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Spider HF Mobile Antenna

Product Review

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Spider™ HF Mobile Antenna

Of the several HF mobile antennas on the market, most of them operate on a similar principle. A 4- to 5-foot-long mast attaches to the mounting point, and then some sort of loading coil or resonator goes on top of the mast, with an adjustable-length whip above the loading coil. Different loading coils, or resonators, allow operation on the various bands. Several resonators can be mounted on the mast, eliminating the need to stop the car and jump out to change bands. Many of the commercial mobile antennas come with a multiband adapter.

So what is different about the Spider antenna? This antenna uses a unique type of loading coil, or resonator. Tuning within a band is accomplished by sliding a plastic-coated tuning sleeve along the side of the resonator. There are no electrical connections between the tuning sleeve and the coil. A logging scale is provided on each resonator to index the position of the tuning sleeve. With a simple chart of resonant frequency as a function of logging scale, the antenna can be adjusted to resonance at any frequency within the band. There is no whip above the resonator.

The antenna is supplied with resonators for 40, 20, 15 and 10 meters. The optional 80/75-meter resonator was included with the review antenna. If you already have a ½-inch mobile antenna mast, then you may need only the Spider adapter that permits installation of the Spider resonators at the top of your mast.

Mounting the Antenna

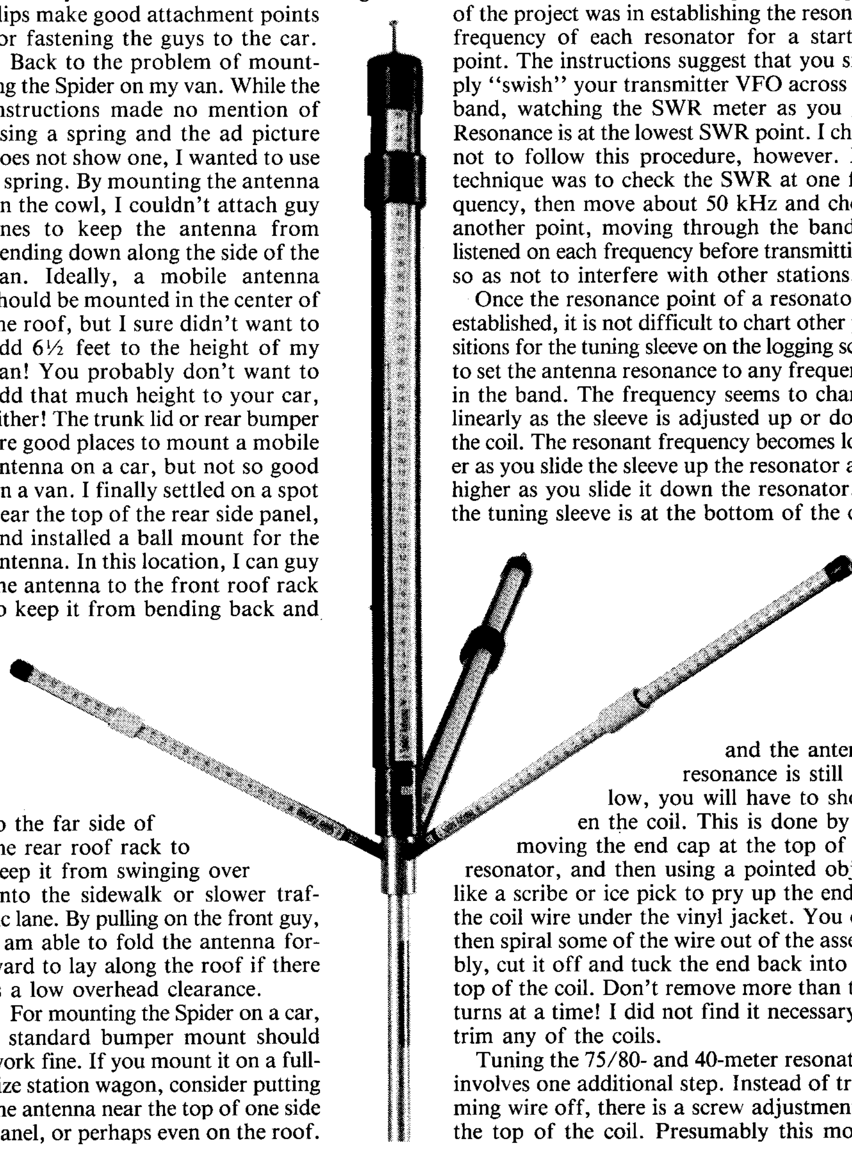
The instructions provide little information about mounting the Spider antenna on a vehicle. I have a van and did not want to use the conventional bumper-mounting method. I was intrigued by the picture in the Spider ads that show it mounted on the front cowl of a van. I have some fairly strong opinions about how a mobile antenna should be mounted. Some of those opinions come from personal experience with mobile antennas, and some come from my knowledge of mechanical construction and antenna principles. Certainly, there are people who do not agree with me or who would not want to follow my suggestions.

A few years ago, I picked up a second-hand mobile antenna for a few dollars at a hamfest. I attached the mast to a bumper mount on my station wagon and soon learned the joys of HF mobile hamming. After about a month, to my dismay, the antenna mast would no longer stay on my car! It seems that the swaying action of the antenna as I drove along had torn the threads out of the bottom of the mast. The antenna was useless. I learned the hard way about using a heavy-duty spring at the base of the mast so as to allow it to sway and not damage the mounting threads.

People have told me that it is not necessary to use a spring at the base of the mast. One person even went so far as to explain how he visited his friendly, local machine shop when the threads tore out of the bottom of his antenna mast. The machinist was able to enlarge the hole, tap new threads and then install an adapter for the standard 3/8-24 mounting stud. Every few months he would go back to the machinist to have a new adapter installed. Like I said, use a heavy-duty spring at the base of the mast! If you don't think having the antenna sway will damage the mast, just wait until you hit a low-hanging tree branch at 30 mi/h or so!

Of course, the spring will bend as you drive down the highway. In fact, the antenna can bend over quite far, and become a rather serious hazard. The simplest solution is to attach one or two nylon or twine guys near the top of the antenna, and then tie the guy lines to some point on the car to prevent the antenna from bending too far backwards or to the sides as you drive. A roof rack or rain-gutter clips make good attachment points for fastening the guys to the car.

Back to the problem of mounting the Spider on my van. While the instructions made no mention of using a spring and the ad picture does not show one, I wanted to use a spring. By mounting the antenna on the cowl, I couldn't attach guy lines to keep the antenna from bending down along the side of the van. Ideally, a mobile antenna should be mounted in the center of the roof, but I sure didn't want to add 6½ feet to the height of my van! You probably don't want to add that much height to your car, either! The trunk lid or rear bumper are good places to mount a mobile antenna on a car, but not so good on a van. I finally settled on a spot near the top of the rear side panel, and installed a ball mount for the antenna. In this location, I can guy the antenna to the front roof rack to keep it from bending back and to the far side of the rear roof rack to keep it from swinging over onto the sidewalk or slower traffic lane. By pulling on the front guy, I am able to fold the antenna forward to lay along the roof if there is a low overhead clearance.



For mounting the Spider on a car, a standard bumper mount should work fine. If you mount it on a full-size station wagon, consider putting the antenna near the top of one side panel, or perhaps even on the roof. In either case, you should have less of a problem determining a suitable mounting location than I did.

If you live in a location where you cannot erect some other type of antenna, the Spider antenna can be used in an apartment or fastened to the metal railing on a patio or porch. With a few radials to form a ground plane, the Spider should serve well as your main station antenna. The instructions that come with the antenna give some details on this type of installation.

Tuning the Antenna

I spent about an hour and a half making up tuning charts for the various bands. The procedure is rather simple, although it is time consuming if you have to get in the car, adjust the transmitter, read the SWR, then get out and move the tuning sleeve on the resonator. Most of the time I spent on this part of the project was in establishing the resonant frequency of each resonator for a starting point. The instructions suggest that you simply "swish" your transmitter VFO across the band, watching the SWR meter as you go. Resonance is at the lowest SWR point. I chose not to follow this procedure, however. My technique was to check the SWR at one frequency, then move about 50 kHz and check another point, moving through the band. I listened on each frequency before transmitting, so as not to interfere with other stations.

Once the resonance point of a resonator is established, it is not difficult to chart other positions for the tuning sleeve on the logging scale to set the antenna resonance to any frequency in the band. The frequency seems to change linearly as the sleeve is adjusted up or down the coil. The resonant frequency becomes lower as you slide the sleeve up the resonator and higher as you slide it down the resonator. If the tuning sleeve is at the bottom of the coil and the antenna resonance is still too low, you will have to shorten the coil. This is done by removing the end cap at the top of the resonator, and then using a pointed object like a scribe or ice pick to pry up the end of the coil wire under the vinyl jacket. You can then spiral some of the wire out of the assembly, cut it off and tuck the end back into the top of the coil. Don't remove more than two turns at a time! I did not find it necessary to trim any of the coils.

Tuning the 75/80- and 40-meter resonators involves one additional step. Instead of trimming wire off, there is a screw adjustment in the top of the coil. Presumably this moves

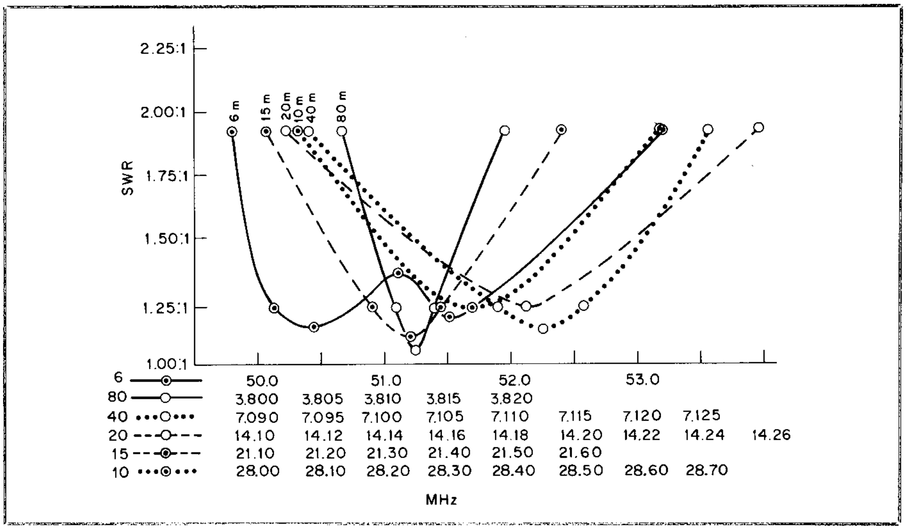


Fig 1—Plot of 80- through 6-meter SWR values calculated from return-loss measurements for the Spider antenna.

some type of core material into or out of the coil. To tune these, you start with the tuning sleeve at the bottom of the coil and your transmitter set near the high-frequency end of the band. The screw adjustment is used to set the high-end antenna resonance, and then moving the tuning sleeve up the coil will lower the resonant frequency.

Operation

The basic operating principle of the Spider is not difficult to understand. The mast is like any mobile antenna, and the resonators take the place of the loading coil and the remaining portion of the whip. But how do those tuning sleeves, that appear to be nothing more than plastic-covered toroids, work? As the sleeve slides along the tuning coil, it effectively isolates the part of the coil above the sleeve from the rest of the antenna. The lower the sleeve on the coil, the shorter the effective length of the antenna and the higher the resonant frequency.

The idea of having more than one resonator on the antenna at the same time is based on the principle that the RF will be transmitted by the resonant antenna and be rejected by the nonresonant ones. There is always the possibility that a multiband antenna will radiate harmonics of the desired signal, if harmonics are present in the signal that is supplied from the transmitter. Modern commercial equipment is filtered well enough that this should not be a problem. If you are using a piece of homemade equipment, however, you should be certain that all harmonics are adequately filtered out of the transmitted signal.

Construction

The Spider mast is made of solid 5/8-inch-diameter aluminum. At the top of the mast is a 1-inch-diameter section of aluminum with three resonator-mounting holes positioned 120° apart. The hole for a fourth resonator is in the top of this adapter. The bottom of the mast is also a 1-inch-diameter section of aluminum with a standard 3/8-24 mounting stud. This bottom section has three setscrews to hold the mast in position. By loosening these screws, you can rotate the mast to position the resonators after the mast is attached to your vehicle.

The 80-meter resonator outside diameter is just under 2½ inches, the 40-meter resonator is slightly less than 1 inch, and the 20, 15 and 10-meter resonators are each just under ½ inch. The higher-frequency resonators use thin-walled fiberglass tubing. The top of the fiberglass tubing is open, with an end cap to seal out moisture. The low-frequency resonators seem to be made from an acrylic tubing with both ends of the tubing plugged with pieces of plastic for strength and to help seal out the weather. The mounting stud is sealed into the fiberglass. The resonator form is covered with a tightly wound coil of approximately no. 18 copper wire. The entire assembly is covered with a heavy-duty plastic similar to heat-shrink tubing. A clear plastic coating covers the logging scale.

As I learned the first day I had the antenna on my van, the coil wire is attached to the mounting stud by running it through a hole drilled in the stud and soldering them together. While this makes an excellent electrical connection and simplifies construction, it may also weaken the mounting stud. When I stopped at a stop sign, the motion of my van caused the antenna to swing forward. To the best of my knowledge, the antenna did not hit anything, yet the 40-meter resonator snapped off at the base, right at the hole for the wire. (That's how I discovered the method of attaching the wire!) I had no problems with a replacement resonator, and have driven many miles with the antenna on my van.

Later, I also learned that the coil wire is passed through a hole in the fiberglass on the smaller resonators. I had the antenna folded down along the roof of the van with the 20-meter resonator straight up in the air. There is a possibility that I may have hit a low-hanging tree branch, but I am not positive. At any rate, I noticed that the 20-meter resonator was bent toward the back of the van. Further investigation revealed that the fiberglass had cracked, right at the hole that the wire passes through.

Operating Impressions

After spending the time to make some tuning graphs so that I could set the antenna resonators for operation at almost any desired frequency, it was a pleasure to use this antenna for mobile operation. While the antenna bandwidth is rather narrow on 80 and 40 meters, I could cover a sizeable piece of the higher-frequency bands without retuning the antenna.

Anyone who has ever tried HF mobile operation knows the joy of driving along the highway and chatting with a fellow ham hundreds, or thousands of miles away! The miles pass all too quickly when you get into a good ragchew with a ham on the other side of the country. I had many enjoyable QSOs with stations in California, Texas and Midwestern states using the Spider. During one trip to Pennsylvania, I checked into the East Coast Amateur Radio Service (ECARS), chatted with the net control station and listened to other check-ins. When I asked for signal reports, a number of stations responded. While no one told me I had the loudest signal on the band, they could hear me with little or no difficulty.

To make the SWR plots shown in Fig 1, I used the spectrum analyzer from the ARRL Lab to make return-loss measurements. The tracking generator produces a signal that sweeps a wide range of frequencies, and a directional coupler is used to pick up the signals that are reflected from the antenna for the spectrum analyzer input. In this way, you can see a display of the antenna response to a range of frequencies and easily determine both the resonant frequency and the impedance match of the antenna.

If the signal returned to the analyzer is 10 dB or more below the tracking generator output, the SWR is 2:1 or better. If the returned signal is 20 dB less than the generator output, the SWR is 1.2:1 or better. By recording the return loss for a range of frequencies in each band, I produced the SWR curves shown. These curves are only for one setting of the tuning sleeve in each band, and so they give an idea of the possible frequency range.

Using this test setup, I discovered an interesting antenna resonance in the 6-meter band. I made no effort to tune the 6-meter response, and it is possible that it occurred because of something in my installation. I decided to include the curve with the other information of Fig 1 because it might be worth further investigation for someone interested in 6-meter mobile operation.

The Spider antenna is rated for use with transmitters of up to 200-W output. My Heath HW-5400 is rated for half that, and I made no attempt to put the rated power into the antenna. The antenna is not designed for operation at 1500 W, so don't plan to use it with an amplifier.

I had some problems with the antenna, but most of those were related to the vehicle I used, and the fact that I mounted it near the top of my van so the top of the antenna was at least 11 feet above the ground. If you mount the antenna on the bumper, or even the trunk lid of a car, you should not have those problems. If you are looking for a mobile antenna that is designed to operate on any one of up to four bands while you drive down the highway, consider the Spider antenna. If you need a simple, easy-to-mount antenna for apartment or other "base" operation, then this may be the antenna for you, too.

The Spider antenna is available only from Multi-Band Antennas, 7131 Owensmouth Ave, Suite 363C, Canoga Park, CA 91303, tel 818-341-5460. Price class: Antenna mast with 40, 20, 15 and 10-meter resonators, $140; 80-meter resonator, $38; adapter with 40- through 10-meter resonators for use with your existing mast, $83.—*Larry D. Wolfgang, WA3VIL*