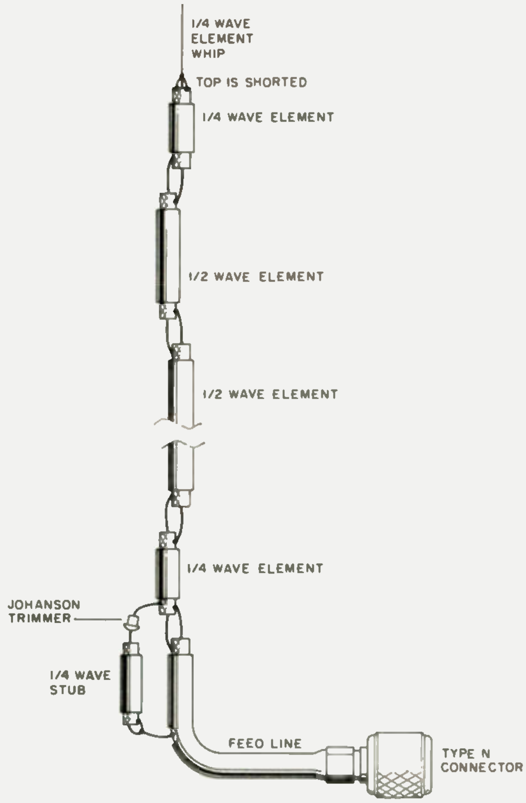


Fig. 3. 8 elements = 6 dB. 16 elements = 9 dB.

Tune-Up

Adjust the trimmer for minimum vswr. If the minimum is at one end of the trimmer, then adjust the spacing of the stub to feedline distance. One-eighth inch is normal for the spacing.

Housing

The antenna is housed in PVC pipe. The heavy wall is the one to use and it is also known as schedule 40 PVC. One-inch diameter can be used for either the 1241-MHz model or the 434 model, but if the antenna is to be mounted as a free-standing antenna, the 434-MHz housing should be tapered. This can be done with ¾-inch, 1-inch, and 1¼-inch pipe. The pipe may need to be heated to make a better fit. Pipe caps are used to keep the rain out of the housing and the bottom should be open so it can breathe. The antenna can be mounted one half wavelength from a mast for a cardioid pattern and the gain will increase 2 dB over that of an omnidirectional pattern. See Fig. 4 for the patterns.

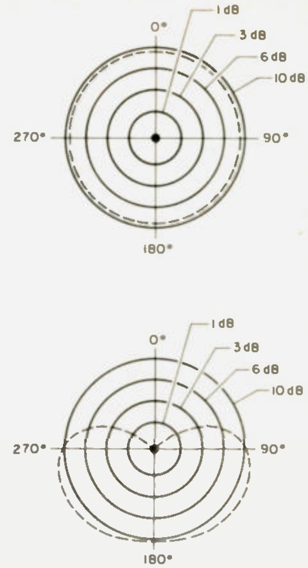


Fig. 4. (a) Omnidirectional pattern. (b) Cardioid pattern.

Conclusions

Construction time is one to two evenings. Take your time and you will have a better working antenna. The 434-MHz version has been in use for one year now on Mount Wilson and has survived all four seasons from 100 degrees heat to snow and ice. Many of these particular antennas in Los Angeles and San Diego have been built and used with the same results as I have obtained. Recently, a second 1241-MHz version was installed on Mount Wilson for the aural transmitter on the ATV repeater. It is identical to the one used for the visual transmitter and the results have been good.

Acknowledgements

I would like to thank Jay N6BDT for his help in testing the antenna, and also all others who helped me in this endeavor. ■

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