The NEWSLETTER

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Mercury Amateur Radio Association - MARA

North America - North East

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Links that will take you to web locations referenced in this newsletter are shown in **BOLD blue text**.

E-mail your comments, ideas, or submissions to marane@mara.net or to ve1vq@eastlink.ca

Grandma Mara's RAMBLINGS

In a reversal of roles, Wendy is now an Elmer, or more correctly, an Elma, to a group of older adults at a nearby seniors' facility. It started out when Fred, an acquaintance of her grandparents, "retired" and moved to a retirement facility at the age of 83, after his wife of sixty-one years died and he found it too much to live by himself. After a few months of "the good life", he said he was bored to tears with playing cribbage in the common room every evening, trying to avoid the home's single women looking for companionship, watching the soaps, and taking van trips to a local mall to walk for exercise. When he lived at home, he had things to do, to fix, and to tinker with. In years past, he had worked in communications in the military, knew the code, and had thought he might get his ham license some day. Work, family, and other things always seemed to conspire against it.

Now with time to spare, he was looking for something he could do to engage both his mind and his hands. During a visit one evening to Wendy's grand parents (when he managed to escape the evening cribbage games and the women offering him home-made cookies), the conversation turned to grandchildren, and Wendy's ham radio hobby was mentioned. Fred's interest was sparked and he asked if he might have her home phone number. There was a few days hesitation before he got up enough courage to make the call, wondering what a teenage girl would think about an old man calling her, but make the call he finally did. They talked for only a few minutes that first time, as Wendy had to leave for a YW activity. He said later he wondered if she would actually call him back.

> **Fred later commented to me that for the first time in a long time he felt excited about something.**

The next evening she did indeed return his phone call and they talked for almost an hour about ham radio, family, about music, and other topics in which they had a mutual interest, agreeing to meet in person at the home on the coming Saturday.

That Saturday afternoon, Fred and Wendy met and formed an instant friendship. She had brought her two-meter HT, a CW qrp rig, and a home-brew code practice oscillator to show. His comment was "how really small they were", remembering what he had used in the military. Before she left she loaned him her copy of **The Ham Radio License Manual**.

Fred later said to me that for the first time in a long time he felt excited about something.

A couple of Saturdays later, Wendy and Fred again met at the home. This time there were five more residents present who had also expressed an interest in ham radio. They told their stories around the table. Most had a spouse, close friend or relative who had been a ham at one time. Wendy wondered if the two women present were interested more in Fred than in amateur radio, but she kept her thoughts to herself. She told the group that she needed to bring in outside help so she asked them if it was all right if she asked two of her friends to assist. All the seniors were fine with the idea and so Wendy said she would ask us. And that's how Walter and I became part of the group. Assistant mentors, if you will.

AR

New Operator App Note 2014-1

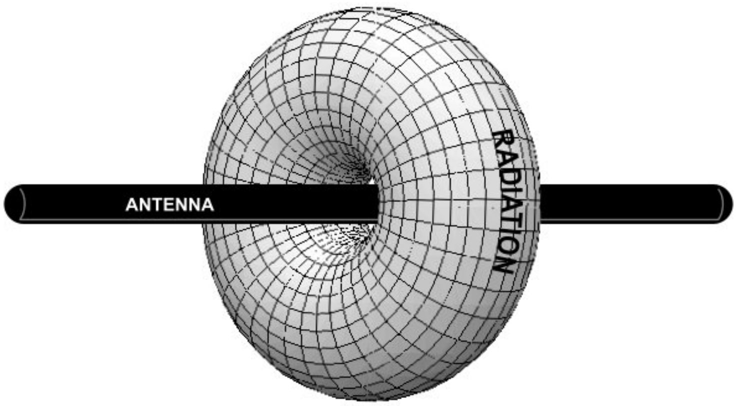
by a contributor who, for job related reasons, requests anonymity until retirement.

Real World Resonant Dipole Characteristics

There is a lot of mystique and pseudo science circulating in the realm of antennae and how they operate [Just scan a few on-line sites covering CB antennas! - Ed]. Hopefully this write-up will help remove some of that mystery. The intent is to show general antenna behavior and not engage in rigorous mathematical proof of the information presented. NEC2 and text references are used to textually and visually describe behavior of the dipole antenna. I hope this will allow the reader insight into real antenna performance.

Where to Start

The discussion will use the well characterized *Free Space*[1] *½ λ Dipole* as the base model. In antenna labs around the world this is a known standard, an easily constructed and repeatable antenna.



RADIATION PATTERN FROM A DIPOLE IN FREE SPACE

Dipoles in Free Space are well known to exhibit 2.1 dB nominal gain when compared to an Isotropic Antenna (an antenna that produces a perfect spherical pattern). It also produces a torus pattern much like a doughnut with little space in the middle.

Practical Dipole

In this discussion, the dipole will be assumed to be ½ λ at 3872.5 KHz (legacy MARA Net operational frequency). The dipole is driven at the midpoint out of convenience and exhibits well defined predictable behavior.

Now here comes the impractical part of the practical dipole. We are going to stick it in Free Space to compare it to other antenna and obtain a plot of the pattern. Using 4NEC2[2], the HF dipole for use at 3872.5 KHz is modeled in free space resulting in the pattern shown in Figure 1. Putting the plot into perspective, the display shows the cross section of the electromagnetic field surrounding the wire antenna. Imagine if you will a doughnut turned up on the edge with the hole perpendicular to your view. Now slice the doughnut in half so that the result is two half semicircular sections. The graph displays the flat butt ends of the doughnut or more accurately in this case the shape of the torus pattern if you could physically cut the torus in half.

Notice that the outer extremes of the plot extend just slightly over the polar plots 2 dB circle. This matches our expectation that the dipole will exhibit a peak gain point of 2.1 dB nominal over an isotropic antenna in Free Space. The dipole antenna exhibits this apparent power gain over the isotropic antenna as the power that is uniformly distributed around the sphere of the isotropic antenna is packed into the torus pattern around the dipole. Remember basic physics, energy is never thrown away.

Note also the wire for the antenna lies along the axis of the plot marked XY. (This is a two dimensional plot that attempts to capture three dimensions.) If you rotated the plot around the Z axis by 90 degrees you would observe a circle lying just outside the polar plot 2 dB circle.

The question however remains, what happens to our radiated power and pattern when we bring the antenna back to a practical place of utilization, specifically our backyard. The results are nothing short of amazing and for me it was an unexpected discovery. Changing 4NEC2 simulation software to calculate the antenna performance based on "Real Earth" under the antenna the software is again run. In this initial case of real world placement the 80 meter antenna is elevated 10 meters (32.8 feet) above the earth surface. The results are displayed in Figure 2.

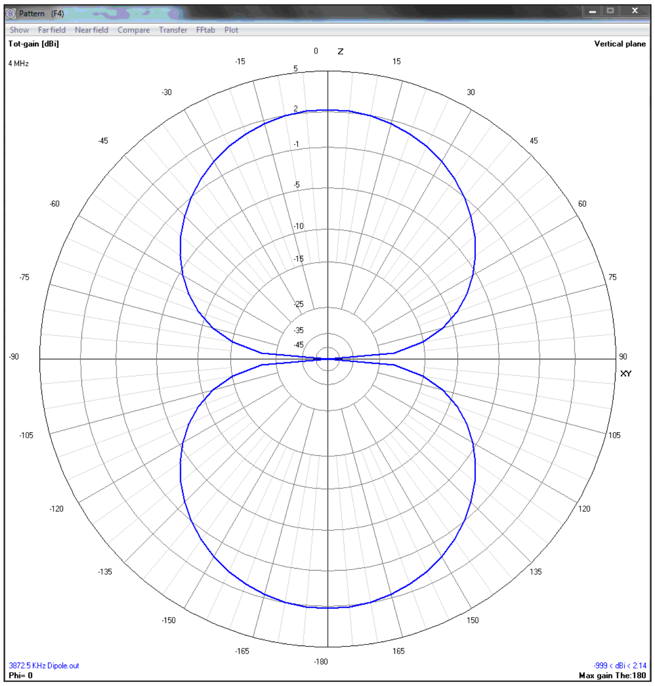


Figure 1

[1] A theoretical place in the universe were the only matter is the antenna i.e.; the wire used to realize the antenna. There are no buildings, no earth, nothing to interfere with the emanation of electromagnetic waves from the dipole.

[2] 4NEC2 is an antenna modeling program for the Windows environment available at no charge on the Internet. Simply Google "4NEC2" and follow the links to Arie Voors web page where you can download the most recent version.

Note that the lower half of the torus displayed in the Free Space condition is gone, the antenna now exhibits a gain of 5.8 dB peak and the bulk of the signal is directed right straight up overhead.

What happened? A good portion of the radiated RF has been reflected from the earth's surface and adds back to the signal being directed upwards. A portion is also lost to the earth where it is dissipated in the soil (converted to heat).

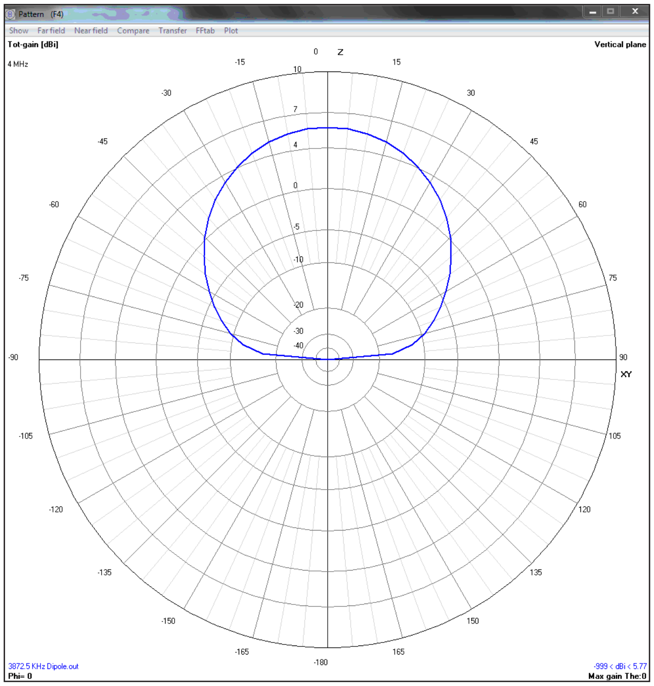


Figure 2

While placing the antenna over earth has provided unexpected directivity and additional effective radiated power in one direction, it is not what the amateur might anticipate. This is not necessarily a bad outcome. If your objective is close-in communications (less than a few hundred miles) this result is nearly ideal for the operator. If however, you are desiring long range DX then you want the radiated signal peak to occur at a much lower angle of radiation. You would like to see the graph displaying the radiated power directed low to the horizontal axis of the graph (approximately -75 or +75 degree elevation on the plot as this would result in the most power traveling in a direction towards the ionosphere which would provide the longest path via reflection before returning to earth for reception. For long range operations just how bad is this? Consider 5.8 dB increase of effective gain on your 100 watt signal means you are radiating a 400 watt effective radiated power nominal signal straight up. Following the plot curve down in Figure 2 to the 75 degree point note that the signal level is 10 dB down from the 0 dB reference circle. That means of your 100 watts you have less than 10 watts radiating in a direction that will provide best long haul comms.

We know the dipole can and will provide relatively low angle radiation, so what must one do if the desire is to use low angle radiated signals? In most antenna texts dealing with real world utilization of the dipole at HF frequencies, the dipole is almost universally placed ½ λ above ground. Unfortunately, a lot of the literature explains this placement away as the sweet spot to provide an optimal resistive impedance match at resonance. While true, they fail to mention it also dramatically drops the angle of radiation closer to the horizon so now more of your 100 watts is radiated in a direction for longer range comms.

Refer to Figure 3 which displays the same dipole raised to a height of 40 meters (131 feet nominal), approximately ½ λ at 80 meters. Note first the dramatic change in radiated power directly overhead. More revealing is the power radiated at an angle of 65 degrees. In the lower right hand corner of the plot also note that the peak radiated power is now 8 dB above the isotropic reference. This is a dramatic increase when compared to the isotropic antenna and yes, it is real. If you are running 100 watts SSB then this roughly translates into an ERP (Effective Radiated Power) of almost 631 watts. Suddenly the revelation occurs; the dipole which many thought was

continued on page 6...

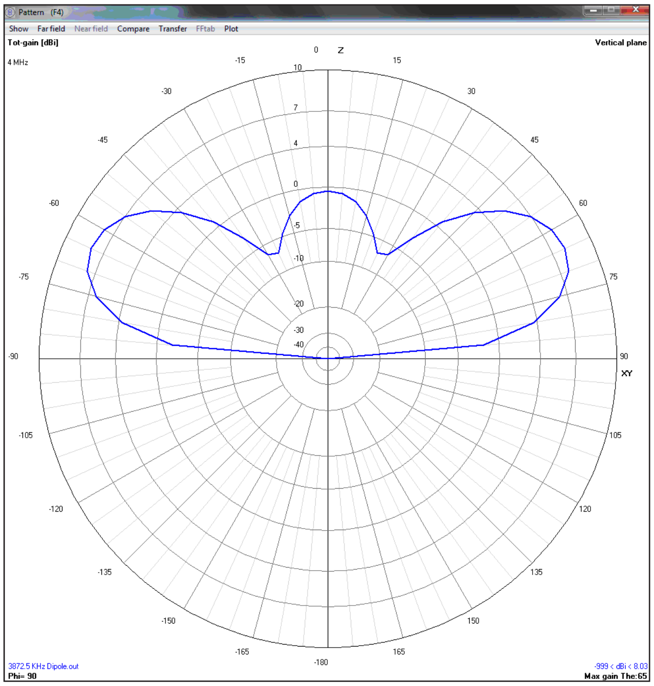


Figure 3

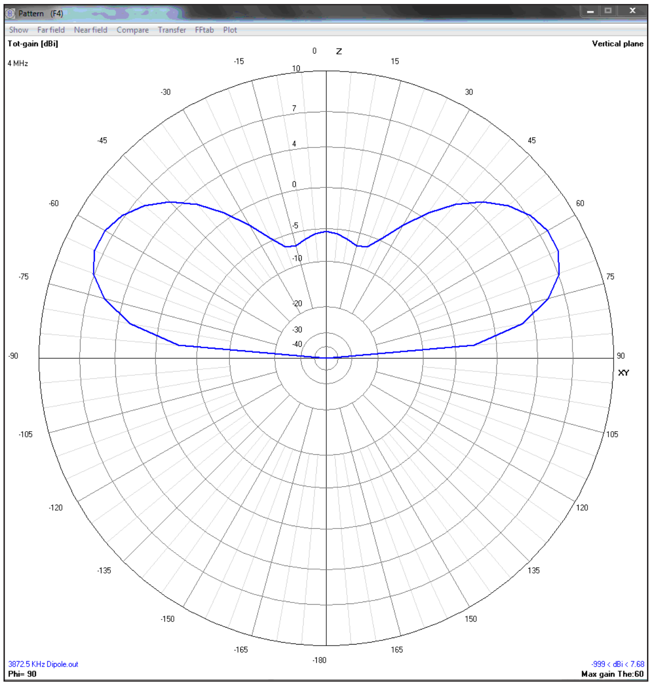


Figure 4 - 37 Meters AGL

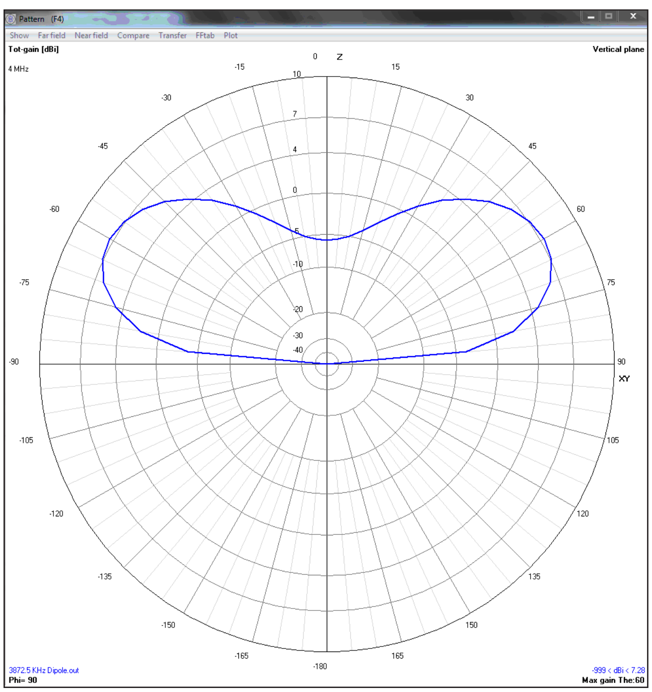


Figure 5 - 34 Meters AGL

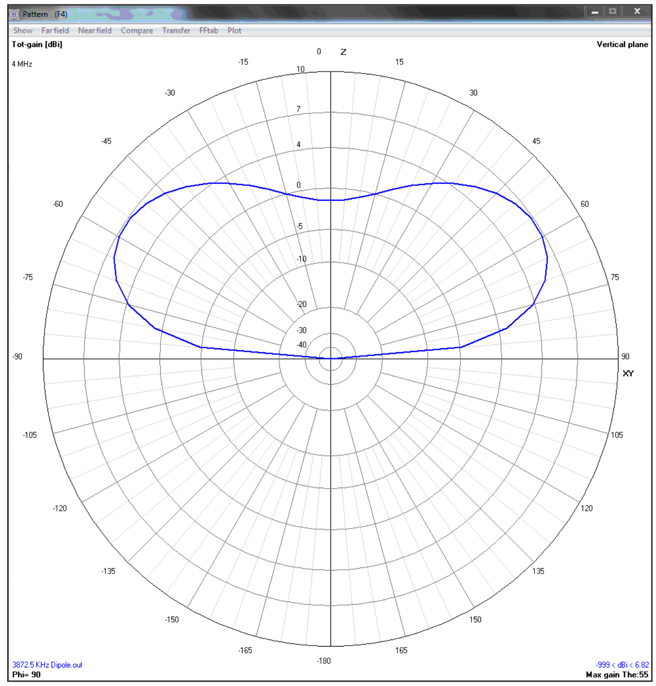


Figure 6 - 31 Meters AGL

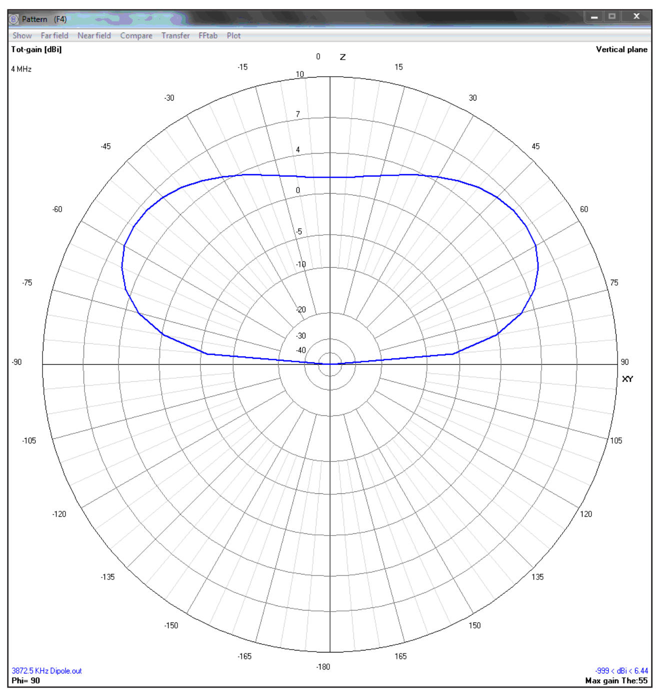


Figure 7 - 28 Meters AGL

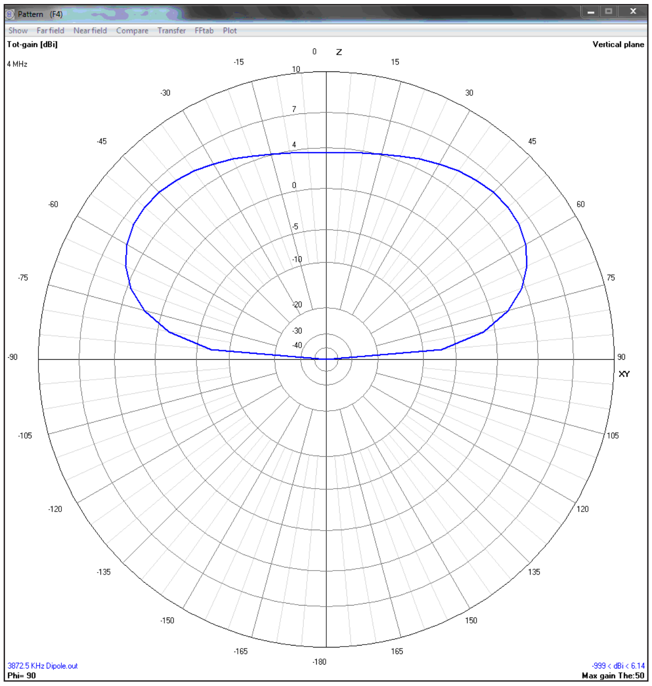


Figure 8 - 25 Meters AGL

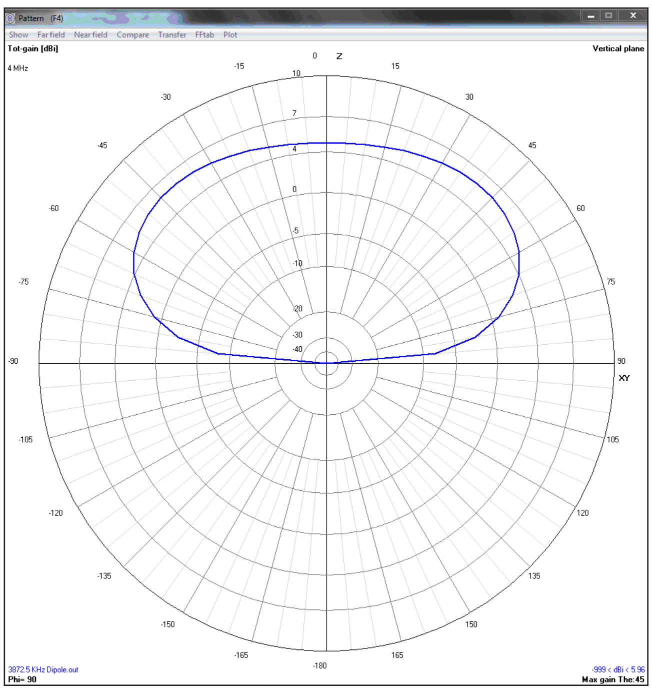


Figure 9 - 22 Meters AGL

...continued from page 4

simply a 2.1 dB best case radiator is actually providing gain in the right direction with an effective power level in the desired direction that exceeds the rated output of many amateur linear amplifiers[3].

Unfortunately 40 meters (131 feet) above the earth's surface is no small feat. So how does one gain the performance of the dipole at 40 meters above the earth without sending the XYL on a screaming rant about your effort to install a couple of 150 foot high antenna supports?

This has been a vexing problem for amateurs since the first ones realized that ½ λ above ground was kind of the sweet spot. In some cases, the amateur may have nearby trees which are high enough to allow raising the antenna to 40 meters AGL[4] . In others, the trees may only provide 100 feet of height or even less. Rather than be discouraged however, take a look at the subsequent plots that were run in 3 meter (9.85 feet) increments and notice the transition from a NVIS[5] performance antenna to one that provides more gain and lower angle of radiation.

Starting with the plot for an antenna at approximately 40 meters above earth for use at 3.8725 MHz, the height is reduced until the last plot provides a radiated signal peak at approximately 45 degrees and 6 dB of gain over the isotropic model. While 22 meters (about 70 feet) for a gain peak at 45 degrees is still above the height of supports available to many amateurs, the operator with access to trees in that height range can realize considerable advantage when using the simple dipole.

The effect of height above ground relative to the performance of the dipole should be pretty evident by this point. While not all amateurs will be able to erect great performers, even a dipole mounted at five meters above the ground still allow an op to communicate.

One thing to keep in mind is that the effects of height on other forms of HF antennae are similar. So if you are using a vertical or horizontal loop on 80 or 40 meters and the antenna is less than ½ λ above ground you can expect the pattern to be distorted as well as gain and radiation angle to be less than optimal. AR

3 Many amateur linear amplifiers were designed for 1000 watts DC input power to the final tubes. Assuming 50% efficiency, best case output would be about 500 watts from the amp.

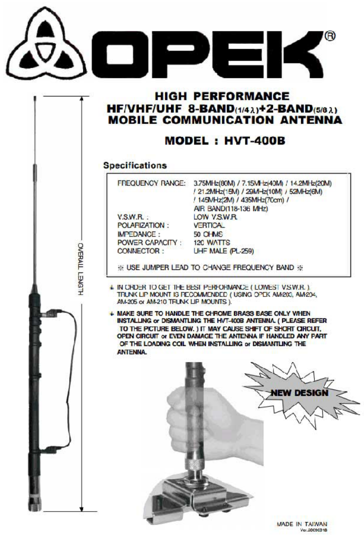
4 AGL - Above Ground Level

5 NVIS - Near Vertical Incidence System

TECH AND OTHER STUFF

by VE1VQ

Last month, Steve, AG4SO posted an e-mail on the NANE ERC reflector wondering if the OPTEK HVT-400B mobile antenna might be used as a home station antenna in those circumstances where restrictive homeowner covenants prohibited the installation of full size antennas. For a few minutes of weakness, I was tempted to buy one of these to try but quickly realized that, at best, it would be a poor radiator of radio frequencies, especially at the lower ones such as 80 and 40 meters.



The antenna is set to the band of interest by using a jumper wire to short out part (I'm guessing), or all, of the coil which forms the lower (approximately) half of the antenna. In the case of the 80m band, no jumper is used so the full length of the coil is in play. SWR is then adjusted by changing the length of the top section of the whip.

A quarter wavelength on the MARA NE net frequency of 3.8725 MHz is 60.42 feet. The length on the chart of the OPTEK vertical for 3.875MHz (close enough) is 1395 millimeters (54.92 inches or 4.58 feet). As you may imagine, this difference in height will mean a lot less efficiency and that translates into a lot less radiated power.

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How much less? Well, making some guesstimates, I tried modeling it with EZNEC over four 33' radials using the LOAD feature (lumped inductance). I couldn't get it to resonate anywhere near the MARA NE net frequency! It gave me an SWR or 2.12 at 10.6 MHz. Replacing the inductance with a HELIX (fancy word for coil) of 1.5 inches in diameter (and half the antenna length) gave me an SWR of 2.3 at approximately 23 MHz. Either I don't have the modeling correct (likely) or OPTEK did something I don't know about (very likely). I also tried modeling it with a single 33' radial with no better results.

All of the dimensions I used for the calculations were guesses based on the picture above about the coil construction as to wire size, spacing between coil turns, and coil length.

I even searched on-line for EZNEC files that someone else had done, to no avail. Perhaps, I'm not alone with my problem here.

FREQUENCY CHART

80M BAND (3.5~4 MHz) (JUMPER LEAD IS NOT NEEDED)					
Freq.(MHz)	3.5	3.625	3.75	3.875	4
LENGTH (mm)	1760	1635	1510	1395	1300
40M BAND (7~7.3 MHz) (JUMPER LEAD P1 TO P2)					
Freq.(MHz)	7	7.075	7.15	7.225	7.3
LENGTH (mm)	1760	1760	1715	1665	1620
20M BAND (14~14.35 MHz) (JUMPER LEAD P1 TO P3)					
Freq.(MHz)	14	14.075	14.15	14.25	14.35
LENGTH (mm)	1735	1735	1695	1695	1655
15M BAND (21~21.45 MHz) (JUMPER LEAD P1 TO P4)					
Freq.(MHz)	21	21.1	21.2	21.325	21.45
LENGTH (mm)	1850	1850	1850	1850	1850
10M BAND (28~29.7 MHz) (JUMPER LEAD P1 TO P5)					
Freq.(MHz)	28	28.15	28.3	29	29.7
LENGTH (mm)	1800	1800	1780	1715	1675
6M BAND (50~54 MHz) (JUMPER LEAD P1 TO P6)					
Freq.(MHz)	50	50.1	51.4	52.7	54
LENGTH (mm)	1475	1475	1410	1375	1355
2M BAND (144~148 MHz) (JUMPER LEAD P1 TO P6)					
Freq.(MHz)	144	146	148		
LENGTH (mm)	1420	1420	1400		
70cm BAND (420~450 MHz) (JUMPER LEAD P1 TO P6)					
Freq.(MHz)	420	430	440	450	
LENGTH (mm)	1440	1410	1365	1355	
AIR BAND (118-136 MHz) (JUMPER LEAD P1 TO P6)					
Freq.(MHz)	118	127	136		
LENGTH (mm)	1760	1620	1510		

One web site I found, talked about an efficiency of less than 3% for a ***carefully*** designed mobile antenna on 80 meters. That's less than 3 watts radiated from the antenna for 100 watts to the feed point. One with a coil of lower Q had an efficiency of ***less than 1%***.[1,2]

Jerry Sevick, W2FMI (SK) is noted for his articles on short verticals. His work involved radials (and lots of them) and capacitive top hats to greatly increase the efficiency, neither of which this vertical has.

Any antenna for hams is a trade-off of some kind.

Whether in usable frequency range, gain, take-off angle, or efficiency. Verticals for mobile work are losers in most of these categories (and most especially on the lower frequency bands). This one is no better and, unless you are desperate for a home station antenna, stay away from it. Make your own antenna out of wire or tubing - you will do a better job.

[1] **http://www.eham.net/articles/22397**

[2] **http://www.k0bg.com/eff.html**

QRP Rig - Ten-Tec Rebel 506

A recent visit to my local post office netted me a late combination Christmas and birthday present. **Ten-Tec** was nice enough to send me a box containing their latest QRP rig, the Rebel 506, in exchange for a just a few numbers off my credit card.

The following is taken from the Ten Tec web site...

> "The **TEN-TEC Rebel model 506 transceiver** is designed with the purpose of providing Ham Radio operators a platform for developing and writing code using the open-source Arduino programming environment. It is a factory built CW QRP radio with a Chip Kit Uno 32 Arduino compatible processing unit that holds the operating program. The radio is provided with programming for basic operating functions that allow it to be used immediately as a basic QRP transceiver. Additional operating functions can

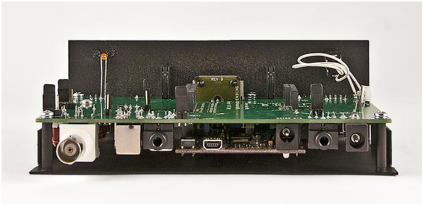
> be programmed by the user, either by writing the code or copying/adapting code developed by members of a growing number of Arduino special interest groups. It is this sharing of programming routines and ideas for functionality that is the heart of the Arduino open-source concept.

> "Basic features include a 40 & 20 meter QRP transceiver with internal jumpers to change bands. Full band coverage on both bands. Typical power output will run 4-5 watts with 13.5 VDC. A drift free operation is achieved through DDS synthesizer technology. CW sidetone through headphones. Three filter bandwidth choices and three tuning rate adjustments included with the stock program."

One of the first things you notice is the lack of any frequency display. When you turn the rig on, it defaults to the qrp calling frequency of whatever band you have selected (7.030 MHz on the 40 meter band, or 14.060 MHz on 20 meter band). The Ten-Tec firmware has provisions for either a 16x2 or a 20x4 LCD display. The manufacturer has indicated that an optional top cover will be available in the future to house the display. For now, you have to provide an external case.

Out of the box, a frequency indicator (of sorts) is provided by having the LED (in the middle of the TT logo) blink at the rate the tune knob is set at. If you have it set to 100 Hz, the LED will flash once for every 100 Hz change (up or down) in frequency. If you want to go up a kilohertz, then you would count ten flashes as you tune.

There is a fairly active Yahoo Groups **Rebel reflector** and already members have contributed new firmware/ hardware upgrades for additional types of displays, keyers, switchable band change (out of the box, the user has to manually move several on-board jumper plugs), S-meter, and other modifications to Ten-Tec's factory firmware. One of the good things about this rig is that the manufacturer actively encourages experimentation and modification. Their stated policy is that they will incorporate the best of the improvements into future official versions of their firmware. Ten-Tec staff are members of the e-mail reflector and frequently post ideas or make comments.



This is not an SDR (software defined radio) and is limited by the hardware to the two bands (40 and 20 meters). It is a platform upon which to experiment with additional hardware and firmware.

And besides all that - it's cute too!

TEN-TEC Rebel 506 SPECIFICATIONS

Key Jack: 1/8” stereo

Power Connector: 2.1 mm coaxial

RF Output Connector: BNC female

Headphone/Speaker Jack: 1/8” stereo

Frequency Range: 7.000-7.300 MHz
14.000-14.350 MHz

Antenna Impedance: 50 ohms

DC Power Requirement: 10-15 volts

Operating Temperature Range: 0-50º C

Dimensions (H×W×D): 2.0”×6.0”×4.0”
(not including feet, knobs, connectors)

Weight: 1.33 lbs.

Construction: Painted steel enclosure

RF Power Output: Approximately 5 watts at 13 VDC; reduced output at lower supply voltages

Harmonic & Spurious Outputs:
Meets FCC specifications

ARRL Field Day

June 28 and 29th, 2014

“**ARRL Field Day** is the single most popular on-the-air event held annually in the US and Canada. On the fourth weekend of June of each year, more than 35,000 radio amateurs gather with their clubs, groups or simply with friends to operate from remote locations.

“Field Day is a picnic, a camp out, practice for emergencies, an informal contest and, most of all, FUN!
It is a time where many aspects of Amateur Radio come together to highlight our many roles. While some will treat it as a contest, other groups use the opportunity to practice their emergency response capabilities. It is an excellent opportunity to demonstrate Amateur Radio to the organizations that Amateur Radio might serve in an emergency, as well as the general public. For many clubs, ARRL Field Day is one of the highlights of their annual calendar.

“The contest part is simply to contact as many other stations as possible and to learn to operate our radio gear in abnormal situations and less than optimal conditions.” AR

QUOTE OF THE MONTH

“He is not here: for he is risen, as he said.”

Matthew 28:6

DI-DAH-DI-DAH DIT

It’s always interesting to read the April issue of QST, trying to pick out the bits of trickery the magazine staff scatter among the pages. Some are obvious, some are a not so. Some are very clever.

One such article, published quite a few years ago now, was for a VFO frequency stabilizer. The only problem was, as you turned the frequency dial, the frequency always returned to the original setting (*making it very stable*).

Some of these articles have been so convincing that readers have written in asking where they can obtain the parts to construct the projects!

As I write this, it is the 26th of March and outside the wind is roaring and the snow is whipping by the window. Authorities were warning everyone to stay off the roads and inside where it was warm. Most businesses and government offices throughout the province are shut down.

This has been a long winter and, what with the sunshine, the seasonal temperatures, and the bare ground we had yesterday, people were thinking that actual spring was, hopefully, right around the corner.

Perhaps today was Mother Nature’s idea of a early April 1st prank.

Until next month,

VE1VQ

Oh, in case you are wondering - there is no April Fool’s material in this issue of the newsletter.