An Easy, On-Glass Antenna with Multiband Capability

Are you mobile on one VHF/UHF band, or two? Either way, this on-glass antenna design is for you!

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With every new car purchase comes the agonizing decision of where to punch the hole for my 2-meter antenna. Recently I purchased a dual-band transceiver, and the problem became where to punch *two* holes. I'd rather punch *no* holes at all!

An on-glass antenna seemed like the ideal solution. Such antennas couple RF through the windshield without the need to drill holes for cables and mounting hardware. Being a builder at heart, I designed an on-glass antenna to suit my needs. Not only does it feature the ability to disconnect the radiating element quickly (for car washes, etc), it has multiband capability, too!

Construction

I built the base of my antenna out of heat-sink material (see Fig 1). I happened to find a piece of bare aluminum heat-sink stock with long, straight fins. Each fin was spaced about ¼ inch apart. You can find similar heat-sink material at your local hamfest flea market. It's cheap and relatively easy to machine. You can also use aluminum channel stock, which is available from a variety of sources.

The first step was to cut out a piece roughly 1⅝ inches square and remove all but the two middle fins. The fins were a bit too tall, so I carefully trimmed them to ½ inch in height. I used a grinding wheel to round the corners and drilled 9/64-inch holes in the centers of both fins.

The antenna coupling plate is cut from a piece of sheet steel. Its dimensions equal those of the antenna mount. (Avoid using aluminum for the coupling plate, since it's very difficult to solder.)

The quick-disconnect assembly is made from two hexagonal brass standoffs just wide enough to fit snugly between the fins. One standoff has a hole threaded through its entire length. The other standoff has a threaded stub on one end and a threaded hole in the other. I carefully drilled a 9/64-inch hole through the open end of the second standoff. Using a #6-32 × ½-inch screw, I assembled the standoff to the base as shown (see Fig 2).

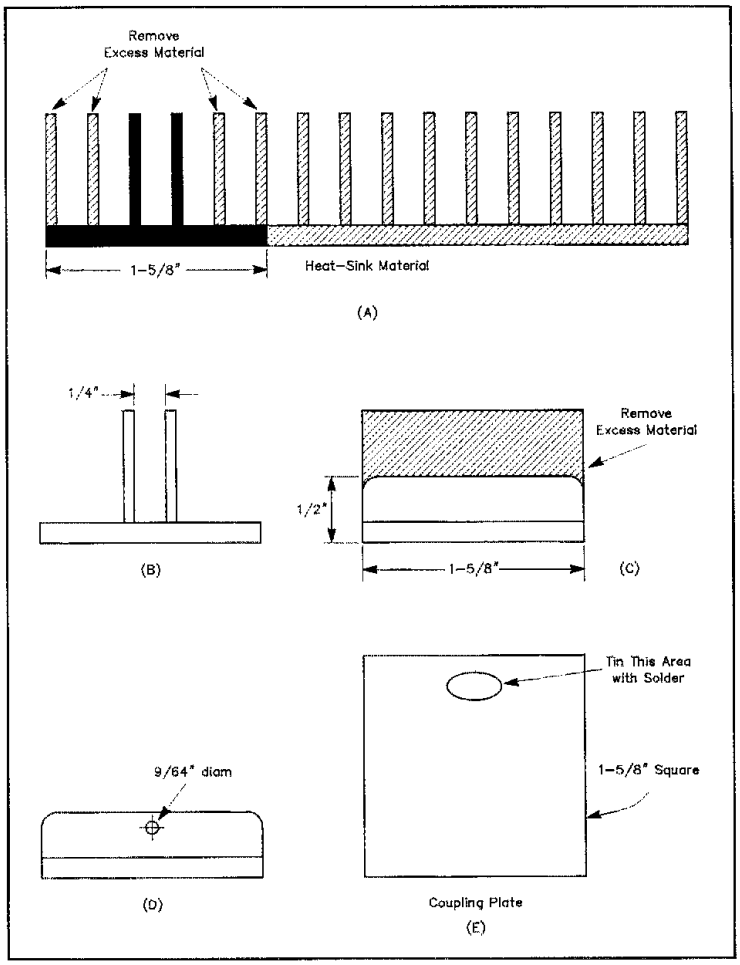


Fig 1—The antenna base is fabricated from a piece of heat-sink stock. Cut out a 1⅝-inch section and remove all but the two center fins (A and B). Round off the sharp corners of the fins and trim for a ½-inch height (C). Drill a 9/64-inch hole through the centers of both fins (D). The coupling plate is cut from a 1⅝-inch section of sheet steel. Tin a small area as shown at E.

The radiating element is made of 1/16-inch brass welding rod. I cut a #6-32 thread about ¼ inch up one end. This end is screwed tightly onto the first standoff. If you lack the tools to thread the rod yourself, use 1/16-inch welding rod and solder it to the standoff.

The total antenna length depends on the band you wish to use. See Table 1 for approximate lengths for various bands. As you can see in Fig 2, the finished section

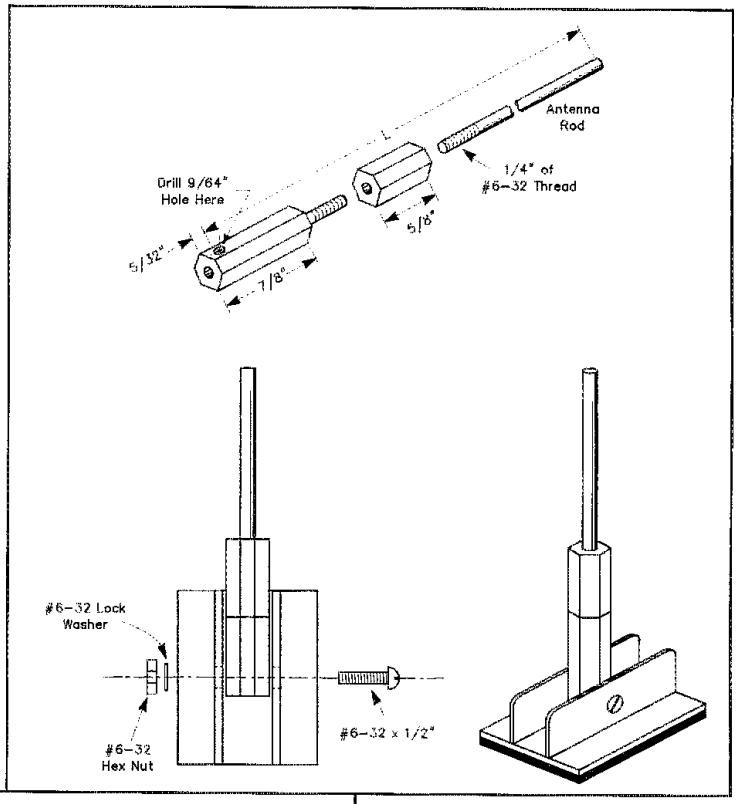
Fig 2—The on-glass antenna is made of brass welding rod attached to two threaded standoffs (see text). Drill a #6-32 hole in the bottom standoff as shown. Using a #6-32 × ½-inch screw, nut and lock washer, secure the antenna to the base. The total length of the antenna (L) is measured from the tip of the welding rod to the mounting screw. Use the lengths listed in Table 1 and then trim as necessary to obtain a low SWR.

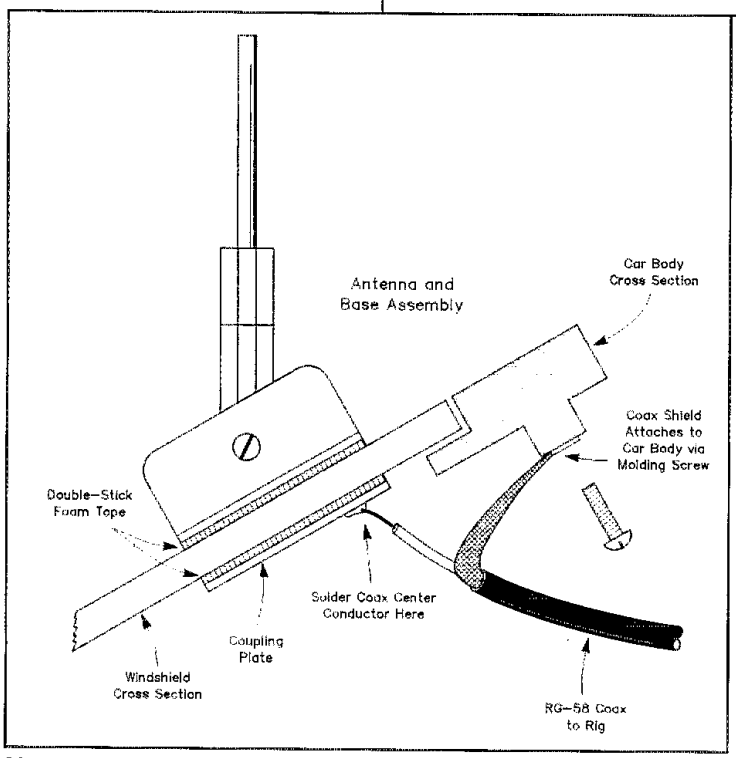
Table 1
Antenna Lengths for Various Bands

Frequency (MHz)	*Length (inches)*
145	23¼
223	15⁵⁄₁₆
444	7¹⁷⁄₃₂
880 (cellular telephone)	11⅛ (¾ λ)
920	11 (¾ λ)
1296	7¾ (¾ λ)

screws onto the stub of the base-mounted standoff. Whenever I need to remove it, a few twists is all it takes!

The coupling plate and the antenna base are attached to the windshield with double-sided foam tape (Radio Shack 64-2361). One tape strip isn't wide enough to cover the base and the plate, so I applied two strips side-by-side. It was a simple matter to cut the strips, peel off the backing and apply the





← Fig 3—Use strong foam tape to hold the base and the coupling plate to the windshield. The coaxial cable center conductor is soldered to the coupling plate. The braid is grounded to the car body via a nearby molding screw. The braid *must* be grounded at the antenna for proper performance.

tape to each piece. Any excess is easily trimmed away. The important thing to remember is *not* to peel the paper backing from the tape until just before you're ready to install the antenna.

Mounting

As you search for just the right spot to mount your antenna, bear in mind that you *must* ground the coaxial cable shield to the car body *near* the mount. In most cars, the top center of the front or rear windshields is best. Older cars usually have screws to attach the molding in these areas. These screws can often be used for grounding. If you own a newer car without strategically located screws, you'll have to install one yourself. In my Dodge Caravan, I drilled a small hole in the roof support (not the roof itself!) and used a small sheet-metal screw to fasten a solder lug in place. Whichever approach you use, check the screw with your VOM and ensure that it really makes contact

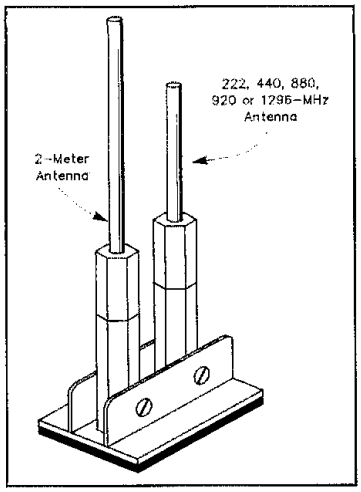


Fig 4—The multiband option. You can mount two antennas in the same base. This is ideal for today's dual-band, VHF/UHF transceivers.

with the chassis of your car. Many screws anchor in metal, but the metal isn't always grounded!

Hold the base to your windshield in the area where you intend to install it. Adjust the antenna until it is vertical, then tighten the nut. Remove the mount and spray paint the entire assembly black—or whatever color looks best with your car!

When the paint is dry, clean the glass thoroughly (inside and outside). Check your chosen antenna location one more time. Is it in the path of windshield wipers? If you open the trunk or hatch, will the antenna be crushed?

If everything looks safe, peel the paper from the foam tape and attach the base to the outside glass. Press firmly to ensure that the tape sticks to the surface. Attach the coupling plate to the inside glass directly opposite the base. Solder the center coax conductor to the coupling plate and connect the coax shield to the ground screw or lug.

Tuning

With an accurate SWR/power meter, make SWR measurements and begin pruning the antenna for the lowest SWR. In my 2-meter installation, with 50 watts forward power, the needle doesn't even wiggle in the reverse-power position (a 1:1 SWR). If you can't get the SWR below 3:1, check your coax ground at the antenna. This is often the culprit.

Multibanding

I saved the best for last! You can create a dual-band antenna by simply mounting a second antenna and quick-disconnect assembly on the same mounting base (see Fig 4). For example, here's a fancy system for hams who own cellular phones: Install 2-meter and 880-MHz antennas in the same mount. The 2-meter whip will do double duty on 2 meters and 70 cm, while the 880-MHz antenna is perfect for your cellular telephone. An antenna farm on glass! (This configuration must be fed with a single feed line and an appropriate diplexer must be purchased or homebrewed.[1])

Conclusion

I am extremely happy with the antennas I have made using this on-glass method. No external holes were necessary and the antennas disconnect easily. SWR is low on every band and the antenna's radiation efficiency seems to rival any hole-mounted antenna I've used in the past!

[1]D. Jenkins, "A Simple VHF/UHF Diplexer," *QST*, October 1991, pp 18-25.

Robin Rumbolt, WA4TEM, has been active in many different phases of Amateur Radio for over 29 years. In addition to his Advanced class and General Radiotelephone licenses, Robin earned BS and MS degrees in engineering. He is currently employed as a staff engineer at Philips Consumer Electronics. QST

Strays

SMOKE TEST

◊ A friend of mine was trying to tune in the Jackalope Net on 40 meters, but there was a strong heterodyne right on the net frequency. His brand-new transceiver wouldn't notch it out, no matter how hard he tried. He tweaked the knobs and cussed the radio until his wife—also a ham—came out of the kitchen and asked, "Don't you know the difference between a heterodyne and the smoke alarm?"—*Lynn Bilyeu, KØODF, Chadron, Nebraska*

FAMILY OF HAMS

◊ In late October 1990, our family decided to take up Amateur Radio as a "family project." I was all for it, but my older brother, Jay, needed some extra encouragement. By listening to the local Quakertown, Pennsylvania, repeater, we were able to find a hamfest. We stopped by and looked around with great anticipation. We picked up a copy of the ARRL's *Tune in the World with Ham Radio* and asked around for information on Novice classes. We were directed to Warren Erdman, K3ZXQ. Warren took our names and "signed us up" in his soon-to-start Novice class.

The class didn't last long for the family. My dad passed his Novice theory and code on November 15, 1990, after an extended study session while waiting (more than four hours) for his boss at the Orlando Airport. Upon returning home, Mr Erdman came over to our house to administer the tests. It was great to have our family "Elmer," Mr Dee Hester, N6BQR, there to sign the paperwork for submission to the FCC.

"Black Friday," November 23, 1990, wasn't so black for our family. It seemed as if it were "Good Friday" for us. Mom, Jay and I passed our Novice tests that day. Dad even passed his Technician theory test. Mr Erdman accidentally played a 13-WPM tape and I thought I was a goner. Dad had promised Jay and me he'd get us a radio if we passed our tests. Dad came through with two brand-new hand-held 222-MHz transceivers for the holiday. Our new licenses showed up in the mail the last week of 1990. Mom was issued KA3YFL, Jay was issued KA3YFJ, Dad received N3IVB and I got KA3YFK. We were on our way.

Although Dad wanted all of us to at least try to reach Technician class, Mom was the only one to do so, in January 1991. Mom was issued the new call sign N3IWL in early February. I think Dad had it planned that way. He had gotten Mom a dual-band (2-meter/440-MHz) radio, which she couldn't use until she was a Technician.

Instead of watching TV in November of 1991, I listened to the Gordon West, WB6NOA, theory tapes. Dad had gotten them for Mom. Each evening I'd go to sleep listening to "Gordo." Then, after reviewing the question pool with Dad, I took my test. I aced it! Wow, what a feeling! Dad said it would be easy to go on to General theory with the Technician so fresh in my mind. Again, I listened to "Gordo" as I went to sleep, reviewed the question pool, and again I aced the test!

Then I was on to the 13-WPM code test. Dad has a copy of the *Super Morse* IBM-compatible code training software by M. Lee Murrah, WD5CID, and that helped me get back in the swing of things. I hadn't used the code for almost a year. It took about two weeks (10 minutes in the morning and 10 minutes in the evening) to get up to speed to pass the test. In late 1991, Dad offered Jay and me an incentive to upgrade. We could add something to the shack if Jay upgraded to Technician and I upgraded to General by January 6, 1992. When Jay and I passed, we suggested adding packet to our station. Dad got us a multimode TNC, so now we log onto the WB3JOE PBBS, not to mention the other modes.

I was looking forward to getting on 40 meters and the Fish Net, now I can. Some of my friends are Tom, KA1UGH; Rick, KD1BR; Brian, WS3F; Joe Sr, WA1JKS; Jack, N2JTO; Ken, N1GPL; Alan, KF8PM; Derrick, WM1U; Marty, KA1IRA; Dave, N4FFG; and Fran, KA3WTF.

I enjoyed working the W3OK Christmas City special-event station on December 21, 1991. I made 40 contacts. Some of the contacts were my Fish Net friends.

Dad kept ahead of us: He took his Advanced and Extra Class elements in November and December of 1991. He was issued his KE3AH call sign on December 12, 1991.

February 11, 1992, brought three new licenses to our house. Jay was issued N3LQV, Dad received WV3M and I got KA3YFK (Young Fine Kid), only this time with "General" printed on it.

Mom may try to go on to General. I hope she does, so when I go away to school I can talk to her. I was eight years old (almost nine) when I passed my Novice tests. I was nine when I passed the Technician and General elements. I hope to upgrade to Extra Class within the next few months.

I want to thank all my friends who helped me and encouraged me along the way. Steve, N3ANW, took time to come and see me take my General code test; Bob, WF3H, saw to it I could work W3OK, all my Fish Net buddies (even though they are "a little older than me"), and of course my "Family of Hams."—*Christopher Breish, KA3YFK, Coopersburg, Pennsylvania*