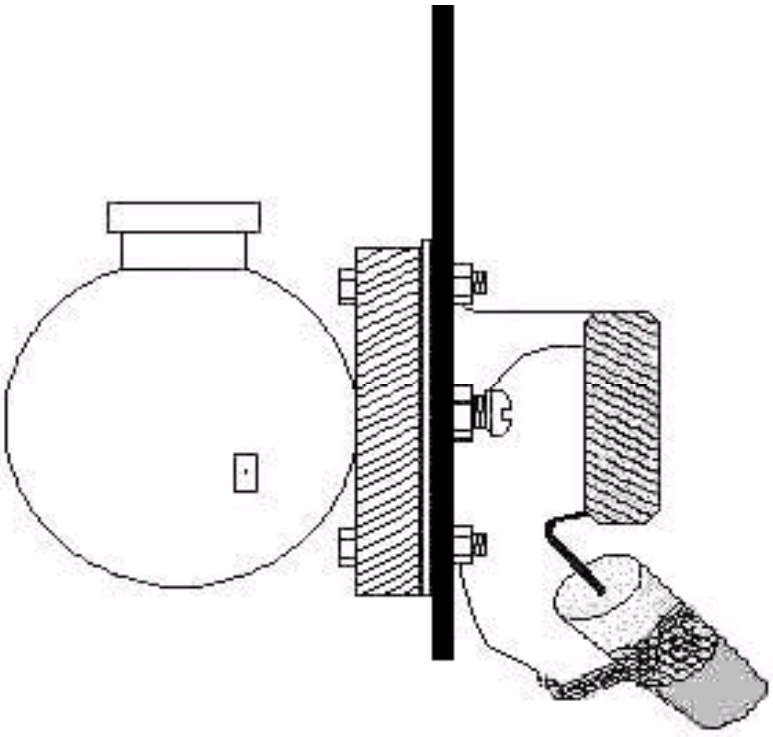
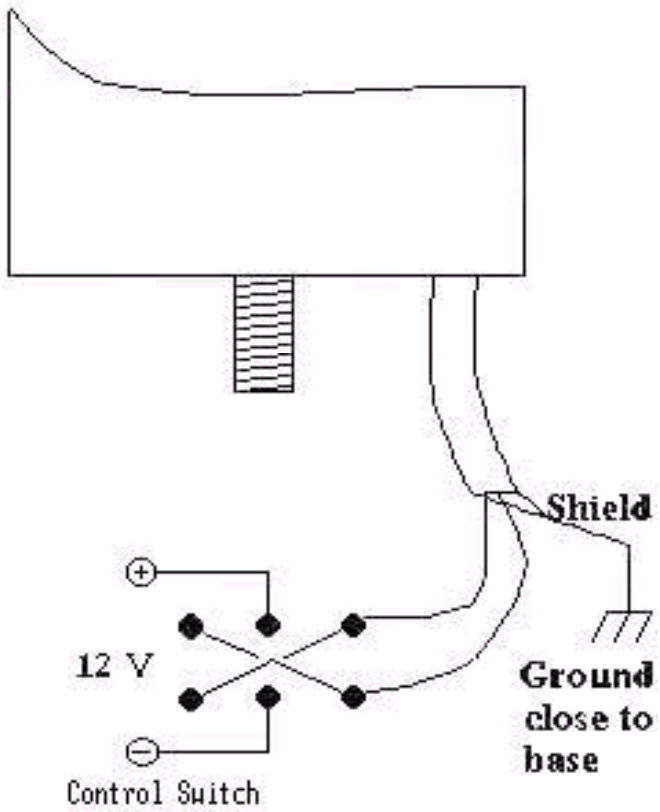
The DK3 HF Mobile Antenna

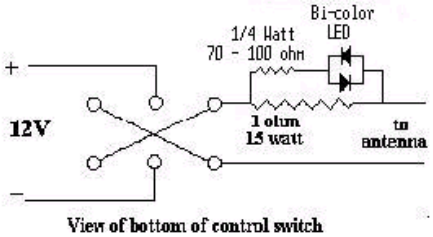
A complete 23 page manuscript is available from W6AAQ, D. K. Johnson, 26659 Capay St., Esparto CA, 95627-0595 for $5.00 and Don's book 40+5 years of HF Mobileering is available from Worldradio.

Profits from the sale of this antenna are to be used by the El Paso Amateur Radio Club and not it's dedicated members who spent much of their wives quality time to build it for you. So enjoy mobileering. The antenna has been modified to be ball mounted with the feed to the connection at the ball. Do not attempt to mount it on a spring. A spring will not hold the load and in most cases is a source of noise.
The coupling toroid must be mounted as close as possible to the ball mount. The lead from it to the ball is part of the antenna and must be considered during installation.
Better results will be obtained if the antenna is mounted as high as possible, at least so the coil is above the roof-line of your vehicle.
The antenna is adjusted to the frequency on which you wish to operate by extending the coil above the tubing which is the lower portion. This is done without having to transmit. Just set your transceiver to the desired frequency and listen to the noise generated by the drive motor as you run the coil up or down. Tune for maximum audio. Then adjust it back and forth to peak.





Here is a little trick which will tell you when you have reached the End Of Travel. When EOT is reached the one of the LEDs will illuminate. If you can't find a bi-polar LED use two LEDs in parallel. Just reverse one of them.
Red in one direction.
Green in the other.



View of bottom of control switch

Electra-Slide Antenna **Made by the members of W5ES**

Each antenna is built as a proto-type, and each is individually tested on at least two different vehicles (usually on my truck and my wife's car but we have tested them on several other cars from time to time).

A few instructions on installation and tuning the Electra-Slide Antenna.

On installation:

The shield on the control wiring is to reduce noise. So keep it short and ground it on both ends. The ground is a VERY important part of any antenna. Make sure it is solid and will not come loose. Ground the toroid and the control cable shield as close to the antenna as possible. No more than 6 or 7 inches from the mount. Your vehicle is acting as the counter-poise for the antenna and if the leads are not short and secure it will not function properly. The length of your whip should be cut so that the overall length from the mount to the tip is resonant on ten meters. Include the ball, the tube and the whip. They are all part of the antenna. When you have the length right the antenna will cover from below 75 meters to the top of the 10 meter bands and all frequencies in between.

The formula to calculate the length is:

Length in feet = 234 divided by the frequency in megahertz.

Leave an extra inch or so, it is easier to shorten than to lengthen the whip. If you mount your antenna close to the metal body of your motor home, you should allow for a longer whip. So start out extra long, 3, 4 or 6 inches long may require more cutting but it's better than buying a new whip.

The antenna should be braced to prevent it from exerting a bending action on the mount. Brace it solidly between the vehicle and at least half way up the tube. A non-conductive clamp to limit sway is all thats needed. One pound of pressure exerted at the top of the tube will present a bending action on the base of over thirty pounds. So please brace it.

On tuning:

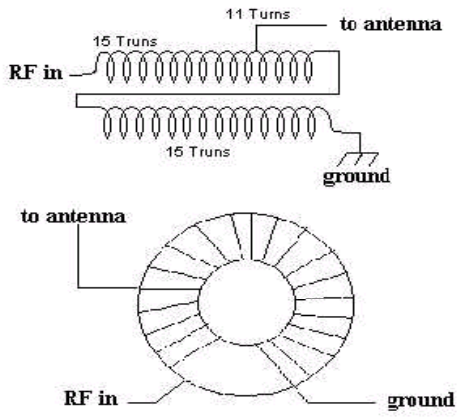
With the antenna fully retracted, set your radio to the top of the 10 meter band. With an SWR bridge installed in the transmit line, obtain a reading at your lowest power output. Tune your radio to the bottom of the 10 meter band and get another reading. Compare these two reading. If the second reading is higher than the first reading you have to cut off a little of the whip. Do not cut too much, only about 1/8" at a time. When the readings are the same, the antenna is resonant in the middle of the 10 Meter band. This is all the trimming that is needed. All the HF frequencies between 75 and 10 Meters can now be obtained by extending or retracting the coil inside the base tube by running it in and out with the screwdriver. There is always a temptation to make these adjustments at another frequency but if you want to work 10 Meters then you will do better making them in this way. If you would like to use a longer or even a shorter whip it will work but you will always have to have some of the coil extended on every band. If you get the whip too short you will lose the ability to work MARS just below 75 Meters and you may lose 75 as well. When the coil is retracted it is shorted out by the finger stock inside the tube and is not in the antenna circuit. As the coil extends the antenna becomes electrically longer and the "Q" increases. This is caused by the capacitance and inductance between the turns of the coil. Please note that the band width will decrease as the "Q" goes up.

If you are using an SWR meter to tune the antenna you will have to watch it carefully on the lower bands. A difficult thing to do while driving. A better way is to tune to the frequency you want to operate on and run the antenna coil in or out as you listen to the noise. When resonance is obtained the noise level will increase dramatically.

Today's radios will operate very well with an SWR of 2:1, so don't worry if a perfect match is not reached. Surrounding trees, cars, houses and the like will cause a change in SWR but will not adversely effect the operation of your radio. If you are in a fixed location while operating a slight adjustment will reduce the SWR again.

About the Toroid:

Mount it as close to the base of the antenna as you can. The leads must be kept as short as possible. Make good solid connections.



Best 73
Clay, K5TRW

Bill NADWORNICK
K7CTS

VE7TEC

Big DK3

by W6AAQ DK Johnson

WOW! Think about this: -- *spend about a kilo-buck for an all band transceiver ... with zillions of automatic this-n-that buttons splattered all over the front panel .. then while mobile, to QSY, do you have to send the spouse out on the turtle back to either change antennas or re-resonate the one you're using ? !*

ARE YOU USING **A DUMMY LOAD ON A STICK?**

It will soon be twenty years that many of my HF mobileering friends have been band-hopping, operating from band-edge to band-edge without even lifting their foot off the accelerator. I started out with a home brew no nonsense multi-band antenna -- Bruce Brown, W6TWW[SK], designed a companion mobile automatic antenna matcher that could be assembled for less $ than most dinners for two. Brown's matcher/resonator is mounted either inside an enlarged antenna mount or within very few inches of the mount. Scores of HF Mobileers have been using this new Big DK^3 for several years, -some with Brown's matcher and others with their own. They are challenging all comers to field strength duels --barefooted-- Their motto is: *When you come up with more field strength while hopping from band to band in seconds, we are going to be the first to steal your thunder.* 1,2,3,4

ANTENNA DESCRIPTION

This antenna has withstood the rigors of snow and ice in Alaska and furnace like heat in Arizona. Now in use at some Military and Gov't installations, MARS - CAP - RACES. Some Mobile and Motor home owners have been operating the antenna mounted horizontally very successfully as well as vertical. Some are strapped to chimneys at fixed stations. We have received pictures where two Big DK^{3}s have been mounted butt-to-butt horizontally as a dipole. The dipole configuration does not require any matching, tuner or otherwise -- Absolutely flat on every frequency from 3.5 to 30 MHz .. Does not require grounding or radials. As a dipole, the 75 meter overall length is only 19 feet which installs very nicely on most RV's.

Don't worry about GDOs, SWR or Noise Bridges; neither winding the exact number of turns on the coil or the exact length of top whip is NOT critical. Once assembled, the antenna will be operational within minutes --- you don't have to get out and 'tweak' the top whip or move jumpers, taps or shorting bars. When the feed point impedance has been properly matched to the feed line, just turn on the rig and start transmitting. Move around from band to band -- band edge to band edge -- the antenna is always resonant and flat.

The antenna is designed with a motor driven center loading coil; the coil slides up and down inside a thin-wall pipe as you move down and up in frequency. As the lower turns disappear into the lower mast they become an integral part of that mast. NO! - there are NO shorted turns -- they are not *turns* anymore. The extremely high capacity between the submerged turns and the lower mast at RF frequencies effectively ties them together. With the coil fully extended, the antenna resonates on the lowest frequency -- let's say 3800kHz (or 3500 if you wish) . . . as the coil descends into the pipe, the antenna resonates higher and higher in frequency.

The antenna will resonate at any frequency from 3.5 right up to 30MHz *without leaving the drivers seat*! An interesting freebie on this motor driven configuration is that no limit switches are necessary when either the upper or lower travel limit is reached, --- if, by accident, the drive screw bottoms out, the entire coil will start to rotate until motor is shut off or the direction is reversed.

When the coil is completely submerged into the tube, the top whip length can be adjusted to resonate the antenna for 10 meters. This is truly a full coverage antenna .. particularly to get into MARS or do some SWLing in the short wave bands. If you are an amateur with communications duties on general service frequencies you may be able to slip into the ham bands between other schedules. No attempt was made to design a 160 meter model, however, we have heard reports of some who have done the 160 mod ... See K6RRC Modification page 93.

Endless frills can be added to the installation. Automatic position indicators --(bar magnets work thru aluminum, brass or copper pipe [tubing])– Position seeking selector switches; automatic positioning when the band switch on the transceiver is changed ... and more. Automatic voice-controlled resonating with the W6TWW Mobile TennaMatic is also being used with many of the Big DK^3s. Some of those units were built as far back as 1974 and have followed the procession of Big DK antenna series. **NOTES 2,3,4,7.** Weather proofing is as simple as picking up a free plastic `beef jerky' tube at your corner convenience market.

PARTS PROCUREMENT **See Parts List**

Every part for the antenna can be found at the same do-it-urself home center -- one trip through one checkout counter! However, you may improvise with parts you have on hand; you do not have to duplicate the procedure exactly as shown here ... no doubt with your own ideas, spawned by looking over this assembly, you may make worthwhile improvements.

DRIVE MOTOR Part H

After spending a few C-notes trying various drive motors, the solution was laying on our workbench all the time! All the antennas that have been assembled since early 1991 utilize the SKIL Twist Model 2105 or the *True Value* MASTER Mechanic Model 8521 Cordless Screwdrivers. The only modification necessary to operate on 12 volts DC is to remove the 2.4 volt nicad battery stick and switch; a 5 ohm, 10 to 20 watt, WW resistor is installed in the vacated battery cavity. Both screwdriver models are identical and have been found priced all the way from $8.99 to $25.00 (1993) -- so do a little shopping. Here again some feedback has been received --- one group of amateurs had access to some stepping motors ... they are programmed where the antenna moves automatically with the transceiver dial. That is real sophistication and certainly beyond this paper.

LOADING COIL DISCUSSION Part C

The loading coil is not too shabby either - Q in the 200s. The coil is wound on Schedule 40 PVC pipe (white). Endless methods of winding this coil have been reported. The OD of the Sked 40 PVC all seem to hold pretty close, so there's no problem there. The ID of the lower mast section varies considerably with the type and material and the manufacturer. Brass Escutcheon Pipe is my favorite -- however, brass is quite expensive and how much can you spend is determined by the individual. The next great pipe with perfect fit is decorative brass railing found at most 'home-centers' but it is thick walled and very heavy. Numerous builders have used 2" copper pipe and the price varies with the degree of daylight.(or moonlight?) The ID of the copper pipe is a bit greater than needed but the smarter builders have used correct size plastic spray can lids as bushings. Using the copper pipe and the bushings require no special tools or preparation of the PVC form to wind the coil. In our area 2" aluminum irrigation pipe is plentiful -- from nothing to about 0.50¢ a foot. Some .. not all.. irrigation pipe is just a bit

too small to accept the PVC coil form. So the entire length of the PVC has to be reduced plus cutting the 10 TPI groves in the winding area. Oh, don't throw up your hands and say that is beyond the average amateur! The real easy way is of course -- line up a lathe. That lathe may not be as far away as you think. At our monthly breakfasts we have several retired machinists who help out fellow hams. The vocational classes at the city college; Clubs and individuals continue to report great success with vocational shop teachers assigning the project to students. -- do a little leg work.

Let me tell you about one really dedicated and ingenious radio amateur:- As a long haul truck driver he has to take forced rest periods. To prepare his PVC coil form he used these rest periods to dress the PVC coil form with sand paper and the grooves for the 10TPI were prepared with a pen knife. Recently I received a ***terrible*** letter from the **ARRL** (and I am a Life Member). *" .....this project .....appears too complex for most readers. ... "* That statement can be translated into *"most hams are dumb and only want to be entertained"*. Insulting! Why, we have had Junior High School shop build this antenna and **none** of the students, nor instructor, were hams.

THE MAIN ANTENNA MAST Figure 3

Being redundant -- here it comes again: The lower antenna mast material can be Aluminum Irrigation Pipe, thin-wall Copper Pipe or thin-wall Brass Pipe. The brass pipe can be located as decorative coverings for plumbing fixtures, hand railings etc. We located ours at a pipe supplier that specializes in all types of pipe and tubing. The irrigation pipe and copper pipe are common items.

Although a number of antennas were made using the brass tubing, it was found that the aluminum irrigation pipe was cheaper by a factor of at least ten. Needless to say, the last couple of years, the majority of antennas are made with the aluminum pipe. Salvage lengths may be bummed from sympathetic farmers. A little steel wool and elbow grease makes it look pretty presentable. The lower mast may be painted to match the vehicle; any kind of paint.

As indicated above, the inside diameter of the aluminum and brass tubing may vary by several thousandths so it is advisable to verify the ID before turning down the internal antenna parts. Some 2" irrigation pipe was found where the ID was enough to permit inserting the 1½" PVC blank form as it came off the pipe rack -- for that reason it has been found helpful to take the PVC blank coil form out to the pipe pile and rummage around.

COIL ELECTRICAL CONTACT Finger Stock Figure 6

Although the coil turns are eliminated as they go into the pipe mast, electrical integrity is assured by installing finger-stock at the top end of the lower mast section. Finger stock is a common item found on much electrical equipment - it comes in various sizes. Several parts catalogs show finger stock in stock. NOTES 5 & 12 & 13

We have been shown finger stock fabricated from regular 0.005" auto parts brass shim stock. It took no more than a little imagination and a pair of household shears. Manicure the shim stock into shape and secure it to the pipe. A valid part number at NAPA auto parts counter is **Victor No. 9014.** If your home-brewed finger stock does not seem to have sufficient tension to satisfy you, a small diameter spring can be placed around the outside .. no doubt rubber bands would work after a fashion. However, commercial finger stock is obviously preferable and extra tension is not required.

Of course it is a little difficult to solder copper or brass to an aluminum pipe. The commercial or home-made finger stock can be soldered to a half inch wide strip of brass shim stock -- punch holes in the shim stock and attach it to the mast by drilling and tapping for small screws. Oxidation could be a problem in time but as long as you are aware of it, proper preventive maintenance will avoid trouble.

An advantage of the finger stock is that no key-way is necessary to keep the coil from rotating as the all-thread drive rod spins; unless, like I say, you goof and let it bottom out - up or down.

W0SEV modified the coil wire contacts one some of his antennas. He used the spring leaf contacts from surplus long phone jacks. Three are positioned equally around the mast. The convex dimples fit between two turns, engaging both wires. Secure only the bottom end of the leaves to the mast to permit maximum flexibility.

The Alaska group report they coat the entire coil with Silicon Electrical Compound **NAPA Part # LM-3.** This is done to prevent any condensation between the mast and the section of the coil that is inside the mast from freezing and locking up the coil.

Multicore Solders, Westbury NY 11590 (516) 334 7450, have a solder that will solder aluminum. Alu-Sol® 45 D, Soldering Temp 600-700°F. Available in gauges 14,16,18,20,22. Can be used on Aluminum, brass, copper, tin-plate, nickel, steel. I do not use it.

--- NOW GET OUT THE PARTS PICTORIAL ON PAGE 91 AND FOLLOW ALONG ---

ANTENNA MAST BOTTOM CONNECTION K,L,M

Although simple, this has been an area with a lot of suggestions. Depending on the material and tooling on hand, no doubt many methods may be devised — go for it.

Definitely DO NOT use a spring base mount. DO NOT worry about the apparent hugeness of the antenna -- The lower mast is only an eighth of an inch larger than one current commercial unit. The wind loading is less than many of the popular bug catchers. AND - remember, in addition to having outstanding field strength -- the absolute advantage of the Big DK^3 is **ALL** the HF bands, *band edge to band edge, can be operated without stepping outside the vehicle* Not only all the HF ham bands but also **every** frequency in between!

PREPARING THE COIL FORM Part C

Figure 1. A 22 inch piece of 1 ½" schedule 40 PVC pipe is used for the all band coil form. The PVC pipe will slide up and down freely inside most of the brass tubing we have procured. It is more likely to find the aluminum irrigation pipe slightly undersize. If the ID is too small, The PVC diameter will have to be reduced to allow about 0.050" clearance all around for the entire length. See previous LOADING COIL DISCUSSION.

The coil is wound with 150 ± turns of **#16** solid, tinned or silver plated, copper wire (buss wire) spaced 10 turns per inch. Do not use larger sized wire at 10 TPI -- the Q will go to pot. Excellent wire source - any quantity: **1-800-727-WIRE** . Some coils have been wound with #16 bare copper house grounding wire. A Yuma AZ station is using aluminum welding wire from his heli-arc spool. Also there are various types of phosphor-bronze spooled welding wire. 0.045 is a good size to play around with. Don't be afraid to experiment.

To allow for clearance when the coil is wound; starting about 3/4" from the top of the form, an additional 0.030" of material is removed in the 15" winding area. Be sure to study **Figure 1.** to determine the proper area to size. Next, cut 0.030" deep threaded groves - ten per inch - to accept the bare #16 buss wire (or whatever you wind up using). The radius of the groove should be about the same radius as the wire.

Use a size #36 drill or smaller and drill holes through the coil form at the beginning and end (top and bottom) of the wire grooves. Drill two more holes below the winding area -- used to secure the lower end of the coil wire. See **Figure 1** *Do not wind the coil yet.*

PREPPING FOR THE TOP OF COIL

Figure 1, Parts A & B: The top of the coil has to be prepared for a 5 to 6 ft stiff upper whip. Chase the 1/8" NPT threads in the 1/2" to 1/8" brass pipe bushing, **Part A,** with a regular machine screw 3/8s by 24 tap. Into the side of one of the hex-flats, drill and tap a 6-32 hole ... the top coil wire will be secured there later. Screw the brass bushing into the 1¼" slip to ½"NPT PVC bushing. **Part B**

Reduce the slip area (sandpaper-file-lathe) of the PVC bushing so it will fit snugly inside the top of the 1½ PVC coil form. Also slightly reduce the hex-area of the PVC bushing where it will just slide thru the lower mast section. Later the completed coil and drive assembly will be shoved up thru the mast from the bottom. At the top of the PVC bushing, drill a small hole downward for the coil wire in the area of the 6-32 screw hole. This completes the prep for assembly A/B

PREPPING FOR THE BOTTOM OF COIL

Figure 1, Part E: 1" slip PVC pipe cap. Drill a 3/8" hole in the center of the cap. Suggest using a Uni-bit or Cobra-bit for clean perfectly round hole.

Part F: 1/4 - 20 KNIFE-THREAD WOOD INSERT for wood, particle board, plastic. A RENSEN PRODUCT item found in most home-center super markets in the cabinet or wood working area. Orchard Hardware in California.

This insert is force-threaded into the 3/8s hole drilled into the PVC pipe cap **E.** Use a short piece of 1/4 x 20 all-thread with a jam nut -- use as an insertion tool. If a lathe is not available, run the insert into the cap as straight as you can by hand -- if it appears to be crooked, **carefully** heat the cap near the insert, straighten and keep in line until PVC cools. It will be found that the coarse outside threads bind so tightly in the cap there's no danger of it coming out. This completes assembly **E\F.** During final assembly, the ¼ x 20 all thread, **G** will be screwed into the insert.

In the event the Wood Insert cannot be located, pick up a ¼ brass pipe plug, (auto parts) and drill and tap it for ¼ x 20. The ¼ plug will screw tightly into a ½" hole in the pipe cap --- strange eh? - but true.

ANTENNA DRIVE MOTOR Part H

Cordless screwdriver preparation. Three screws free the top motor case for removal. Carefully tilt off the top half of the case, starting from the front end -- business end. Here's where you have to be careful; snap rubber bands around the motor and gear case so the parts won't fall out while you're working on it. Remove the battery pack and switch by merely picking up the battery from the far end and pull out ... this will not be used with this antenna.

Install three 0.01, or larger, disc caps; one across the motor terminals and one from each motor terminal to the motor frame. The motor frame will tin nicely when a bit of the cad is scraped off. Study **Figure 5.** for the following paragraph.

From one motor terminal, where there are already 2 capacitor leads inserted, connect a 4 or 5 ohm - 10 to 20 watt - resistor. The two 12-volt power leads, (from the motor to the control box DPDT switch); connect one to the free end of the resistor and the other to the opposite motor terminal. For starters, make the power leads about 12" long; shielded wire not necessary --- solder all the connections on the motor terminals and the dropping resistor. Drill a small hole in the end of the handle and pass the wires thru. The rubber bands can now be removed and the top motor case replaced. Both the SKIL Twist and the MASTER Mechanic screwdriver housings are held together with 3 screws. Do not replace the single screw in the middle of the handle toward the motor; at this screw hole, drill completely through the case/handle with a #28 drill ... later, when the motor assembly is dropped into the 5½" piece of PVC, **Figure 2.** A 1-7/8" long pin is pushed through the hole to secure the motor in the PVC pipe. I use a piece of 1/8th" brazing rod. About an 1/8 of an inch in from the open end of the motor bit\chuck, drill a #36 hole to accept a cotter pin. The all-thread drive rod will be pinned in the motor chuck during assembly.

Mid 1992 we received some reports of the motor power leads causing trouble on 17 meters. To correct this, operators recommend that the leads be brought out at the very bottom of the antenna. Install a Molex connector (Radio Shack) close to the antenna. Then near the Molex plug mate that comes from the control box, wind about ten turns or more of the power cord thru a toroid to decouple possible RF feedback. Amidon T 94-2 cores are working ok. **The drive motor prepping is now complete.**

MOTOR SUPPORT

Figure 1, Part J: Select, and if necessary, size the OD of the 5½" piece of PVC. Measure down 5/16" from the top end, and with a #28 drill bit, drill through both sides. Drop the screwdriver assembly into this PVC until it bottoms on the shoulder (don't forget the motor power leads) push the 1-7/8" screw\pin through these holes and the middle hole that was drilled in the screwdriver handle. It is not necessary to put a nut on the screw/pin or insulate it

BASE MOUNT ADAPTER

Figure 1, PARTS K, L, M : (Later, assembly **K L M** will be secured in the bottom end of the antenna mast). **Part M** drops right over the solid stud mount explained in the next section.

Insert the 2 ½" piece of Type M copper pipe, **M** into the 3/4" copper pipe adapter **L**, secure firmly by sweat soldering.

Screw the L\M assembly into the 1½ PVC bushing, **K**. Now **K L M** is one assembly. Assembly **K L M** is complete and just wait awhile, we have some more sub assemblies to do.

One group thrashed all this nonsense and just dropped the lower mast into a short piece of 2" Sked 40 PVC which was attached to the vehicle with hose or saddle muffler clamps. Pretty smart - huh! I like it.

VEHICLE ANTENNA MOUNT Figure 7

For nearly 40 years all our antenna base-mounts sport a 3" long brass stud screwed onto the standard antenna mount. The 3/4" copper base adapter, part **M**, sets right over the stud when you mount the antenna on the vehicle. This makes for a very quick disconnect, especially trying for a quick dismount in the rain at a motel archway. The stud is machined with a slight taper; when the copper pipe base section slips over the top there is no problem with a poor connection, either mechanically or electrically. The top and bottom of this stud is drilled and tapped 3/8s x 24 so it will still receive one of the standard `old fashioned' antennas.

WINDING THE COIL

Winding the coil is now a breeze. Use bare solid #16 buss wire .. tinned or silver plated. If your lathe operator is experienced, let that person spin the 150 turns on. If your welcome does not extend that far, here's how to do it by hand: From the outside of the coil form, insert the coil wire through the top hole - then thru the previously prepared top bushing and fasten to the 6-32 screw in the brass bushing. Now, insert the coil top assembly **A/B** into the top of the coil form -- drive it in tight to the shoulder that was left on the bushing when it was sized.

Secure the far end of the 75 foot coil wire in a vise or other sturdy device - walk out to the end of the wire, be sure to remove any kinks or loops, then pull it tight and start winding. Position the form so the wire comes up over the top toward you .. with right-hand threads (grooves) this will place the upper end of the coil form on your right and winding will be from right to left. ...you will feel the wire snap down into the grooves. Don't let the turns get away from you, if necessary, the windings can temporarily be held in place with some electrical tape until you get the bottom end secured. Thread the lower end of the coil wire thru the lower three holes. Where the wire is tied off in the bottom two holes, to maintain clearance inside the mast, it may be necessary to apply a little heat with the soldering iron tip to push the wire into the softening PVC --- *careful!* Oh! it is a good idea to turn off the blasted telephone bells and instruct the spouse not to let anyone bother you until the coil is complete!

If you do not have to cut threads or grooves for your coil wire, the correct spacing can be accomplished by winding the wire side by side with nylon fishing line or weed-eater cord. The #16 wire is about 50.8 mils in diameter so spacing the turns one diameter will be close enough to 10 turns per inch ... use spacing line that has the same approximate diameter. The slick trick is to connect the wire and hold the coil form as explained in the above paragraph — the wire fed over the top of the coil. Tie 75 ft of the nylon line to a weight .. I use a 12" crescent wrench .. carry this weight out behind you so the free end of the line will just reach the coil form. Let's review this — The free end of the coil wire is secured in the vise 75' in front of you. The weight tied to the nylon line is laying on the deck 75' behind you -- You and the coil form are in the middle of this 150' stretch of property. Bring the free end of the nylon line between your legs and up UNDER the coil form, attach it firmly to the beginning\first winding. Now as the top of the coil form is turned toward you, you and the coil will be heading toward the vise. The weight will keep the nylon line taut as it creeps up behind you. By the time your coil form is full, you, the coil and the weighted end of the nylon line will all end up pretty close together. Leave the wire-spacing line in place, secure both ends of the wire and

line. To keep the nylon line in place, dab two or three narrow bands of fiberglass resin the full length of the winding ... Let it set up. The entire circumference of the winding **must not** be covered due to the fact the finger stock must make electrical contact with the winding at any turn.

FINGER STOCK Figure 6

Position and secure the finger-stock on the 2" mast section. A couple of methods are suggested in the section, COIL ELECTRICAL CONTACT PAGE 5

ANTENNA ASSEMBLY

All the sub-assemblies are now complete and they are ready to connect together as shown in **Figure 2**

Screw a couple of inches of the 20" long all-thread, **G**, into assembly **E/F**. Cut off about a 1" piece of someone's small air hose -- with a flat washer on each end of the air hose, pop these parts over the upper end of the all thread ... then install the cap nut (or jam-nuts) **D** firmly onto the top end of the all-thread drive rod. This will prevent the coil from shooting out to the moon if the if the UP switch is accidentally held on too long. It is advantageous to coat the all thread very lightly with Anti-Seize Compound **NAPA No. 765-1151.** Last step here --- spin the cap assembly up the rod until it is stopped by the hose/washer assembly.

Push, or drive, the PVC cap into the bottom of the coil form. It is suggested that PVC glue **not** be used on these connections ... if there is any doubt about the cap coming out, drill and tap and insert a headless set screw.

Before installing the all-thread into the screwdriver chuck, make another air hose\washer assembly and slide over the lower end of this drive rod. Position the top of this assembly 15" below the lower end of the pipe cap assembly **E,F** - now install a couple of jam nuts below the hose\washers. When the jam-nuts are secured, run about 6" or more of the all-thread up into the coil form.

Place the lower end of the all-thread into the cordless screwdriver chuck, drill thru the previously drilled holes in the chuck and thru the all-thread ... secure with a cotter pin.

Lay the lower mast on the work table and from the bottom, shove the entire - **Figure 2** - assembly inside until the PVC motor mount part **J** is about ½" inside the lower mast section. The coil should be sticking out of the upper end of the pipe, past the finger stock.

Next, shove in the assembly **K L M** until the shoulder of the PVC bushing is tight up against the lower end of the mast. Now before doing anything else, ---> about 3" inches up from the bottom of the mast, drill and tap a 6-32 hole thru the mast and into the inside PVC **J** --- insert a 1/2 long inch screw. This screw holds the entire inside assembly in place from now on.. Around the bottom of the metal mast, drill and tap 3 holes spaced 120°, -- insert screws thru the mast and into the copper adapter Part **L**.

Be absolutely sure that there is electrical continuity between the 2" main mast and the piece of 3/4" copper pipe that is going to fit over the antenna mount stud. We have seen some installations that had jumpers installed between the bottom mast and copper pipe ... play it by ear.

This completes the antenna assembly To check out mechanically, apply 12V DC to the motor power leads, alternately reversing polarity, to observe the coil moving up and down.

TOP WHIP

Chart I (1) shows the approximate coil position for the various bands when using a 66" top whip. -(surplus CHP)-- If you are a little jumpy about the over all length, during tune up do

this: Run the coil way up until just the **bottom** two turns of the coil are contacting the finger stock. Now select a top whip length which will resonate the antenna at the lowest 75/80 meter frequency you plan to operate. The hams who do not use 10 meters are using the longer stainless steel CB whips for the top section -(96 to 108")-. With the longer whip on 75, about 25 to 30 less turns are used on the loading coil ... also about 3dB of field strength will be gained.

ANTENNA MATCHING Unless you fully understand Chapter six of Maxwell's book REFLECTIONS

Do not, under any circumstances, attempt to operate this all band antenna without proper impedance matching at the antenna base. HF Mobile antenna matching is covered in the ARRL publications: **ARRL Handbook; ARRL Antenna Book; ARRL Antenna Compendium- Vols I & II & III** and very explicit in Maxwell's book **REFLECTIONS**[8]. One of the best explanations is contained in an April 1981 **QST** article by Andrew Pfeiffer, K1KLO

NOTE 10 THIS SHOULD BE REQUIRED READING FOR ALL MOBILEERS!

As with any good HF Mobile antenna, the base impedance is much less than 50 ohms -- the lowest on 75M -- higher on the higher bands. Also the better the antenna - the lower the base impedance. Install a switchable/adjustable impedance matching network at the very base of the antenna which can be selected when changing bands. For real convenience, wires can be picked up from the transceiver band switch to do this automatically; Fig 5 my QST article. Again, it cannot be over emphasized, do not mess with the auto-tuner in your rig unless you understand Maxwell. **The mobile antenna must always be *resonated* first.**--Then we go about matching. From the majority of the phone calls I get, I think we better stay with the following method. Also look at my little note using the MFJ-247™ or MFJ-249™, on page 39.

BARE BONES BASE MATCHING DEVICE

A very practical, simple and effective matching device is shown in **Figure 10** on the separate supplemental cover sheet titled CONTINUOUS COVERAGE HF MOBILE ANTENNA The matching unit can even be mounted *inside* the antenna; inside the base or in a small box as shown in **Figure 10.** Regardless of what you may read in other articles, this antenna will remain matched with *one* setting of the matching capacitors, regardless where you move the antenna on your vehicle. We move antennas from car to car, to different positions all the time.

Repeating -- mount the Matching Network as close to the base of the antenna as possible ---- inches --- *and no shielded wire or co-ax between the 'matcher' and the base of the antenna.*

FULLY AUTOMATIC ! RESONATOR and MATCHER *TENNAMATIC*

However, as long as we are really enjoying all-band mobile, leaving the appliance operators setting there on one band on one frequency, let's really go for it! Once the antenna is moved into the approximate `band-area' on the all band coil, the antenna re-resonating adjustment can be fully automatic ... the antenna resonates and is flat before you can complete your call sign! If you had absolutely NO junk box parts, it would still be surprisingly cheap. This unit also mounts at the base of the antenna; it is small enough to mount right inside the antenna base mount.

Best system: --> A&A Engineering has a high quality kit, (or just boards-MilSpec-Type) for fully automatic control. **NOTES 1, 2, 3 and 4** These systems are controlled from the cockpit as bands are changed. Parts sources are listed in **NOTES 5 thru 7.**

If you have already built the unit from the October 1982 **QST**, or the July 1979 **73**, you can use it on this antenna -- with one modification; to drive the Cordless Screwdrivers, replace the TIP-32's (Q 1,2,3,4) with the higher current TIP-105's in the same sockets ... no circuit changes. A & A kits now supply the TIP 105* (or leave the TIP 32s in and use the circuit in fig 4 of my Oct 1982 QST article - I prefer installing the relays [Radio Shack #275-248].

INITIAL TUNEUP CHART I (using 66" top whip)

This is going to be the easiest HF Mobile antenna that you have ever attempted to tune up. Once the base matching section is installed and adjusted, minimum effort is required to get this antenna on the air. Mount on the vehicle and if you plan to use 10 meters, run the antenna motor to position the loading coil where the finger stock just touches the top coil turn. ... adjust the length of the top whip to resonate the antenna for ten meters. *Do not do this if you are not interested in the ten meter band..* No external matching is necessary on 14 MHz and above. You will find that it will go down to absolutely 1:1.

The following procedure is for a 66" top whip using the matching section, at the base, shown in **Figure 10**: Select the 75 meter position (K1 energized). Tune the **receiver** to the middle of the **75** meter band -- turn up the receiver RF and Audio gain; run the antenna motor to position approximately 12½" of the coil windings above the finger-stock; there will be no question when the coil reaches that area --- the receiver noise will increase significantly. Now you can apply a low power carrier and tap the UP/\DOWN switch gently to achieve minimum SWR ... for this **-lst time only-** tune up, **C1** is adjusted to bring the SWR to 1:1 --- The total capacity will be approx **1000pF** or higher .. the coil may require a very slight readjusting with the motor.... yes, it will drop right down to the zero pin. If it don't, you goofed somewhere --- start over. **40** meters is adjusted exactly the same way; De-energize K1, energize K2; run the coil down with the motor to approximately turn 41 from the top; the receiver noise will peak, then zero in the same way with the transmitter and adjust **C2.** C2 WILL BE SOMEWHERE NEAR 500pF. The capacitors will never have to be adjusted again. For 20 meters and above, both relays are de-energized ... find the coil area with receiver noise and then make fine adjustments by applying carrier then raise or lower the coil for 1:1 on the SWR bridge. The high frequency bands take very little tweaking ... just tap the switch **slightly.** *repeating -- DO NOT, under any circumstances, operate this antenna without proper feed point matching.* (75 & 40) **To some readers this may seem a bit severe; don't worry about it now) The *antenna* must be resonated to your operating frequency by moving the coil to the proper position.** Refer to **Chart I**

CLEANUP and TIPS

No details are given relative to making the electrical connections to the motor power leads or the method of firmly securing the PVC parts. An accident may make it necessary to disassemble for repairs, so PVC glue is not a good idea. On units that did not appear secure, we drilled and tapped and inserted 6-32 set screws. These are all basic operations and many of us have our own pet procedures.

A word or two about the escutcheon pipe --- this pipe looks similar to the chrome drain pipe that you see under some sinks. The longer lengths are more normally used as decoration to cover plumbing etc that may run thru a living area. Some is used on antique toilet tanks that are placed high on the bulkhead -- where you pull the chain. Some is chromed -- some is polished brass .. The outside dimensions seem to be the same on the various types altho the wall thickness varies. The larger hardware supply houses in our area carry all types. A number of hams opted for thin wall copper pipe rather than brass or aluminum.

Be absolutely sure that the corona ball is on the antenna tip or there will be fireworks that cause all sorts of mysterious things to happen.

COIL POSITION INDICATORS

You will find that remote coil position indicators are not necessary if you listen for noise on the desired frequency while running the antenna up and down. However, if you want a little gingerbread, let your imagination be your guide. K1KLO QST April 1981, installed a solid-state digital readout to show frequency; really neat. [10]

Or how would you like this ----> We have all seen a drooping loop of water-filled hose to match levels across a foundation or lot. My antenna test vehicle uses that method to indicate the DK[3] coil position (band). Quarter inch transparent tubing is used: One end is taped up alongside the windshield post ... the tubing goes down through the floor boards, under the vehicle, up between the inner and outer walls of the pickup box and then the far end is hooked

to the bottom of the coil weather shield. (next section) With the coil fully raised in the 75 meter position, water is fed into the tubing until the water level reaches the upper part of the windshield. Place a mark on the windshield or tubing for an index to mark "75". As you move to the higher frequencies, the tubing will droop as the coil shield descends --- the water level on the windshield goes down correspondingly --- place other indices for your favorite freqs. When everything is in place, inject a half eye-dropper of food coloring. Real high tech!
One of the Southern U.S. *Screwdriver Net* members WB5BBP reports using a TV rotor control box as a position indicator --- as the antenna goes up and down, the control box clicks accordingly to indicate band\frequency on the dial -- memory, too, eh! Another hi-tech method was demonstrated --- as simple as looking in the rear view mirror!! Again, GoFerIt.

From N9JMX Nov. 92: A motor connected in parallel with the antenna motor. This motor turns one revolution per full movement of antenna. The motor mounted at the operator position turns a disc which is inscribed with antenna positions/frequencies.

From N7GID Nov. 92: Connects a MFJ-247™ to the antenna thru a co-ax switch. The MFJ-247™ passively indicates exact resonant freq of the antenna .. displayed on LCD readout.

PROTECTING THE COIL

Good old pure rain water does not seem to hurt the coil at all and we don't even have much of that in our part of California. However, road film (grease!), bugs and particularly ice and snow sure louses up mobile antennas. We were down at the corner convenience store and setting by the cashier was exactly what we needed! There were various lengths of plastic tubes, complete with caps, that dispensed ropes of beef jerky. We made off with the long empties and whacked off 18" long pieces. A 3/8s hole was cut in the center of the top end cap, the cap and tube were placed over the top end of the coil. The plastic tube rides up and down with the coil and extends down over the lower mast. The Tap-Plastics store sells a very light, correct diameter, tube with end caps. Also blueprint supply houses stock these lighter enclosures. Oh, use both end caps --- cut the hole in the lower cap so it freely slides over the 2" base section --- that sorta keeps the bottom from banging around. At press time: K6RRC picked up two 1.5 liter bottles of Spring Water at the super market. Cut the bottoms off, then the two serrated bottles snap together --- great! Cheap!

Sure hope this paper gave you some great ideas and it certainly beats running around with

A Dummy Load on a Stick!

During the many months of developing and helping build the first few score of these antennas; my deepest appreciation for the unfailing continued support, suggestions and environmental testing by my friend and neighbor, Tom, AA6VK

And --- of course --- none of this development over the past few years would have been possible without the sincere support of my XYL - Letha, W6HMD. Suggestions, errand running, parts procurement and encouragement -- not complaining too much when I'm caught dipping into the `sugar-bowl` for supporting cash --- and it's taken a lot of it.

There are still some callers out there who neglect to practice simple telephone etiquette. For those few, we wish they would preface their message with an ID, otherwise the phone may go back on the hook. That is about the only way to screen calls from solicitor pests. Hams? Welcome! cuz we can usually pick their brain!

The 1st DK[3] in 1990. The first public disclosure of this design is dated 18 March 1991.

NOTE: A patent search revealed a similar antenna was designed in 1927!

LATE FEEDBACK

Early 1993

Questions received via land line and mail prompts the following:

The length of the lower mast: Changing the lower mast section from 5 feet to 3 feet only results in a 1dB loss in field strength.

The length of the top whip: Changing the top whip from 66" to 102" increases the field strength 3dB. The longer whip limits the upper frequency band the antenna will reach.

Dumb trouble: For reasons explained earlier in this book, I suggest: *Put the AAQ assembly impedance matching device within inches of the antenna base.* What do I discover? Troubled rigs roll into the yard with the matching unit mounted almost anywhere --- yes, yards of wire threaded all round the trunk and under the vehicle. Please don't do that. Go back to Maxwell's book. Do not use any co-ax or shielded wire between match and antenna.

How about the shorted turns inside of the lower mast? This question keeps coming from supposedly knowledgeable antenna gurus. There are no shorted turns -- they are not coil turns anymore when they disappear below the finger stock. That part of the coil becomes part of the mast. It is *NOT* the same as shorting out turns on a coil with a jumper. The extremely high capacity between the submerged turns and the mast are practically a RF short.

Horizontal installations. The antenna appears to work OK mounted horizontally on RV's. Just remember one thing --- proximity of vehicle metal to the lower mast has minimum effect, however, be sure there is maximum possible clearance for the top whip. The more successful RV horizontal installations are arranged so the top whip is slanted up and away from a metal roof --- go for the max legal height at that end. KL7JHR slopes his antenna so the tip of the top whip is at maximum height. On my El Camino the so called, top whip, sticks out over the pickup box -- with that configuration we do not have to get out of the vehicle to drive in the garage. Keeping the top whip clear also means; no metal brackets, wire guys etc in the near vicinity of the upper whip. Pieces of PVC pipe and fittings make good support hardware.

Grounding the transceiver to the firewall with low inductance braid/strap important ... that's why that ground post was put on the rig. The same important type of ground is needed at the matching unit ... don't hang on a long wire and call it a ground just because the other end is grounded. Besides a good connection to the vehicle body, follow thru by shortest possible route, from that point to the main frame.

The active part of the coil must clear the highest part of the vehicle by at least 12 inches. The best rule to follow on mobile installations is to go for every inch of height possible.

+ + + +

Well, It happened again. Just as we were getting this wound up to go to the printers another land line came in. Question: *How much do I have to lengthen my lower mast section on my DK³ to go down the band 100kc on 75 meters?* Wow! That was addressed on page 49 of this manual. Since there is some room left on this page, here the answer is again: FORGET IT! You are working on the wrong end of the horse. The only practical way to move the center loaded 75 meter mobile antenna frequency is to 1. Change the length of the TOP whip. or, 2. Change the number of turns on the inductor. --- Now you can thumb back to page 49 for the rest of the story.

OTHER NOTES: I keep yakking about AUTOMATIC RESONATOR. Do not confuse RESONATOR with tuner. A mobile antenna first has to be RESONATED, then you Tune and Match. The TENNAMATIC at the base of the antenna automatically resonates the HF Mobile Antenna. It is NOT an antenna tuner. If you install and operate this antenna without the TENNAMATIC, you RESONATE it with a manually operated switch. Using my system, the antenna is matched at the original installation only --no grabbing for knobs and buttons.

Quick Disconnects. To quickly break down the DK³ (removing the top whip from the top of the coil) for storage in the vehicle, we have found the Hustler **QD-2** as the most reliable and convenient Quick Disconnect. Electrically & Mechanically superior.

Available 1-800-727-WIRE

PARTS LIST FOR BIG DK^3 CONTINUOUS COVERAGE HF ANTENNA

Qty	Part	Description
1	C	22" piece of 1 ½" Schedule 40 PVC (white) plastic plumbing pipe -
1	J	piece of same PVC, 5½" long
1	E	PVC cap for 1" sked 40 PVC pipe -slip-
1	B	PVC bushing 1¼" slip to ½" NPT
1	K	PVC bushing 1½" slip to 3/4" NPT
1	F	¼ by 20 (inside threads) KNIFE-THREAD WOOD INSERT -see text
1	G	20" piece ¼" x 20 all-thread - steel or brass
1		7 inch length 0.005" brass shim stock or Finger-stock (see text)
1		36" length of 2" OD Brass escutcheon pipe \or aluminum or copper
1	M	2½" piece of 3/4" type M copper pipe
1	L	copper adapter - 3/4" male NPT- to 3/4" -solder- for 3/4" copper pipe
1	A	brass pipe bushing - ½" to 1/8" NPT
75ft		#16 bare tinned solid copper buss wire Note 11
1		5 to 6' or more, stiff upper whip - (see text)
1	H	SKIL TWIST Model 2105 Cordless Screwdriver
		or *True Value* MASTER MECHANIC Model 8521
1		4 to 5Ω WW Resistor - 10 to 20 watt

These are all the main parts .. a few screws are needed

Notes

[1] Don Johnson, "Build a Weird 2-Band Mobile Antenna" 73, Oct 1976, p.20

[2] Bruce Brown, "TennaMatic:An Auto-Tuning Mobile Antenna Tuner, " 73, July 1979, p. 132

[3] Don Johnson, "Mobile Antenna Matching --Automatically!" QST, Oct 1982, p. 15

[4] Don Johnson, "40 Years of HF Mobileering: Antennas- Installations - Tuners" $15. -out of print 8/1992- Box 595 Esparto CA, 95627

[5] Editor's Note: Capacitors - Types 302 through 306 from Allied Electronics, 401 E 8th St Forth Worth, TX 76102
or
HSC Electronic Supply 4837 Amber Lane Sacramento CA 95841
or
3500 Ryder Street Santa Clara CA 95051
HSC also stocks Finger Stock
1-800-442-5833

[6] Toroid T-108-2 available from Amidon Associates, Box 956, Torrance CA, 90508.
(213) 763-5770
FAX (213) 763-2250

[7] PCB boards available for Tenna-Matic: A&A Engineering, 2221 W. LaPalma #K, Anaheim CA 92801
(714) 952-2114 FAX (714) 952-3280
Their boards #191 & #192.
Kit of parts also available.

[8] REFLECTIONS
by M Walter MAXWELL W2DU
an ARRL Publication

[9] Digi-Key Corporation
701 Brooks Ave South Box 677
Thief River Falls MN 56701-0677
Cat # RLC05-ND Sub Cub D
LCD Bi-directional module - 8 digit
-(order the PCB & Bezel that goes with it)-

[10] QST April 1981, page 16

[11] A wire source:
WireMan 1-800-727-WIRE

[12] Circuit Specialists Inc
PO Box 3047 Scottsdale AZ 85271-3047
~~1-800-528-1417 FAX 602-464-5824~~
Authors favorite supplier.

[13] Finger Stock --
Bob Denniston
21970 Kern Road
South Bend IN 46614
1-219-291-0252

[14] Aluminum Tubing Pt# 6063-T832
Texas Towers 1108 Summit Ave Suite #4
Plano TX 75074
1-800-272-3467 214-422-7306 FAX 881-0776

Instrument Specialties
Finger Stock #0097-0320-02
-no address 1 Jan-wait....

A--1/8" to 1/2" BRASS BUSHING
B--½" NPT to 1¼" SLIP PVC BUSHING
C--1½" SKED 40 PVC by 22" long
D--¼" CAP NUT
E--1" PVC (slip) PIPE CAP
F--1/4 x20 Wood Insert-C Text pg 7
G--20" of ¼" by 20 ALL-THREAD
H--CORDLESS SCREWDRIVER
J--1½" SKED 40 PVC 5½" long
K--3/4" NPT to 1½" SLIP PVC BUSHING
L--3/4" COPPER PIPE ADAPTER
M--2½" of 3/4" TYPE M COPPER PIPE

--and-- 6½" FINGER STOCK \ commercial or home made..see text.

--also-- 75' #16 BUSS WIRE FOR COIL

CORDLESS SCREWDRIVER is either *SKIL TWIST Model 2105* or a *True Value-MASTER MECHANIC Model 8521*
To operate from 12V vehicle battery - remove switch & batteries - replace batteries with 5-ohm, 10 to 20 watt WW resistor

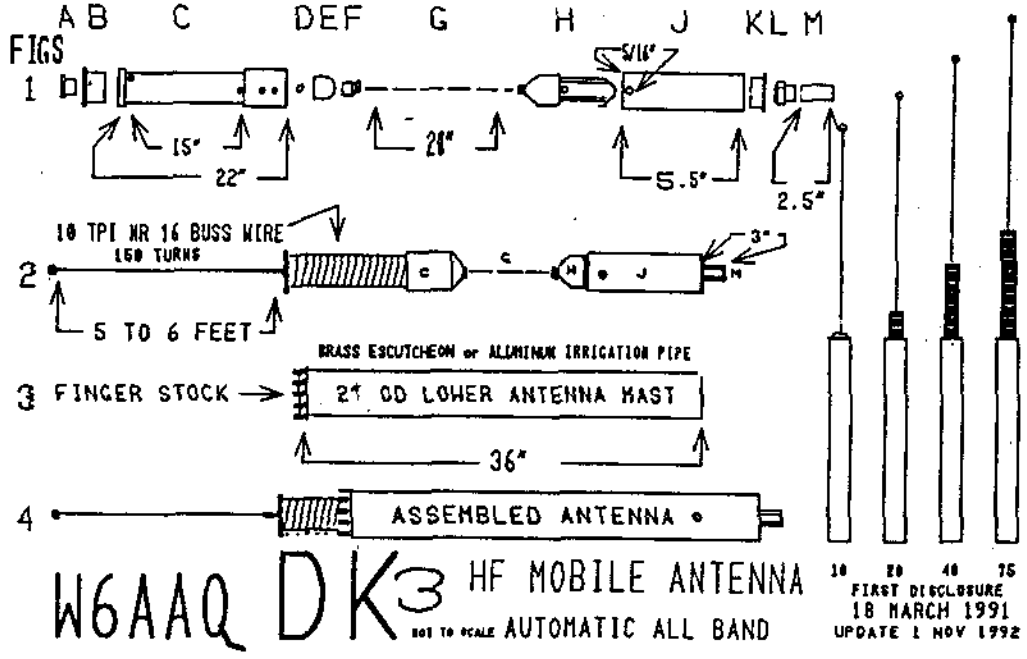


FIGURE 5

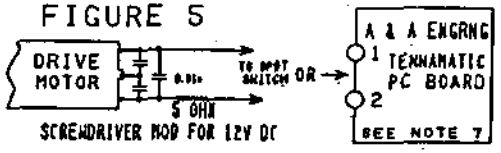


FIGURE 6

FIGURE 7.

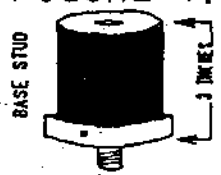


CHART 66" WHIP I

FREQ	TURNS
10 MTRS	NONE
15 MTRS	7 +-
20 MTRS	10 +-
40 MTRS	40 +-
3.900 mHZ	125 +-

THE REAL TRUTH IN MATCHING HF MOBILE ANTENNAS

It is very disturbing to read HF Mobile Antenna articles which infer it is not possible to achieve an absolute perfect match at the feed point of the antenna. There is no reason not to be able to complete a match on all bands before a cup of coffee cools.

Other inferences, that the antenna could be mounted too high or too low on a vehicle for a perfect match. Nothing could further from the truth! The picture and caption on page 50 of Worldradio August 1992 is rather shocking and conceivably could discourage some from even attempting HF Mobile.

A proper matching device installed at the base of a HF Mobile Antenna usually will not have to be readjusted ***regardless of where the antenna mount is located on the vehicle.***

This has been demonstrated by welding a clamp on an antenna mount and attaching it at various locations. Refer to the sketch on the next page. **First** you must be properly set up by following a few simple rules.

1. You must have a decent HF Mobile antenna. Not a Dummy Load on a Stick.
2. Obviously the best place for the antenna mount would be dead center on top of the vehicle roof but go ahead and put it anywhere you wish. [really - where you get permission]
3. As close as possible **INCHES** to the antenna mount, provide a heavy direct ground. If the ground point is to the vehicle skin, bumper, pickup box etc ... connect another lead --- a strap or braid -- from that connection to the vehicle frame. Bodies, bumpers and beds are usually mounted on rubber shock mounts. OK?
4. Provide for a short heavy ground from the ground post on the back of the transceiver to the vehicle ground --- firewall, transmission hump --- also from that point follow through to the frame.
5. If necessary, prepare a base section or an extension for the lower part of the antenna so the loading coil will be above the roof line. Making the base section longer or shorter by 20 to 30% will have very little affect on the 75 or 40 meter Mobile antenna. At 14 MHz and above, you have to watch so the *overall* length of the antenna is not over 1/4 wavelength.
6. It will not matter how close the mast under the loading coil is to the vehicle body. Of course maximum clearance is preferable but don't worry about it too much.
7. IT IS IMPORTANT that the *coil and upper whip* have maximum clearance.
8. If the antenna manufacturer supplied an inductor for a base matching device, throw it in the thrash.
9. Gather up parts and assemble the matching unit shown in Figs 9 &10, pages 77 & 88. This matching unit must be mounted right at the antenna feedpoint. Both leads to the antenna and ground minimum minimum. When using the DK[3] antenna, the entire matching unit, including the relays, can be mounted inside the antenna or the antenna base.

Now you have everything you need. You are ready to tune and match.

For absolute ease and convenience it is great if you have a MFJ-249™ Antenna Analyzer. If one is not available, the transceiver can be used on low power AM

75 meter antenna.

Connect **C1,** from antenna to ground.

A . Excite the antenna with RF at selected frequency; If you are setting up a DK[3] antenna, any frequency in the 75 meter band is ok.

i. Using the MFJ-249, vary the frequency for minimum SWR The built in frequency counter will show the exact resonant frequency.

ii. Using the transceiver on AM, low power, move the VFO for minimum SWR.

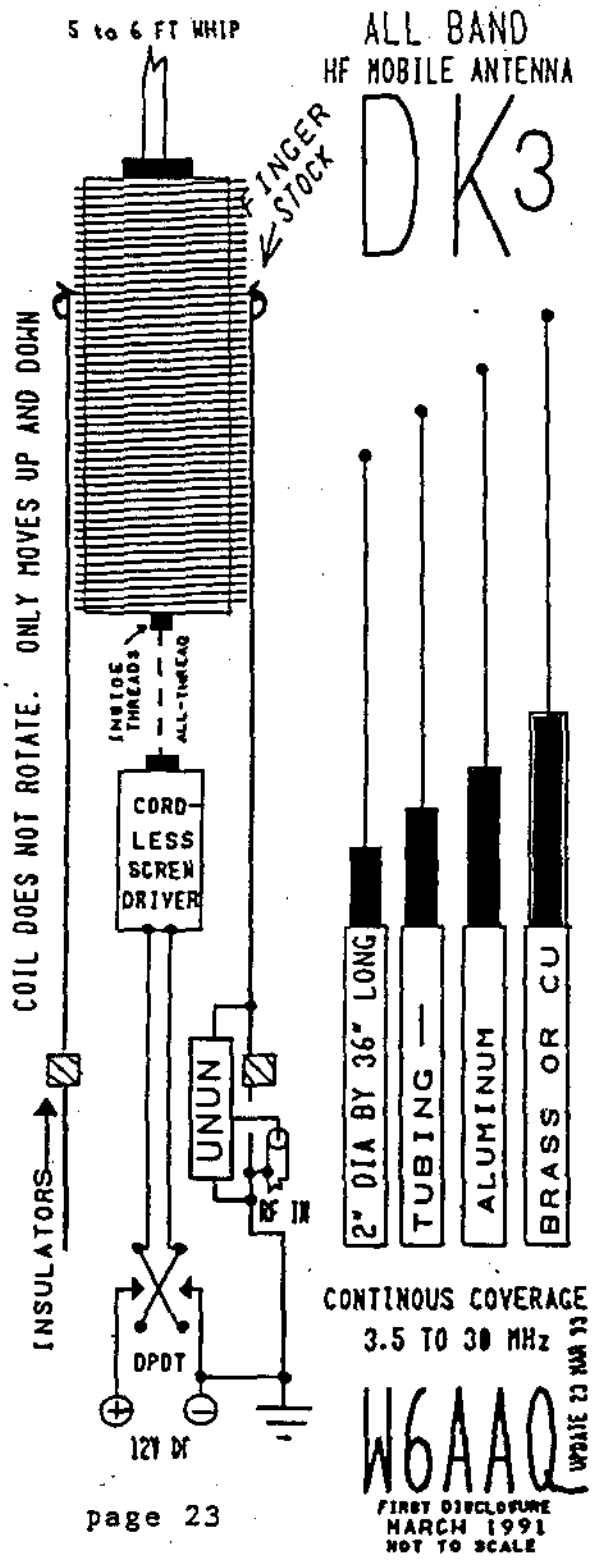
B. With excitation to the antenna, adjust **C1** for 1 to 1 SWR.. As C1 is adjusted, the resonant frequency of the antenna will move slightly; readjust input frequency and re-tweak C1. This is the last time you ever have to make that adjustment.

CONTINUOUS COVERAGE HF MOBILE ANTENNA

ANTENNA RESONATES WITHOUT, TAPS, ROLLER COILS OR OTHER DEGRADING GARBAGE

FIG 9

DK (Don) Johnson W6AAQ



Mobile - RVs - Portable - Motorhomes

Use two as Horizontal dipole.

In use in apartments - mobile home parks - hotels

Continuous coverage ALL frequencies 3.5 to 30. HAM, CB, WARC, MARS, CAP, Commercial, Gov't, Military

QSY to any frequency in any band without stopping or getting out of vehicle.

There is NO other HF mobile antenna that has this capability

Easily assembled, installed and operating in minimum time. No tuning, tweaking or tip pruning. No jumpers, taps, shorted or open turns. No tuner required.

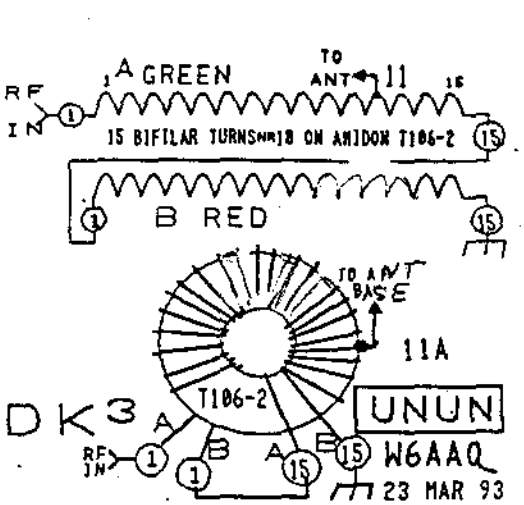
Absolutely 1 to 1 SWR on all freqs with no fuss .. can be automated (voice controlled) within 100 Kz windows when using the tuning unit described in QST October 1982

Lower mast, 3' or more. Top whip, 5' or more. Recommended combination: 3 foot base section; 66" top section for 3.8 to 30 MHz.

All construction parts available at most large discount hardware stores or home improvement centers.

Scores of units in continuous use now into 4th year in all environments ... completely debugged.

Search for an instant band change *all frequency* Mobile antenna with more field strength. We can not find one!



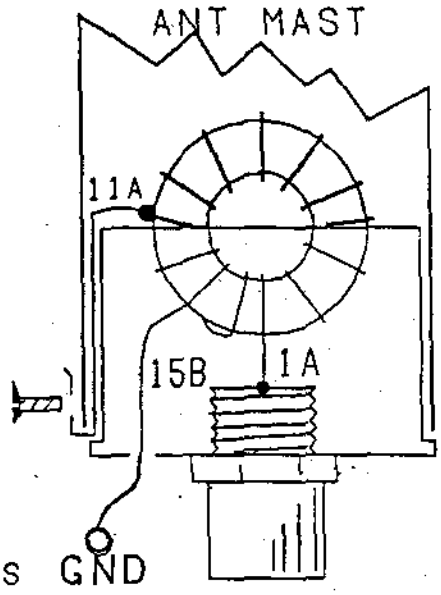
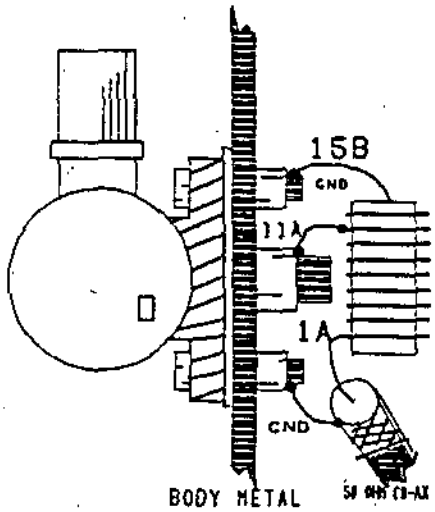
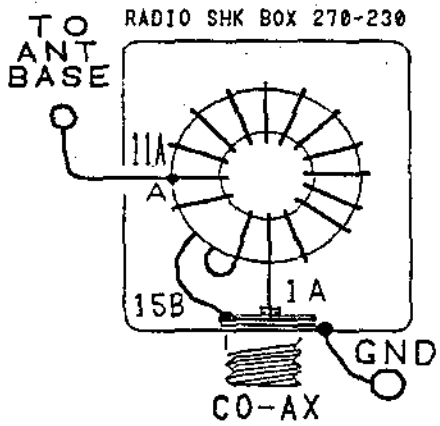


Figure 10 POSSIBLE INSTALLATIONS





10-10-93

Altho we show Tap #11 here, don't hesitate to experiment and fool around with other tap positions. If one tap does not work on all bands for you, go ahead and switch taps with a relay.

Here is the way it tested with the DK^3 on the El Camino

FREQUENCY	11TH TAP SWR
20 Meters	1.20:1
40 Meters	1.10:1
75 Meters	1.00:1

17, 15, 12, 10 & CB band also will come right down if you do this: Use shielded leads for the screwdriver motor power. One end of the shield is soldered to the motor frame and the other end to ground at the antenna base. By-pass both motor brush leads to the motor frame with at least 0.01 discs -- also put one across the brush terminals. Leads to toroid MUST be kept short.

W6AAQ tools around on tap 11 for all bands. Don't worry about a small amount of reflected if you go a bit past resonance. Remember, 1.5 reflected results in less than 0.1 dB loss in field strength. Actually measured on the test vehicle. Refer to Walter Maxwell's REFLECTIONS, Chapter 1, Sec. 1.3 and Fig 1-1

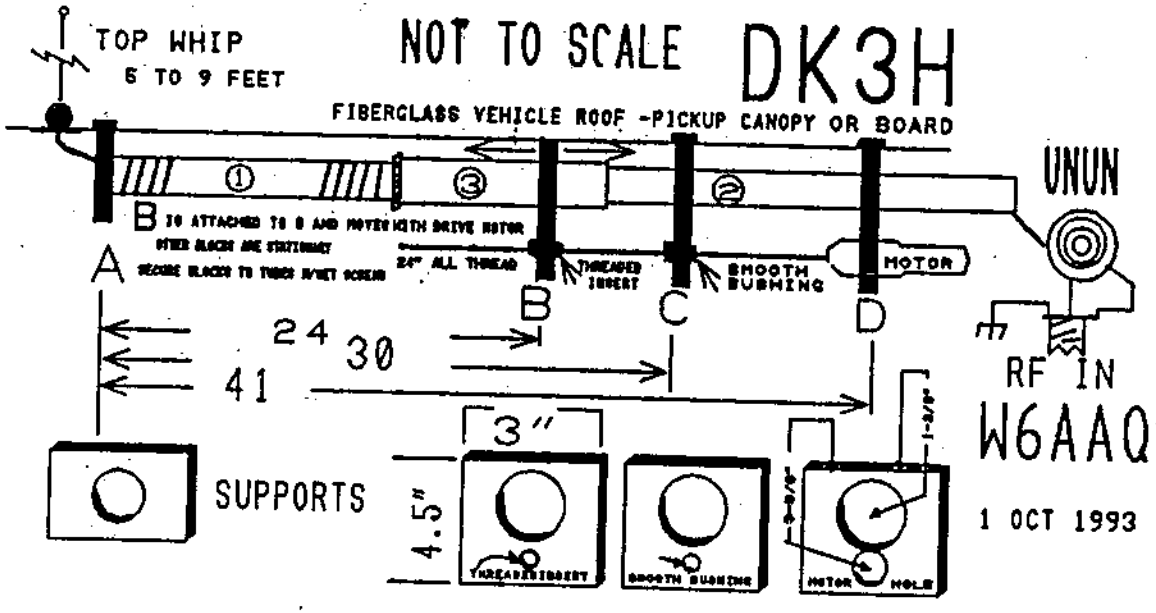
Be sure to read thru from Sec 6.4 to Sec 6.5 concerning Mobile Antennas

If this book is not in your library, you better get it to save hours of frustrations.

Available by mail from W6ACW at (408) 739-6105

W6AAQ HAS BEEN SUPPLYING WOUND TOROIDS FOR $5.50pp. TOROID MOUNTED IN RS BOX WITH PL-239 $10.50pp. W6AAQ BOOK AVAILABLE - - CALL LOU ANN KB6HP (916) 457-3655
26 page manuscript/construction details\available fm W6AAQ $5.00. Box 595, Esparto CA 95627.

21 - 36½



(1) DK3 COIL SECURED IN FIXED POSITION IN END OF 2" ALUMNINUM MAST

(2) STANDARD DK3 LOWER MAST 2" ALUMINUM OR BRASS-.032 OR .050 WALL

(3) 2"· CU TUBING 15" LONG - FINGER STOCK ON ONE END

IN OPERATION (3) SLIDES OVER (1) TO VARY INDUCTANCE

-2" ALUMINUM & BRASS IS MEASURED AS OD. THE CU IS MEASURED AS ID

ARRL
LIFE MEMBER
DK Johnson
Retired USN (Aviation)

W6AAQ Esparto

QCWA #21832
OOTC # 2273
95627 - 0595
26659 Capay Street
Box 595

Big DK³ HF Mobile Antenna

For several years now, hundreds of HF Mobileers are already experiencing the thrill and convenience of operating with this continuous coverage revolutionary antenna. World wide, numerous groups of hams and radio clubs are building and sharing this antenna with enlightened HF Mobileers.

I am not in the antenna business ... retired from manufacturing years ago -- certainly am not a machinist, but sometimes in my spare time I putter around the shop to keep a few antennas in stock. The antennas are not commercial grade, all are prototypes, assembled from materials on hand and are available on a "ham-to-ham" basis when we have the spare time.

For those who cannot conveniently construct their own unit we can arrange to ship one with an aluminum base section and the toroid matching unit (Fig. 10) for $145 US. If a brass base section is desired, add $25.00 The antenna is shipped minus the top whip; see text for suggested lengths. (if parts prices increase there will have to be total price adjustment)

Whatever you do --- the coupling unit must be mounted within inches of the antenna base. I sure have a lot of trouble with the no-code Extras who cannot follow this simple instruction. Install it exactly as I direct and you will not be disappointed; or be getting me outa bed in the middle of the night to answer the land line! -- However, I do have plenty of patience (sometimes!) so if you run up against a problem, don't hesitate to get in touch.

In band automatic resonating is possible with the W6TWW[sk] TennaMatic (see text for kit supplier - **Note 7** at the end of the manuscript). If this is your first experience with HF Mobileering I would recommend starting out with the **Figure 10** configuration --- then after you get your feet wet think about it. Altho I have used the W6TWW TennaMatic since 1974, this antenna is so simple to resonate and match I have abandoned all my units. Some circuit changes have been made to the TennaMatic - - drop a SASE to Box 595, Esparto CA 95627

Oh, and be sure to study the **Notes** at the end of the manuscript. More often than not, we get phone calls and the answer is right there in the **Notes.**

Scores of excellent pictures & some videos have been received from successful builders. If you build this antenna, it would be nice to add pictures of your efforts. The pictures travel with us on our radio club tours.

73 Don

PS: I have been shipping wound coils, complete with end fittings for $35.
My new book is being distributed by *Worldradio Visa\MC AEx*
Call Lou Ann, KB6HP, (916) 457-3655 (promo 12-10-93/dk)

GENERAL INFORMATION

Mobile H.F. operation is far more difficult than base operations due primarily to the "shortened" antennas necessary. Many first time mobile operators become discouraged because their new 80 meter antenna is not a "bolt on and use it" installation as is with two meters or eleven meters, and, the following is intended to help the new H.F. operator get over those first difficulties and enjoy the pleasures of mobile operation.

Remember the basic laws of electricity will always apply, and you will never get "SOMETHING for NOTHING".

Whenever any $\frac{1}{4}$ wave vertical antenna is shortened from its full $\frac{1}{4}$ wave length it is compromised in several ways. Two most important ones concerning mobile operation are:- (1) The radiation resistance is reduced much in proportion to the degree of shortening and the resistance (heat) is increased due to the inductive loading in the coil. The resulting combination (impedence) will be treated under "tuning". (2) The "band width" of the antenna will be reduced.

The antenna mounting location is a very important consideration and good grounding of the mount to the vehicle is crutial. Mounting should not be such that the antenna runs close by and parallel to any part of the vehicles body, for instance, a van or pick-up truck using a rear bumper mount cannot expect to get good antenna performance while the same mount on a sedan will work well. Common sense must be used in selecting the mounting location, ie, the higher and more centered the antenna can be located on the vehicle the better the performance and the easier it will be to "match".

Center loaded antennas are much preferred to base loaded antennas due to improved current distribution.

Fiberglass, low profile antennas will stay vertical at high speeds without guying and also are not damaged by an occasional blow from a limb or overpass.

TUNING MOBILE ANTENNAS

Tuning refers here only to setting the antenna to the desired resonant frequency. This is most easily done by positioning the stainless steel whip into the hollow fiberglass base to the dimension indicated on the tuning chart furnished by the antenna manufacturer. (Warning! Do not overtighten the set screws. If you ream out the hex of the socket the screws will be very difficult to remove). Verify the setting with a dip meter or by checking the lowest S.W.R. at several frequencies. Make adjustments as required by lengthening the tip to get a lower frequency and shortening it to go higher until the resonant frequency (lowest S.W.R.) is where you want it. Important note: "Lowest S.W.R." may not be low enough for operation with solid state rigs. Proceed to "Matching".

MATCHING MOBILE ANTENNAS TO 50 OHMS

If the antenna has shown a S.W.R. of 1.5 to 1 or better no further matching should be necessary for that particular antenna at that mounting position and with that length of coax. However, if the S.W.R. is above 1.5 to 1 there are several easy methods of matching available to you; CAPACITIVE, R.F. TRANSFORMER and a TUNER being most versatile.

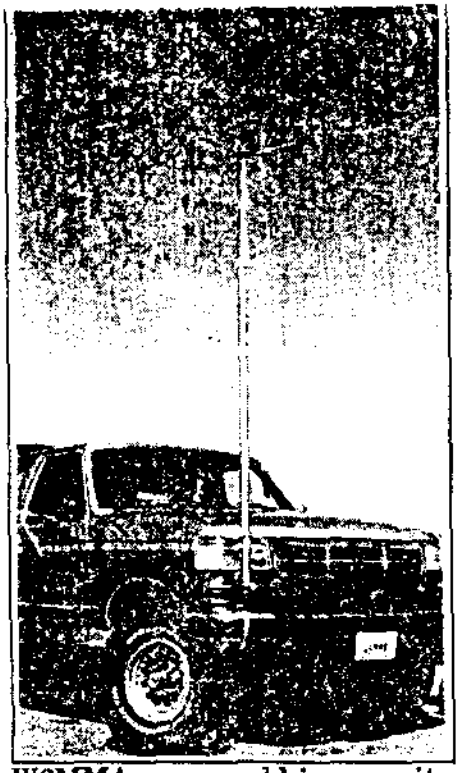
CAPACITIVE MATCHING. For monoband operation or where antennas will not be changed frequently capacitive matching at the feed point is the simplist and least expensive. All that is necessary is a 1000V ceramic or Smica capacitor of the proper value from the feed point to ground. (See Fig. 1 for schematic).

(1) For multi-band operation, a switching arrangement can be made at or very near the feed point with the appropriate capacitive values. 1000 volt capacitors are suitable for 100 watt output. Higher outputs require higher voltage rating.

(2) An R.F. transformer such as the Swan or Cubic MMBX is an excellent method for switching impedences if frequent band changes are to be made. Be sure the transformer is in series with the antennas when thay are being resonated (tuned) and mounted very near the base of the antenna. Information for homebrewing such transformers can be found in QST, page 39, August 1982.

After matching, by methods (1) or (2), a re-check and of the resonant frequency is necessary as they will have detuned the antenna to a slight degree.

(3) A mobile tuner located near the output of the transceiver will also achieve excellent matching with the additional benefit of making much greater band width available without resetting the antenna on 75M and 40M. Your tuner can also be used in series with any of the previously covered matching methods.



W6MMA prepared his capacity hat modified Broadbander BB3 for field strength testing.

—photos by KO6AN

Visalia "shootout"

(continued from page 12)

strength. Each system was tested 3 times and averaged for consistency. On tler and a Hamstick. The results are shown above in decibels. For example a reading of 58.4 is one dB stronger than a reading of 57.4.

Lessons learned? The tunable "high Q" antennas consistently outperformed the nontunable broad banded Hustler and Hamstick. Homebuilts were less consistent with the best unit(with a sophisticated matching network) out performing the field by .5 dB but the last place home brew trailed its commercial counter parts by nearly 2 dB. Jessie has done several additional studies on the tunable antennas with some interesting observations. No one brand of screwdriver antenna is substantially better than the others, but there is a preferred configuration. One achieves up to 2 dB gain in performance by using the 3 foot base with a 102" whip as opposed to the longer 5 foot base and a 60" whip. He strongly recommends the use of an in-line SWR meter mounted where it can be easily seen from the operators position to provide the best match even with changing conditions.

But, there is more to this story than just field strength. For multiple band operation without leaving the car, the clear choice is one of the Don Johnson style (DK-3) tunable antennas that costs about $250 and requires moderately elaborate installations. If you simply wish to try mobile radio without a large investments of time, money or holes in the body of your car then the Hamstick may give you the best bang for your buck. For around $50 you can purchase a magnetic mount and one hamstick and be on the air. I used this arrangement on my trip to the International DX convention and worked seven states, (including Maryland), Canada and Mexico, all with a Solar Flare Index of 74! But hmmm, when the solar cycle gets a little better, maybe I'll want to follow the M.U.F. and switch bands from the car? Maybe that BB3 just might be the ticket for the next trip? Now if I can just figure out how to fill out my log at 55 mph and still be able to read the entry! ...

Entrant	Antenna	Score
W6KKT, Jessie Touhey	Coiled homebrew with capacity hat	58.9 @ 50 W
WA6KHM, Sandford Simmons	Broadbander BB3 102" whip	58.4 @ 50 W
WE6A, Robert Selman	DK3-HOMEBUILT	58.4 @ 57 W
K6UMB, Jay Hughes	California Bugsmasher	58.4 @ 52 W
W6MMA, Vern Wright	Broadbander BB3 W capacity hat	58.3 @ 50 W
AH3I, Carl Severa	Texas Bugcatcher	58.0 @ 50 W
KA7W, Tom Wilson	Broadbander BB3 (90 height mod)	57.4 @ 50 W
K6SDQ, Jim Sequine	Coiled homebrew	56.5 @ 48 W
WA6JPR, Wally Linstruth	Super Resonator Hustler	50.2 @ 51 W
WE6A, Robert Selman	Hamstick	48.2 @ 58 W

the line were bragging rights for the 3 commercial screwdriver Broadbander BB3s, the Texas Bugcatcher (and a modified Bugcatcher called the California Bugsmasher), 3 homebuilts with

Morse code

Joe Sabutis, NWØA

Here is a copy of an editorial that appeared in Omaha, Nebraska's *Omaha World-Herald* newspaper on April 4, 1995. It describes Morse code's link with the current information "superhighway." I feel that the article illustrates quite nicely the place that Morse code has in the history of the information revolution. I am currently using this article when I show students in my Amateur Radio classes the place in the FCC's Part 97 rules that outline why Amateur Radio exists, and why amateurs are allowed to keep and use large portions of the radio spectrum, even as government accountants estimate how much revenue can be generated if the amateur bands were sold.

One of the reasons for the existence of Amateur Radio in the United States is to "...maintain a pool of *trained* operators...." (emphasis is mine). I point out that the "trained" not only means in the technical side, but also trained in various methods of communications. It is to an Amateur Radio operator's advantage, as well as the community in which he/she lives, to be skilled in communicating in highly technical methods, such as packet and satellites, and less technical methods, such as Morse code. It is very reassuring to know that I can communicate by touching two wires together, instead of wasting time looking for a microphone or power to run a computer packet station when a disaster strikes. It is also comforting to know that there are some people, the "*trained* pool of operators," who will be ready and *able* to receive my messages, if the need exists.

I fully support the current "no-code" amateur license, although I feel that the question pool for element 3A does not adequately test on the technical background. The creation of this license class increased the number of Amateur Radio operators by not only introducing younger people in to the hobby, but also people who were too busy with work or family to find the time to learn the code.

As for myself, I would never really consider myself a *real* member of the fraternal organization of amateur operators unless I knew Morse code. By this I mean that I could never consider myself on the same level as the great men and women pioneers whose only option was to use Morse code to communicate. All that separates the "no-code Techs" from these pioneers is the

Jack, W6ISQ (left), and Chen, BZ1HAM, during the DX Forum.

operators present. The situation was dubbed "Six Flags Under Conway." A total of 5000 Europeans made the log.

Contest Forum

The last session of the day was that of the Contest Forum, with Bob Wilson, N6TV, of the Northern California Contest Club, as the coordinator. This year's panel consisted of the usual contest leaders who attend Visalia: Mark Beckwith, WA6OTU; Dick Norton, N6AA; Bob, N6TV; Fred Laun, K3ZO, and Jim Neiger, N6TJ. As in the past, several questions were presented to the panel for their opinion, with the coordinator asking for a vote at the end of each discussion.

The first item was that of the multi-transmitter, single-operator class, in which a new category "multi-single" would be added. Dick, N6AA's opinion was that he thought this type of operating was illegal (simultaneously transmitting on more than one band). It was clarified that this was not the case. The single operator would be running more than one radio at a time. It was felt that if he could operate that way, more power to him.

The next item was WRTC (World Radiosport Team Championship) portion of the goodwill games to be held in Washington, DC, in 1996. The proposed rules require published scores of selected radio contests to establish eligibility of a contestant to represent his country. It was felt that other scores should also be considered, (Sweepstakes of operators from the United States and/or Canada). Fred, K3ZO, had the most logical solution to this, which was to allow each country to decide on its own. Bob then took a vote to see which each panel member thought would be the most important contests to use in this selection. Bob said the right answer (which none listed) was the IARU Contest, which will be taking place at the same time.

Another item was that of reducing the DX window size during the ARRL 160 Meter contest. There are right ways and wrong ways of using the windows, and there would be no fair way of enforcing it. Jim, N6TJ, felt that all windows should be abolished.

The questions and complaints from the floor, some serious, and some not so serious included the following:

- When will the ARRL allow DXpedition scores to be credited with the club scores? This item is presently in committee (CAC) right now.
- What about a Senior Citizen category, 75 years and older?
- Sweepstakes should be limited to 100 watts or less. This one would be too hard to enforce.
- How do you handle a false claim by a single operator that had been heard by other contestants on other bands at the same time?
- The WPX scoring on 40, 80 and 160 Meters is an unfair advantage to those stations operating on the east coast.
- Dick Zalewski, W7ZR, who just recently retired from the Portland area to Mexico, would like to see Mexico added as a multiplier to Sweepstakes. Dick now signs with XE2DV.
- Should 6 Meters be added to the Worldwide and ARRL DX contests? The response to this was favorable.

The forum was concluded with the recognition of Jenny, KD6KKP, for her achievement of completing 600 contacts during the last Novice Roundup. Jenny is only nine years old!

Some people might question how a contest forum contributes to a DX convention. That's a good question as much of the material doesn't necessarily relate to DX. However, remember that most contesters are DXers. WR

The Visalia HF mobile antenna "shootout"

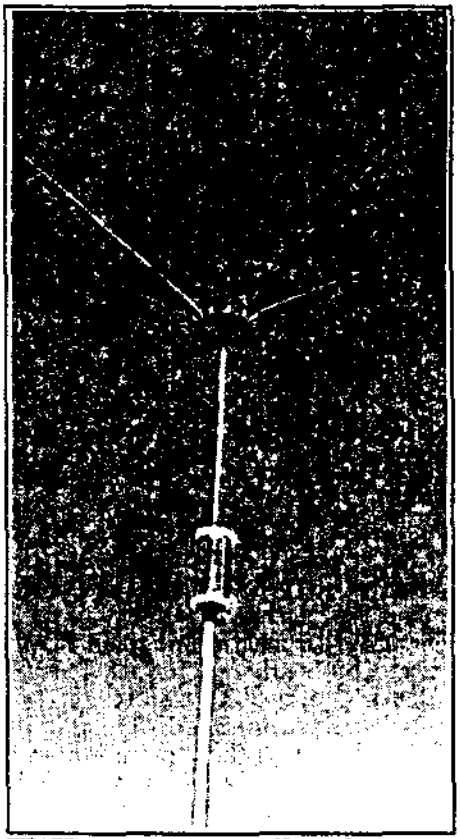
Jerry Levy, KO6AN

What would you do if you were driving to the Visalia International DX convention and wanted make HF contacts in the car and didn't know a thing about it? Go to the 1995 Visalia International DX Convention HF mobile antenna shoot out of course!

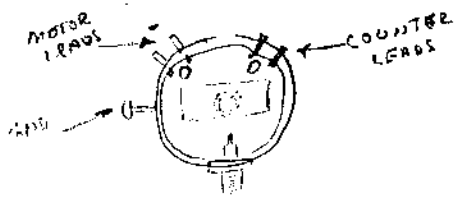
There are so many options facing the new HF mobiler, that frankly I was a little confused about the possibilities. I wanted to make sure that I could choose a system that would fit my needs and didn't have me drilling holes all over my car just to find out that it didn't work well or that I didn't like it. Enter Jessie Touhey, W6KKT, with a passion for HF mobile radio since 1955. Jessie organized a HF mobile antenna "shootout" at this year's DX convention in the shadow of the granddaddy of mobile antennas, a trailer mounted 120 foot tower parked next to U.S. Towers annual Bar-B-Que.

Ten hams drove the vehicles to the same spot to test their antennas against everyone else in a scientific test to see who radiated the most power from their set up. The rules were simple, power out- 50 watts measured in line with the antenna with an RF 3000 meter, no antenna greater than 13'6" in height and the set up had to be truly mobile (i.e. operational at highway speeds). The readings were taken by a custom Signetics Devices field strength meter across an open field one half mile away. Each contestant's 50W carrier was received on a ferrite magnetic antenna, run through a preamp and read out on an digital volt meter for its relative

(please turn to page 14)



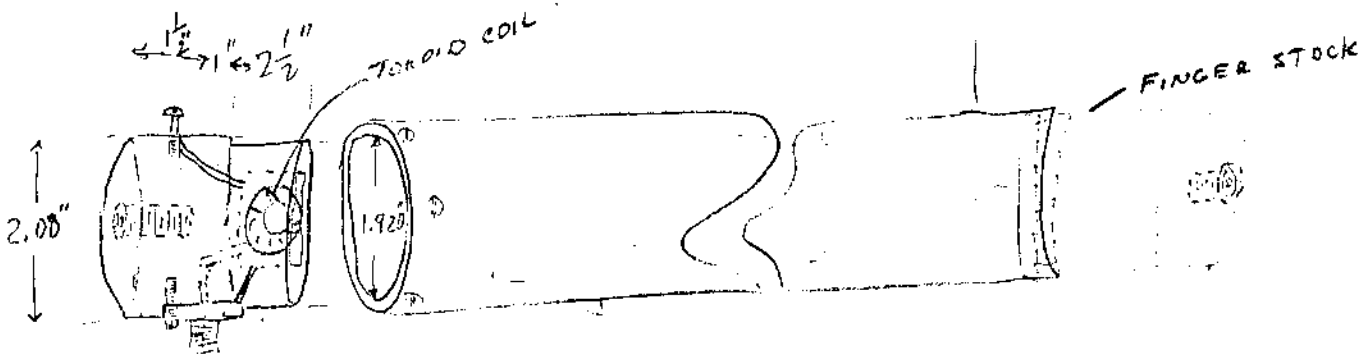
W6KKT custom coil and capacity hat.

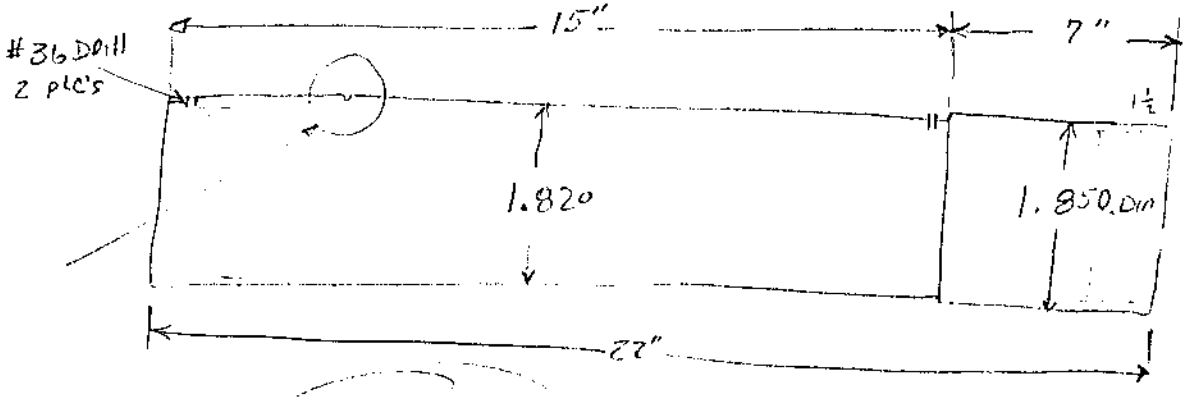


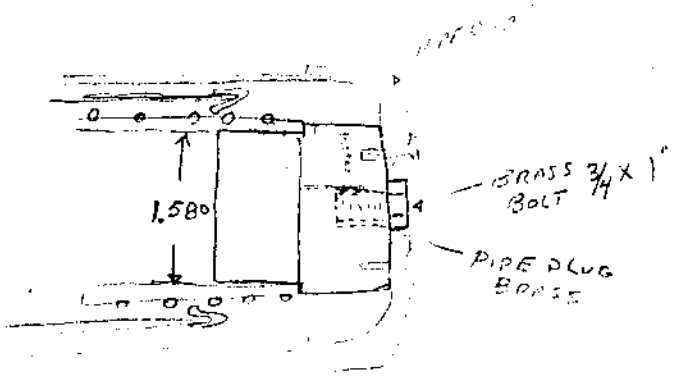
5"

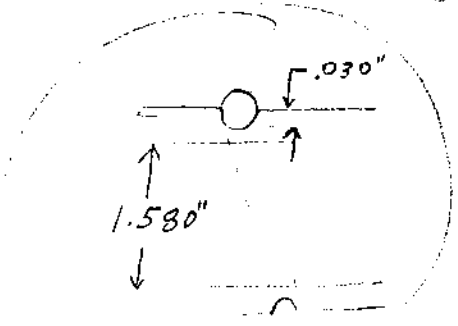
1.812
40
1.852

PLASTIC
1.50
5.00
2.5"
9.00
.54 inch









SCREWDRIVER ANTENNA
PARTS AND PRICE

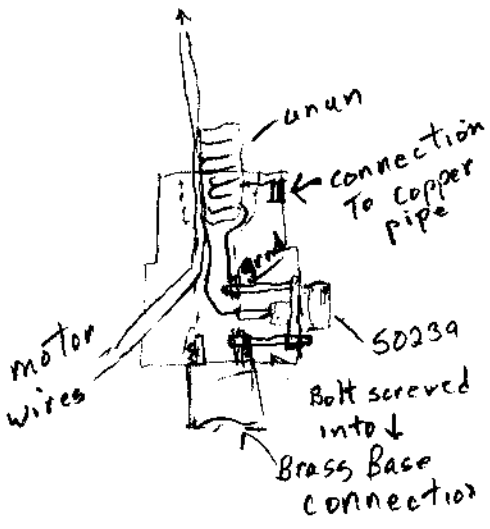
	MAT'L COST	ONE ANT.
A- 1/8" TO ½" BRASS BUSHING	1.61	1.61
Eagle Hardware		
B- ½" NPT TO 1 ¼" SLIP PVC BUSHING	.75	.75
Eagle Hardware		
C- 1 ½" SCH.40 PVC X 22" LONG 10 FT.	4.92	1.64
Eagle Hardware		
D-1/4" CAP NUT (SHAKE PROOF W/ NYLON INSERT .10)	.50	1.00
Eagle Hardware		
E- 1" PVC (SLIP) PIPE CAP	.32	.32
Eagle Hardware		
F- ¼ -20 WOOD INSERT-C TEXT PG 7.	.40	.40
Eagle Hardware		
G- 20" ¼-20 ALL THREAD ROD.	1.75	1.75
Eagle Hardware		
H- CORDLESS SCREWDRIVER SKILL	17.93	17.93
Eagle Hardware		
K- ¾" NPT X 1 ½" SLIP PVC BUSHING	.85	.85
Eagle Hardware		
L- ¾" COPPER PIPE ADAPTER	.94	.94
Eagle Hardware		
M- 2 ½" OF ¾" TYPE M COPPER PIPE		
Eagle Hardware		
6 ½" FINGER STOCK 16" Purchase Length	12.16	7.00
Instument Specialties 505 Porter Way Paceentia Ca. 92670 714-579-7100		
75' #16 TIN PLATED BUSS WIRE 1000 ft	89.47	7.50
75 INCHES # 18 WIRE 60" 80 FT INC.		
The Wireman 261 Pitman Road Landrum Sc. 29356 1-800-727-wire (ordrer) 1-800-442-5833		
BRASS HAND RAIL 6 FT.	34.00	18.36
Eagle Hardware		
5 OHM 10 0R 20 WATT WIRE WOUND RESISTOR	1.50	1.50
Hoesfelt Electronics 1-800 524 6464		
3 EA. .01 CERAMIC CAP'S	.11	.33
Radar Electric		
1 EA. WHIP STAINLESS STEEL 55" OR 102"	14.95	14.95
1 EA. TOROID AMIDON T 106-2	2.71	2.71
1 EA. TOROID AMIDON T 94-2 Motor leads(if needed)	1.50	
P.O. BOX 25867 SANTA ANNA CA. 92799 1 800-898-1883		
1 EA. 2" PVC SOLID9" LONG	6.44	
Caddilac Plastic 18292 Andover Park West Seattle,Wa. 98188 927-4861		
Switch Motor # 275-710A		
Radio Shack		
Brass Washer 3/8 x 1	.66	
Eagle Hardware		
Brass Screw 6-32 x 3/8 FH 6 ea.	.11	
Brass Screw 10-32 x 1/2 FH 4 ea.	.16	
Greenthumb Hardware		
2" PVC Pipe Cap Slip 1ea.	.57	.57
2" PVC Pipe 20 "	.80	.80
		80.91

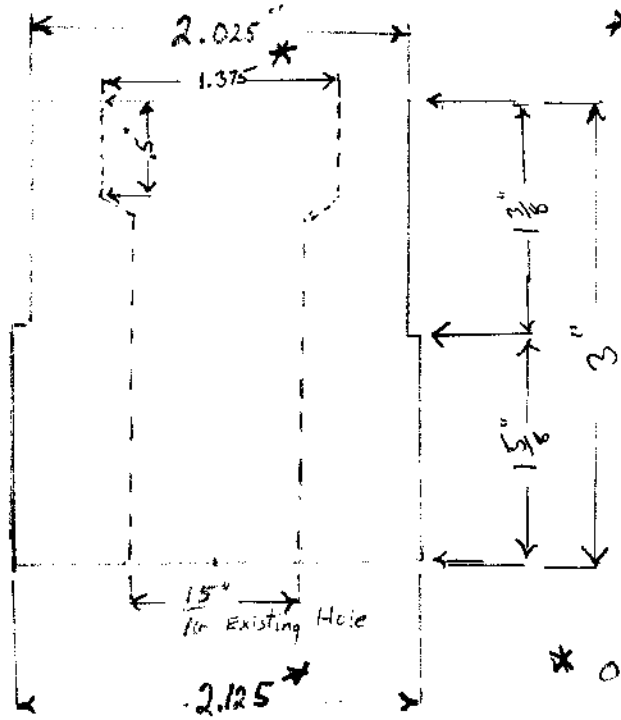
This would work Goos

24V gearhead motor Princess Auto #0756650
$7.99
(requires gear mod to set speed at 120rpm) ← simple!

Plastic Fittings For DK 3

Base

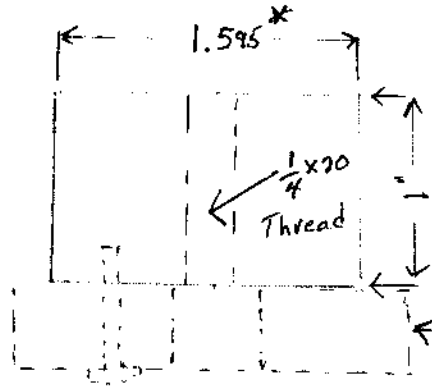




* inside dia. of copper pipe

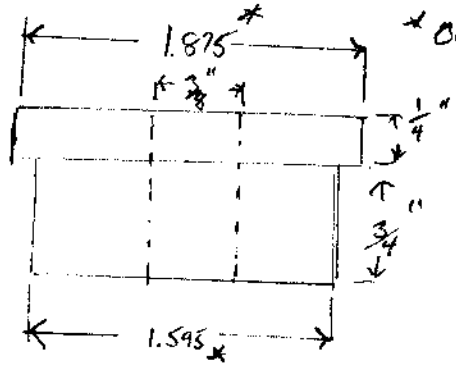
* outside dia. of copper pipe

Nylon Bushing
(Drive Bushing)



* inside dia of Sked 40 pvc pipe (turn to press fit.)

Top Bushing
(white urathane)
(antenna Support on top of coil)



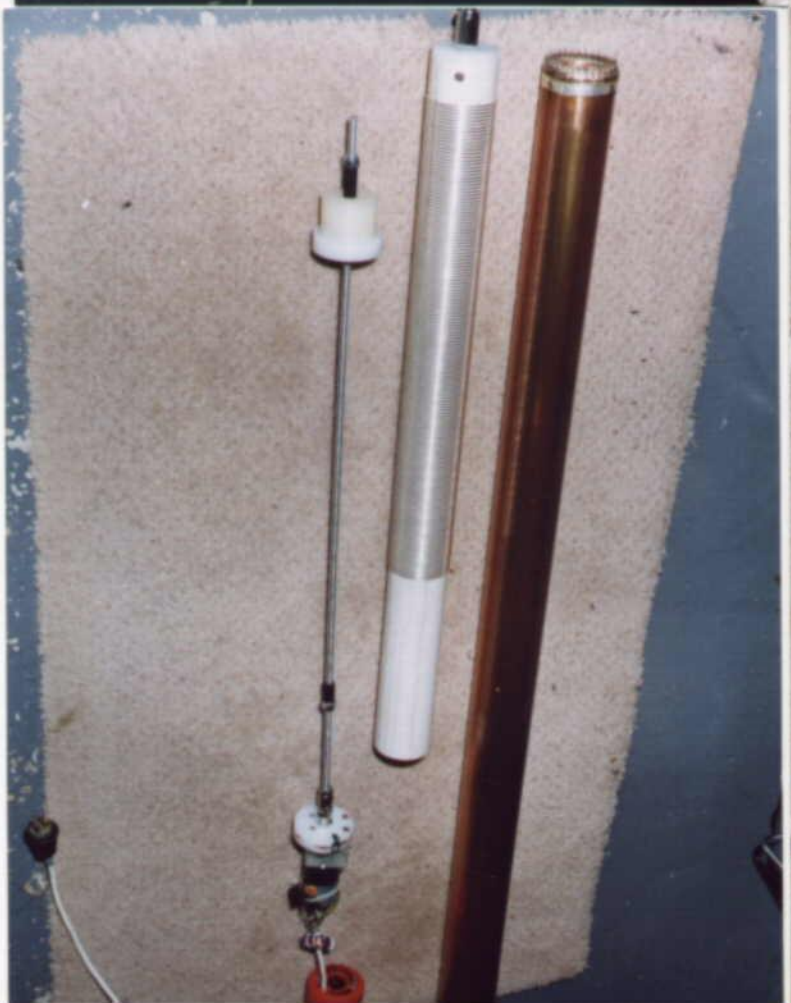
* outside dia. Sked 40.

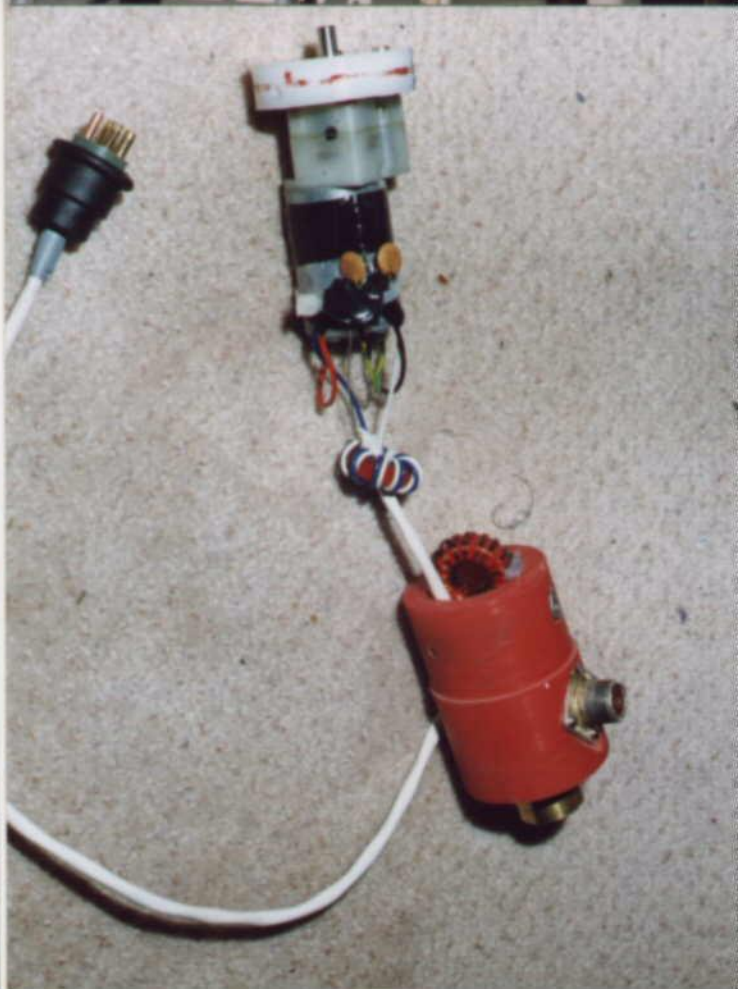
* Inside dia. sked. 40 PVC pipe

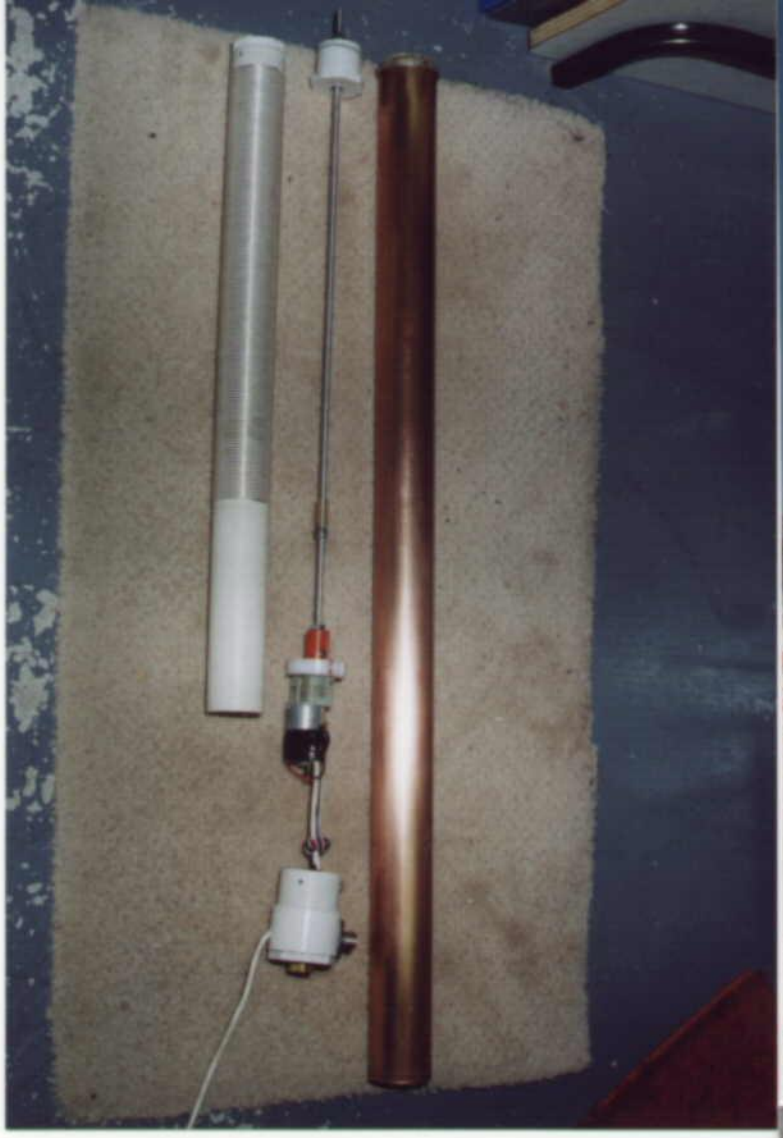
COPPER WIRE TABLE

Table of Contents Pricing Order information

Wire size AWG	Diameter in inches (enamel)	Circular mil area	Turns per linear inch	Turns per sq. cm	Continuous duty current (amp) single wire, open air	Continuous duty, (amp) conduit or in wire bundles
8	.1285	16510	7.6	-	73	46.0
10	.1019	10380	10.7	13.8	55	33.0
12	.0808	6530	12.0	21.7	41	23.0
14	.0640	4107	15.0	34.1	32	17.0
16	.0508	2583	18.9	61.2	22	13.0
18	.0403	1624	23.6	79.1	16	10.0
20	.0319	1022	29.4	124.0	11	7.5
22	.0253	642	37.0	186.0	-	5.0
24	.0201	404	46.3	294.0	-	-
26	.0159	254	58.0	465.0	-	-
28	.0126	160	72.7	728.0	-	-
30	.0100	101	90.5	1085.0	-	-
32	.0079	63	113.0	1628.0	-	-
34	.0063	40	141.0	2480.0	-	-
36	.0050	25	175.0	3876.0	-	-
38	.0039	16	224.0	5736.0	-	-
40	.0031	10	382.0	10077.0	-	-








OFF
ON
DOWN
UP
NORM
SLOW
K1SLO
DK3 CONTROLLER

The Ultimate Apartment Antenna: DK3 Screwdriver

Background

- The DK3 Screwdriver antenna was invented by Don Johnson (W6AAQ). The DK3 is an HF antenna designed for operating on any HF frequency (10m through 80m) WITHOUT leaving the vehicle to change or adjust the antenna.
- The DK3 Screwdriver antenna is adjusted by remote control to give it multiband capability. A cordless screwdriver motor (which gives the antenna its name) housed inside the lower mast unit of the antenna moves the embedded inductance loading coil up and down. The portion of the coil that remains inside this lower mast unit is inactive. The exposed portion of the coil provides inductance loading to compensate for the capactive reactance associated with short monopole antennas like this one. The adjustable inductance loading allows you to achieve resonance for a wide range of frequencies.
- The Z-match built into the bottom of the lower mast unit matches the antenna to a standard 50-ohm coaxial transmission line. This eliminates the need for a tuner.
- Although the DK3 antenna is not plug-and-play, Don Johnson provides good written instructions, suggestions, and even excellent telephone support to help you set it up and make it work. For $150 plus $10 shipping (at the time I bought it in early 2001), you receive the lower mast unit that includes the screwdriver motor and the inductance coil it controls. You must supply the antenna whip (for the top half of the antenna) that screws into the top of the lower mast unit, a quick disconnect (for allowing you to connect and disconnect the whip more quickly), a switch for controlling the screwdriver motor, wires for connecting the switch to the antenna and its DC power source, and a mount to support the antenna structure.
- Due to its popularity, there are several different versions of the Screwdriver antenna on the market. Some of the vendors offer improvements over the DK3 (such as a plug-and-play version, 160m capability, or a lighter and more portable version of the DK3). But beware of the sleazy vendors who stole Don Johnson's idea, don't give him the credit he deserves, and blatantly plagiarize his literature. (I won't name any names, but I'm sure that if you ask around, you can find out which vendors to avoid.) However, it should be noted that the original DK3 antenna is the cheapest of the Screwdriver antennas.

Why I Use the DK3 Screwdriver Antenna

- It is small enough to use in an apartment. The lower mast unit is just over 3 feet tall. Although Don Johnson recommends using a 66-inch whip for the upper part of the antenna, the DK3 is usable with a shorter whip (though 80m capability is lost without the use of a capacitance hat).
- It is portable enough that I can bring the antenna inside when I am not operating. Since I live in a ground floor apartment, I need to do this for security reasons and to keep my amateur radio activity under a reasonably low profile (so I don't get blamed for alleged RFI problems).
- It's a better value than competing antennas.
  - In the mobile antenna shootouts on the 80m band, the Screwdriver antennas are top performers and are a close second to the Texas Bugcatcher antennas. Other antennas (including Hamsticks, Hustlers, and Outbackers) rank far behind the Screwdrivers. In fairness, performance differences are smaller on the higher bands. However, I wanted capability on as many bands as possible, especially during the lower points in the sunspot cycle.
  - The DK3 Screwdriver is much cheaper than the top-performing Texas Bugcatcher antenna (over $300) and the rugged but lower-performing Outbacker antenna (also over $300).
  - Although small loop antennas can be efficient, those on the market do NOT cover 80m and are also much more expensive than the DK3 ($300 to $500 vs. $160).
  - Although Hamstick antennas are cheap for singleband operation ($20 to $25 each), buying one for every band from 10m through 80m would cost $160 to $200. And as I mentioned before, they substantially underperform Screwdrivers on the lower bands.
- The inductance loading coil has a high Q value. This lowers the coil resistance and thus boosts efficiency, particularly on the lower bands. The high Q of the coil is the reason the Screwdriver antenna is a strong performer among mobile HF antennas.
- The remote tuning of the antenna is another good plus. Although I use the antenna in my apartment and do not operate mobile, moving the switch to adjust the inductance loading coil is far easier than stepping out to the patio to change taps, change antennas, or make other adjustments.

The Overall Setup

Lower Mast Unit And Stud

Coil Cover

A cover for the exposed part of the inductance loading coil is needed to prevent dust, dirt, and other debris from accumulating and thus degrading the antenna. As suggested by Don Johnson, I use the remains of two clear plastic 1.5L water bottles.

Ground Plane

- Ground loss resistance reduces antenna efficiency. The purpose of an RF ground plane is to conduct ground currents toward the antenna feedpoint and thus complete the virtual circuit.
- Most people suggest using wire radials for a ground plane. However, I think wire radials are cumbersome to work with. (Remember: My antenna must be portable.)
- My ground plane is made of aluminum foil attic insulation I bought from Home Depot. I cut up several sheets of the foil attic insulation and spliced it together with aluminum foil and aluminum foil duct tape to form a ground plane 64-inches by 72-inches in area. It's not a super ground plane, but it fits on the small patio outside my sliding door and stays out of the way of people and pets walking past. Fortunately for me, ground currents of shortened vertical antennas are concentrated closer to the antenna. Also, using a continuous metal ground plane instead of radial wires ensures that I have the best ground plane for a fixed amount of space (as radial wires have gaps).

Mount

- The DK3 Screwdriver antenna is larger and heavier than most other mobile antennas, such as the Outbackers and Hamsticks. Thus, a sturdier and more stable mount is needed.
- My mount consists of four 2x4s (24 inches long, 3.5 inches wide, and .5 inches thick) nailed into a cross pattern (or "X" pattern). The mount is 24 inches wide and 27.5 inches long.
- The mount consists of three layers.
    - The top layer consists of one 2x4. The center of it contains a 1-inch diameter hole. Then the 1-inch diameter stud that came with the DK3 is inserted into this hole with the threaded hole inside the stud pointing down.
    - The middle layer also consists of one 2x4 and is nailed directly under the top layer. The center of it contains a 3/8-inch diameter hole for a 3/8-inch x 24 screw that secures the stud to the mount.
    - The bottom layer consists of two parts. The first part is a third 2x4 perpendicular to the top two layers. This 2x4 has a hole in the center (1 inch in diameter) so you have room maneuver your socket wrench to insert the 3/8-inch x 24 screw into the middle layer of the mount. The second part of this bottom layer consists of the remaining 2x4. I sliced the 2x4 in half and nailed it directly below the middle layer (so that it touches and is perpendicular to the first part of the bottom layer).
    - As I mentioned before, the 1-inch diameter stud fits into the hole in the top layer of the mount. The 3/8-inch by 24 screw is inserted through the hole in the bottom layer of the mount and fits into the 3/8-inch hole in the middle layer of the mount and the 3/8-inch threaded hole in the stud above. I then used a socket wrench to tighten the screw so that the stud is secured to the mount.
- The entire mount is wrapped with aluminum foil duct tape. This conducts RF current between the ground side of the antenna (the bottom of the DK3) and the RF ground plane below.
- The lower mast unit of the DK3 (which contains a 1-inch diameter hole in the bottom) slides onto the stud. To remove the DK3, simply slide it back off.

Upper Whip

- Don Johnson recommends using a 66-inch antenna whip for the upper part of the antenna (the part that mounts onto the top of the DK3 lower mast unit).
- However, the 8.5-foot ceiling height above my outside patio prevented the 66-inch antenna whip (which give the antenna a total height of up to 10 feet) from being a viable solution for me.
- I originally used a shortened version of the Hustler SF-2 whip antenna for the upper whip. However, I couldn't find a way to use a capacitance hat with it. Any capacitance hat I tried either sagged, made the whip sag, or lost contact with the whip.

- I use a 3-foot aluminum rod with the appropriate threading at both ends. The aluminum rod is light (for less stress on the rest of the antenna) and rigid (so it can support capacitance hats). The threading allows me to connect the rod to the lower mast unit at the bottom and to add a capacitance hat to the top.

Capacitance Hat

- My capacitance hats are a 12-inch metal pizza pan and a 9-inch metal pie pan. Both have 3/8-inch holes at the center so they can fit onto the threaded rod.
- As shown in the photographs below, a pan is secured to the threaded rod with washers and hex screws. Immediately above and below the pan are ordinary hex screws (which I bought at Home Depot) that secure the pan to the antenna. I also use ordinary metal washers (also from Home Depot) between the screws and the pan to provide further support and to ensure even more metal-to-metal contact.