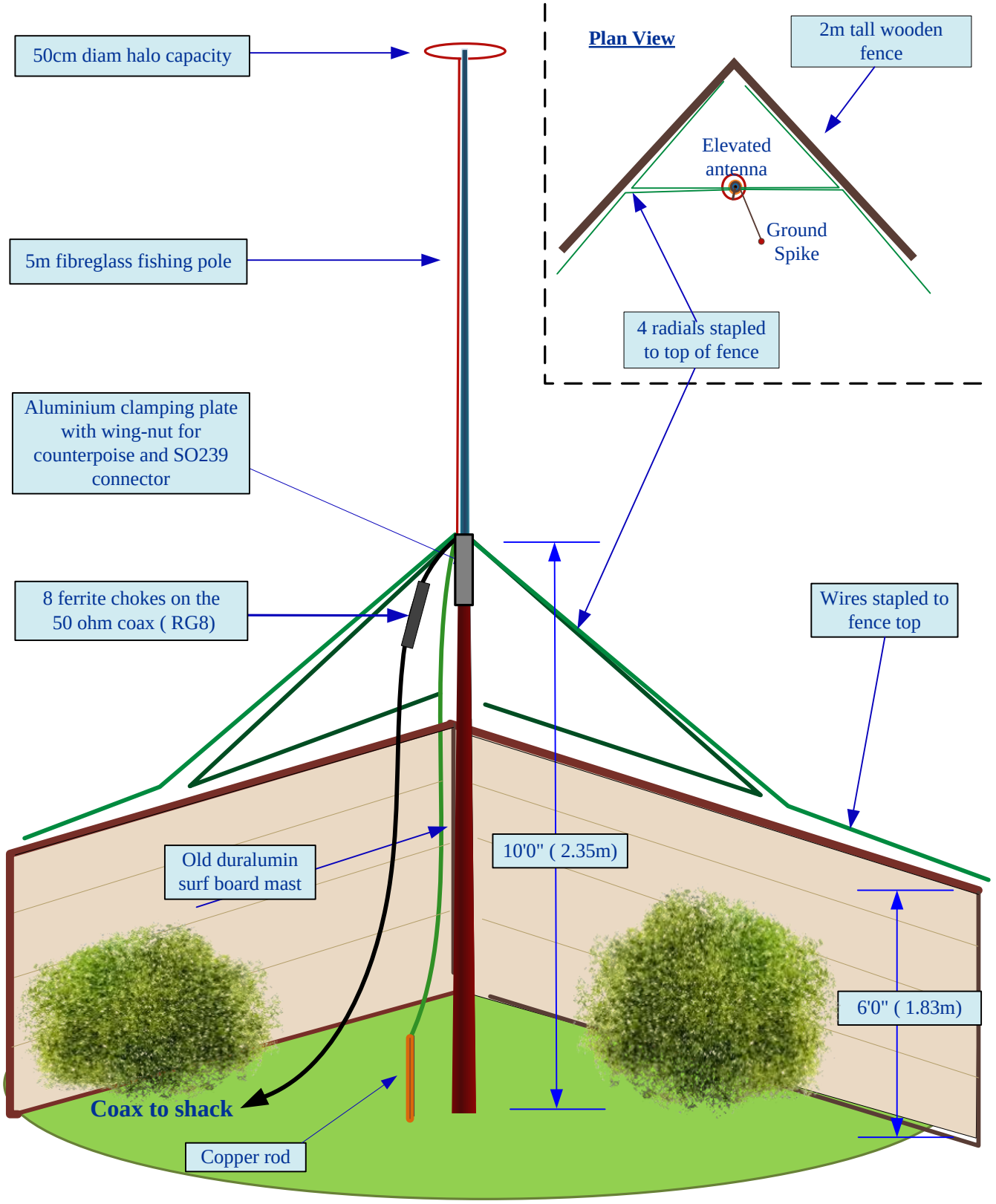
20m Elevated Vertical Antenna – G8ODE



NOTE:- The antenna wire is cut to the length calculated by the formula ;

1/4 λ = 234 / F MHz (Feet) or 1/4 λ = 75/F MHz (metres).

The counterpoise wires are cut 5-10% longer than the antenna wire, and are used to support the antenna.

Graphics by G8ODE DEC 2010 iss 1.3

20m Elevated Vertical Antenna – G8ODE

Tuning the Antenna

It may be necessary to dismount the fishing pole from the aluminium plate several times in order to adjust the length of the vertical and reposition the halo slightly on the pole

An antenna analyser such as the Autek VA 1 is useful for this task, but with care a transceiver on low power and a good quality SWR meter will suffice. A cross-needle SWR meter is recommended. Other types with a forward power calibrate will require re-calibration to full-scale whenever the SWR changes. The wire lengths are calculated using the formula;

1/ 4 wave = 234/ Frequency (MHz) feet or 75/F (MHz) metres

14.000 MHz = 16' 8" (5.1m approx)
14.350 MHz = 16' 4 " (5.0m approx)

Cut the antenna wire slightly longer than the result given by the formula (+10% approx) and trim the wire for the best SWR. The four radials wires should be cut to the same length as the antenna wire, but these should not be trimmed during tuning. The elevated vertical antenna counterpoise wires are intentionally drooped as this increases the input impedance to around 50 ohms (see page 4 Theory). The design of the counterpoise system has been dictated by the restriction in space

The radiator is carefully trimmed 1-2 cm at a time until a low SWR is obtained <1.4:1.

Note that a 4" (10cm) change in antenna length shifts the frequency by 350 KHz.

Picture shows the shorter 20m Elevated Vertical "fishing pole" antenna alongside the 40m Vertical.

The 20m halo top-hat loading capacitor is obscured by the branch of the nearby tree.

The 20m vertical is only guyed at the top of the duralumin ex-sailboard mast using the 4 counterpoise wires.
The fibreglass pole has no guys and has survived 60km gusts and three winters.

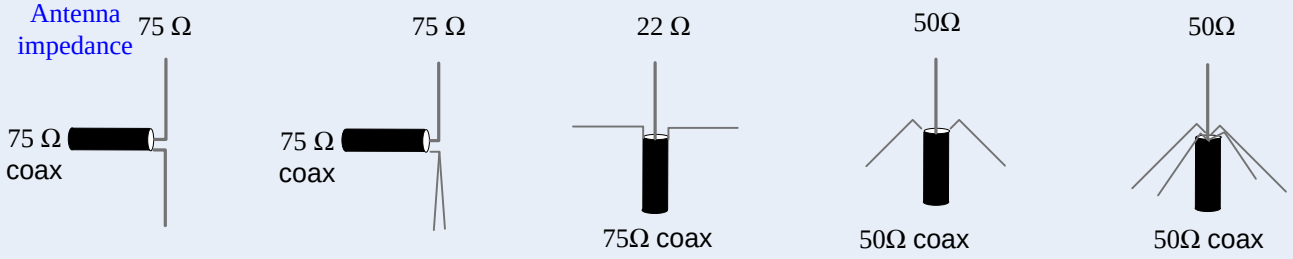
In contrast the longer 40m vertical requires guys halfway up the fibreglass fishing pole allowing only the top half to flex in the gusts.

Graphics by G8ODE DEC 2010 iss 1.3

20m Elevated Vertical Antenna – G8ODE

THEORY

Development of the elevated quarter wave vertical antenna



1/2 wave dipole

1/2 wave dipole bottom radiator split in two

Antenna rotated & radials formed, antenna impedance falls SWR 3.4:1

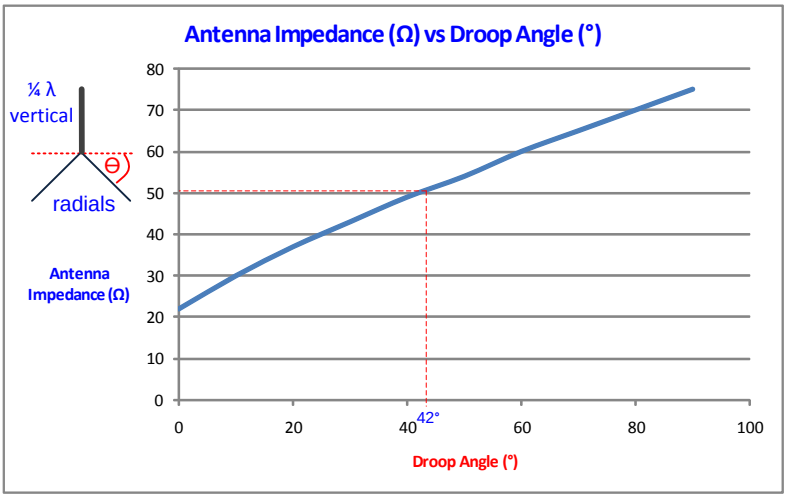
Radials drooped 45°, impedance rises, coax changed to 50Ω SWR 1:1

Standard form with more radials

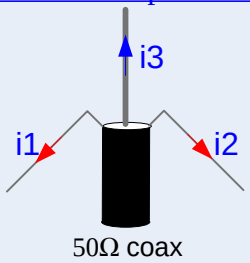
DROOP ANGLE

The graph on the right shows the effect of an increasing angle of droop. Eventually at an angle of 90° the radials will combine and the ground plane antenna becomes an vertical dipole and exhibits an impedance of 75 Ω.

It can be seen from the graph that by dropping the radials at about 45° that the antennas impedance is close to 50Ω.

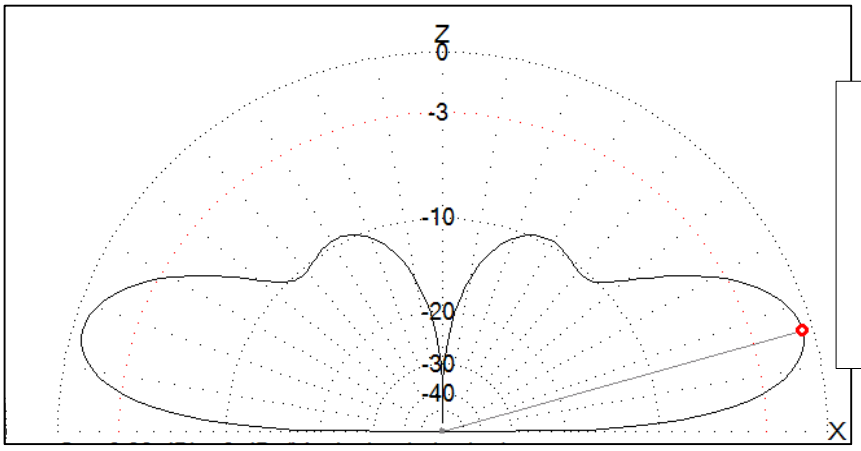


Effect of the paired radials



A Ground Plane antenna's radials are provided in pairs and are slightly longer(5-10%) than the radiator. The currents i1 and i2 in the radials flow in opposite directions and their fields cancel, consequently only the vertical's current i3 produces radiation. Ideally the antenna should be at a height of about 0.2 λ above the ground, if lower then ground losses start to increase unless the ground is good.

The antenna's main characteristic is that it produces relatively low angle radiation suitable for DX operation.



Typical MMANA-GAL model values

Ga : 0.33 dBi = 0 dB (Vertical polarization)
F/B: -0.34 dB; Rear: Azim. 120 deg, Elev. 60 deg
Freq: 14.150 MHz
Z: 59.489 + j0.434 Ohm
SWR: 1.2 (50.0 Ohm),
Elev: 16.1 deg (Real GND :2.00 m height)

See also Study of 20m quarterwave vert - elevated groundplane 1.3.pdf in the e-Library

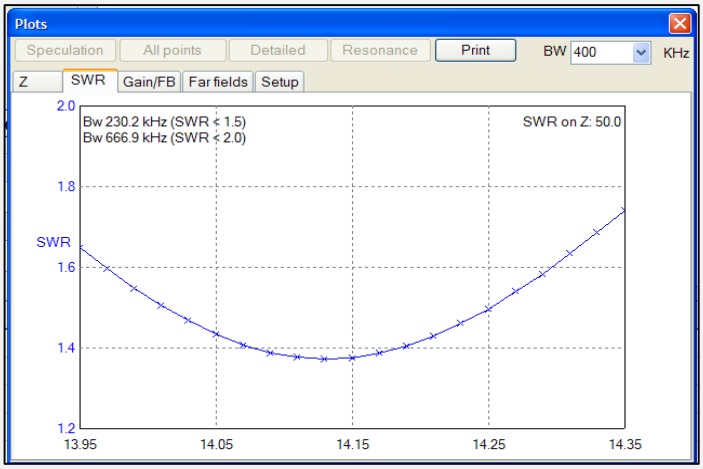
Graphics by G8ODE DEC 2010 iss 1.3

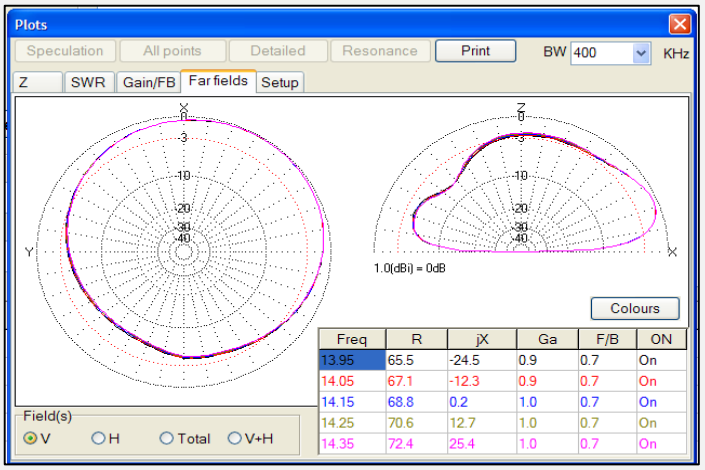
20m Elevated Vertical Antenna – G8ODE

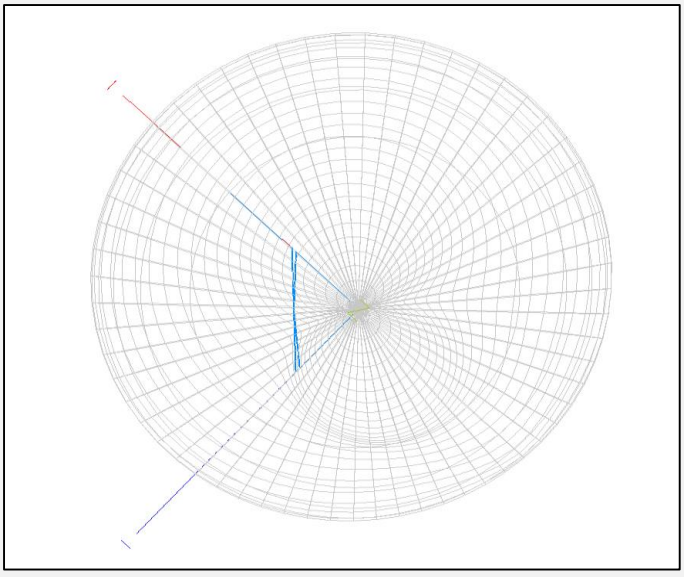
MMANA-GAL Model of the Antenna

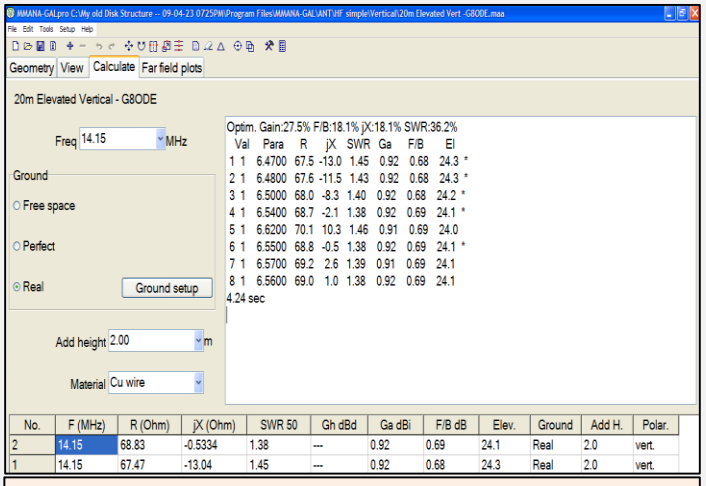
MMANA-GAL calculated results before, and after, optimizing the vertical wire are displayed below. The SWR graph shows the antenna is tuned close to 14.15MHz corresponding to the minimum value of SWR (1.38:1). The small Far Field plot table shows the R +jX values and gain and the vertical field. The three other plots are screen snapshots taken from the 3D Far Field screen showing the vertical polarisation. In practice, it was not possible to achieve the ideal 42° angle, however, the SWR measured with an Autek VA1 antenna analyser at the feed point is 1.4:1 and closely matches the MMANA-GAL calculated value.

Mario G8ODE

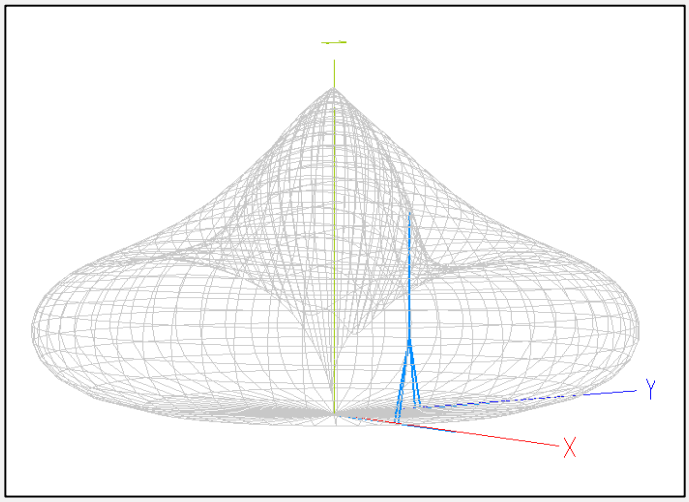


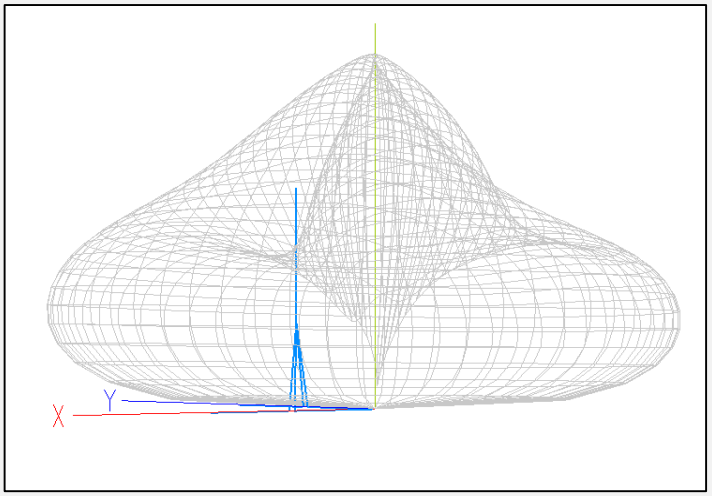






The MMANA-GAL calculations. Line 1 is the first run & line 2 shows the last value recorded after the antenna was optimised for minimum SWR





Graphics by G8ODE DEC 2010 iss 1.3

20m Elevated Vertical Antenna – G8ODE

Modification to Attach PL259 to the end of the Fishing Rod

Unscrew the nylon end cap with a rubber disc off the fishing rod. The rubber disc is discarded and replaced with a thick brass washer. The washer's hole is enlarged to be very slightly larger than the diameter of the PL259 cable end. Carefully position the PL259 connector in the washer ready for soldering. Flow solder over the top of the washer and into the gap between the washer and connector to firmly secure the PL259 connector. Remove any flux residue and insert the washer & PL259 connector into the end cap. Complete the modification by firmly screwing on the end cap.