Sierra Signals

Sierra Foothills Amateur Radio Club
Auburn, CA
An ARRL Special Service Club

http://www.sf-arc.org/ FEBRUARY 2010 PO BOX 1005. NEWCASTLE. CA

At the key of SFARC

S F A R C

OFFICERS

PRESIDENT
Al Martin, NI2U
amartin4@wavecable.com
VICE PRESIDENT
Charles Baker, AE6LR
ae6lr@yahoo.com
SECRETARY
Bill Mahl, W6WEM
wemahl@wildblue.net
TREASURER
Bob Balthrope, KD6WTY
kd6wty@yahoo.com
DIRECTORS
George Simmons, KG6LSB
grsim@mindspring.com
Kurt Hess, N6RS
khess01@comcast.net
Frank Sharit, N6GP
n6gp4900@sbcglobal.net

REPORTERS
Satellites: Greg, KO6TH
History: Gary, KQ6RT
Misc Radio: Fred, K6DGW
Sunshine: Richard WA6RWS
rkuepper@ymail.com
916-482-5027

RESOURCES

REPEATERS
145.430 (-0.6 MHz/PL 162.2)
440.575 (+5.0 MHz/PL 94.8)
223.860 (-1.6 MHz/PL 100.0)
CLUB NET
Thursdays, 7:30PM, W6EK/R 145.430
CLUB MEETINGS
Second Friday of the month, 7:30PM at the Library, 350 Nevada St, Auburn CA
CLUB BREAKFAST
Last Sat of the month at Susie's Café, Cirby at Riversi Roseville – 8:00 AM
NET CONTROL OPS
Dave Jenkins, WB6RBE
Gary Cunningham, KQ6RT
Norm Medland, W6AFR
Casey McPartland, W7IB
NEWSLETTER EDITOR
Matthew Diridoni, KC6RUO
916-749-3032
matteod@comcast.net

SPECIAL SERVICE CLUB ARRL

Calendar of Events

February 12	Club Meeting CALSTAR, the air ambulance service will be presenting to SFARC
April 30–May 2	**EMCOMMWEST** Reno, Nevada http://www.emcommwest.org/
May 23	**Sacramento Hamfest NHRC, Natomas High School, off Truxel Rd.**
June 26 & 27	**ARRL Field Days**

For more information and rules on the ARRL activities listed above, go to:
http://www.arrl.org/contests/calendar.html?year=2010

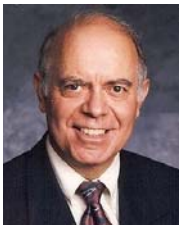
SFARC CLUB MEETING February 12
CALSTAR, the air ambulance service will be presenting to SFARC. Don't miss this interesting presentation!

"Tech Ten" Presentation
"Radiation vs. Humans"
Antenna Distance.
By Al Martin

Bring a friend
See you there!

In this issue

We encourage members to receive Sierra Signals via email to save the Club the cost of reproduction and mailing



From the Presidents Shack

Al Martin, NI2U

This club has a number of family orientated activities. These activities only work well when members step forward to do the work, the club needs help to put on the picnic and the Christmas party.

It is common for people to let those who start doing something like cooking at a picnic to continue doing it forever. We all like to socialize. For socialization to happen, we need to have volunteers to do the cooking and purchase the food. Cooking will require a couple of teams so that the teams can trade off.

I would like to see two team leaders volunteer for the picnic. Bob, WA2ULL, has signed us up for his private picnic area that everyone enjoys. Please come forward to help have this function. The idea is to take a job for one year and then not have the job the following year.

The Christmas Party is more complicated. We need someone to buy the food, someone to purchase the lady's gifts, someone for clean-up and someone to coordinate entertainment. Again the idea is to take a job for one year and then not have the job the following year

There is plenty of time to make these wonderful events happen. The most important thing is preventing burn-out of a few. We all enjoy the events and new hands provide the old hands time for their enjoyment.

See you at the meeting on February twelfth.

Miscellaneous Radio

By Fred Jensen, K6DGW

End of an Era

In Olden Times [as in REALLY Olden], era's lasted millions of years. They had to, since archaeologists can't date things much closer than a few million years, give or take one or two. Then, people came along, and era's got shorter – a few thousand years, as in Egypt or the Middle East. Now, eras are measured in years with numbers less than 100.

Consider the Cell Phone Era. In the early 80's I recall reading papers in the IEEE Vehicular Communications Journal about a brand new idea ... low power, 'carryable' wireless devices that would be serviced by a multitude of low power "cells," each handing off a user to the adjacent cell as she moved. I wondered at that time, "Is this really feasible? Who wants to lug around a canvas bag filled with radio and batteries?"

Apparently, it is feasible. I recently washed my somewhat old cell phone. Long story, not worth retelling, ask my wife if you want to hear it. So now, I have a new phone. It will take pictures and send them somewhere if I knew how, it will surf the Internet if I knew how, I can send text messages using a full QWERTY keyboard [very small, my thumbs are too big] if I knew how, and now my three local grandsons can annoy the crap out of me with text messages.

Unfortunately, they know how to do that. Clearly, the "Cell Phone Era" happened and seems to be accelerating. Whether or not that's good may yet to be determined, Andrea was rear-ended a couple of weeks ago while stopped to make a left turn by a 21 year old who probably was texting on her phone ... no skid marks.

Or, take the "GPS Era." About the same time that I was reading about cellular communications systems, I was also reading about a yet-to-be-deployed satellite navigation system being funded by the DoD. It sounded a bit far fetched to me, and I wondered if this was yet another DoD boondoggle. For at least 5 years now, I've had a little hand-held Garmin GPS-III+ that runs on a few AA cells, and does amazing things. Then, Andrea bought 'Daphne,' another Garmin machine, about 3/4" thick and less than 3"x5", that is full of maps of everywhere and of course, "Daphne," a moderately pleasant voice who talks to us. Want to get to Harry's Hof Brau in San Jose for the NCCC meeting?, ... just key in the address, and Daphne gets you there.

The GPS Era has finally signaled the end of another era that isn't even as old as I am. The US Coast Guard has announced that beginning in February, and taking most of the year, they will be shutting down the LORAN-C navigation systems world-wide. LORAN [Long Range Navigation] originated during WW2. Its first incarnation was LORAN-A, and after a lot of research, the

War Department decided to field it in the range 1750 – 2000 KHz. Sound familiar?

It wasn't a problem for hams then, we were off the air due to the war, and never a problem for those who lived in fly-over country like Nebraska, LORAN-A stations were sited on coastlines and were primarily for maritime navigation. We won the war and hams got back on the air. If you wanted to get on 160 and you lived on a coast, you did so with severe power limitations, as if that mattered. LORAN-A was a pulsed system, peak powers in the several hundred KW range, and the racket on 160 was intolerable and the band was pretty much useless except maybe in Nebraska. Those power limitations are the reason that older linear amplifiers [think Heath SB-200 and SB-220] did not include 160.

LORAN-A began to slowly fade from the scene in the 60's, however in the US, it operated in some places until the 80's. It was replaced by LORAN-C, which operated on one frequency – 100 KHz -- with peak pulse powers around a megawatt. Since time synchronization of the stations was essential, over time, the USCG began to use them to distribute highly accurate time hacks to ships [and ultimately aircraft] world-wide. LORAN-C set the stage for experiments in satellite-based navigation systems [which require REALLY accurate time], and thus probably sealed its fate.

In the mid-60's, the USCG installed a LORAN-C chain in SE Asia. Coincidentally, I ran into my next door neighbor Paul, then K6EIU, on the northern coast of South Vietnam. As 13-yr olds, we had shared a Novice station, but by this time, he was a CG PO3 and was working on that LORAN-C chain and I was an AF 1Lt with an airborne combat communications team.

So, LORAN-C will end and so will a bunch of USCG jobs. A few of them were in a dust hole on US95, south of Las Vegas at Searchlight NV and I'm sure they won't be missed, Searchlight is the southern end of the Western US chain [the master station is at Fallon NV, there is one in Middletown CA over by Clear Lake, and the northern end is in George, WA]. All the chains are not shutting down together, and unlike 500 Kcs did a few years ago, it will take most of the year.

An era does end, but opportunities arise from the ashes. Many current transceivers will receive in the LF band, and around here, the Middletown CA station is so strong at night it drives your receiver into severe overload even if you're only within 150-200 KHz or so of it, and you can't miss the incredible racket LORAN-C puts out, basically just like what we heard on 160 from LORAN-A in the 50's. Things will be much more quiet on LF, we might all be able to hear and report reception of the experimental hams on 510 KHz, and we might even get a small allocation there.

So LORAN-A begat LORAN-C. "What happened to LORAN-B?" I hear you ask. Well, the DoD funded that too. It didn't work out technically, but before we jump on the DoD, consider-- LORAN's-A and C, and GPS, worked ... possibly beyond any of our expectations. They were/are world-wide systems, operated in many countries, and are mainstays of both maritime and aircraft navigation and have been for many years. One strike-out in four-at-bats isn't too shabby an average.

We have been having sunspots, and they're all Cycle 24. Be sure to give 10m a try, it has been open recently mid-day.

73,

Fred K6DGW

BOARD MEETING - JANUARY 27, 2010

The meeting commenced at 1630 hours at the Round Table Pizza in Loomis.

Present were - President Al Martin NI2U, Vice President Chuck Baker AE6LR, Secretary Bill Mahl W6WEM, Treasurer Bob Balthrope KD6RUO, Director George Simmons KG6LSB, Director Frank Sharit N6GP, and Richard Kuepper WA6RWS. Absent was Director Kurt Hess N6RS.

We discussed revisions and typos in the By-Laws. The Officers will be working this year on the By-Laws to correct some redundant sections, parts that need to be rewritten and parts that need to be added.

Al NI2U thought it would be good to submit any club news to the ARRL Section Manager. Frank N6GP said he would take care of this.

There was discussion about the roster format keeping the roster updated regularly, and adding a column for ARRL members.

There was some discussion about the Mystery question on the club net every week that some of the questions are too technical and difficult. An effort will be made to find easier questions.

George KG6LSB and Richard WA6RWS completed the needed maintenance at the repeater site. The roof was repaired, the tree was trimmed, and the auto-patch is in.

Frank N6GP thought it would be good to visit near-by radio clubs and to exchange newsletters.

Bill W6WEM stated that he updated the clubs information with ARRL on January 10, 2010. This has to be done yearly to keep club status.

Also discussed was having the Officer's meeting on the same day as the regular club meeting. We decided to have the meeting at 1730 hours at the Round Table Pizza in the Elm Shopping Center in Auburn.

Respectfully Submitted by
Bill Mahl W6WEM
Secretary

Repeater News

By Richard Kuepper, WA6RWS

On 27 Jan I was able to get up to the repeater site and install the autopatch. I am working on coding for the autopatch and it should be available soon.

There are 200 memories for telephone numbers. For those members who frequently call the same numbers, I can program a speed dialer for those numbers. Please let me know by email.

George, KG6LSB also came up and trimmed the branches that were touching the roof while I was there. I also secured the metal roof edges to prevent any rain from entering the building. Thanks to George for supplying the tools and parts.

We will soon have training for those members that want to be able to do controlling of the repeater. This would be especially important for the net control operators.

Richard, WA6RWS
Repeater Chairperson

ARRL VEC
AMATEUR RADIO VOLUNTEER EXAMINER

Local ARRL Exam Sessions
Courtesy of the ARRL

06-Feb-2010
Sponsor: UNSPONSORED
Time: 8:00AM (Walk-ins allowed)
Contact: LARRY R HODGE
(916)361-2476
Email: LARRYHODGE2000@COMCAST.NET
VEC: ARRL/VEC
Location: RALEY'S COMMUNITY EVENT CENTER
6845 DOUGLAS BLVD
GRANITE BAY, CA 95746

20-Feb-2010
Sponsor: RIVER CITY ARCS
Time: 7:00AM (Walk-ins allowed)
Contact: KENNETH M HALL
(916)492-6115
Email: WO6J@ARRL.NET
VEC: ARRL/VEC
Location: CARMICHAEL ELKS LODGE-USE EAST ENTRANCE
5631 CYPRESS AVE
CARMICHAEL, CA 95608

20-Mar-2010
Sponsor: RIVER CITY ARCS
Time: 7:00AM (Walk-ins allowed)
Contact: KENNETH M HALL
(916)492-6115
Email: WO6J@ARRL.NET
VEC: ARRL/VEC
Location: CARMICHAEL ELKS LODGE-USE EAST ENTRANCE
5631 CYPRESS AVE
CARMICHAEL, CA 95608

03-Apr-2010
Sponsor: UNSPONSORED
Time: 8:00AM (Walk-ins allowed)
Contact: LARRY R HODGE
(916)361-2476
Email: LARRYHODGE2000@COMCAST.NET
VEC: ARRL/VEC
Location: RALEY'S COMMUNITY EVENT CENTER
6845 DOUGLAS BLVD
GRANITE BAY, CA 95746

ARRL Pacific Division Cabinet Meeting
December 5, 2009

Introduction

Jim Tiemstra, K6JAT, invited the Sierra Foothills Radio Club to the annual ARRL Pacific Division Cabinet meeting in Livermore California to talk about several topics of interest to Radio Amateurs. The topics covered were the continuing threat of the proliferation of Broadband over Power Lines (BPL), commercialization of the Amateur Radio Service, the continuing impact of Pave Paws, organizational issues and other matters of significance to the membership. This annual meeting provides an opportunity for Pacific Division clubs to bring issues to the Division management that may be addressed at the January ARRL Board meetings.

Norm Medland and Al Martin attended for the SFARC. Richard Hill NU6T joined us in a carpool. Richard represented another club.

The Meeting covered these topics Section Manager Reports, a report by Dwayne Hendricks WA8DZP, Pave Paws, BPL, Commercialization, Several Shorts and a program on Iraq by K6MD.

Section Manager Reports

Emergency Support was discussed by several of the Section managers. Publicity of Amateur support is an important action to accomplish. Santa Clara RACES/ARES made a case to look at setting up its own training.

Ron Murdock (SV Section Manager, W6KJ) mentioned that CAARES-RACES is becoming dominant over ARES. Ron also drove over 500 miles during Field Day visiting various locations.

Pacificon 2010 - the West Coast Ham Radio Convention will be in October at the *San Ramon Marriott Hotel* and the issues that had it move to Reno last year are resolved. Parking will be about a half mile from the meeting facility. There was mention of transportation.

There is a Makers Fair held at the San Mateo Fair Grounds. This fair is for anything except home improvement.

Dwayne Hendricks, WA8DZP

Dwayne talked about several topics. The most interesting is cognitive defined radio; radio that runs heuristically. The FCC wants Amateur Radio to run experiments. Dwayne has prepared a proposal that the FCC is reviewing. [The IEEE magazine has an article on radios built using micromechanical parts. The "Q" of these parts is in excess of 10000. The "Q" of L-C filters is on the order of 100. These radios have the ability to support cognitive radio. Al, NI2U]. Cognitive radios will decide things like power and frequency to use.

Pave Paws

Jim (K6JAT) showed emotion on the following statement. If we are not careful, the CRAP some hams are pulling in the 440 band will get a 250 mile quiet zone implemented. There are a number of stories about hams operating illegal, unlicensed repeaters. Since they never identify themselves, these operators are difficult to locate.

This does not set well with the Air Force who thinks they have been open and co-operative in this difficult situation. 440 is a shared band and hams are not the primary user. (A discussion of Official Observers (OO) came up and OO's have no authority to take any statements).

Commercialization of Amateur Radio

Dwayne brought up the point that Colleges and Universities are confused about whether they should use Amateur Radio in curriculum because they have believed that their use of ham radio would be illegal because they are paid to teach. Using Amateur Radio in curriculum is not a commercial application of Amateur Radio; it is included in the specific exception in part 97.

Dwayne discussed problems related to planned use of Amateur Radio by government or businesses. He noted that many businesses and agencies are buying ham equipment and sending staff to training so they can avoid buying more restrictive and expensive communications gear appropriate to the Service related to their business interest. He warned that many are gaining "normal" use of ham radio and will eventually demand to use the frequencies based on historic use. This is why the FCC has clarified that ham radio is not a first response emergency Service and employees may not use equipment owned by their business for non-emergency practice, although volunteers may.

Hams are not first responders. Hams are not public safety. Hams are also inexpensive.

At the FCC, Dwaine pointed out that the political appointments have resulted in the strong technical people leaving the commission. Essentially, right now, everything is about policy and money. There is essentially no enforcement capability. Right now, Amateur Radio is negative money to the government.

Dwayne also pointed out that there is a philosophy at the FCC no enforcement results in no problems.

Dwayne pointed out that the decisions that affect Amateur Radio in the long run are being made at high levels. It is important that hams make their issues know to the upper level managers and directors in government. He noted that

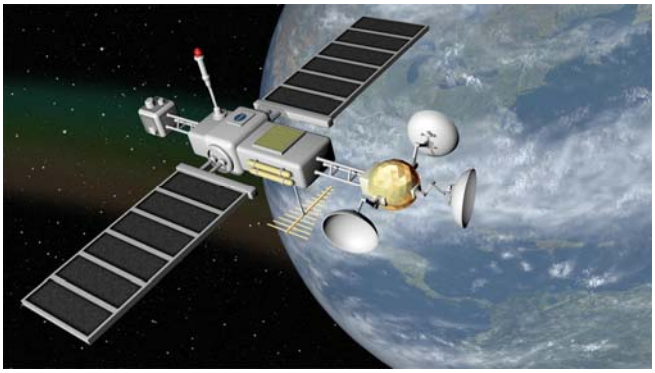
trying to change the direction of the future of amateur radio by dealing with new Technicians who attend our trainings, meetings and events is not going to help. We need to influence the movers and shakers at high levels.

Broadband over Power Lines (BPL)

Congress has been tasked to improve BPL.

BPL appears to be dead except for some home networks.

There was some discussion of the 900 MHz band here. First, it is a shared band and Amateur Radio is not primary. A Ham who works for PG&E spoke up and said there are 23 channels for smart meters. Four of the channels conflict with the Amateur Frequencies. The devices put out a signal for 40 mSec once per hour. There are also a series of repeaters on 60 KV and 12 KV lines.



SFARC Satellite Report
By Greg Dolkas, KO6TH

China Launches First Ham Satellite

On December 15th, 2009, China AMSAT successfully launched their first satellite carrying amateur radio equipment. Dubbed "XW-1" in Chinese ("Hope-1" in English), the satellite began operating on the ham bands and was given it's official OSCAR designator of HO-68 barely a week after launch. The satellite can run in three different modes - an FM cross-band repeater, a linear transponder (for SSB/CW modes), and a 1200 bps Packet system. Each of these uses an uplink on the 2 meter band, with the corresponding downlink on 70 centimeters. There is also a CW beacon on 70cm, which runs slow enough that even I can decode it by ear.

While there are a number of amateur radio satellites currently in orbit with similar capabilities, HO-68 is unique in a couple of ways. First, it is in a relatively high orbit, nearly 800 miles up. This compares with most Low Earth Orbit (LEO) satellites that orbit around 400 miles up, and the International Space Station (ISS) which is only a little over 200 miles up. The significance of this is that the higher orbit gives the satellite a much larger "footprint", or the area on the ground which can see the satellite at the same time. Only the AO-7 satellite is still operational in a higher orbit, at 900 miles, and there's been a friendly contest to see who can make the longest distance QSO through it. Currently, that record appears to be between Kerry, WC7V in grid square DN45 and Ted, RN1NW in KP71, covering a distance of about 7,659 km or 4,748 miles. They call that "stretching the footprint". Indeed!

In addition, the higher the orbit, the longer it takes the satellite (moving at over 18,000 miles per hour) to pass by. HO-68 passes can often last from 18 to nearly 20 minutes, compared to less than 10 minutes for the ISS. One can actually have a conversation in that time. Some HF openings don't even last that long, and satellite passes can be predicted with accuracy weeks in advance. That almost makes it too easy to have a QSO.

HO-68 also is unique in that the 1200 BPS Packet system can operate at the same time as the FM repeater, interleaving packet and voice communications. Most satellites that have a digital mode operate in one mode or the other. AO-51 can do both at the same time, but using different transponders. (That's cheating!) With this flexibility,
HO-68 can handle a more complex mix of communications than the others, and I understand that it actually works surprisingly well.

HO-68 is still being checked out, and an operating schedule has not been settled as yet. So, it's best to check on the Internet
(http://www.camsat.cn) for the latest news and planned schedule. In the mean time, if you're listening around 435.790, +/- a bit of doppler, and hear a slow, boring CW signal (boring because there are lots of "T"
characters in a row), ending with "XW", that's HO-68's beacon!

Congrats to China AMSAT!

73s,
Greg KO6TH

6 Meter 1/4 Wave Antenna by Mike Fedler N6TWW

December 28th, 2009

Building this project requires the use of tools that are capable of serious injury to you. If you attempt to build this project or something similar be sure you wear safety glasses and use all necessary safety precautions. If you are not familiar with the use of the tools required, obtain assistance from someone who is familiar with their proper use.

Tools

Tools used to build this project were as follows:

- Safety glasses
- Drill press & bits
- Hack saw
- Flat metal file
- Round metal file
- Philips screwdriver
- Reciprocating saw
- Adjustable wrenches
- Center punch

- Hammer
- Threading die 3/8 x 24 and handle
- Small framing square
- Pliers
- Vise grips
- Tape measure

Not all of these tools are absolutely necessary and substitution could be used for some. As an example a hand drill could be used in place of the drill press. If you are new to building and are missing a few tools, you can use this project as an excuse to purchase a new tool. Remember, any tools you buy for this projects will make it easier for you to build future projects.

Project Background & Goals

There were a few goals for this antenna. The first goal was to be able to talk to some of my friends on a 6 meter link that is within easy radio reach of my home. Second was to be able to use some of the local 6 meter repeaters and third was to be able to use single side band when the band opens. For FM operation vertically polarized antennas are standard. So this antenna should work well for FM.

For single side band it is really best to have a horizontally polarized antenna which this antenna is not. Using an antenna that is crossed polarized from other stations in your area results in about a 20 dB loss in signal strength. If the band is open and you are receiving signals that are bouncing off the ionosphere then polarization is not so important since the polarization tends to get mixed up. Another consideration is that the radiation angle for a quarter wave antenna is pretty high and will not be as good for DX signals as compared to an antenna the has a lower angle of radiation. At some point I will build something else that is better suited for sideband, but for now having an antenna that is vertically polarized is better than nothing on sideband.

Another consideration was the gain of the antenna. I wanted something that was small and relatively easy to build. I was not as concerned about putting out the most potent signal. Since this is a quarter wave antenna it is considered a unity gain antenna as compared to a dipole "0 dBd". Quarter wave antennas are pretty simple and do not require any matching circuitry when fed with standard 50 ohm coax.

A couple more considerations were materials and level of mechanical complexity. I wanted a design that was fairly simple but mechanically strong enough to stand up to the weather. I live in a relatively moderate climate so I did not have to worry about snow or ice loading. The design just had to stand up to rain and wind. I knew that I wanted to make the radials out of aluminum rod but other than that my design was open to whatever material I could find.

Mast Mounting Materials

I knew that I wanted the antenna mount to be fairly strong so I chose my materials with that in mind. At a local metal supply house I found a length of steel tubing and some U-bolts with brackets that would work great for the main mounting components. The steel tube which the antenna will be mounted to is 1-3/8" in diameter and 12" long. The U-bolts and brackets were originally made for some other type of antenna system and were being sold as surplus. Standard U-bolts would also work for this project but these surplus brackets were cheaper and came with additional brackets to center the mast sections. Also shown in this picture is a piece of 1/4" aluminum plate that will be used to bolt the mast to the antenna mounting tube. I already had the 1/4" plate material that I cut off of a larger piece of aluminum sheet.

Additional Mounting Materials

The square piece of metal in the first photo is the plate that the antenna radiating element will be mounted on. This piece is 1/8" thick steel that is 4" by 4" square. As you can see in the picture, I had already drilled a hole in the center of the plate to mount the feed point hardware in. The feed point hardware shown in the photo is standard hardware that can be purchased from any radio supply company. It accepts a 3/8" x 24 thread size antenna element on one side and is fitted with a standard SO-259 connector on the other side to plug in your PL-259 coax connector.

Notice that the feed point hardware shown in the first photo has two plastic insulators (one already on the bolt portion of the SO-239 and another separate one). These are used to keep the radiating element connections isolated from the rest of the grounding structure. The center (threaded brass) portion of the feed point hardware will attach to the radiating element while the body of the SO-239 will be in contact with the ground portion of the hardware.

The second photo shows a close up view of the mounting tube along with four right angle mounting brackets. The right angle brackets will be attached to the mounting tube and will eventually support the top plate. As you can see in the picture I have already drilled the four holes in the mounting tube where the right angle brackets will be attached.

Antenna Materials

The material used for the actual antenna radiator and ground radials is aluminum rod. I used 1/4" diameter rod for the ground radials and 3/8" aluminum rod for the radiating element. I chose 3/8" rod for the radiating element so that I could thread one end of it and then screw it into the standard feed point hardware that I had already purchased. The only other hardware needed were some clamp brackets to hold the ground radials in place. I decided to make the radial clamps out of 1/8" thick 1-1/2" aluminum that I already had on hand.

Antenna Construction Details



The first item to fabricate was the mast mounting plate. The first photo shows the raw aluminum plate that I used. In the second photo I am cutting the plate to size with a reciprocating saw. The third photo shows the mast plate after is has been cut to size (3-1/2" x 8-1/2"). Before moving on to the next step it is a good idea to use a file on the edges of the mast plate to remove any rough edges that could cut you. I generally just file all edges at a 45 degree angle.


The next step is to layout where the holes will be drilled to attach the U-bolts and brackets. In the first photo I am laying out lines to determine where the holes will be drilled. The second photo shows me center punching where the holes will be drilled. Center punching helps keep the drill bit in place when starting to drill a hole.


Once the hole locations are marked and punched they can be drilled as shown in the first photo. I used a small drill press to drill the holes but a hand drill could also be used. The drill press just makes the task a little easier. The second photo shows the completed mast plate with the mast tube installed to test the fit. There are a second set of holes, two of which can be seen in the photo. The second set of holes will be used for a second set of U-bots to attach to the mast.


There are a few more pieces that need holes drilled. The first is the mast tube. The holes are drilled to accept the right angle brackets that will secure the top plate in place. When marking the tube for the bracket holes I just made the marks at about every 90 degrees. I was not as careful as I should have been with making sure the holes were exactly at 90 degrees from each other. This made it a little more difficult when locating the holes on the top plate since they were not in the exact location I would have liked. The point is that you should take your time and do it right the first time rather than giving yourself additional problems later on. I was able to deal with the issue but it would have been better to be more careful. The second photo here shows the top plate after the holes were drilled where the mast tube brackets will be attached. These same holes will also be used to attach the radial clamps. Since I was not as careful in laying out the hole locations on the mast tube as I should have been there were slight differences. Due to these slight differences I marked the four locations with a center punch so that

adial clamp would be used in the correct location.

in position. They were cut from 1-1/2" wide aluminum and bent into shape using a vise. Bending the pieces into the shape as shown allows the pieces to hold on to the radial rods without the rods slipping out of position. As can be seen in the photo there are a few scuff marks on the pieces due to test fitting the parts prior to taking the picture.


Another thing I did when fabricating the radial clamps was to cut a notch that would keep each radial from rotating in the horizontal plane. How this is accomplished will be easier to see once you see the assembled top plate. As you can see I cut the notch using a file with fairly aggressive teeth. This made cutting the notch quicker. The first photo shows the notch being cut with the file and the second photo shows the completed cut. The square rod seen in the picture was only there to space the clamp away from the vise jaws so that the vise would not flatten the shape of the clamp. Remember the clamp was bent to hold on to the round radial stock.


These two pictures show the notch that has been made in one of the radial clamps and how the radial will fit into the notch to keep it from moving. Again this will be easier to understand once you have seen the entire assembled top plate.


In the first photo you can see the mast tube has been mounted to the mast. Note the four right angle brackets have been attached to the mast tube in preparation for mounting the top plate. Also you can see that I have painted the steel parts to help prevent rusting. The feed line is in place waiting for the feed point hardware to be attached. In the second photo you can see the radials have been attached to the top plate using the radial clamps. Please note how each radial fits into the adjacent clamp notch to keep the radial from rotating in the horizontal plane. There are other ways that this could have been accomplished but this method kept the number of parts to a minimum. The four bolts that hold the radial clamps in place also secure the top plate to the mast tube brackets.

One of the last steps is to cut the radiating element to size and thread one end of it so that it can be attached to the feed point hardware. In this photo the die and handle are still in place after cutting the threads on the rod. I used a 3/8" x 24 threads per inch die which is standard for this type of antenna mount.

As can be seen the radiating element has been installed in the feed point hardware using the 3/8" x 24 threads. All other components are now in place and the antenna is ready to be raised to test. Up to this point I have not talked about the length of the elements or the angle of the radials. I will talk about these two items next. Please notice that the

ground radials have been bent so that they will be at a downward angle from horizontal.

Element Length Calculation

Up to this point I have not talked about the length of the elements. One of the reasons for this is that this antenna design can be used for many different bands depending on the length of the elements. This type of antenna is usually used for VHF and UHF frequencies but sometimes even lower band designs are made.

I don't use the formulas normally found in books to calculate the length of the elements because I tend to forget the exact number used. I just calculate it using the speed of light as a starting point. The speed of light is approximately 186000 miles per second in free space. 186000 miles per second is not exact but it is close enough for our use. I want to convert 186000 miles to a number that will mean something to me. So I converted the distance to feet. There are 5280 feet per mile so (186000 miles X 5280 feet = 982080000 feet). We now need to divide the number of feet traveled in one second by the target frequency (982080000/52000000 = 18.89 feet). Since our antenna will be a 1/4 wave antenna we need to divide the wave length of 18.89 feet by 4. This gives us a length of 4.72 feet. We then to convert 4.72 feet to inches (4.72 feet X 12 inches = 56.6 inches). Since the propagation velocity of the signal traveling through a metal element is somewhat less than the speed of light through free space the length calculated will be a little longer that what is actually needed. Using this longer length is actually good since it allows some extra length in the radiating element that we can trim to tune the antenna. We will trim it to the exact length when we tune the antenna. The ground radials should be about 5% longer than the radiating element.

Radiation Resistance - SWR

We want to match the antenna to the impedance of our radio and feed line which happens to be 50 ohms. From previous experience I knew that the radials should be bent down on a 1/4 wave ground plane antenna to better match 50 ohms. I used an MFJ antenna analyzer to obtain my measurements. Just for the heck of it I started off with the ground radials un-bent so that they stuck out straight in the horizontal plane to see what the radiation resistance would be. First I needed to find the resonant frequency of the antenna. The resonant frequency is where the inductance and capacitance cancel each other and all that is left is the radiation resistance and some feed line resistance. I found the resonant frequency by sweeping the frequency until I found were the inductance and capacitance canceled each other. This happened to be about 50MHz. At that point the resistance read 25 ohms. If left in this condition the best SWR I could ever obtain would be 2:1. I knew that by bending the ground radials down I could raise the radiation resistance closer to 50 ohms. After bending the radials down and taking a second reading I found that the resonant frequency was about the same but the radiation resistance was about 47 ohms. This was much better. Since I bent the radials down without checking for an exact angle I did not have them all bent to the same angle. I checked to find which one was bent down the most. I measured the angle and bent the remaining three radials to the same angle (about 45 degrees).

After bending them all to the same angle I took another reading and found that the radiation resistance was right where I wanted it at 50 ohms. This would result in a 1:1 SWR, but not on the frequency I wanted. Since the antenna was resonant at about 50MHz the SWR would be 1:1 at that frequency and rise in either direction away from that frequency. Next step would be to tune the antenna for the frequency I wanted. One other thing to note on bending the ground radials. When I bent them at the top plate I bent them in a slow curve (about a 2" radius) rather than a sharp angle. The reason for this was to keep from creating a weak point at the bend point. If I had bent the radials at a sharp angle, the radials would have the potential to break at that bend point in the future after being exposed to the stress of the weather (wind).

Tuning For Resonance

I have always found that it is better to have your initial antenna a little too long rather than a little too short. It is much easier to cut a little off of your antenna to tune it to the desired frequency rather than to add length to it. Since the resonant frequency of my antenna was low it meant that my antenna was a little too long. The difference in the calculated values of a 1/4 wave length antenna at 50MHz vs. 52Mhz is about 2.3 inches. When trimming an antenna for tuning you should trim less than the calculated difference to be on the safe side. Sometime there are other effects that make the calculated value too large and if you trim off the entire calculated amount you may have made the antenna too short. This will result in your antenna being resonant at a higher frequency than desired. As a rule of thumb I don't cut off anymore than about 1/2 the calculated value at any one time. This may mean that you have to trim more than once to get the frequency you want, but remember it is easier to make an antenna shorter if it is too long than to make it longer if it is too short. I ended up cutting the radiating element twice to get to a resonant frequency of 51.5MHz. This was close enough to my target frequency to feel satisfied.

Conclusions

This project was fairly easy to build and it was easy to tune to obtain a good SWR match. I was very pleased with how easy it was to obtain a flat SWR match by bending the radial to raise the radiation resistance. It is not a high gain antenna but will provide an antenna that works well locally. The design can be easily adapted to other frequencies. I would recommend this type of antenna project for the beginner as well as the experienced builder.

I hope you have enjoyed reading along with me and good luck building your next antenna.

73,
Mike - N6TWW

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