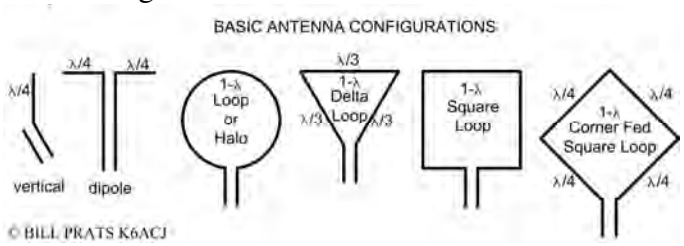
BUILDING A 40 METER SQUARE LOOP ANTENNA

BY Bill Prats K6ACJ

Palm Springs Desert RATS Amateur Radio Club

Building this antenna at a desert camp out and picnic was a Desert RATS Club project organized by myself and Peter VE7REZ/W6 club president and erected by five club members somewhere south west of the Salton Sea in BLM Land. There are many reasons for an antenna of this size, our objective was to create a club project by building a high performance antenna for the weekend campout. What better way to measure success than to operate 2 watts CW and SSB on 40, 20 and 17 meters, I am still smiling.



Detailed information for configuration and electrical properties are found in the ARRL Antenna Book, The ARRL Handbook and L.E. Cebik web site at http://www.cebik.com/ . Use free EZNEC software to model properties and Radiation patterns at http://www.eznec.com/ .

Due to the detail and available space, I'll jump directly into describing the construction of this large loop antenna which also provides building techniques for other antenna construction projects. Preparation and team work is important because you will want to use the antenna while time allows. The bases for the antenna are the popular green metal and fiberglass military tent poles. Each of us purchased 1 complete military pole package containing 12 poles each with various accessories but a total of 24 poles are needed for a 4 square antenna. Some of the odd plastic accessories were machined into guy rings and lanyard supports. At home and in advance, prepare making the masts, collecting rope for the guys and lanyards, mill the guy rings, and purchase the pulleys and stakes. In addition assemble a collection of tools (some are listed below) to complete the field installation. Obtain a balanced line tuner and make sure necessary internal or external jumpers are installed for the antenna balun. Also check the tuner shaft set screws and make all repairs in advance. The old balanced line tuners might have more wear and tear than expected. Our loop was erected on Bureau of Land Management land south west of the Salton Sea where motorcycles race in the hills so mark the antenna perimeter with cones and 'caution' tape so a stray biker doesn't get tangled in the guys ropes. Expect to have a visit from a BL M officer or the local Marshall and be ready to demonstrate that you understand safety issues. The antenna location should be far off to the unused side of the off road area so there is little exposure to others in the area.

Safety First, Plan ahead. This is a large antenna that must stand up against the desert wind.

The Loop was fed from the corner so the opposite corner was directed North, North East for good coverage to eastern populated areas and possibly Europe.

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Mast sections are 48" long and 1-3/4" OD. There are two versions of the popular Military Fiberglass Masts, the fiberglass sections of the old version are noticeably heavier and have a large reinforcing ring at the large end of the section while the newer version sections are a little lighter and do not have the large reinforcing ring at the large end. For this reason, ADD one or two 2" radiator clamps at the large end of each mast for added support.

Parts List:

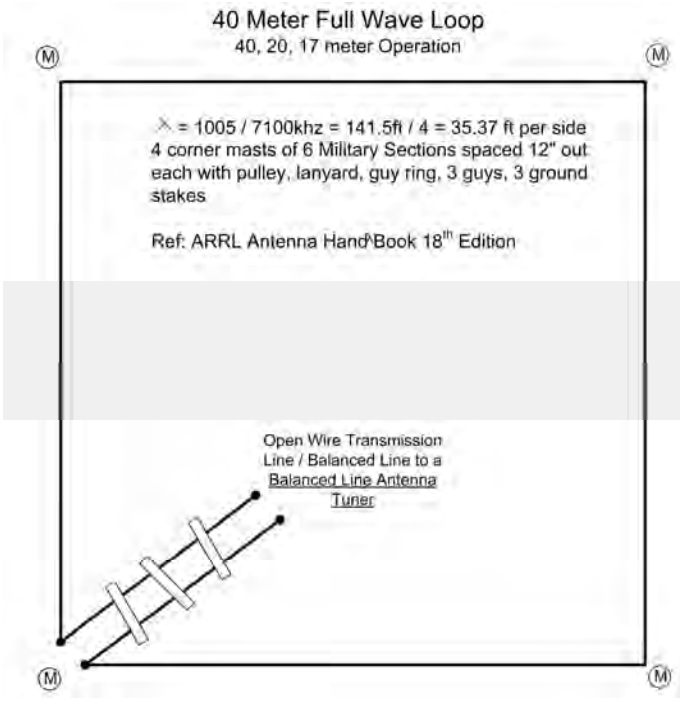
- Radiator Loop: #12 or #14 stranded copper wire cut to 9005/f length in feet (7,100 kHz)
- Balanced feed line. We had 300 ohm line.
- Balanced Line Tuner or Unbalanced Tuner plus 1:1 balun 2KW rated. This is an important component, don't skimp.
- Feed Line/Radiator Termination board
- 6 Military mast sections for each of 4 masts. Overall mast height is 22.5 feet.
- 4 Guy Rings with extensions to support the pulley & lanyards to raise the antenna wire.
- Black Dacron / Nylon rope 3/16 or ¼ inch diameter for guys and lanyards
- 4 x 1 inch quality pulleys

- 12 long heavy duty ground stacks
- 24 clamps for the guy lines at the top and bottom. If you know knots then the number of clamps can be reduced.

  HINT: There are large voltage or current nodes at the feed point, Crimp then solder using a propane torch. A good job here is essential for mechanical strength and electrical conduction.

Tool List:

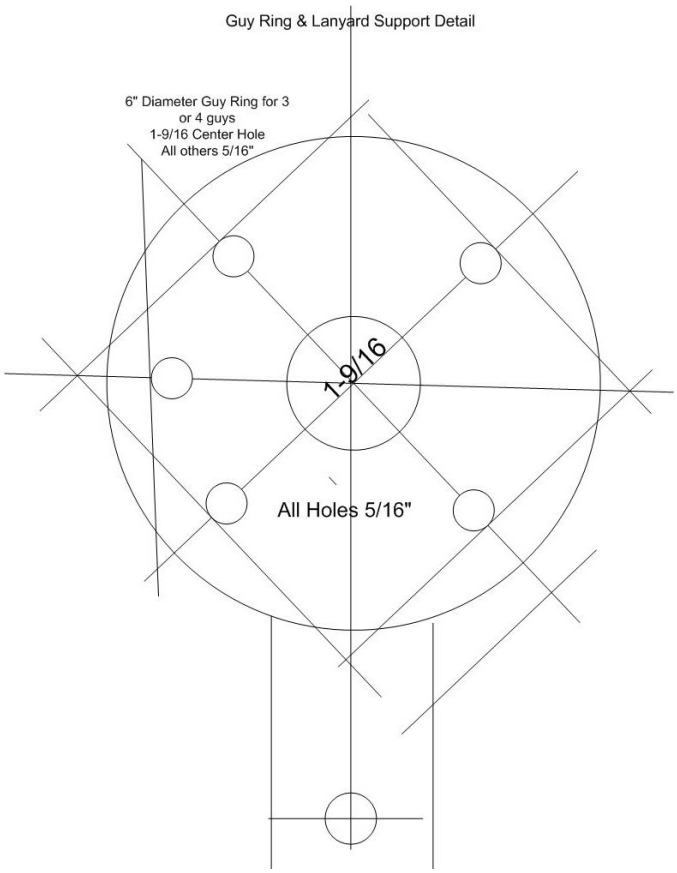
- Large hammer or a small axe to drive the stakes into the ground
- Large shovel and a block of wood to act as a lever for removing the ground stakes
- Propane soldering torch with solder and solder flux
- Measuring Tape, as long as possible.
- Soldering Tools and extra hardware
- Compass, Table, chairs, hats and lots of beer



M = Mast
Loop Radiator: 9005/f wave length in feet (7,100 kHz). ¼ wave length per each of 4 sides.

Calculate Guy Rope Length and angles http://www.csgnetwork.com/righttricalc.html

The masts are located 10-12 inches out from the loop antenna corners. For our purposes, the feed line attachment point is at a corner with the opposite corner pointed NE.



Full Size Template is available from K6ACJ

Locate a large open space. This happens to be on the edge of the BL M land near the Salton Sea. Stay clear of all Off Road Vehicle traffic. Use Orange Safety cones and Yellow Caution Tape to mark off the area.

Guy Ring and Lanyard Support Ring Detail. The hole pattern is for either 3 guy ropes or 4 guy ropes. Chamfer the holes to prevent chafing the ropes.

The guy rings were cut from the mast paddles on the right. The 6" x 1-1/2" wood dowel retains the ring when the ring is placed at the top of the mast.

The feed point support is made from the remainder of the green plastic mast paddles. The center support provides strain relieve to the radiator and the feed line. Termination is soldered into stout ring connectors on 8x32 SS hardware.

Peter VE7REZ/W6 is shown measuring the mounting position for each of four masts and measuring the final cut on the guy ropes down from the top of each mast. Each mast is supported at the bottom in a hole in the ground roughly 10 inches deep then with one person on each of the 3 guy lines the mast is pulled up into position and staked down. Expect the desert floor to be rock hard but the advantage is that it firmly holds the mast and ground stakes.

The first two masts are up, two more to go. The small end of each mast sits in a 10 inch hole. Guy ropes are secured with very large tent stakes pounded into the hard earth

Attached at a corner mast, the feed line details show the lanyard pulley attached to the feed line / loop support.

More Guy Ring and lanyard detail

5 hours in the field and the 40 meter square loop is complete. For Safety, orange cones placed around the perimeter and long streamers on the guys mark the antenna location. Yellow 'Caution Tape' is recommended. After sunset flashing lights were added to the masts to make the antenna perimeter visible.

Time to play radio but note many tuners have input for unbalanced and balanced feed lines. Make sure internal or external jumpers are installed for 'balanced feed line input'. Peak the balanced tuner on the band of choice and begin operation. Performance was excellent as measured by the number and quality of 2 watt QRP contacts. Here we are using a Kenwood TS-2000 at 100 watts into a vintage balanced line tuner. The 40 meter loop easily tuned across 40 meters, 20 meters and 17 meters. We were having so much fun that we did not try operating on other bands.

Busy hams are Happy hams. Lots of fun for everyone and the deep fried turkey and hot tamales for lunch and dinner made this Radio Picnic a real Winner. All of us hope to do this again.

Bill Prats K6ACJ, ARRL ACC Orange Section, Desert RATS, SOARA, HFPack, HBRACES, ARC