Wire Antennas for Ham Radio

Iulian Rosu YO3DAC / VA3IUL http://www.qsl.net/va3iul

01 - Tee Antenna
02 - Half-Lambda Tee Antenna
03 - Twin-Led Marconi Antenna
04 - Swallow-Tail Antenna
05 - Random Length Radiator Wire Antenna
06 - Windom Antenna
07 - Windom Antenna - Feed with coax cable
08 - Quarter Wavelength Vertical Antenna
09 - Folded Marconi Tee Antenna
10 - Zeppelin Antenna
11 - EWE Antenna
12 - Dipole Antenna - Balun
13 - Multiband Dipole Antenna
14 - Inverted-Vee Antenna
15 - Sloping Dipole Antenna
16 - Vertical Dipole
17 - Delta Fed Dipole Antenna
18 - Bow-Tie Dipole Antenna
19 - Bow-Tie Folded Dipole Antenna for RX
20 - Multiband Tuned Doublet Antenna
21 - G5RV Antenna
22 - Wideband Dipole Antenna
23 - Wideband Dipole for Receiving
24 - Tilted Folded Dipole Antenna
25 - Right Angle Marconi Antenna
26 - Linearly Loaded Tee Antenna
27 - Reduced Size Dipole Antenna
28 - Doublet Dipole Antenna
29 - Delta Loop Antenna
30 - Half Delta Loop Antenna
31 - Collinear Franklin Antenna
32 - Four Element Broadside Antenna
33 - The Lazy-H Array Antenna
34 - Sterba Curtain Array Antenna
35 - T-L DX Antenna
36 - 1.9 MHz Full-wave Loop Antenna
37 - Multi-Band Portable Antenna
38 - Off-center-fed Full-wave Doublet Antenna
39 - Terminated Sloper Antenna
40 - Double Extended Zepp Antenna
41 - TCFTFD Dipole Antenna
42 - Vee-Sloper Antenna
43 - Rhombic Inverted-Vee Antenna
44 - Counterpoise Longwire
45 - Bisquare Loop Antenna
46 - Piggyback Antenna for 10m
47 - Vertical Sleeve Antenna for 10m
48 - Double Windom Antenna
49 - Double Windom for 9 Bands
50 - Collinear Trap Antenna
51 - Short Dipole Antenna for 40m - 80m - 160m
52 - Center Fed-Zepp Antenna for 80m - 40m
53 - All-Bands Antenna
54 - All-Bands Dipole Antenna
55 - Multiband Z Antenna
56 - Multiband Dipole Antenna
57 - Five-Bands No-Tuner Antenna
58 - Dualband Full-wave Loop Antenna for 80m-40m
59 - Loop Antenna for 10m
60 - Lazy Quad Antenna for 10m
61 - Tri-band Delta Loop Antenna for 80m - 40m - 30m
62 - Dual-band Loop Antenna for 30m - 40m
63 - Wire-Beam Antenna for 80m
64 - Dual-Band Sloper Antenna
65 - Inverted-V Beam Antenna for 30m
66 - ZL-Special Beam Antenna for 15m
67 - Half-Sloper Antenna for 160m
68 - Two-Bands Half Sloper for 80m - 40m
69 - Linear Loaded Sloper Antenna for 160m
70 - Super-Sloper Antenna
71 - Tower Pole as a Vertical Antenna for 80m
72 - Clothesline Antenna
73 - Curtain Zepp Antenna for 160m, 80m, 40m
74 - Collinear Array Antenna for 40m, 30m, 20m
75 - 160m Inverted Delta Loop
76 - Half Rhombic Unidirectional Vertical for 20m to 6m
77 - Capacitance Loaded Vertical Antenna for 160m
78 - Fan Dipole Antenna for 80m to 6m
79 - Wire Ground Plane Antenna
80 - Inverted Delta Loop Antenna for 160m
81 - Inverted-L for 160m
82 - 300ohm-Ribbon Dual Band Dipole
83 - Tri-Band Beam for 20m, 15m, 10m
84 - Mini-Horse Yagi Antenna
85 - Backpack J-Pole Antenna for 10m, 6m, 2m
86 - Fan-Dipole Antenna for 80m to 6m
87 - Capacity Tuned Folded Loop Antenna for 20m
88 - Indoor Loop Antenna for 80m to 30m
89 - Indoor Loop Antenna for 80m
90 - Double-Delta Antenna 80m and 40m
91 - Inductance-Loaded Shortened Dipole for 160m
92 - V-Beam Antenna for 15m
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102 - Directive 300-ohm-Ribbon Folded Dipole for 15m
103 - Miniature Directive Antenna for 10m
104 - Biquad Antenna 12dBi-Gain for 2.4GHz
105 - Dual-Rhombooid Antenna for 435MHz to 870MHz
106 - Double-Bazooka Antenna for 80m
107 - J-Style Antenna
108 - Vertical / Horizontal / Circular Polarization Antenna
109 - Coax Inverted-L Antenna for 80m
110 - Indoor Compact Loop Antenna for 80m
111 - Helix Antenna
112 - Novice Vertical Antenna for 80m, 40m, 15m, 10m
113 - Stub-Loaded Shortened Dipole for 80m
114 - Six-Band Wire-Stub Trap Antenna for 40m-10m
115 - Multiband Half-Wave Delta-Loop Antenna
116 - Hybrid Vee for 20m, 17m
117 - Six-Shooter Array Antenna, Gain=7.5dB
118 - Multiband Ground-Plane Antenna for 10m, 15m, 20m
119 - Wire Superbeam Antenna for 10m, 15m, 20m
120 - Two Elements Delta-Loop Antenna
121 - Sterba Curtain Antenna
122 - Half-Wave Vertical Zepp Antenna
123 - Lazy-Loop Antenna for 40m
124 - Terminated Folded Dipole for 80m, 40m
125 - Short-Fat Antenna for 15m
126 - Cobra Antenna for 80m
127 - Log-Periodic Wire Antenna for 20m, 15m, 10m
128 - 5-Element Log-Periodic Vertical Antenna for 80m, 40m, 20m
129 - 2m Vertical Wire Antennas
130 - Earth-Mover Inverted-V Antenna for 40m
131 - Coax-Cable Collinear Antennas
132 - Double Bobtail Antenna for 20m
133 - Collinear Zepp Antenna
134 - Taylor Vee Antenna for 20m
135 - Collinear Vertical Antenna 6dB-Gain for 2m, 1.3m, 73cm
136 - Bi-Loop Antenna for 20m
137 - Wire Beam 6dBd-Gain for 10m
138 - Sloping Diamond Antenna 4dB-Gain for 40m
139 - Twisted Loop Antenna for 160m
140 - DX RX Loop Antenna for 160m
141 - Hentenna 3dB-Gain for 10m, 6m, 2m

01 - Tee Antenna
02 - Half-Lamda Tee Antenna

\[ 2L = \frac{143}{F_{MHz}} \text{ meters} \]

\[ L = \frac{71.5}{F_{MHz}} \text{ meters} \]

03 - Twin-Led Marconi Antenna

04 - Swallow-Tail Antenna
05 - Random Length Radiator Wire Antenna

06 - Windom Antenna
07 - Windom Antenna - Feed with coax cable

08 - Quarter Wavelength Vertical Antenna
09 - Folded Marconi Tee Antenna
10 - Zeppelin Antenna

\[ A_{\text{meters}} = \frac{82}{F_{\text{MHz}}} \text{ meters} \]

\[ B_{\text{meters}} = \frac{82(VF)}{F_{\text{MHz}}} \text{ meters} \]

11 - EWE Antenna
12 - Dipole Antenna - Balun

L1 = 3 m
L2 = 6.5 m

13 - Multiband Dipole Antenna
14 - Inverted-Vee Antenna

\[ L_{\text{meters}} = \frac{76}{F_{\text{MHz}}} \text{ meters} \]

15 - Sloping Dipole Antenna
16 - Vertical Dipole
17 - Delta Fed Dipole Antenna
18 - Bow-Tie Dipole Antenna

\[ A = \frac{142}{F_{\text{MHz}}} \]
\[ B = \frac{54}{F_{\text{MHz}}} \]
\[ C = \frac{45}{F_{\text{MHz}}} \]

19 - Bow-Tie Folded Dipole Antenna for RX

\[ W = 0.11 \, L \]
\[ L = \frac{415}{F_{\text{MHz}}} \]
20 - Multiband Tuned Doublet Antenna

A = 465/F_{MHz}
B = 200/F_{MHz}

450-OHM TWIN-LEAD MATCHING SECTION

75 OHM COAX TO RECEIVER

145/F_{MHz}

73/F_{MHz}

COAX TO RECEIVER
21 - G5RV Antenna

\[ A = \frac{220}{F_{MHz}} \text{ meters} \]
\[ B = \frac{146V}{F_{MHz}} \text{ meters} \]

300-Ohm OR 450-Ohm TWIN-LEAD

COAXIAL CABLE

22 - Wideband Dipole Antenna
23 - Wideband Dipole for Receiving

24 - Tilted Folded Dipole Antenna
25 - Right Angle Marconi Antenna

\[ W = \frac{2.99}{F_{MHz}} \]

\[ L = \frac{54.3}{F_{MHz}} \]

26 - Linearly Loaded Tee Antenna
27 - Reduced Size Dipole Antenna

\[ A = \frac{50}{F_{\text{MHz}}} \text{ meters} \]

\[ B = 25 \text{ cm} \]

\[ C = \frac{75}{F_{\text{MHz}}} \text{ meters} \]
28 - Doublet Dipole Antenna

\[ B = \frac{102}{F_{MHz}} \text{ meters} \]
\[ C = \frac{32}{F_{MHz}} \text{ meters} \]
\[ D = \frac{8.8}{F_{MHz}} \text{ meters} \]

29 - Delta Loop Antenna
30 - Half Delta Loop Antenna

31 - Collinear Franklin Antenna
32 - Four Element Broadside Antenna
HALF-WAVELENGTH VERTICAL ELEMENTS (4)

\[
\frac{\lambda}{2} \quad \frac{\lambda}{2} \quad \frac{\lambda}{2}
\]

600-OHM OPEN PARALLEL LINE

4:1 BALUN

COAX TO TRANSmitter OR RECEiVER

33 - The Lazy-H Array Antenna
34 - Sterba Curtain Array Antenna
35 - T-L DX Antenna

A = \frac{\lambda}{2}

B = \frac{\lambda}{4}
36 - 1.9 MHz Full-wave Loop Antenna

\[ L_1 = \frac{53.2}{f_{\text{MHz}}} \text{ meters} \]
\[ L_2 = \frac{39.8}{f_{\text{MHz}}} \text{ meters} \]
\[ L_3 = \frac{66.6}{f_{\text{MHz}}} \text{ meters} \]
\[ L_4 = \frac{21.3}{f_{\text{MHz}}} \text{ meters} \]
\[ L_5 = \frac{108.4}{f_{\text{MHz}}} \text{ meters} \]
\[ L_6 = \frac{94.2}{f_{\text{MHz}}} \text{ meters} \]
\[ L_7 = \frac{136.8}{f_{\text{MHz}}} \text{ meters} \]
37 - Multi-Band Portable Antenna

- Open-wire or ladder line (any length)
- To 4:1 balun XFMR and ATU
ONE HALF OF INVERTED VEE ANTENNA
(Not drawn to scale)

USE NO. 14 INSULATED BRAIDED ANTENNA WIRE

1/4 IN.
1 3/4 IN. (TYPICAL)
WOOD OR PLASTIC DOWEL 5 3/4 IN. X 5/16 IN. DIA.

1/2 IN. WIRE
BRAD NAIL THROUGH ART WIRE (PREDRILL TIGHT HOLE FOR NAIL)

DETAIL A

TYPICAL SPACER

1 1/4 IN. DIA.

ADD 3 CLIPS AT 20 FOOT DEPTH
SMALL QUICK DISCONNECT HOOKS (4 REQUIRED)

ADD STOP SCREW ON EACH POLE SECTION TO PREVENT BENDING WHEN ASSEMBLED

1/8 IN. DIA. NYLON ROPE

24 FT. X 1/8 IN. DIA. NYLON ROPE (3 REQUIRED)

24 TO 30 FT. POLE (3 X SECTIONS) SEE TEXT

LARGE CHEAP PHILLIPS SCREWDRIVERS FOR ANCHOR POLES AND 3 INCH DIA. METAL PISEN END OF EACH GUY ROPE (3 PLACES)
38 - Off-center-fed Full-wave Doublet Antenna

Rope 1:1 BALUN 75-Ω coaxial cable L_{f_{set}} = \frac{936}{F_{MHz}}

39 - Terminated Sloper Antenna

Wire antenna element (≈ \frac{3}{4} \lambda at lowest frequency) Direction of reception

40 - Double Extended Zepp Antenna

R_1 = 270 \Omega 2-watt Ground connection
41 - TCFTFD Dipole Antenna

42 - Vee-Sloper Antenna
43 - Rhombic Inverted-Vee Antenna

44 - Counterpoise Longwire
45 - Bisquare Loop Antenna

Each side is 1/2:

\[ L_{\text{side}} = \frac{480}{F_{\text{MHz}}} \]

46 - Piggyback Antenna for 10m

52 Ω Coaxial cable to receiver

\[ \frac{\lambda}{4} \text{ Matching section} \]

1:1 BALUN transformer

R = rope

R1 = termination resistor (noninductive)

EI = end insulator
47 - Vertical Sleeve Antenna for 10m

*Should be long enough to prevent tangling

\[
\frac{1}{2} \lambda = \frac{468}{f (\text{MHz})}
\]
48 - Double Windom Antenna
49 - Double Windom for 9 Bands

50 - Collinear Trap Antenna

C1, C2—25-pf. 6000-volt disk ceramic. See text.  
L1—Approx. 2 μH—43/4 turns No. 18, 2 1/4-inch diam., 3/8 inch long, or 5 turns No. 18, 2-inch diam., 16 tpi. See text.  
L2—Approx. 5 μH.  
9 turns No. 18,  
Z1—1 to 1 balun.
51 - Short Dipole Antenna for 40m - 80m - 160m

52 - Center Fed-Zepp Antenna for 80m - 40m

53 - All-Bands Antenna
54 - All-Bands Dipole Antenna
55 - Multiband Z Antenna

56 - Multiband Dipole Antenna
44'2" Insulated and Stranded Copper Wire

Run Twin-Lead to a Point Near Transmitter

35'8" Twin Lead (300 Ω)

Load Here (see text)

7'2" ± 2" of RG-58/U Cable Wound into a 3" Dia. Roll and Taped in Three Places

To Transmitter

57 - Five-Bands No-Tuner Antenna
58 - Dualband Full-wave Loop Antenna for 80m-40m
59 - Loop Antenna for 10m
60 - Lazy Quad Antenna for 10m

Gain = 1.7 dBi

3 turns, 1' diameter

Coax
61 - Tri-band Delta Loop Antenna for 80m - 40m - 30m
62 - Dual-band Loop Antenna for 30m - 40m
63 - Wire-Beam Antenna for 80m
64 - Dual-Band Sloper Antenna
65 - Inverted-V Beam Antenna for 30m
66 - ZL-Special Beam Antenna for 15m
67 - Half-Sloper Antenna for 160m

68 - Two-Bands Half Sloper for 80m - 40m
Center Conductor to Wire, Shield to Mast

31 Ft

45°

40 Ft

90.2 Ft

RG-8/U

-any length 50 Ω coax to Shack

8.2 μH

T:

60 pF
(Resonant at 7.2 MHz)

≈ 2 μH

L:

69 - Linear Loaded Sloper Antenna for 160m
70 - Super-Sloper Antenna
71 - Tower Pole as a Vertical Antenna for 80m
72 - Clothesline Antenna
73 - Curtain Zepp Antenna for 160m, 80m, 40m
74 - Collinear Array Antenna for 40m, 30m, 20m
75 - 160m Inverted Delta Loop
76 - Half Rhombic Unidirectional Vertical for 20m to 6m
77 - Capacitance Loaded Vertical Antenna for 160m
C1 — Variable capacitor, 0-1500 pF, 7 kV.
A, B — Sloping segments of 66 foot, 4 inch pieces of #16 AWG enameled copper wire soldered to the top of segments C and D and forming a 45° angle.
C, D — 59 feet of 450 Ω open wire or window line or, alternatively, two parallel lengths of #16 AWG enameled copper wire with a 1 inch separation.
E — 1 inch triangle formed by the bottom ends of the open wire line. Solder them tightly at the vertex and connect to C1.
F, G — Distance between the lower ends of segments A and B from segments C and D, 51 feet.
H — Any length of 50 Ω coaxial cable (RG-213 in this case). The central conductor must be soldered to C1, and the braid to the ground radials.
I — Approximately 16 feet from ground to lower ends of sloping segments A and B.
J — 60 feet from antenna top to bottom.
K — Ground radials, 60 ⅛λ. (the more the better — 32 will form a reasonable ground.)

78 - Fan Dipole Antenna for 80m to 6m
The lengths of all 3 sides is determined by the formula of a 1/4 wave antenna.

This antenna configuration will work for all frequencies from 160 meters to VHF.

Length (in feet) = \( \frac{234}{\text{frequency in MHz}} \)

The vertical side uses the inner conductor of the coax. On the Crudrig the is the side the shows a "+" (plus sign). The outer (lower) legs use the outer braid or the "−" (minus sign).

Coax to XCVR or XMT.
81 - Inverted-L for 160m
82 - 300ohm-Ribbon Dual Band Dipole

83 - Tri-Band Beam for 20m, 15m, 10m
84 - Mini-Horse Yagi Antenna
85 - Half-Rhombic Directive Antenna for 20m to 6m
86 - Fan-Dipole Antenna for 80m to 6m

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>28.0</th>
<th>28.5</th>
<th>29.0</th>
<th>50.0</th>
<th>51.0</th>
<th>52.0</th>
<th>144</th>
<th>145</th>
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<tbody>
<tr>
<td>Radiator (inches)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>½ wave</td>
<td>197.8</td>
<td>194.3</td>
<td>191.0</td>
<td>110.8</td>
<td>108.6</td>
<td>106.5</td>
<td>38.4</td>
<td>38.2</td>
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<tr>
<td>⅛ wave</td>
<td>102.8</td>
<td>101.0</td>
<td>99.3</td>
<td>57.6</td>
<td>56.4</td>
<td>55.3</td>
<td>20.0</td>
<td>19.8</td>
</tr>
</tbody>
</table>
87 - Capacity Tuned Folded Loop Antenna for 20m
88 - Indoor Loop Antenna for 80m to 30m
89 - Indoor Loop Antenna for 80m

90 - Double-Delta Antenna 80m and 40m
91 - Inductance-Loaded Shortened Dipole for 160m
92 - V-Beam Antenna for 15m
93 - Picnic Vertical Wire Antenna
94 - Laid-Back Quad Antenna for 80m

95 - Phased Loop Antenna
96 - Loop Antenna for TX for 160m
97 - Morgain-Dipole Antenna for 160m and 80m

98 - ZL-Special for 20m, 15m, 10m
99 - Biconical Antenna

100 - Directive Delta-Birdcage Antenna for 20m to 10m
101 - Dual Polarization Antenna for 80m and 40m
102 - Directive 300-ohm-Ribbon Folded Dipole for 15m

14 ft of 300 ohm ribbon, folded dipole, resonates at 30 MHz
* When cut as shown, resonates at 21 MHz

0.25" approx gap

50 ohm coaxial feeder

21 MHz

1/16" gap

4 x 6 ft dowel spreaders

-12 to 18 dB
* 1/4" approx gap

103 - Miniature Directive Antenna for 10m

4 x 4 ft long wooden dowels

Small insulator with gap of approx 3/16"

50 Ω coaxial cable feeder

Phase-shift and voltage-drive to resonant reflector via insulator

Light 7-strand plastic covered wire
104 - Biquad Antenna 12dBi-Gain for 2.4GHz

105 - Dual-Rhomboid Antenna for 435MHz to 870MHz
Dual rhomboid antenna for 435-870 MHz. Beamwidth \( \approx 10^\circ \text{ H} \times 6^\circ \text{ V} \). Gain over DP \( \approx 26 \text{ dB} \). Boom length: \( AB = 19'6'' \). Support spacing: \( AI = 7' \); \( IJ = 5'6'' \); \( JB = 7' \). Support length: \( CD = 7'3'' \); \( EF = 10'3'' \); \( GH = 3'0'' \). Rhomboid sides: \( AC, AD, EG, FH = 7'9.5'' \); \( AE, AF, CH, DG = 13'5.5'' \). Feedline: Wire needed: 14 AWG formvar, \( \approx 86'0'' \). Boom material: \( AI, JB = \text{ wood}; IJ = \text{ metal} \). Cross support: \( CD, EF, GH = \text{ wood} \). Terminators: \( R1, R2 = 600 \text{ Ohms} \); Watts
107 - J-Style Antenna
108 - Vertical / Horizontal / Circular Polarization Antenna
109 - Coax Inverted-L Antenna for 80m
110 - Indoor Compact Loop Antenna for 80m
111 - Helix Antenna
112 - Novice Vertical Antenna for 80m, 40m, 15m, 10m

D = Diameter of the helix
S = Spacing between turns
α = Pitch angle = Arctan \( \frac{S}{πD} \)
L = Length of 1 turn
n = Number of turns
A = Axial length = nS
d = Diameter of conductor
g = Distance of ground plane to first turn
G = Ground plane diameter

\[ L = \sqrt{(πD)^2 + S^2} \]

D = 0.32λ
S = 0.22λ
G ≥ 0.80λ
\[ g = \frac{S}{2} = 0.12 \lambda \]

\[ β = \frac{52}{C_λ \sqrt{nSλ}} \]

Surface of Imaginary Cylinder
113 - Stub-Loaded Shortened Dipole for 80m
114 - Six-Band Wire-Stub Trap Antenna for 40m-10m

115 - Multiband Half-Wave Delta-Loop Antenna
116 - Hybrid Vee for 20m, 17m
117 - Six-Shooter Array Antenna, Gain=7.5dB
118 - Multiband Ground-Plane Antenna for 10m, 15m, 20m
119 - Wire Superbeam Antenna for 10m, 15m, 20m
120 - Two Elements Delta-Loop Antenna
121 - Sterba Curtain Antenna
122 - Half-Wave Vertical Zepp Antenna

\[ L = \frac{491}{f} \quad \text{L in feet} \]
\[ f \text{ in MHz} \]

**Gain** = 6 dB

**Design Frequency MHz**
- 14.300
- 29.600

**Length "L" Feet**
- 34" - 4" (34 feet - 4 feet)
- 16" - 7" (16 feet - 7 feet)
123 - Lazy-Loop Antenna for 40m
Terminated Folded Dipole for 80m, 40m

1005/f(MHz) = total wire length in feet

DIRECTION OF RADIATION

NYLON SUPPORT CORDS TO POLES OR TREES AT EACH CORNER

#14 WIRE LOOP

APPROX. 10 ft.

CENTER CONDUCTOR

SHIELD

COAX CONNECTORS

TO SHACK

1/4 \times 75\text{-OHM COAX}

IMPEDANCE TRANSFORMER

246vf/f(MHz) = coax length feet

vf is the coax velocity

124 - Terminated Folded Dipole for 80m, 40m

INSULATOR (7)

1/2 in. DOWEL ROD (ONE EACH END)

1/4 in. DOWEL RODS (EVENLY SPACED ALONG LENGTH OF ANTENNA TO MAINTAIN SEPARATION)

DRILL HOLES TO ACCEPT ANTENNA WIRE

40-meter version

47 ft.

32 ft.

18 in.

390 \Omega

3000 \Omega TWIN LEAD TO TRANSMITTER

80-meter version

40 ft.

390 \Omega

300 \Omega TWIN LEAD
125 - Short-Fat Antenna for 15m

126 - Cobra Antenna for 80m

127 - Log-Periodic Wire Antenna for 20m, 15m, 10m
128 - 5-Element Log-Periodic Vertical Antenna for 80m, 40m, 20m
129 - 2m Vertical Wire Antennas
130 - Earth-Mover Inverted-V Antenna for 40m
131 - Coax-Cable Collinear Antennas

132 - Double Bobtail Antenna for 20m
133 - Collinear Zepp Antenna

L1 - L2 = 180° - 468/ƒ WHERE ƒ = MHz
L1 - L2 = 230° - 600/ƒ WHERE ƒ = MHz
S1 = S2 = 246 x 0.82/ƒ WHERE ƒ = MHz
S1 - S2 MADE FROM 300Ω TV RIBBON, MAKE ABOUT 6INCHES LONGER THAN CALCULATED VALUES, TRIM IF NECESSARY.
134 - Taylor Vee Antenna for 20m

135 - Collinear Vertical Antenna 6dB-Gain for 2m, 1.3m, 73cm
136 - Bi-Loop Antenna for 20m
137 - Wire Beam 6dBd-Gain for 10m
138 - Sloping Diamond Antenna 4dB-Gain for 40m

139 - Twisted Loop Antenna for 160m
140 - DX RX Loop Antenna for 160m

Dimensions in Feet
141 - Hentenna 3dB-Gain for 10m, 6m, 2m

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