AM Loop Antenna Calculator - UMR EMC Lab Formula

Version 1, 7-8-2004

by Bruce Carter

	Enter:
Loop Width (inches):	36
Loop Height (inches):	36
Winding Spacing (inches):	0.050
Number of Turns:	8
Enter highest capacitance (pF) :	365
Enter lowest capacitance (pF) :	9.6
Loop Inductance (nH):	
Lowest tuned frequency (MHz) :	
Highest tuned frequency (MHz) :	

By entering the height and width of your loop (36 or 48 inches each if building as per above) and the number of turns and distance between turns (I use 0.5 in my design so change to that if need be) you will get the frequency range of the antenna design. These ranges are approximate and will vary a bit depending on the capacitor you use. Those values if know can be entered but most 0-360 capacitors are actually 10-360. You can play with the turns to see the frequency coverage change as you add or subtract turns.

Below you will find plans to build a three or four foot box loop for the AM broadcast band. The
loop will tune from 530 to 1710 kHz covering the whole band including the new expanded band .
This loop design was first produced by Don Moman back in the early 1980's and has proven to be
a good solid design. The main advantage of this loop's design is that it uses almost no metal. This
allows the loop to keep its pattern and increases the loop's ability to null stations.

The loop is Based on Don Moman's famous loop his drawing is at the bottom of the page.

The instructions below are for a four foot loop. If you do not have room for such a large loop all
you have to change is:

The two cross arms should be 33.5 inches in length not 45.5 inches.

I have included drawings as well as pictures of my four foot loop at the end of the article.
These should help you visualize the loop as you build it.

PARTS:

1- Variable capacitor of 0-365 pf, You can often find these in old AM radios that can be found at
flea markets or garage sales or on eBay at www.ebay.com. or KW TUBES at http://kwtubes.s5.com/ or at Midnight Science at http://www.midnightscience.com/

1- Knob for the tuning capacitor. You can use a vernier knob for finer tuning.

175 feet of wire.. 20 gauge coated/insulated works well. The wire can be solid or stranded.

4- Pieces of 2 x 2 cedar cut 7 inches long These will be the end pieces.

2- Pieces of 2 x 2 cedar 45.5 inches long (33.5 inches for the 3 foot loop). These will be the cross
arms.

2- Pieces of 1 x 2 cedar 6 inches long. These will be the braces to tilt the loop.

1- 1.5 inch diameter wood dowel 36 to 40 inches long. This will be the mast.

1- Piece of 2 x 1 cedar 6 inches long. This will allow you to mount the tuning capacitor

1- Piece of 2 x 2 cedar 4 inches long. This will be a brace support.

1- Outdoor plastic umbrella stand and a piece of PVC pipe to fit the mast into it. The stand should
be filled with sand to give it weight to balance the antenna. The pipe should be about 12-15 inches
long. You may substitute another stand but try to insure it has as little metal as possible. Too much
metal will distort or decrease your nulls.

1- Wire connector to connect the wires.

2- Bolts with nuts 3.5 inches long

4- Wood screws 1.5 to 2 inches long

1- Length of coax to feed antenna to the radio. Keep as short as you can but remember that the
loop must still be able to tilt and rotate.

PREPARATION OF THE PARTS.
I used 2 x 2 and 2 x 1 cedar to build the loop but you may wish to substitute the type of wood
with another variety. Just make sure it is a strong wood with few knots.

CROSS ARMS

To form the cross arms find the center of the 45.5 inch pieces of 2 x 2. Measure 3/4 of an inch on
either side of center. Shade this area in. Cut out the shaded area as shown in Figure C. Cut out the
shaded area to a depth of 3/4 of an inch. This will form a notch on each arm that will allow you to
fit the arms together to form an X.

END PIECES
Take each of the 7 inch long pieces of 2 x 2 and line them upside by side.. Mark off a line across
all of the pieces every half an inch. This should give you 13 lines spaced one half an inch apart
across all four end pieces. You then will have to cut a grove about 1/4 of an inch deep in each
line. This will give you 13 grooves on each end piece as shown in Figure A. Once that is done turn all the pieces over to the other side that has not been grooved. You will
have to make a notch cut similar to the one cut on the cross arms. Find the center of each end
piece and again measure 3/4 of an inch from center. Shade in this area as shown in figure B. Cut
out a notch in the shaded area to a depth of about 1/4 of an inch deep. This will form a notch that
will fit to the ends of the cross arms. You must do this to all four end pieces and try to be as
accurate as possible to insure a balanced fit.

BRACES
To form the braces as shown in Figure E drill two holes on the flat side of the 6 inch 2 x 1
wooden pieces. Each hole should be centered one inch from the end of the wooden piece. The
size of the hole should allow the bolts you are using to slide through as tight as possible.

DOWEL STAND
Figure F shows the 36 to 45 inch long 1.5 inch diameter dowel and the 4 inch long piece of 2 x 2
assembled. To make these two pieces fit you must cut a notch into the dowel. Cut a 4 inch long «
inch deep notch out of the end of the dowel. The 4 inch long 2 x 2 will sit on this notch to form a
support for the cross arms. Drill a hole centered about 1 to 1.5 inches from the top of the 2 x 2
piece. The hole should match the bolt you are using.

ASSEMBLY

DOWEL STAND
As shown in Figure F Take the 4 inch long 2 x 2 piece and fit it into the notch on the dowel with
the hole on top. Once you are sure of a good fit glue the two pieces together with a good wood
glue. You could use a screw but it is not necessary. This dowel stand will now fit into the
umbrella stand and should rotate easily.

TUNING BOARD
Take the 6 inch long piece of 1 x 2 as shown in Figure D and mount your wire connector 1 to 2 inches from the end of the board. On the underside of the board mount the tuning capacitor at the opposite end of the board. Keep the capacitor close to the front of the board with enough clearance to attach the knob. You can use a glue or double sided tape to mount the capacitor.

END PIECES
Attach each of the four end pieces to the ends of the cross arms. First of all fit the cross arms together to form an X shape. You can use some wood glue to keep them together. You can attach each end piece using glue and you can put a 1 to 1.5 inch long wood screw into the center of each piece so it will be secured to the end of the arm. This is shown in Figure D.

MOUNTING THE TUNING BOARD
As shown in Figures G and D mount the tuning board on the top side of any of the end pieces. The Top will be the side with no grooves on it. This will now be the bottom of the loop as shown in Figure G.

MOUNTING THE BRACES
Take one of the bolts and put it through one brace as in Figure E then through the piece of 2 x 2 attached to the dowel as shown in Figure F and finally through the second brace. Secure the bolt using the nut (I used a wing nut to make it easier). You now have a stand with a rotating and tilting mechanism. This can be placed into the umbrella stand as in Figure G.

MOUNTING THE LOOP
Slide the loop between the two braces and see where it would balance for tilting and rotating with out hitting anything such as lights in the ceiling. I drilled a hole 17 inches from the center of the loop on the bottom arm with the tuning unit attached to it. You can slide the second bolt through a brace then through the hole in the cross arm and then through the second brace. Secure the loop bolt with a nut as you had done with the first bolt as shown in Figure G.

PICK UP LOOP
In order to install a pick loop of wire into the assembled loop you must drill a hole 3.5 inches from the tip of the loop arm in each arm. The hole need only be big enough to feed you wire through. The pick up loop of wire is now wound the inside of the loop. You will have to drill one more hole on the bottom arm about 1 inch above the first hole. Attach one end of the wire to the wire connector and then string the wire through the holes around the loop until you reach bottom

again. Keep the wire fairly tight so there is little or no slack on the winding. Wind the end of the
wire through the second hole on the bottom arm and attach this end to a separate section of your
wire connector. The two ends must remain separate and not attached.

ATTACHING THE COAX FEED LINE
To attach the coax feed line to your loop strip off some of the covering to expose some of the
center conductor and some of the braid. Attach the center of the coax to one side of the
connector and the braid to the other side of the connector which the pick up loop is attached to.
Check these connections to insure that they are tight and that they are isolated from each other.
If you want you can try placing a capacitor in line with the center feed of the coax. I used a 680 pf
capacitor to help match the loop and the coax . Do not attach this to the braid of the coax.

WINDING THE MAIN COIL
To wind the main coil of the loop Solder the end of you wire to the solder lug on the variable
capacitor . Then proceed to wind the wire around the loop pushing the wire into the groves on the
end pieces of the arms. After you have completed winding the wire around the loop attach the end
of the wire to the capacitor with some solder. The winding such be kept a tight as
possible as you did on the pick up loop. You are now ready to tune the loop.

TUNING THE LOOP
The first step is to attach the coax feed line to your receiver. Tune the radio to around 1000 kHz.
Tune the capacitor to peak the signal even if it is just static. Now go up and down the band
peaking the capacitor to see what the loop's true range is. You will have to re-tune the capacitor
about every 50 to 100 kHz. You will probably find that you can not tune the top of the band
(1710 kHz). If this is the case then take one winding off of the loop by unsoldering the wire
attached to the frame of the capacitor and unwinding once around the loop. Cut the wire and
reattach the new end to the frame. Re-tune the loop and see what its new range is.
With the plates meshed in you should be able to tune to about 525 kHz and with them fully out to
about 1710 kHz. You may have to take off 1 or 2 or even 3 windings to tune the loop to insure it
covers all the frequencies. If you take off more than one winding make sure that you end up with
a balanced number of open grooves on each end of the end pieces.

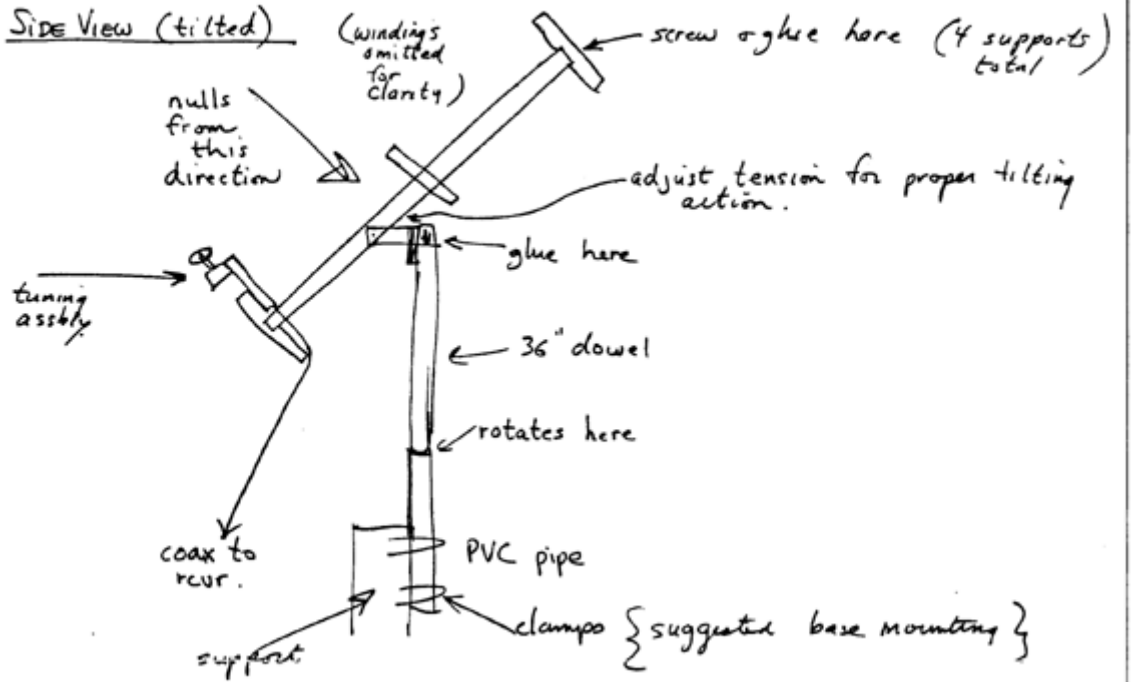
COMPLETED
Once you have this all set up the loop is ready to use and the DX will flow in. You will have to
experiment with tilting and rotating the loop to get the best nulls possible. The main things to

remember are:
-Tune the capacitor to the frequency you are listening to for the best signal.
-Rotate the loop to get a null as deep as possible.
-Tilt the loop to increase the null.
-Experiment with tilting and rotating slowly to peak the nulls as best you can. You may find that
the nulls are very narrow and you have to be careful.
-The best nulls are a combination of tilt and rotation.
-Using a vernier tuning knob will allow you to fine tune for the best signal peaks.

Please remember this is a guide and NOT written in stone. Feel free to experiment with the plans to
suit your needs and situation.

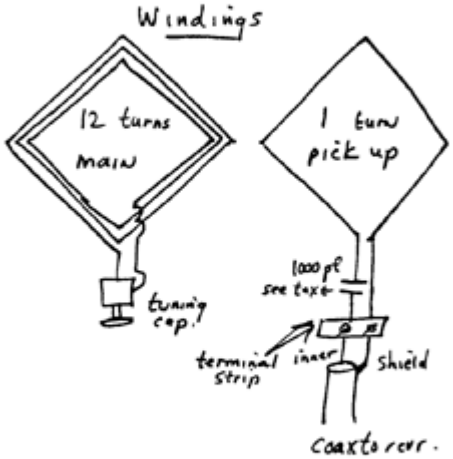
If you have any questions please write me care of amandx@mymts.net

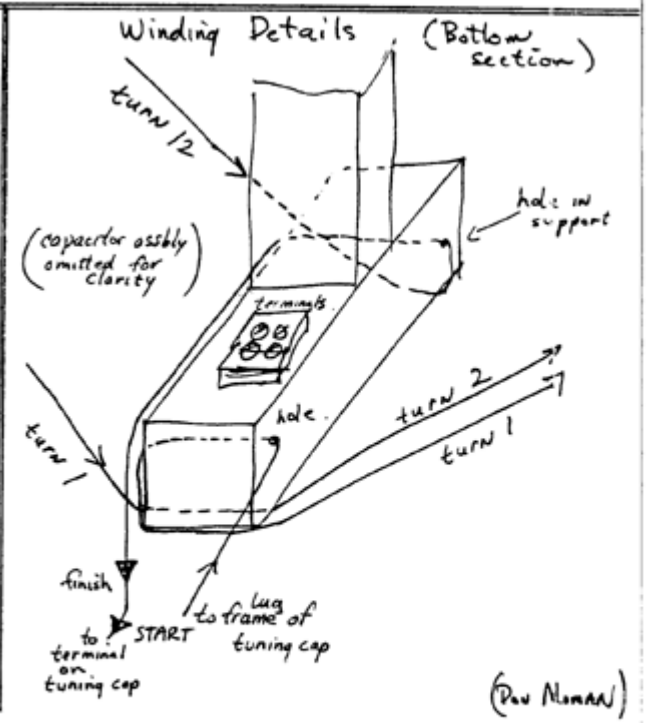
MW Loop



Wiring Diagram

there is no electrical contact between main & pickup windings.





(Dan Noonan)

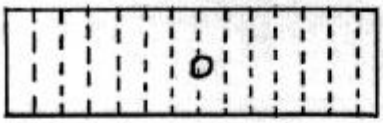


FIGURE A
End Piece Top View

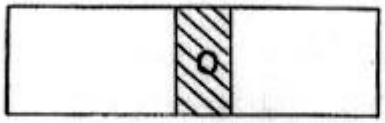
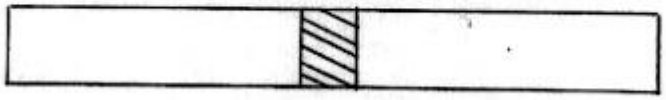
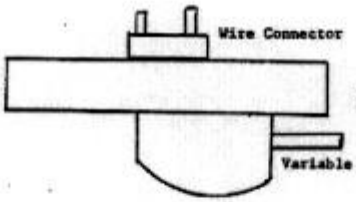


FIGURE B
End Piece Bottom View

Cross Arm Bottom View

FIGURE C





Wire Connector

FIGURE D
Tuning Section Side View

Variable Capicator

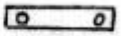


FIGURE E
Brace Side View

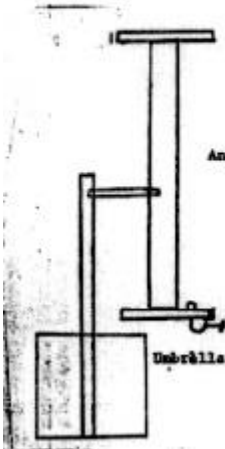


FIGURE G

Antenna Side View

Umbrella Stand

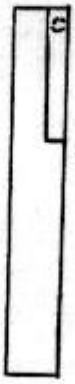


FIGURE F

Dowel Side View

FIGURE F

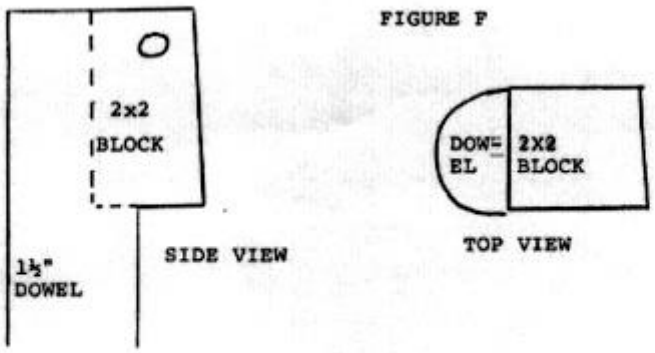
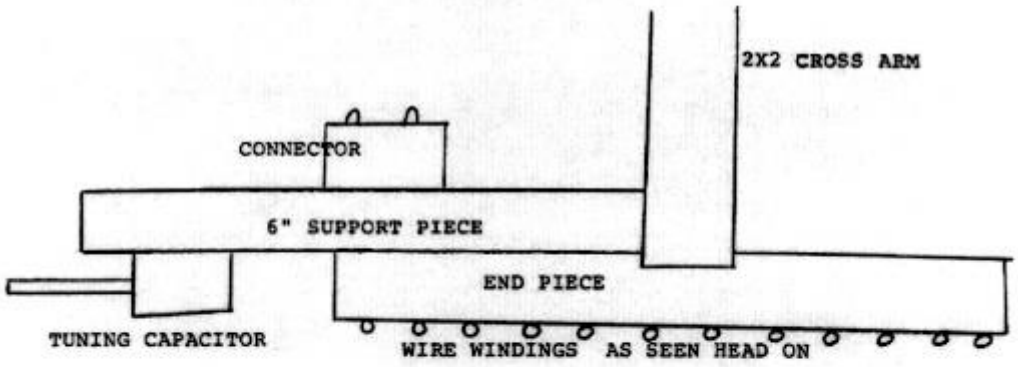
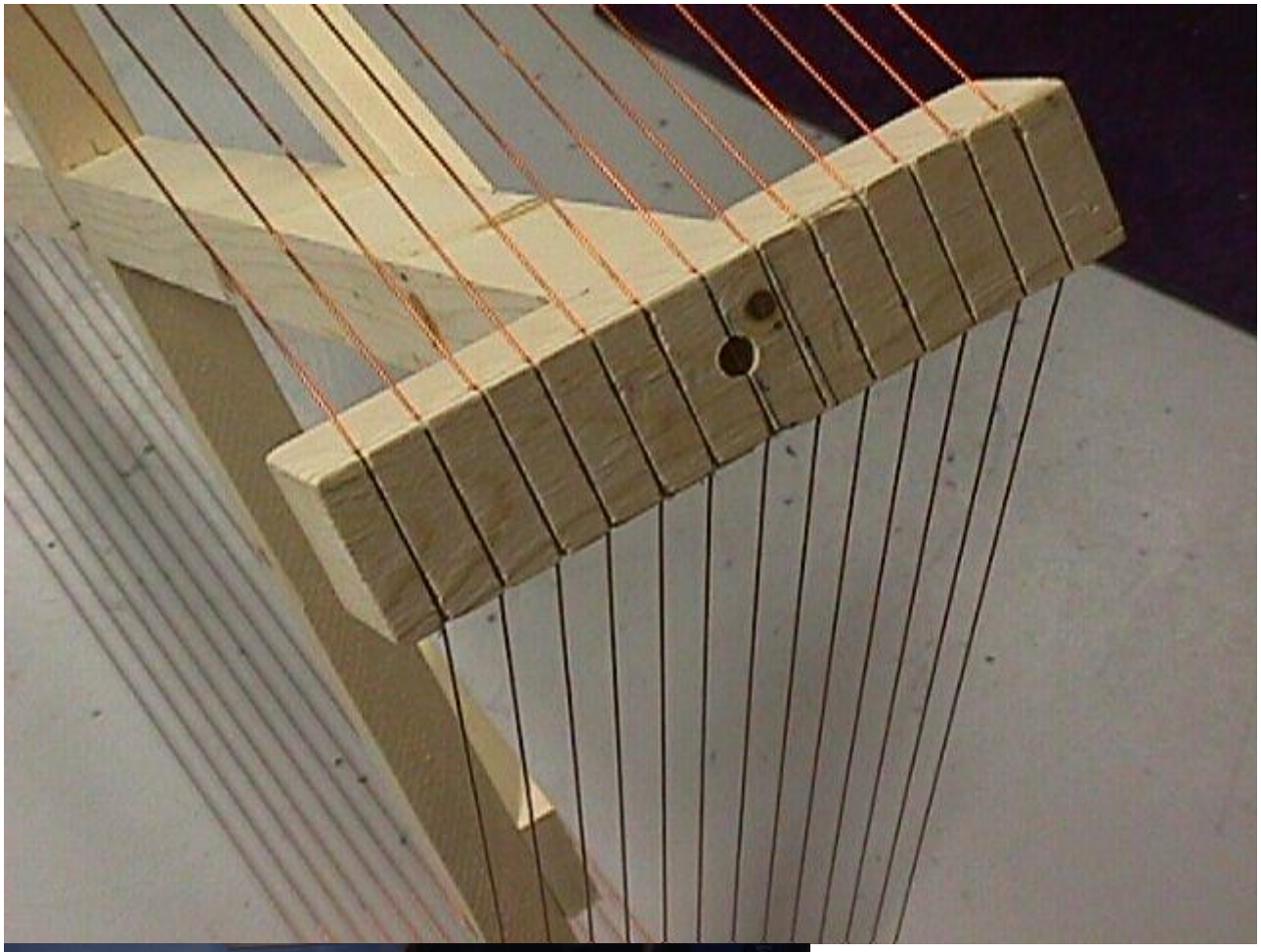
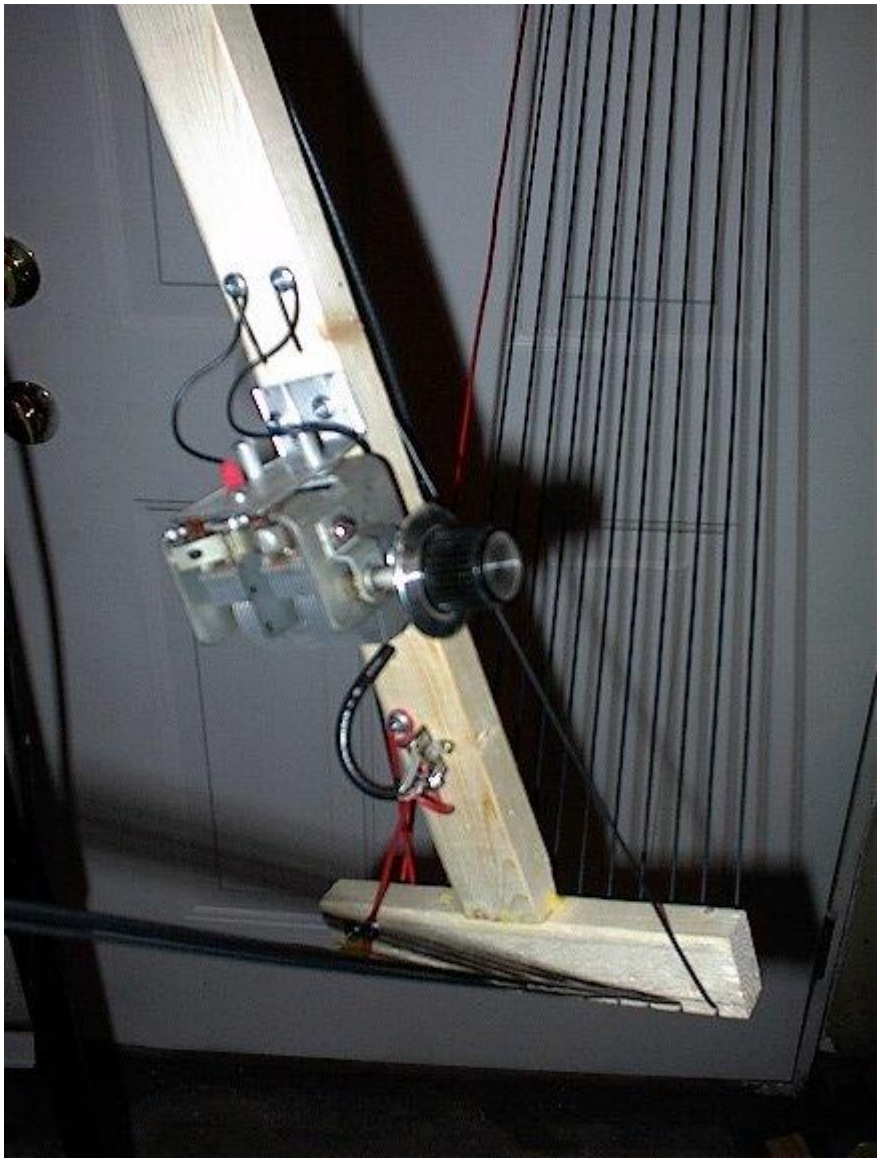


FIGURE D TUNING BOARD





Here is a pic of the loop Tom Doty built with some mods to the plans above. He used a microphone stand.



Loop Antenna (and Related) Links

- AM Antennas - ABC Reception Advice Website

- Ferrite Rods, Bars, Plates and Tubes
- A Magnetic Loop Antenna for Shortwave Listening (SWL) by KR1ST
- Magnetic Loop antenne's.
- RadioIntel.com - THE WOODEN ALTAZIMUTH HOOP LOOP
- Radio Netherlands Media Network An Introduction to Long Distance Medium Wave Listening
- Dave's Loop Antenna Page
- Air Variable Capacitors, Shafted
- RECEIVING LOOP AERIALS FOR 1.8 MHz
- LOOP DISCUSSION!
- Better AM Radio Reception
- The Ultimate AM Antenna
- Doug's R-E Loop Article Page
- Reception techniques An easy loop
- amandx-loop
- DX News, Tips and Information page
- Joe Carr's Tech Notes
- Loop Page
- AM Radio Reception
- a Ten Foot Receiving Loop For Low Frequency Dx Work
- Receiving Loop Theory - N4YWK
- Re Tuned Loop For AM Radio
- A conveniant AM loop antenna
- Loop Antenna Page
- Loop Antenna
- Dave's Loop Antenna Page
- Rectangle Loop
- Interference-reducing Antenna page
- Wellbrook Antenna Page
- PK Loop Antenna Page