The Villages Antenna Guide

Presented to The Villages Amateur Radio Club

on September 18th, 2007

Edited by Ed Crowell, W5TWR

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ACKNOWLEDGEMENTS

The Editor would like to thank the members of The Villages Amateur Radio Club for their cooperation and participation in the Antenna Seminar held on September 18th. Without their help this document would not have been possible.

The tape recording of the discussion during the Antenna Seminar was used as a basis for the text portion of what follows. This manuscript was transcribed, edited, and refined by the Editor and his collaborators. It forms the basis for this document.

I also want to give special credit to the members who provided photos of their installations for the visual part of this paper. The photos are clear record of what these installations look like and provide valuable information about how to proceed with antenna construction and installation.

Thank You!

PRB-1 Historical Background
(Editorial Comment)

At the time of this writing, the legal situation of amateur antenna installation is very much in a quandary On the one hand, our CCR's restrict outside antenna installations in The Villages. While Federal Law pre-empts local law with regard to satellite dishes (absolute requirement not to prohibit), the amateur finds no support of a practical nature while erecting antennas because of the ambiguity of the Federal PRB-1 legislation (which requires that states "must make reasonable accommodation"). You may read Florida's PRB-1 at: http://www.leg.state.fl.us/statutes/index.cfm?pp_mode=Display_Statute&Search_String=&URL=Ch0125/SEC561.HTM

and at:

http://www.leg.state.fl.us/statutes/index.cfm?pp_mode=Display_Statute&Search_String=&URL=Ch0166/SEC0435.HTM&Title=-

Note: If you are connected to the Internet you may access URL's by right clicking on blue web links then selecting "Open Weblink in Browser"

(Continued on page 5)

(Continued from page 4)

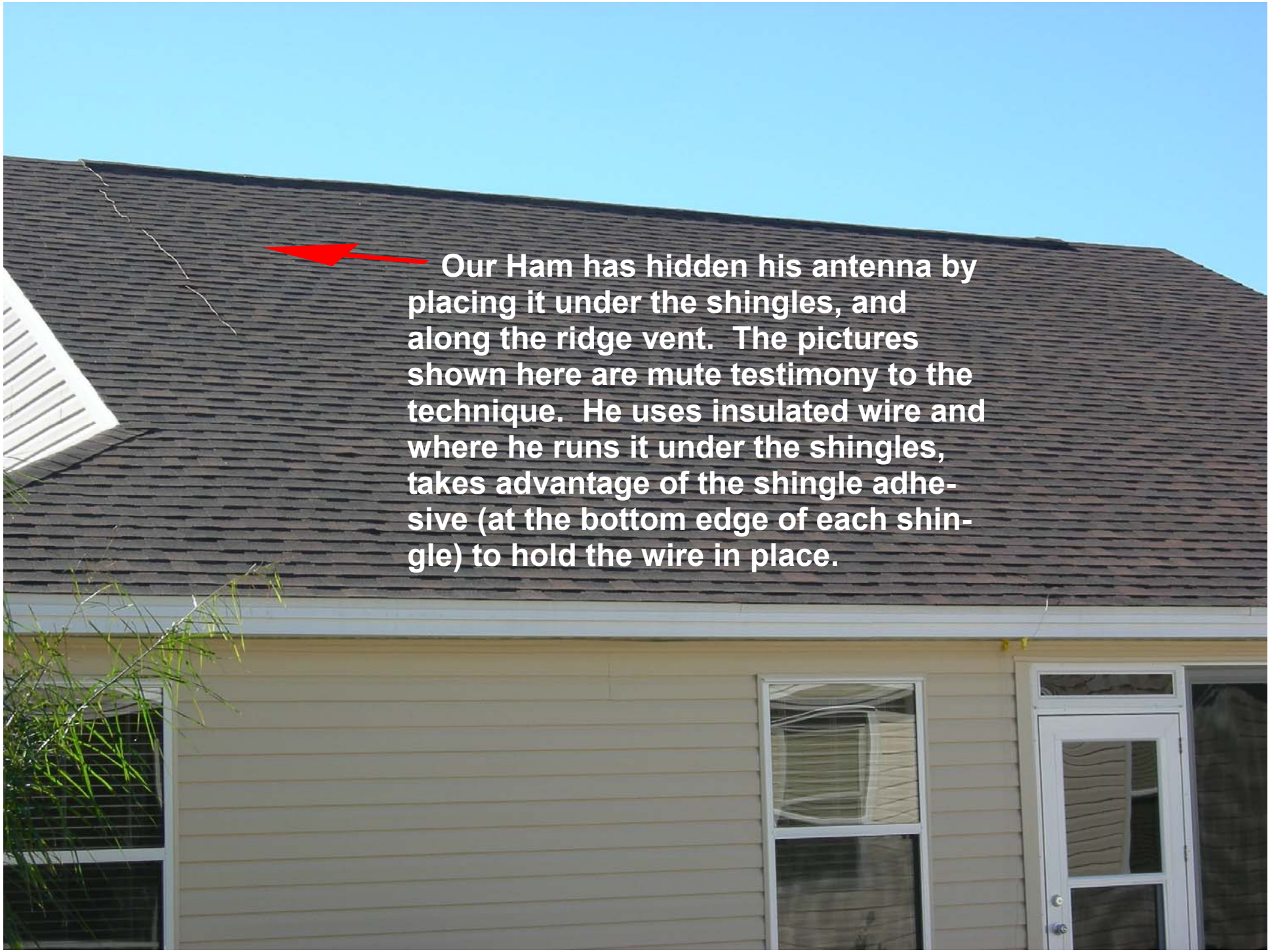
Attempts of the Florida legislature to pass an effective version of PRB-1 have languished in committee because of political issues. Efforts of Rudy Hubbard, the ARRL NFL Section Manager to get this legislation moving have so far failed. Meanwhile the legal profession has continued to write CCR's and ordinances for developers and city councils. In this atmosphere of unsettled law, we hams leap to rescue the stressed-out citizens of this country who have suffered acts of war, natural disasters, and threats to life, limb and property. The victims of this legal morass are not the hams but our friends and neighbors! We only seek to mitigate the problems of our friends and neighbors by using our communications skills effectively. Let us hope that the FCC and the government can bury the hatchet and resolve the issues. Twenty-five states, as of this writing, have passed a version of PRB-1.

See www.arrl.org/FandES/field/regulations/statutes.html.

“Random” Length Long Wires

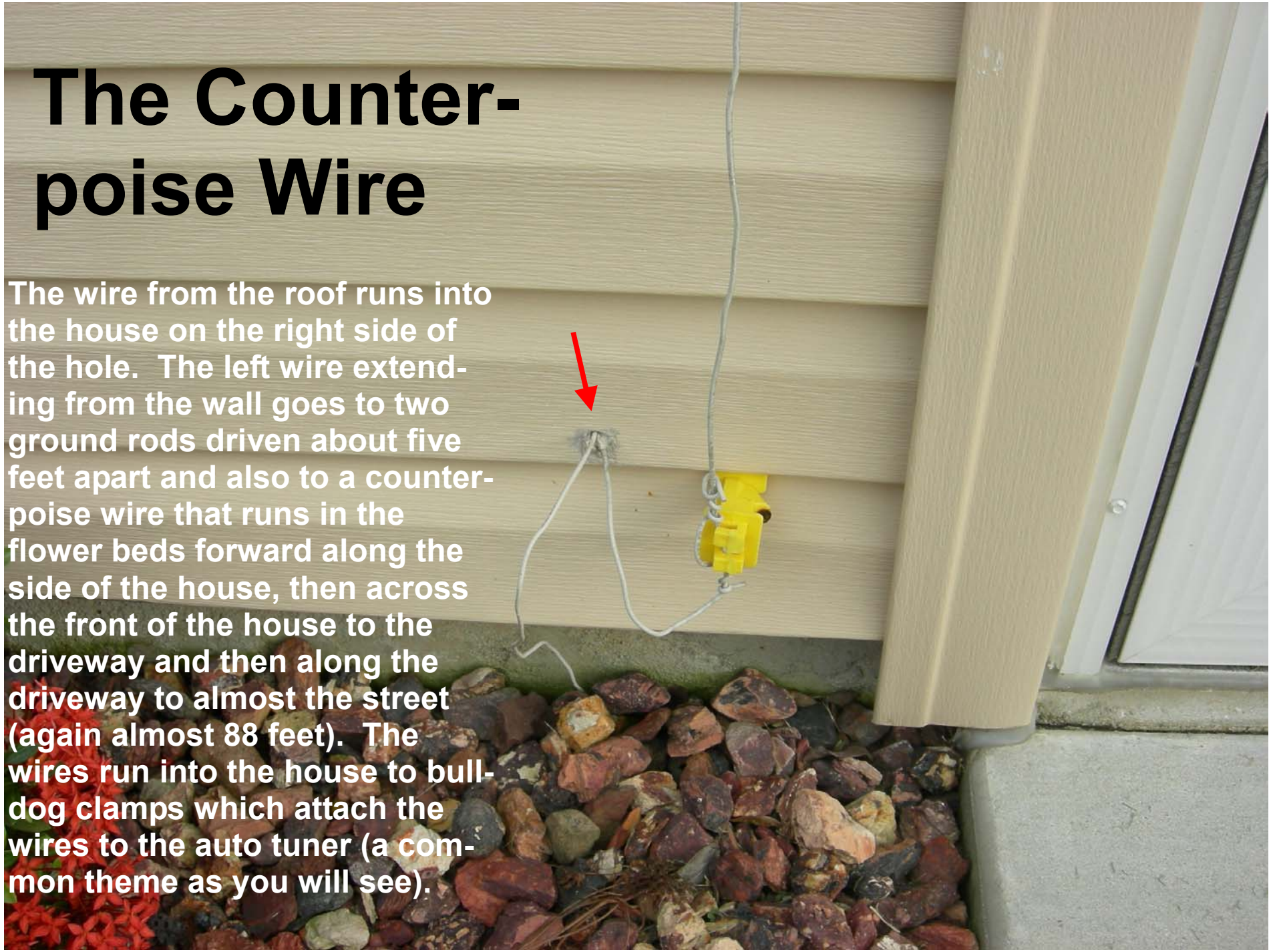
The antenna we discuss next is a longwire for 80 and 40 meters as described by Andy Cebik, W4RNL (www.cebik.com/wire/lw2.html). Further comments regarding the advisability of using a truly “random” length of wire are provided by Pat Lambert, W0IPL (www.w0ipl.net). The wire lies directly on the roof of the house. I think you will agree it is a stealthy antenna.
He also shows us how he tunes his two-band longwire.

Long Wire Antennas

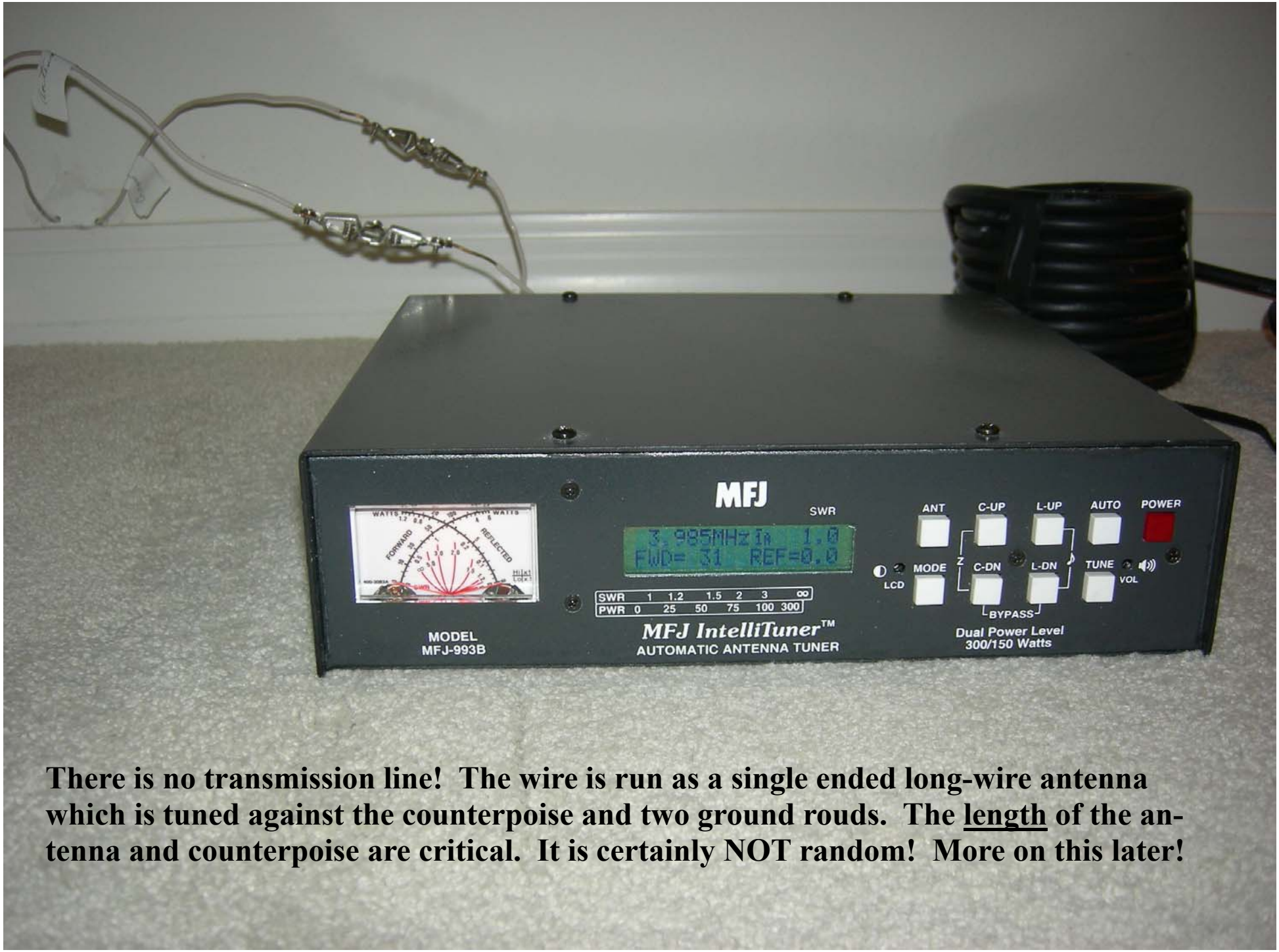

Our Ham has hidden his antenna by placing it under the shingles, and along the ridge vent. The pictures shown here are mute testimony to the technique. He uses insulated wire and where he runs it under the shingles, takes advantage of the shingle adhe-sive (at the bottom edge of each shin-gle) to hold the wire in place.

The wire from the roof drapes over the eave to an electric fence insulator seen here as yellow, then it goes down the side of the house to a hole in the siding where it enters the house shown on the next page. Elsewhere, he uses electric fence insulators, as shown above, easily obtainable at farm supply stores such as TSC, Menards, Lowe's, Home Depot, or Fleet Farm to secure the wire and hold it off the siding. (another idea to which we shall return).

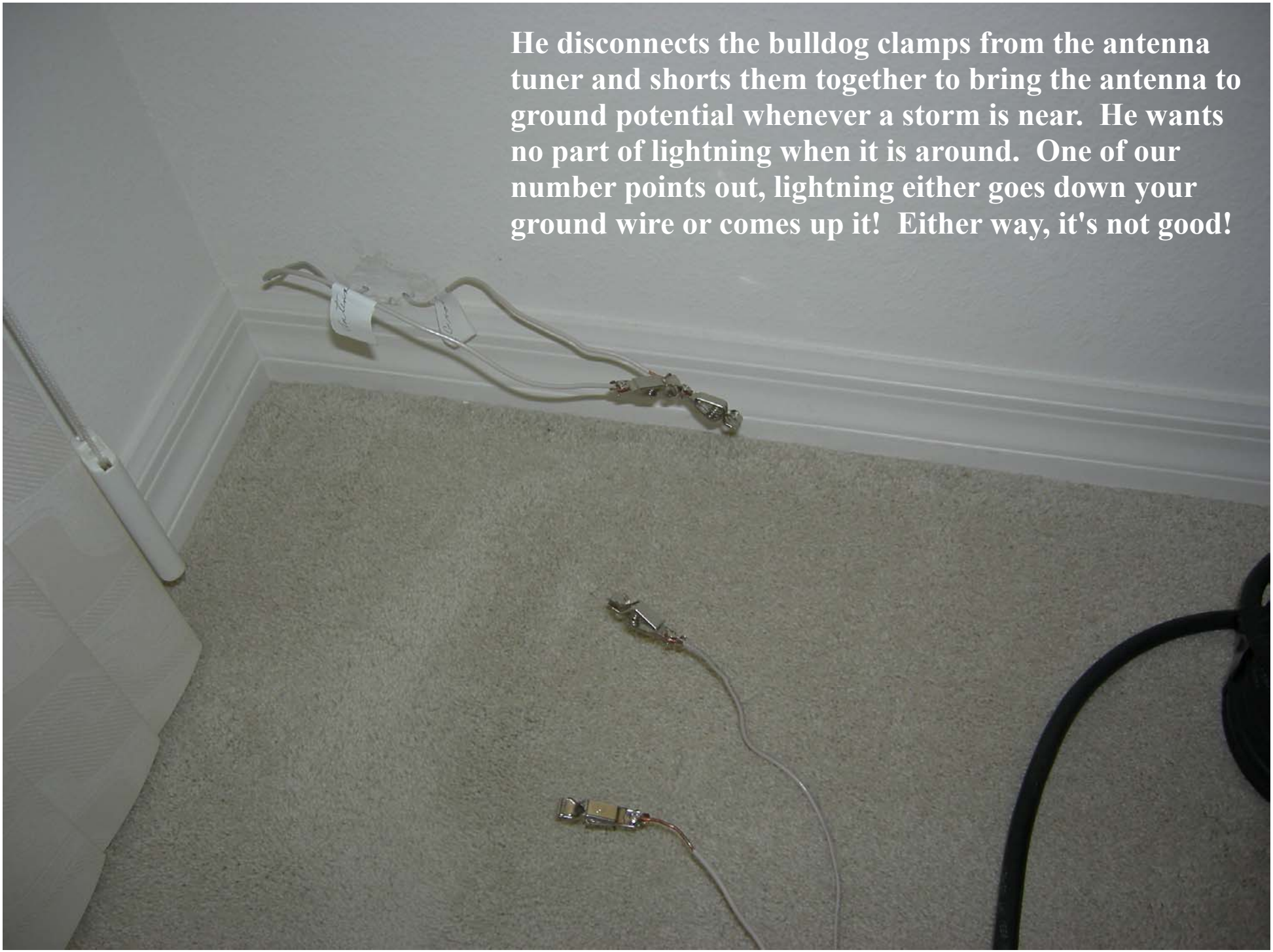
The Counter-poise Wire



The wire from the roof runs into the house on the right side of the hole. The left wire extending from the wall goes to two ground rods driven about five feet apart and also to a counter-poise wire that runs in the flower beds forward along the side of the house, then across the front of the house to the driveway and then along the driveway to almost the street (again almost 88 feet). The wires run into the house to bull-dog clamps which attach the wires to the auto tuner (a common theme as you will see).



There is no transmission line! The wire is run as a single ended long-wire antenna which is tuned against the counterpoise and two ground rouds. The <u>length</u> of the antenna and counterpoise are critical. It is certainly NOT random! More on this later!


He disconnects the bulldog clamps from the antenna tuner and shorts them together to bring the antenna to ground potential whenever a storm is near. He wants no part of lightning when it is around. One of our number points out, lightning either goes down your ground wire or comes up it! Either way, it's not good!

Length of Long Wires

One has a choice of many lengths such as 63 feet, 74 feet, 89 feet, or 111.5 feet. These numbers are obtained from calculations performed by Pat Lambert, W0IPL, and can be found on his web-site at: www.w0ipl.net/random-l.htm. Pat Lambert used to be Section Manager of the Colorado Section. He has done a lot of writing about antennas, emergency management, communications, ARES© Training and NVIS Propagation. Please check his site.

Various Flag Pole Installations

Many people have used this antenna. They almost universally find that the work installing it is worthwhile. Most have used a choke balun, but have placed it at the shack instead of at the antenna. Some have used the standard 4 radials, some used more. Extensions to 20 or 24 feet have been tried with or without the loading coil. All but one have had trouble using it below 20. He has an auto tuner at the base of the antenna and has a logbook (see Appendix) to prove his success. Landscaping around the base of the antenna is to be recommended for aesthetic reasons, and to please the XYL. To bury the radials, we suggest using an electric edging tool with a metal cutting blade. Merely divide the sod with it and tuck the wire into the sod. The grass grows over it nicely.

The appearance has also been enhanced by placing it at the back of the lot in the flower beds like this ham has done. This configuration has required 6 radials to be run in a 180 degree pattern resulting in a directive pattern to the northwest from his location (which is not all that bad if you are in Florida).


How about adding rock and edging to dress up the base of a flagpole antenna?

This installation has a flagpole antenna set in a "well" surrounded with flowers. The "well" is lined with brick and has the mounting for the pole and an auto tuner wrapped in a trash bag (tuner is waterproof). The "well" is filled with pea gravel for drainage, covered with lava rock and surrounded with flowers. This is what it looks like—look hard through the flowers and see if you can make it out?

Force12 antenna AH-4 Combination

We chose the Flagpole, AH-4 combination:

1. Ability to use the antenna effectively on all bands.
2. Stealth operation
3. In the open and away from buildings.
4. Quick and easy tuning with the IC-746
5. Water proof --- Sort of.

I put the antenna up using the manufactures recommendations. A 50lb bag of cement mix and a garden trowel were all that we needed extra. I installed the radials and the feed line/control cable with the help of a skill saw. Edger would work also. I put a "well" around the base using decorator bricks purchased at Wal-Mart. Placed P gravel at the bottom for drainage. Put the tuner in a garbage bag and taped it shut with duct tape. The tuner went in on top of the gravel and then we completed filling the well with lava rock. Placed a few potted plants in the well and you know what? Who would know? It's been that way for the past 2 and one half years with no problems. Works Good! Works Great!

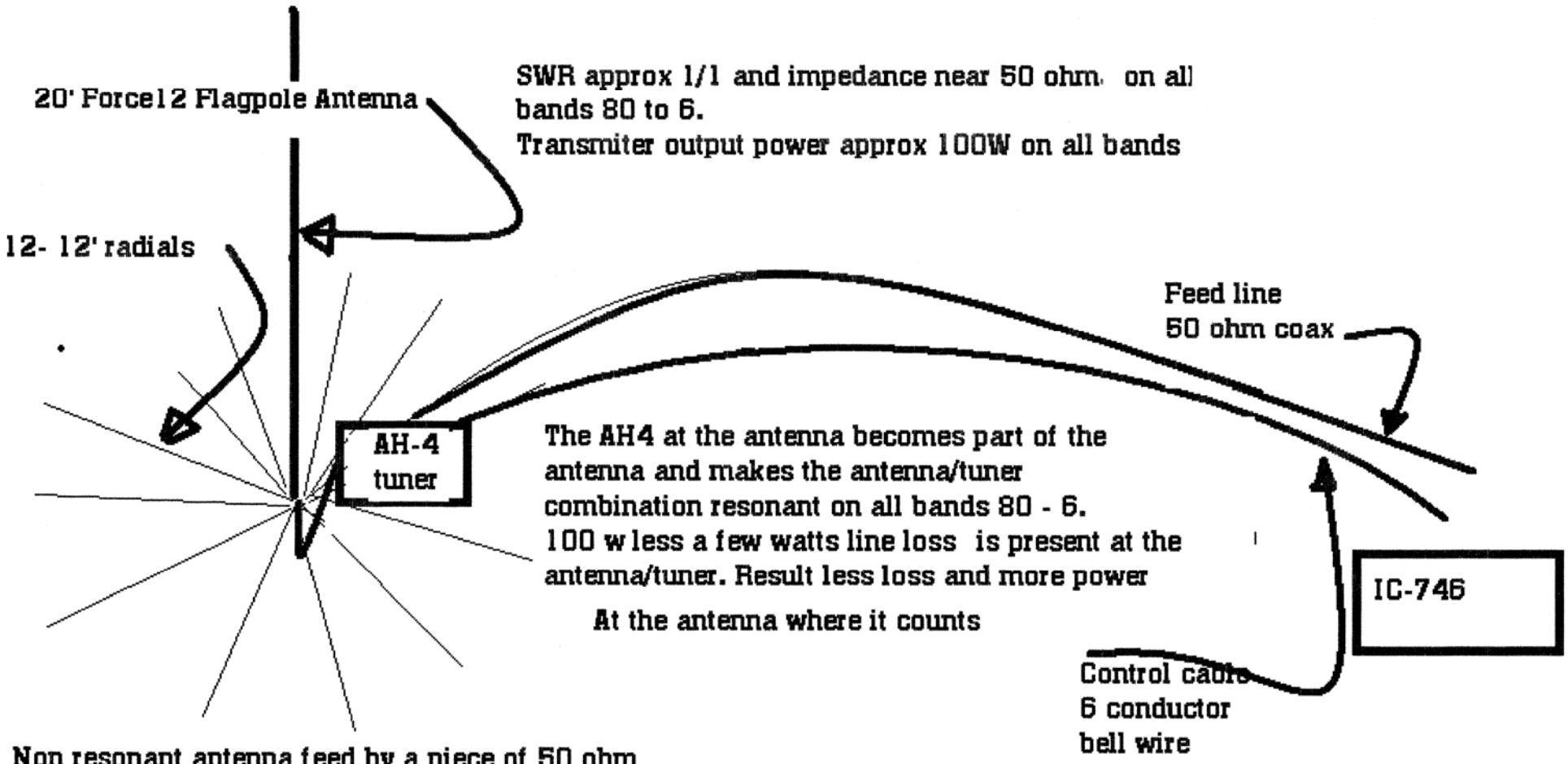
I have included a photo of our installation and a graph of SWR measurements with the tuner in the circuit and with it out of the circuit. Also, I have included diagrams of the AH-4 in place and what it would be like using just a tuner at the station.

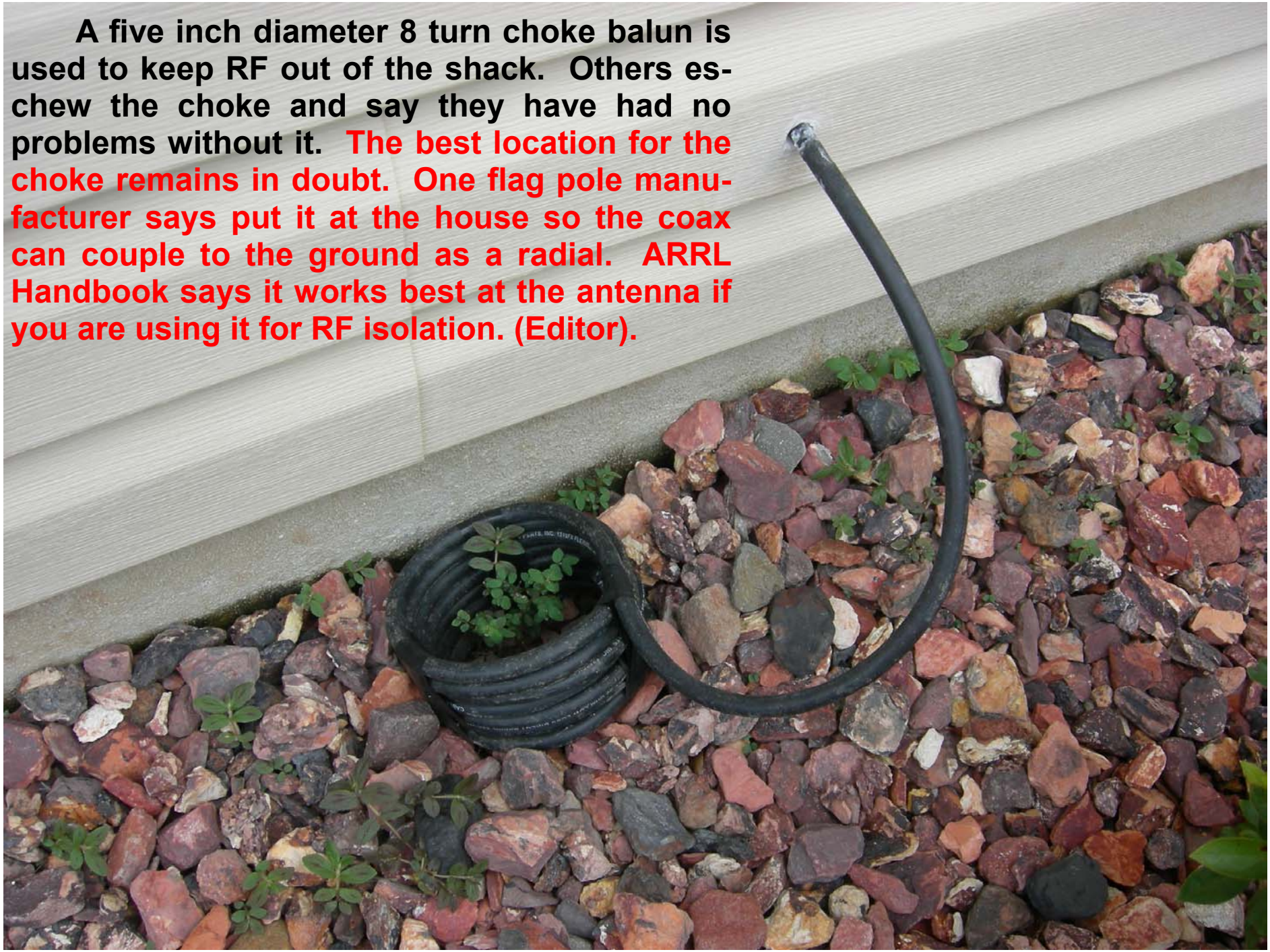
	without tuner measure at Xmtr			With tuner		
Freq	swr	impedance	power out	swr	impedance	power out
80	6/1	50	6W	1.2/1	40	100
40	3.5/1	60	10W	1.2/1	40	100
30	1.4/1	45	100	1.2/1	40	100
20	2.5/1	60	20W	1.2/1	40	90
17	2.2/1	80	18W	1.2/1	40	100
15	3/1	50	17W	1.2/1	40	100
12	3/1	30	19W	1.2/1	40	100
10	2.2/1	20	50W	1.2/1	40	100
6	1.5/1	40	90W	1.2/1	40	100

It's definitely a compromise. It's not a beam on a tower. It won't handle a KW. But it gets me out and I am quite surprised how good it really works. I get out on all bands and I can still chase DX and do all the contesting and county hunting that I want. I use to get 599 and 59 reports and now I get 559 and 55 reports. Bottom of the cycle --- don't you think?

Just to show how I get out, I have included a copy a portion of my log using the existing installation. This is just to show a sample of my casual DX chasing log. It does not include my contesting activities or my county hunting stuff. They are all on separate logs. It's less now than it was before we moved here but I would guess that I have added about 2500 entries to my logs in the past two years. I am sure that some of you do better but I suspect that many don't make an attempt because they think that with compromise stuff you can't get the job done. Not true! In fact, in some ways, it's a great deal more fun.

The challenge is back!


20' Force12 Flagpole Antenna
SWR approx 1/1 and impedance near 50 ohm on all bands 80 to 6.
Transmiter output power approx 100W on all bands
12- 12' radials
Feed line
50 ohm coax
AH-4
tuner
The AH4 at the antenna becomes part of the antenna and makes the antenna/tuner combination resonant on all bands 80 - 6.
100 w less a few watts line loss is present at the antenna/tuner. Result less loss and more power
At the antenna where it counts
IC-746
Control cable
6 conductor
bell wire
Non resonant antenna feed by a piece of 50 ohm feedline.



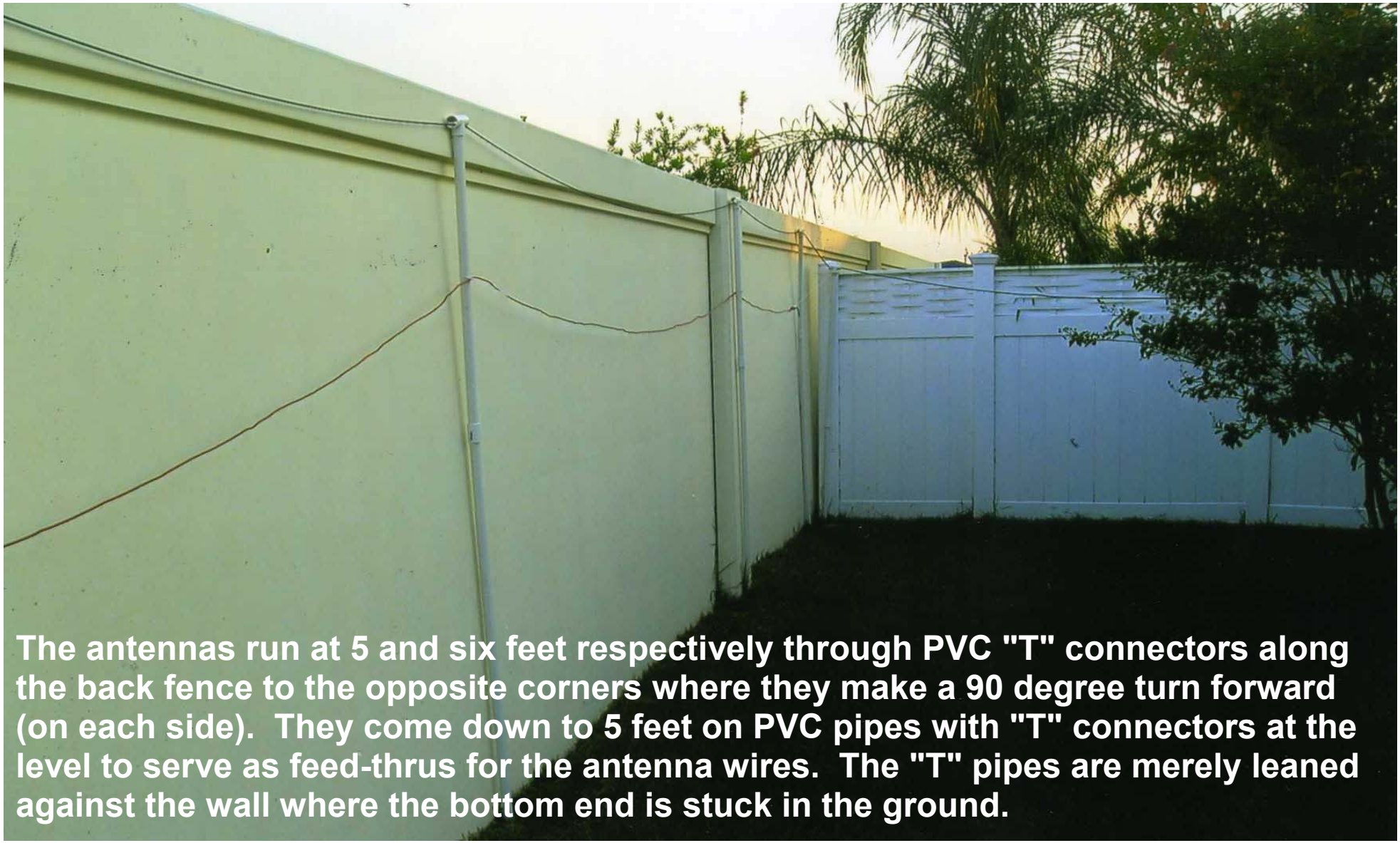
A five inch diameter 8 turn choke balun is used to keep RF out of the shack. Others eschew the choke and say they have had no problems without it. The best location for the choke remains in doubt. One flag pole manufacturer says put it at the house so the coax can couple to the ground as a radial. ARRL Handbook says it works best at the antenna if you are using it for RF isolation. (Editor).

NEAR VERTICAL INCIDENCE SKYWAVE (NVIS) DIPOLES

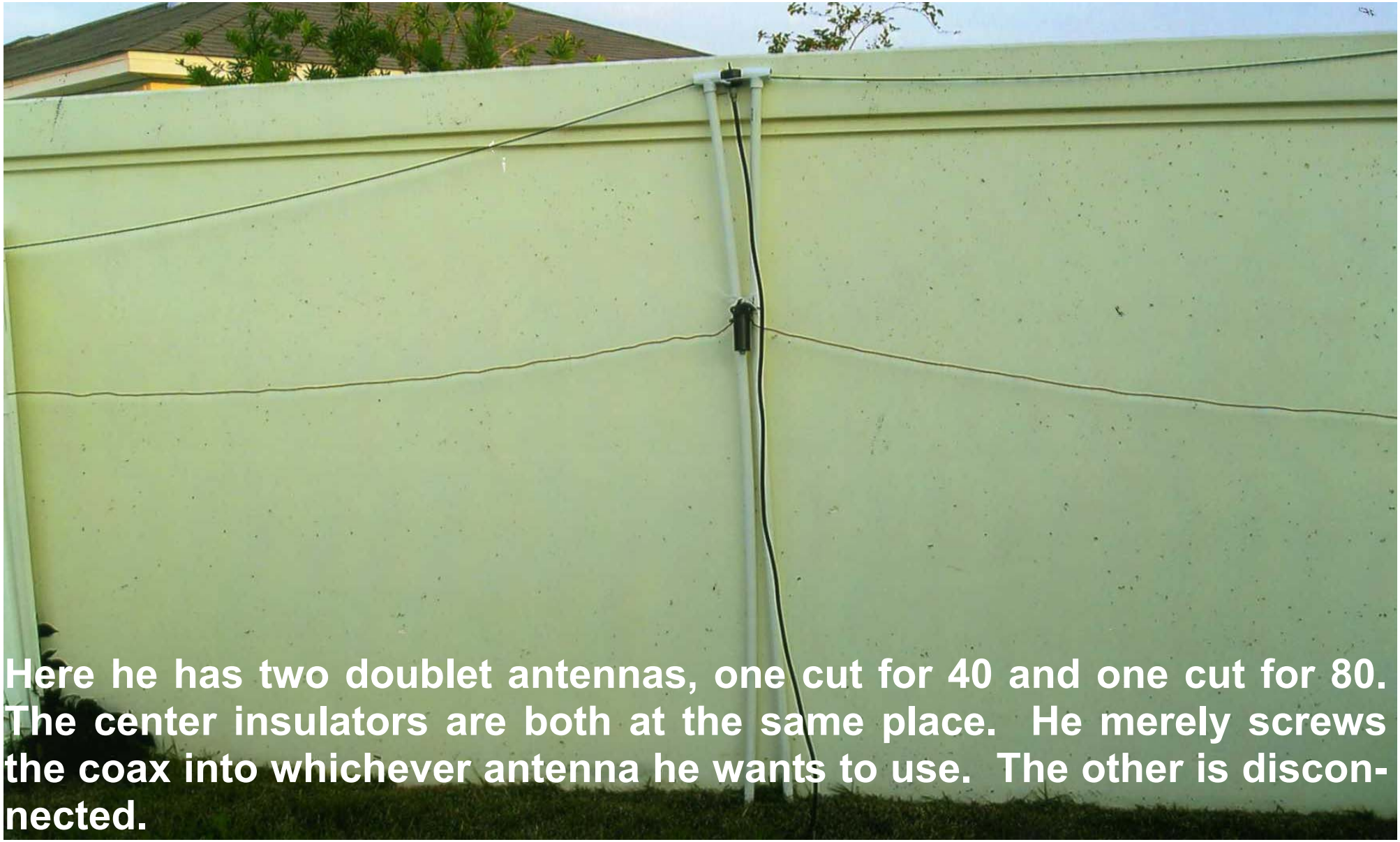
Look at the following backyard antenna setup. He has parallel dipoles for 80 and forty meters fed with 600 ohm twinlead, and a coax lead-in. They are supported by PVC pipe with "T" connectors at the top fashioned around his fenceline. The lead-in goes under the window sash into the shack. He also shows us his 2 meter ground plane antenna mounted on PVC, too. He uses cotton batting to close the space at the window closure.

For a discussion of NVIS, see www.w0ipl.net. NVIS mode is the subject of another whole paper!

This ham lives in a courtyard villa. He operates mainly on 80 and 40 meters. He has two runs of coax which go out the window of the bedroom, one to the HF antenna and the other to the 2 meter ground plane.

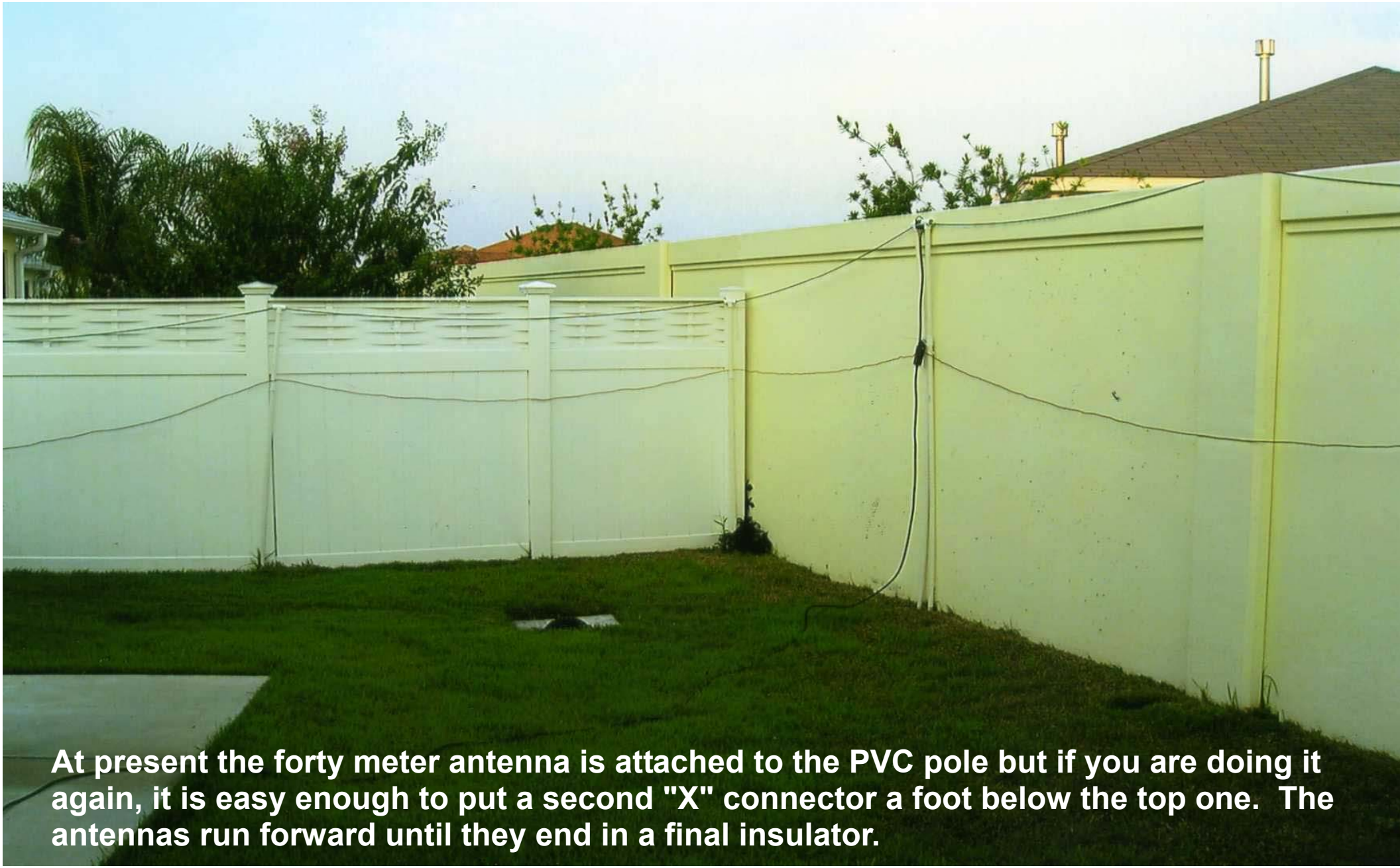


The antennas run at 5 and six feet respectively through PVC "T" connectors along the back fence to the opposite corners where they make a 90 degree turn forward (on each side). They come down to 5 feet on PVC pipes with "T" connectors at the level to serve as feed-thrus for the antenna wires. The "T" pipes are merely leaned against the wall where the bottom end is stuck in the ground.

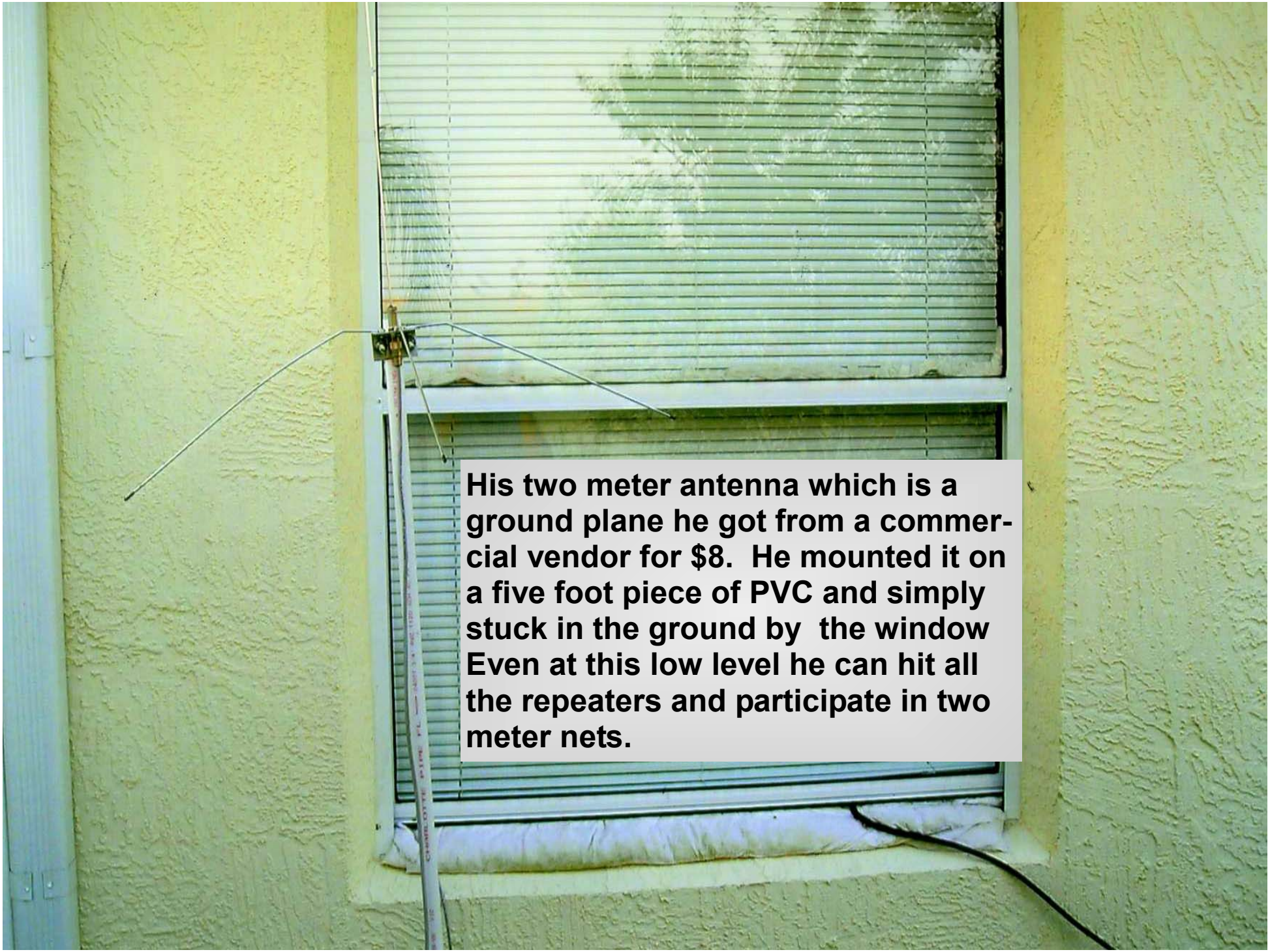


Here he has two doublet antennas, one cut for 40 and one cut for 80. The center insulators are both at the same place. He merely screws the coax into whichever antenna he wants to use. The other is disconnected.

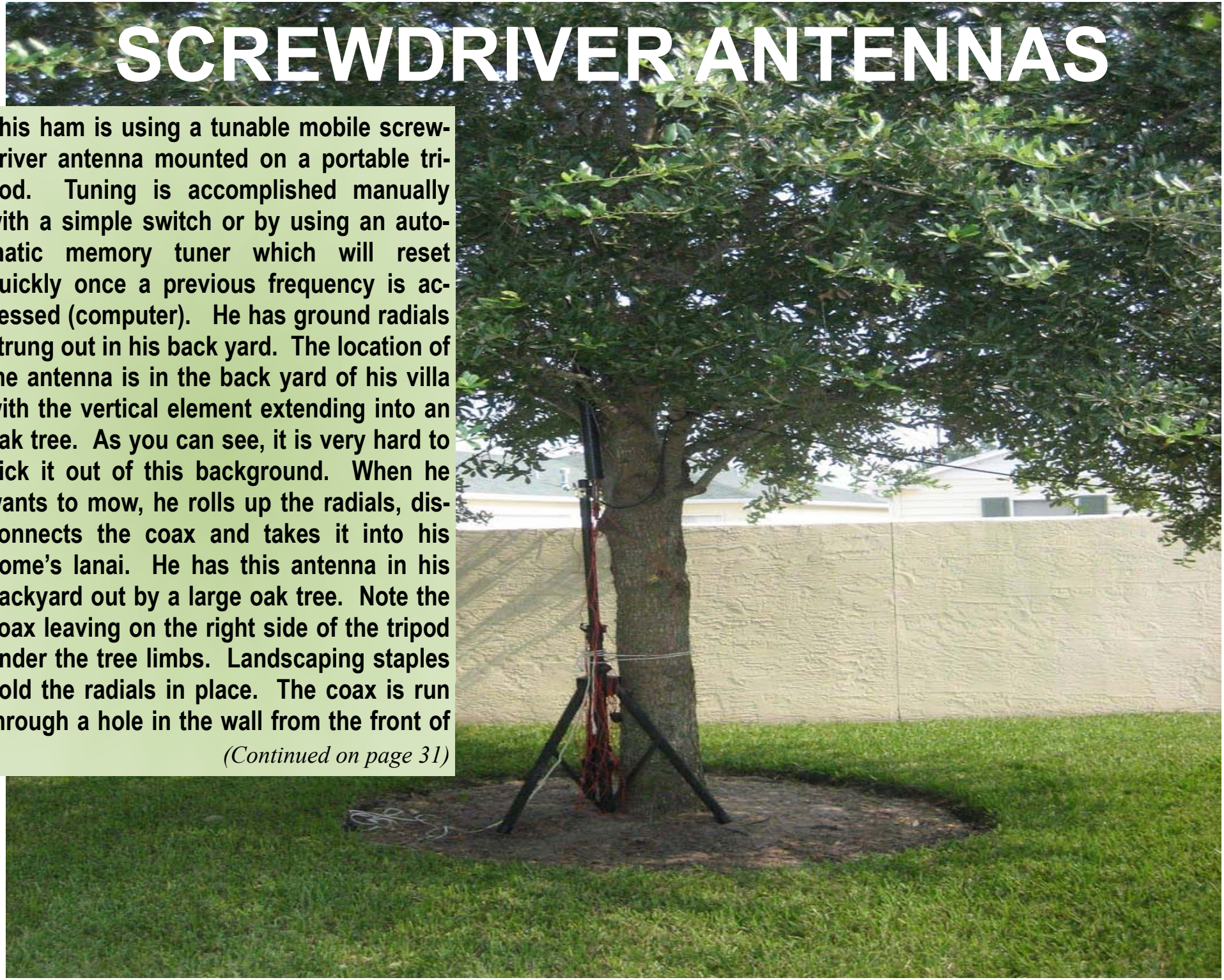
Alternatively, one could connect the two antennas together like a bow-tie antenna and leave them in parallel. There will be some interaction between the antennas, but that is not insurmountable. (Editor)



At present the forty meter antenna is attached to the PVC pole but if you are doing it again, it is easy enough to put a second "X" connector a foot below the top one. The antennas run forward until they end in a final insulator.

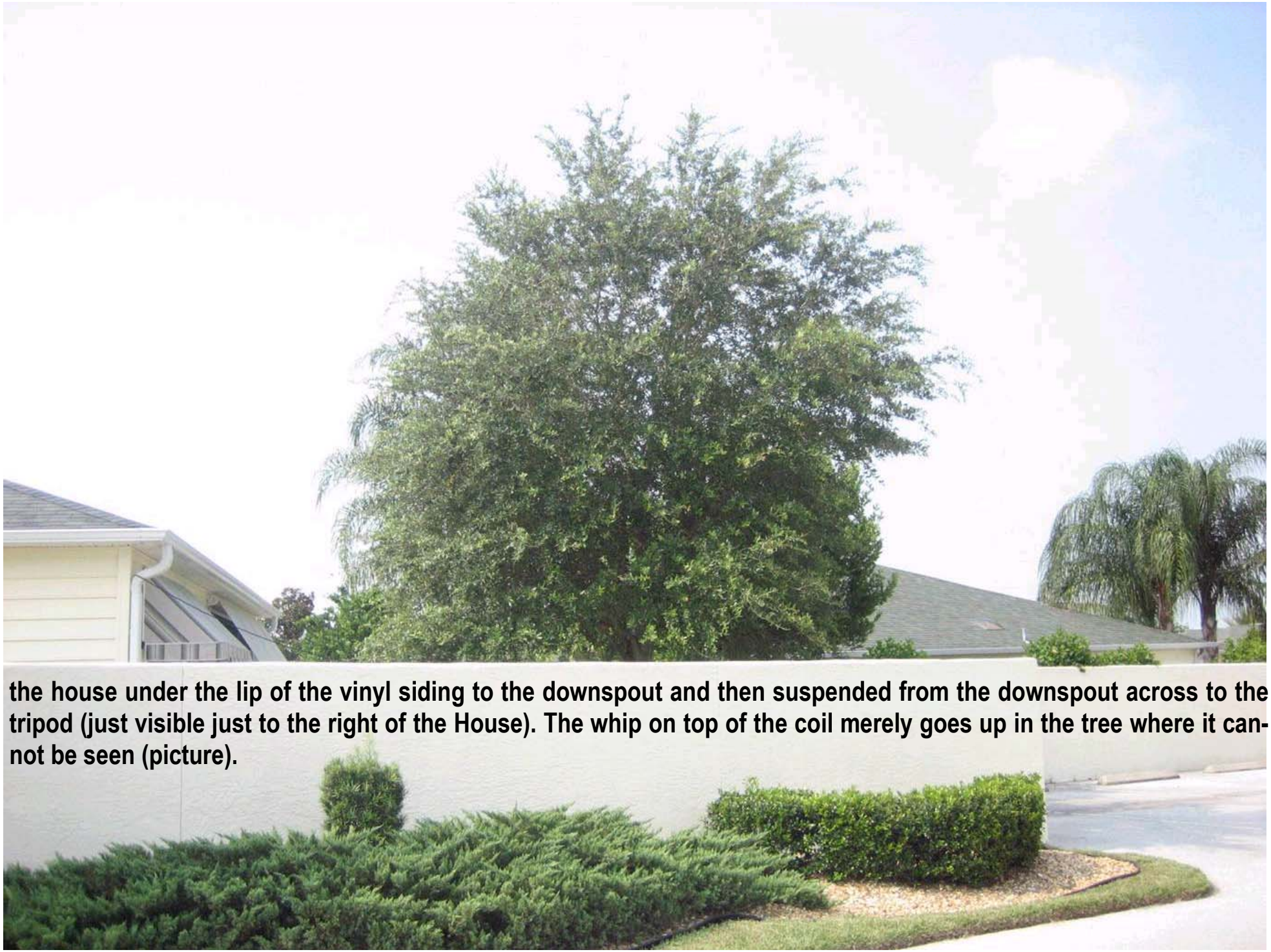

His two meter antenna which is a ground plane he got from a commercial vendor for $8. He mounted it on a five foot piece of PVC and simply stuck in the ground by the window Even at this low level he can hit all the repeaters and participate in two meter nets.

SCREWDRIVER ANTENNAS



This ham is using a tunable mobile screwdriver antenna mounted on a portable tripod. Tuning is accomplished manually with a simple switch or by using an automatic memory tuner which will reset quickly once a previous frequency is accessed (computer). He has ground radials strung out in his back yard. The location of the antenna is in the back yard of his villa with the vertical element extending into an oak tree. As you can see, it is very hard to pick it out of this background. When he wants to mow, he rolls up the radials, disconnects the coax and takes it into his home's lanai. He has this antenna in his backyard out by a large oak tree. Note the coax leaving on the right side of the tripod under the tree limbs. Landscaping staples hold the radials in place. The coax is run through a hole in the wall from the front of

(Continued on page 31)



the house under the lip of the vinyl siding to the downspout and then suspended from the downspout across to the tripod (just visible just to the right of the House). The whip on top of the coil merely goes up in the tree where it cannot be seen (picture).

FULL-SIZED TRAP VERTICALS

Here we have a trap vertical antenna. This one is not a flag pole type but QST has had an article with this antenna hidden in a shroud made of PVC pipe* with a pulley and flag attached. He chooses to raise and lower his antenna. He uses a commercial folding mounting product for the mount as well as the radial attachment ring. *See reference to QST, May 1993.

This mount works with several manufacturer's verticals. Basically it is a strong plate mounted on a pipe set in concrete or packed dirt. The plate is vertical and has "tracks" cut into it that guide the antenna up and down as it folds to 90 degrees as it comes down. In use, it latches the antenna in the straight-up position for operating.

*See Albert Parker in Bibiography

Details of Full Sized Vertical

He has a quick disconnect device at the base so he can remove the coax for mowing and a "fork" in the ground where the antenna comes down to support it until its next use. He has a thin-wall PVC pipe that will fit right over the vertical antenna and make it look just like a flag-pole Antenna. He has forty insulated green radials cut for twenty meters because of the size of his lot, but it still works great on the other bands, too. Verticals mounted above ground level require resonant radials attached to the base of the radiator. Ground mounted verticals do not. Radials in this case merely couple to the ground. One needs to use enough of them long enough to effectively couple in your quality of soil. You can then let it down during daytime so the neighbors can't see it! If you prefer, you can even permanently “lock” the antenna straight

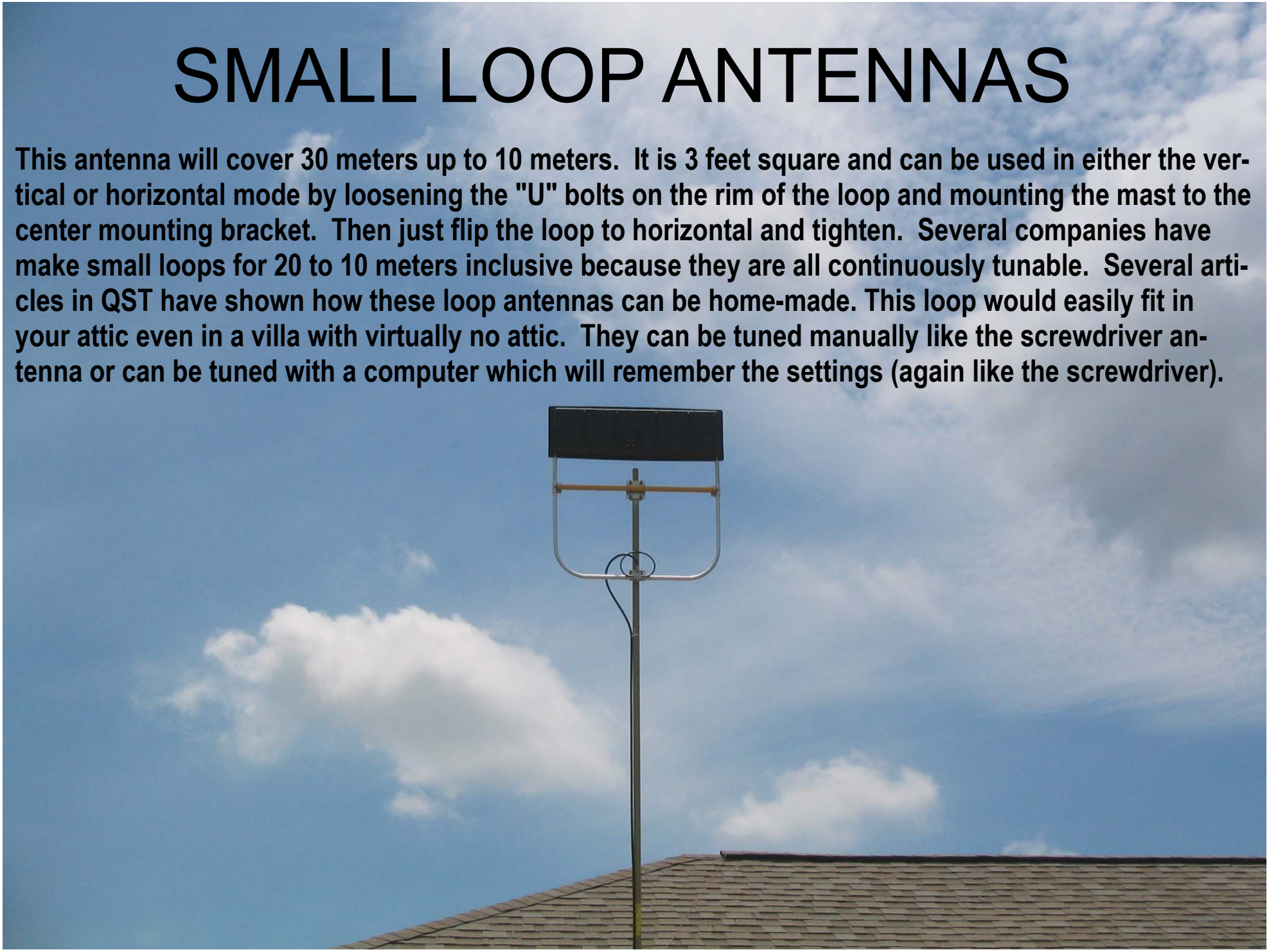
up by using the “U” bolts at the top to tighten to the plate! The radial ring allows an easy attachment of the radials at the base of the antenna where the ground point is connected. When he mows or has visitors, he takes the forty radials off, disconnects the coax, and pulls the "U" bolts of the base pipe and puts the antenna and wires in the bushes. This operator says he also uses a commercial two meter antenna mounted on a broom stick in the attic.

INDOOR BEAM ANTENNAS

This ham has also used part of his beam antenna by putting it in the attic. He had a tri-band beam with a forty meter trap for the driven element, so he took the driven element and placed it in the attic, supporting the ends and the middle so it didn't droop too much. He worked a lot of DX on it without rotating it! I met a ham who was doing the same thing. He had just moved to The Villages and invited me over to see him. He showed me where he had put a tri-band beam driven element into the attic (but of course, couldn't turn it). He was going to give it a try just like the other ham. Several companies make rotatable dipoles similar tri-band driven elements for use on 80, 40, and 20 meters.

SMALL LOOP ANTENNAS

This antenna will cover 30 meters up to 10 meters. It is 3 feet square and can be used in either the vertical or horizontal mode by loosening the "U" bolts on the rim of the loop and mounting the mast to the center mounting bracket. Then just flip the loop to horizontal and tighten. Several companies have make small loops for 20 to 10 meters inclusive because they are all continuously tunable. Several articles in QST have shown how these loop antennas can be home-made. This loop would easily fit in your attic even in a villa with virtually no attic. They can be tuned manually like the screwdriver antenna or can be tuned with a computer which will remember the settings (again like the screwdriver).



SMALL LOOP FEATURES cont...

These antennas are easily portable and/or can be tilted down at night, The picture shows an example of this type antenna. They need to be high and so are a problem unless you wait until night to tilt them up. They do work, but not as well as a full sized antenna. One word of caution however, because they are very Hi-Q resonant they generate high voltage when transmitting. You or your friends can get a nasty RF burn from them so be careful around them when energized!

Refer to the picture on the next page:

Looking at the antenna on the ground, one can see the coax connections to the one turn link near the bottom. In addition to the coax, these antennas require a control cable to allow tuning of the large capacitor in the black box. This arrangement allows the antenna to be used on continuous frequencies from low to high (CAP, Mars, and 60 meters could be covered by and adequately designed loop like this). Note the four silver rivets in the middle of the black box, these are for the tuning cable plug.

SMALL LOOP **CONNECTIONS**

Double Helical Dipole

The following is from QST Issues May 2003, and Jan 2005 articles:

The second antenna uses two helical wound whips. They can be home-made as was shown the QST in May, 2003 (ref.) These are emergency communications antennas par-excellence. They can be mounted on a mast, tripod, or staked to the ground. In fact, a pair of forty meter helical wound whips can be mounted at right angles to a pair of 80 meter helical wound whips and fed with a single coaxial cable. They need to be tuned and are very sharp! The whips on each band need to be tuned to the same fre-

MOUNTED DOUBLE HAMSTICK

quency and you can't QSY far without an antenna tuner. Don't forget to mark the stinger where the tuning is correct so you can reproduce the settings when you reassemble it later. This ham has used these very successfully with 65 watts on HF Packet mounted on the edge of the roof at an elevation of only 12 feet to contact Shreveport, LA. It takes five minutes to set up this antenna so one can go out on an emergency operations and be on the air in a jiffy! You can see that this antenna would fit in your attic easily or on your back roof or along the fence of your yard. If you buy all the parts brand new, you will spend about $100 excluding the ground mount for the pole.

DETAIL OF HELICAL WHIP MOUNT


HELICAL WHIP
MAST ATTACHED TO
ROOF OVERHANG

Full Wave Loop Antennas

The third antenna we have to show you is a full-wave Loop. This antenna has some interesting qualities. You cut it to frequency (1007/ F mhz) and arrange it in the general shape of a circle to a square. It is resonant at the frequency for which it is cut. This means it is about a quarter wavelength on a side. More than four

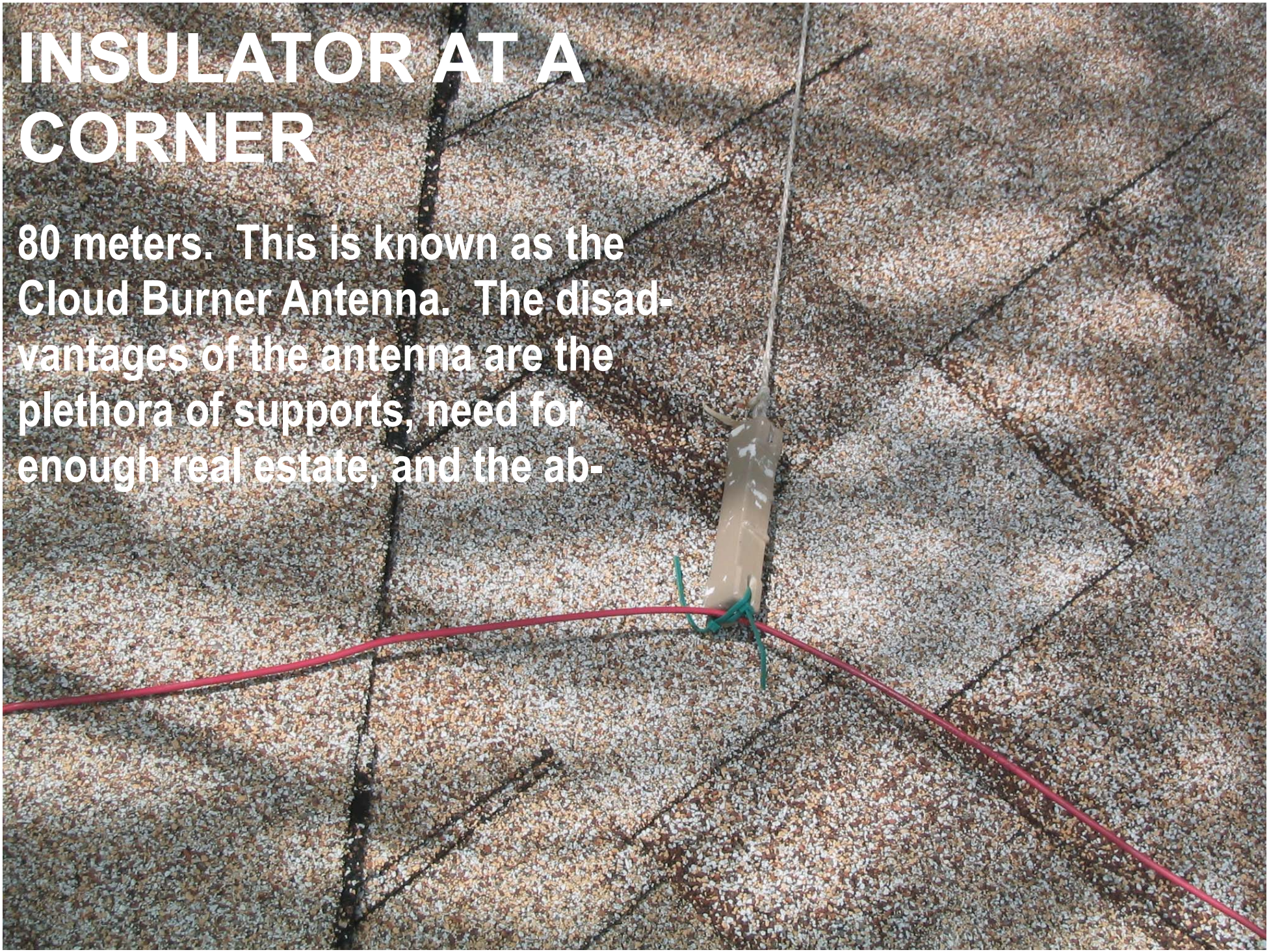
ADVANTAGES/ DISADVANTAGES

supports begins to tax the ingenuity. The delta loop is a variety of this genre. However, it loads up on every harmonic (not just the odd multiples like most antennas). Its feed point impedance is 100 ohms. It can be fed directly with your favorite coax, or you can use parallel feeders or even twin lead. For perfection, one may use a quarter wave "Q" section of RG-11 (75 ohms) to transform the 100 ohms down to 52, but then it would not be multi-band. Its radiation pattern is straight up like a flattened beach ball. It is an NVIS antenna without peer. (for 3955 khz the RG-11 would be ~39 feet.) Even though you can hear everybody on the band which makes it a very good listening antenna, you are unlikely to talk to anyone beyond the

LOOP CORNER AT THE FIBERGLASS MAST

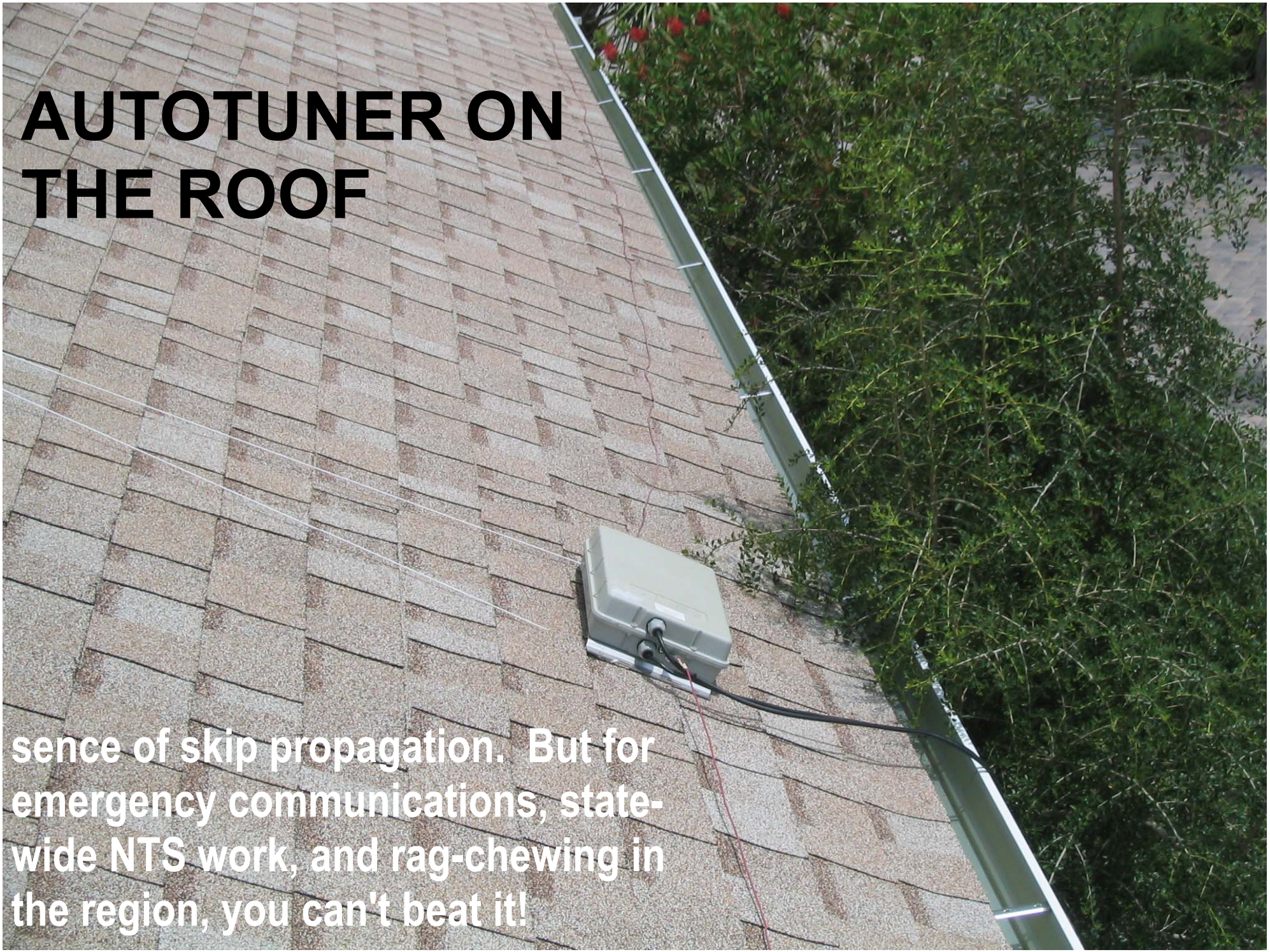
adjoining states because it has virtually no low angle radiated power. However, you can talk to everyone within 400 miles even in the skip zone. It is really cheap to build! If you tune it at the feed-


LOOP SECURED TO RIDGE VENT
point with a wideband auto-tuner, it tunes all harmoni-cally related bands (3.5, 7.0, 10.5, 14, 17.5, 21, you get the drill!) assuming it is cut for



INSULATOR AT A CORNER

80 meters. This is known as the Cloud Burner Antenna. The disad-vantages of the antenna are the plethora of supports, need for enough real estate, and the ab-


AUTOTUNER ON
THE ROOF
sence of skip propagation. But for
emergency communications, state-
wide NTS work, and rag-chewing in
the region, you can't beat it!


ENTRY THROUGH THE WINDOW
(THE YELLOW IS A STYROFOAM
NOODLE)

ANDY CEBIK'S COMMENTS

Andy prepared a program on the five best back-yard antennas for the FDIM QRP Group at the Dayton Hamfest in 2004. He describes and summarizes his feelings about the full-wave Loop starting on page 13 of his article located at:

www.cebik.com/fdim/edim9.pdf

If you refer to this article and have room on your roof to build one, you should find it a most useful stealth antenna.

80/40 Attic* Antenna

The final antenna is the 88 foot attic dipole tuned at the center with an auto tuner. This auto tuner is a wide-range type tuner unlike those found built into your rig back in the shack. Internal antenna tuners are made to tune a resonant antenna (beam or trap vertical) while you move around on the Band beyond the design center of the beam.

Manual tuners and wide-band auto tuners will tune almost anything except an endfed wire one-half wavelength long at the operating frequency (see W0IPL). The 52 ohm coax is flat all the way to the transmitter. The low pass filter works nicely in the line as a further protection against interference in The Village (which would be the kiss of death).

***For other attic antennas see Kai Siwiak in QST October 2007 (in Bibliography).**

(Continued on page 53)

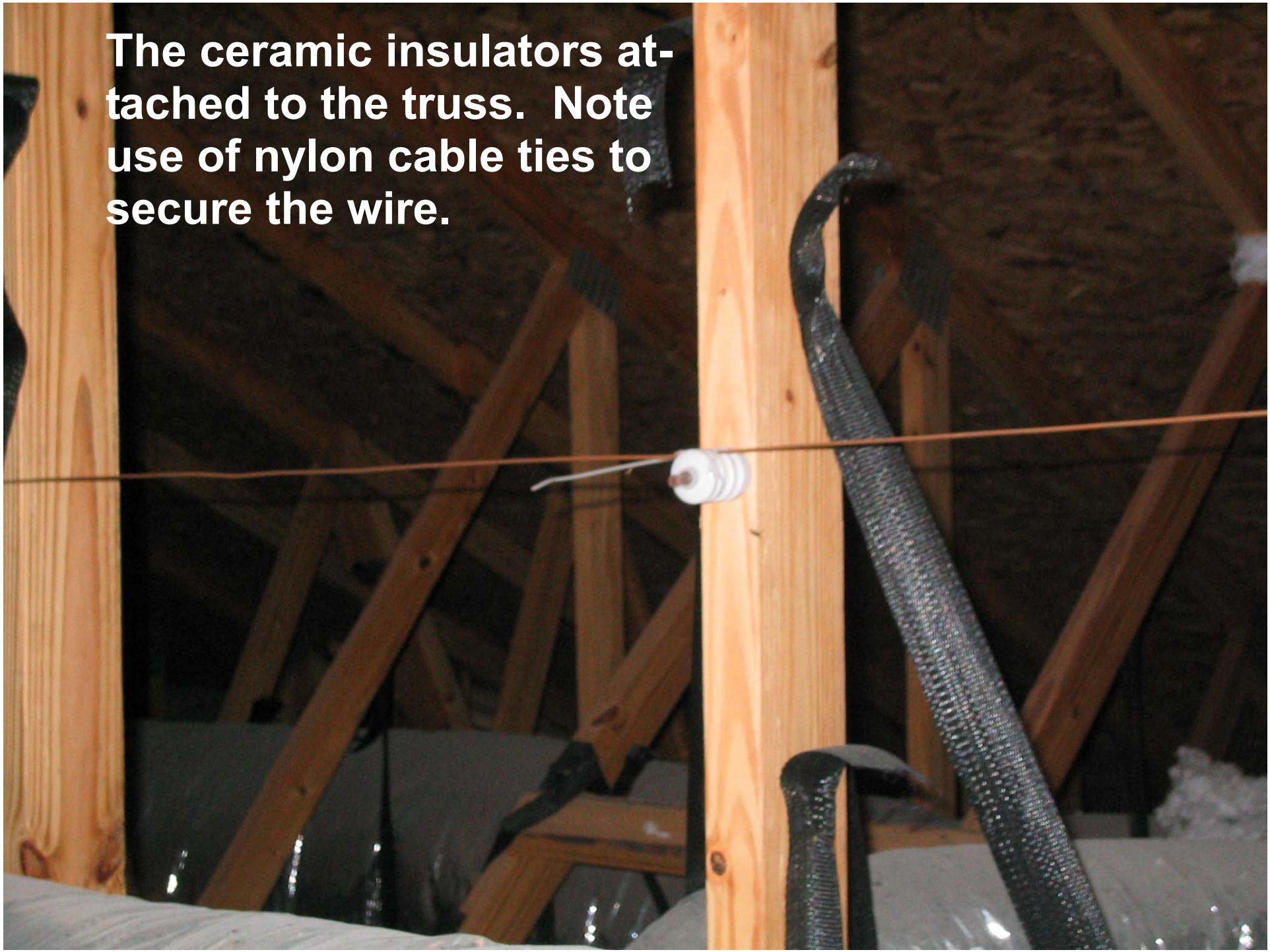
(Continued from page 52)

Andrew Cebik, W4RNL, also has an extensive site at:

www.cebik.com

dedicated to antennas, their evaluation and recommendations. One of his practical suggestions has been for an antenna to use as a back-up for 80 and 40 meter operations only. He comes to the conclusion that a wire doublet antenna 88 feet long is close to the best if you can only have one antenna. A bowtie antenna for 80 and 40 meters would be 128 feet for 80 in parallel with a 59 foot dipole for 40 meters. This antenna is 40 feet shorter and still is tunable on both Bands.

THE AUTOTUNER IN THE ATTIC


The ceramic insulators at-
tached to the truss. Note
use of nylon cable ties to
secure the wire.


Antenna turning the corner
at insulator


The end insulator and
tie-off point

Make the Legs Fit Shape of Attic

The trick is to get the antenna to fit my attic. One can use stand-off insulators (either electric fence type or ceramic--see pictures). The antenna is then started in the center of the house where the antenna tuner is bolted to the trusses (picture). Each limb runs straight as far as it can, and then is bent 90 degrees to the garage on one end, and to the bedroom on the other. It is always better to bend the antenna only 90 degrees rather than make a true "Z" out of it.

P.S. Read "Attic Antennas" in QST for October 2007! He makes many interesting points including RF Safety when using indoor (attic) antennas. A very good article. Also refer to "Table 4" for information regarding RF safety at:
www.arrl.org/news/rfsafety/eval

BIBLIOGRAPHY

1. A Disguised Flagpole Antenna, Albert Parker, N4AQ, QST, May 1973, p. 65.
2. An All-Band Attic Antenna, Kai Siwiak, KE4PT, QST, October 2007, pp. 33-37.
3. A Small, Portable Dipole for Field Use, Ron Herring, W7HD, QST, May 2003, pp. 33-39.
4. A Portable NVIS Antenna, Robert Hollister, N7INK, QST, January 2005, pp. 56-58.
5. “Honey I Shrunk the Antenna”, Rod Newkirk, W9BRD, QST, July 1993, pp. 34-39.

INTERNET RESOURCES

1. www.w0ipl.net/random-l.htm
2. www.force12inc.com/F12-flagpole-ants-003.htm
3. www.hamcq.com/index.php
4. www.new-tronics.com/main/index.html
5. www.cebik.com/fdim/fdim9.pdf

Also try following the hyperlinks in these sites for much more info.