LOOP ANTENNAS FOR 2 METERS

SQUARES, DIPOLES, TRIANGLES AND HOUR-GLASS GEOMETRIES

7/10/2018

NASSAU COUNTY AMATEUR RADIO EMERGENCY SERVICE

RECTANGULAR & SQUARE LOOP GEOMETRY DETERMINS ANTENNA IMPEDANCE

- Wire length is equal to one wavelength for resonance
- The shape of the loop determines the impedance of the antenna
- All are feed with coax at the bottom of the loop.
- You have to adjust geometry to get maximum gain or best match to the coax.

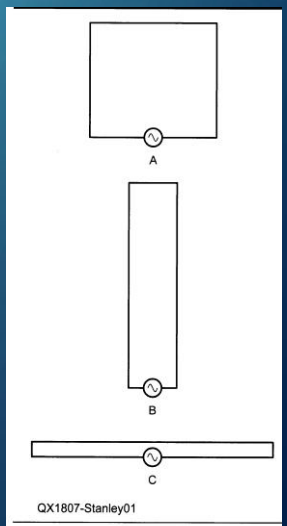

Figure 1 — Antenna A is the familiar square loop, B is a rectangular loop, C is a folded dipole. All use one wavelength of wire.

SINGLE LOOP GEOMETRY

- Adjust loop to 1 x 2 for near max gain and 50 ohm impedance.

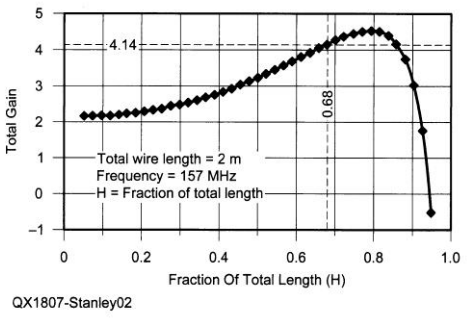

Figure 2 — Gain, dBi, of a full wave loop vs. H (height) as a fraction of one wavelength.

- 1x2 geometry gives 4.14 dB gain with 50 ohms impedance

WANT A LITTLE MORE GAIN FROM THE ANTENNA

- ❑ You can stack two loops one on top of the other increase gain.
- ❑ Notice that the two center wires do not touch… they need to be separated by ½ inch or so.
- ❑ Total wire length is 2 wavelengths.
- ❑ Again feed with coax from the bottom center of the lowest horizontal wire.

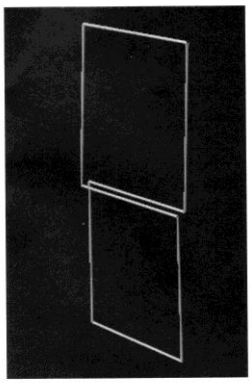

Figure 5 — Stacked loops are fed via cross-connected wires that are displaced slightly in the horizontal plane. The feed point, not shown, is at the mid-point of the bottom horizontal wire.

THE DOUBLE HOURGLASS WHAT WE ARE BUILDING

- sdf

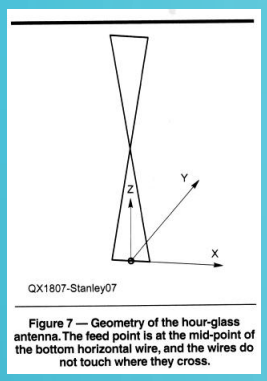

Figure 7 — Geometry of the hour-glass antenna. The feed point is at the mid-point of the bottom horizontal wire, and the wires do not touch where they cross.

- We are going for 7 dB gain with an hour glass 2 wavelengths long
- Two cross pieces each about 12” long are used

Table 3.
Dimensions of the single and double diamond antennas at 144.2 MHz. Width and height of each diamond vs. gain and R_{in}.

Wire length, m	*Width/2, m*	*Height/2, m*	*R_{in} of single, Ω*	*Gain, dBi, of single*	*R_{in} of 2 stack, Ω*	*Gain of 2 stack*
2.22	0.392	0.392	117	3.65	275	5.6
2.21	0.37	0.41	100	3.73	235	5.8
2.21	0.32	0.45	75	3.95	160	6.0
2.23	0.3	0.47	63	4.03	135	6.2
2.23	0.275	0.485	50	4.10	120	6.4
2.24	0.26	0.496	45	4.13	100	6.45
2.24	0.25	0.5	42	4.18	96	6.5
2.24	0.15	0.54	15	4.36	40	6.6

HOURGLASS LOOP

- Cut 4 pieces of ½” pvc pipe 10.5” long
- Measure 86” of #14 wire then cut and strip ½ inch of insulation on each end.
- Cut off a piece of RG-6U coax to match your lead at home.
- Thread onto one end of the #14 gauge wire two 10.5 pieces, one T fitting, two 10.5” Pieces and one Cross Connector….. In that order
- Push the coax in the bottom of the cross connector and out to the left side.
- Thread the starting end of the #14 wire through the Cross connector Right to Left.

- Solder the coax onto the two ends of the #14 wire and put the top and bottom arms together.
- Streatch and even out the two crossing wires so that the hour glass is formed. Measure and cut a vertical support for the antenna. YOU MIGHT WANT TO CUT IT 1" LONGER THAN MEASURED and then fit snugly.
- The cross (Hourglass) wires should go on opposite sides of the center support.
- Solder on a PL-259 connector.

PATTERN WITH 7 DB GAIN

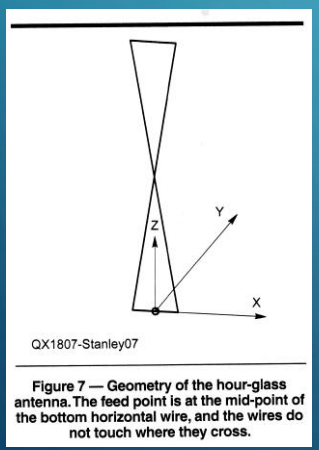

Figure 7 — Geometry of the hour-glass antenna. The feed point is at the mid-point of the bottom horizontal wire, and the wires do not touch where they cross.

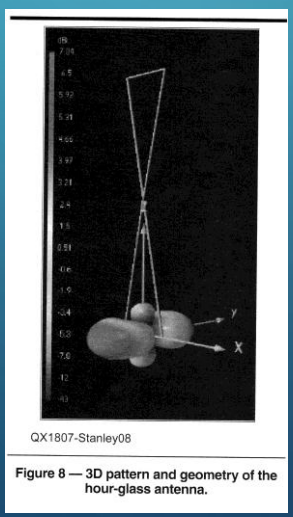

Figure 8 — 3D pattern and geometry of the hour-glass antenna.

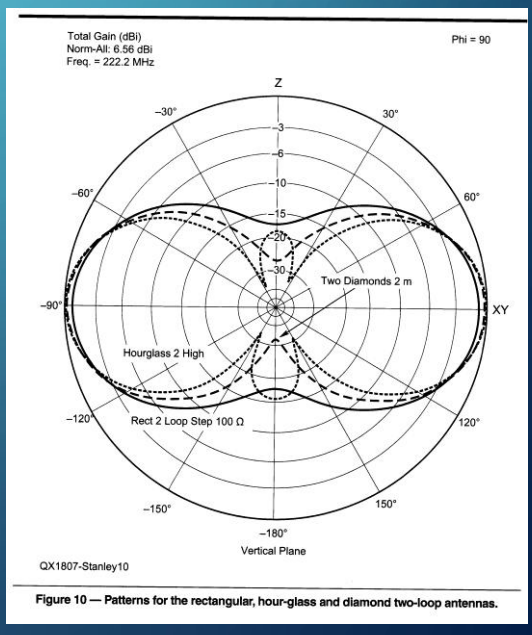

Figure 10 — Patterns for the rectangular, hour-glass and diamond two-loop antennas.

SOME OTHER FREQUENCIES

Figure A1 — Left to right, a three-high stack rectangular loop for 144 MHz, hour-glass antennas for 144 and 432 MHz.

Appendix A

Tables A1, A2 and A3 show calculated dimensions in meters for 50.1 MHz, 222.2 MHz and 432.1 MHz single loops, respectively. Figure A1 shows three-high

Table A1.
Calculated dimensions for 50.1 MHz.

R_n	Length L, m	Height H, m	Width W, m
25	6.25	2.34	0.78
50	6.31	2.12	1.04
75	6.33	1.92	1.24
100	6.35	1.77	1.41
112	6.37	1.68	1.50
282	5.71	0.02	2.83

Table A2.
Calculated dimensions for 222.2 MHz.

R_n	Length L, m	Height H, m	Width W, m
25	1.409	0.527	0.176
50	1.422	0.477	0.234
75	1.427	0.432	0.279
100	1.431	0.398	0.317
112	1.436	0.378	0.338
282	1.287	0.005	0.639

Table A3.
Calculated dimensions for 432.1 MHz.

R_n	Length L, m	Height H, m	Width W, m
25	0.724	0.271	0.090
50	0.731	0.245	0.120
75	0.734	0.222	0.143
100	0.736	0.205	0.163
112	0.738	0.194	0.174
282	0.662	0.002	0.329

FORMULAS FOR WAVELENGTH

- For wavelength in feet

  1006/f in MHz

  1006/146.400= 6.871 Feet

- For wavelength in meters

  300/f in MHz

  300/146.400 = 2.049 Meters