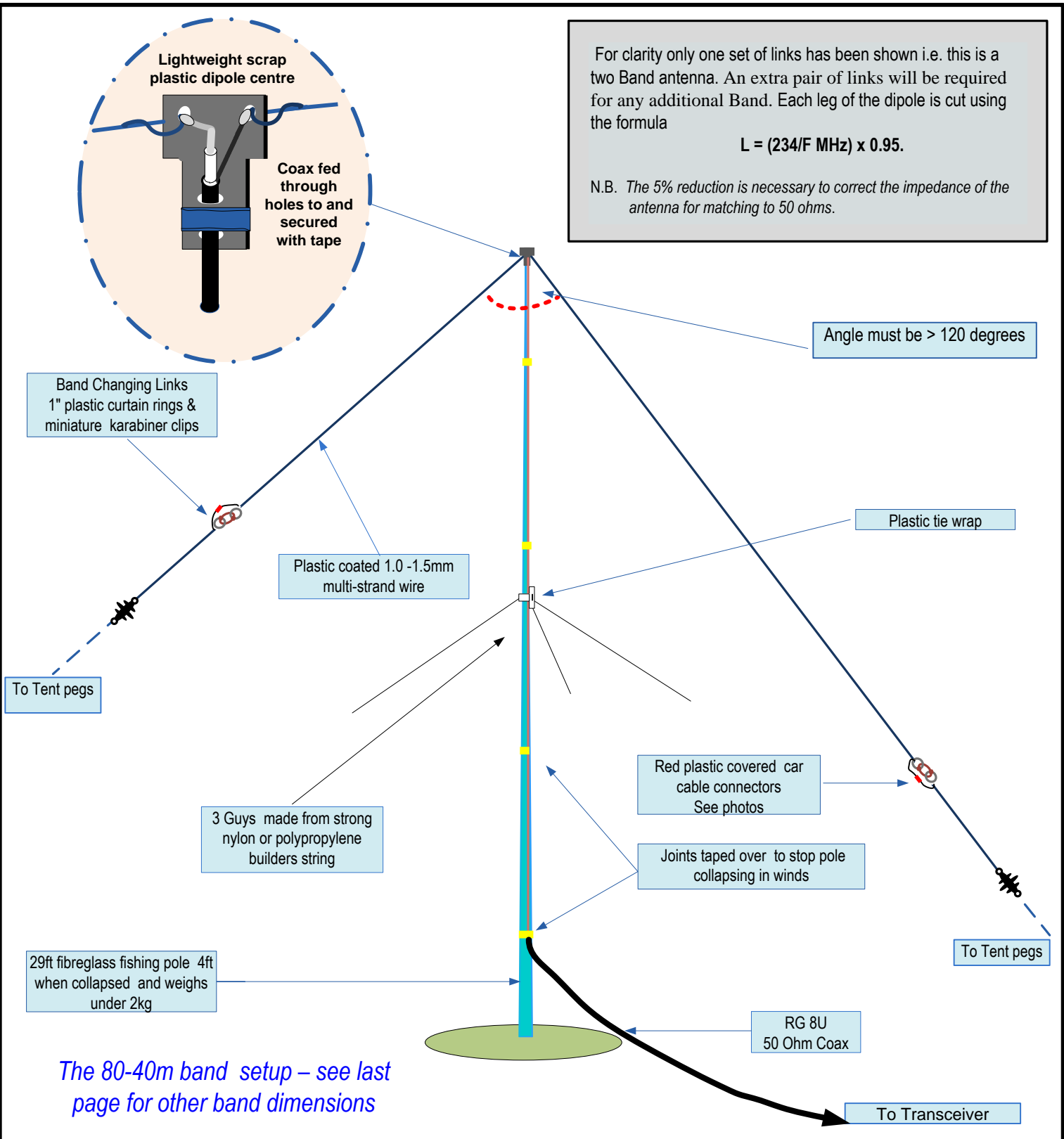
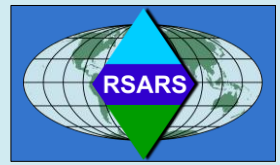


# “SAFARI” INVERTED V ANTENNA - G3RWF

<http://www.rsars.org.uk/ELIBRARY/docsants.htm>



For clarity only one set of links has been shown i.e. this is a two Band antenna. An extra pair of links will be required for any additional Band. Each leg of the dipole is cut using the formula

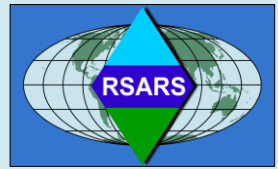
$$L = (234/F \text{ MHz}) \times 0.95.$$

N.B. *The 5% reduction is necessary to correct the impedance of the antenna for matching to 50 ohms.*

*The 80-40m band setup – see last page for other band dimensions*

**Notes:-** The top thin section of the fishing pole is not extended, since it is too weak to support the dipole. The 1" (25mm) plastic curtain rings are used as insulators and the miniature karabiner clips, enables the antenna sections to be disconnected just by pulling on a spring catch. This arrangement is used to detach the wire for 7.0MHz and 3.5MHz to make the antenna even lighter for the higher Bands. A 1:1 balun was not used with this antenna design, and no RF feedback was experienced, but one can be used if required. It is very easy to adjust wire lengths to get a low SWR on all the Bands. Lightweight guys about 9ft up the pole ensured it is free standing. Accurate cutting for frequencies above 10MHz will provide a good match, while for 7MHz and 3.5MHz two different lengths of wire will be required to ensure a good match on both CW and SSB sectors.

# “SAFARI” INVERTED V ANTENNA - G3RWF



<http://www.rsars.org.uk/ELIBRARY/docsants.htm>

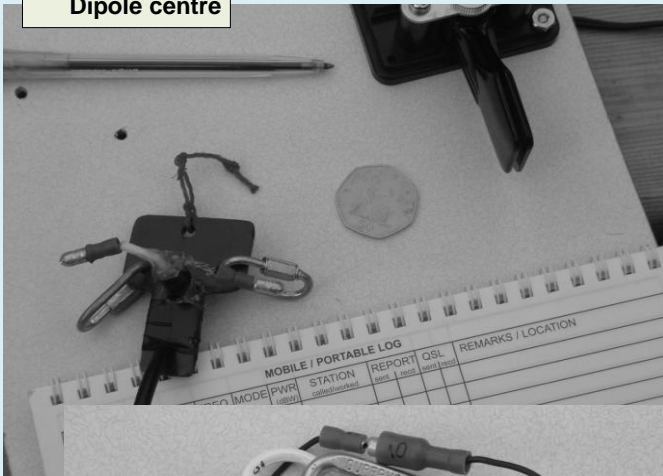
I found that I could easily raise the antenna on my own because it is so light. A halyard would put too much weight on the top and so to change bands you just take the whole pole down. On 10MHz and below, it is possible to reach the clips without dropping the antenna.

Final test ..was completed with a £30 day trip to France, with the aim of setting up shop for RSARS members on Cap Blanc Nez (CBN). This proved the antenna design, and it even operated on the 80m net in the evening with a relatively low height (25ft).

I am very positive about my new antenna support and plan to take it with me abroad in future so I am free from reliance on trees. My new dipole is certainly light but I have yet to discover whether it is sufficiently robust – recalling Army advice years ago about not soldering antennas because they snap – a reef knot is better.

Nick Henwood G3RWF

Dipole centre



Band Change Links



FT-857

# “SAFARI” INVERTED V ANTENNA - G3RWF

Text in italics were summarised from Mercury No.142 article



My efforts are all about minimum weight since I need to get it on a plane for my Safaris. I have quite a few roach poles but only take one on my foreign jaunts. It goes in a carrying case which SOTA Beams <http://www.sotabeams.co.uk/> sell from time to time. Inside the case I have a length of water pipe with the pole inside that. I am able to slot together the case and the water pipe as the base section with the roach pole sitting in the top, this elevates the lightweight Dipole to about 34feet (11m) and excludes the top section which is too weak and is never used. I have also taken to buying a longer water pipe locally if I can (they are usually very cheap) – I bought a 4 metre length of pipe in Cyprus last year which hoisted the roach pole up a further 10 feet plus.

## **“Can you hear me Mother?” : a portable dipole for all seasons.**

*The “Inverted Vee dipole” strung up a tree has since been to Portugal, Namibia, South Africa, and Guernsey and twice to Cyprus. It has worked well but has always been dependent on the availability of a useful tree. So the challenge was to produce a lightweight mast which can be taken by air.*

*The “roach pole” – a fibreglass fishing pole is 29ft in length and collapses to less than 4ft. Weighs under 2kg and is increasingly used by UK portable operators. The inverted vee dipole does not need an earth system or an ATU. I generally dislike ATUs because they are used to match compromise antennas; tend to waste RF and require earth systems which are difficult to install when portable – hence the inverted vee. An important exception is the use of a vertical antenna immediately over water and*

*The little task that I set myself was to produce a dipole so light that it could be supported on a roach pole but fed directly with 50ohm low loss coax, thus providing a good match to my FT857’s 100W without an ATU.*

*The new antenna uses lightweight 50ohm coax, but even with short lengths losses can be significant. RG8U cable was tried but the fishing rod bent over when the coax was taped to the top of the thinnest section. However, without the very whippy top section, the pole happily supported RG8U at 25 feet without bending. The friction-fit sections also needed taping when erected to prevent the chance of the pole collapsing into itself.*

*The dipole design is simply a multi-band dipole with insulators and links to adjust it for individual bands. To reduce weight car cable connectors are used, being simple and light. Insulators are one inch plastic curtain rings and some miniature karabiner clips, which mean that sections can be disconnected just by pulling on a spring catch, and are used to detach the wire for 7 and 3.5MHz to make the antenna even lighter for the higher bands. The dipole centre piece is made from a small piece of lightweight discarded rainwater pipe with the coax hard-wired. Purists say that a balun is needed, but it was used without one, with no RF feedback problems being experienced after adjusting wire lengths to get a low SWR,.*

*Tests confirmed that the pole was strong enough to take the weight imposed at its highest point, and it would stay in the air vertically provided that the ends were not pulled too tight. Some very simple lightweight guys about 9ft up the pole ensured it is free standing. The antenna is set up with an angle greater than 120 degrees at the apex (to get the impedance match about right).*

*It is a simple matter of making some adjustments to ensure the best match on each band. I determined the antenna length by using the usual dipole formula less 5% (because of the inverted Vee configuration). Accurate cutting for frequencies above 10MHz provided a good match almost immediately. Below that frequency some adjustment in length was needed (usually further shortening) 7 MHz and 3.5MHz really need two different lengths to ensure a good match on both CW and SSB sectors and I left plenty of spare wire connected for adjustment.*

*The final test culminated with a £30 day trip to France, with the aim of getting contacts with other RSARS members on Cap Blanc Nez (CBN). I found that the antenna worked excellently. The good location, that I was able to secure, without having to rely on finding a tree, more than compensated for the relatively low height (25ft).*

*I am very positive about my new antenna support and plan to take it with me abroad in future so I am free from reliance on trees. My new dipole is certainly light but I have yet to discover whether it is sufficiently robust*

*– recalling Army advice years ago about not soldering antennas because they snap – a reef knot is better.*

**NICK HENWOOD G3RWF**

A Useful Web link for designing the inverted vee is provided here

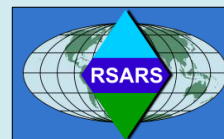
[http://www.k7mem.150m.com/Electronic\\_Notebook/antennas/inverted\\_vee.html#Page\\_Top](http://www.k7mem.150m.com/Electronic_Notebook/antennas/inverted_vee.html#Page_Top)

Sample values from the program shown below

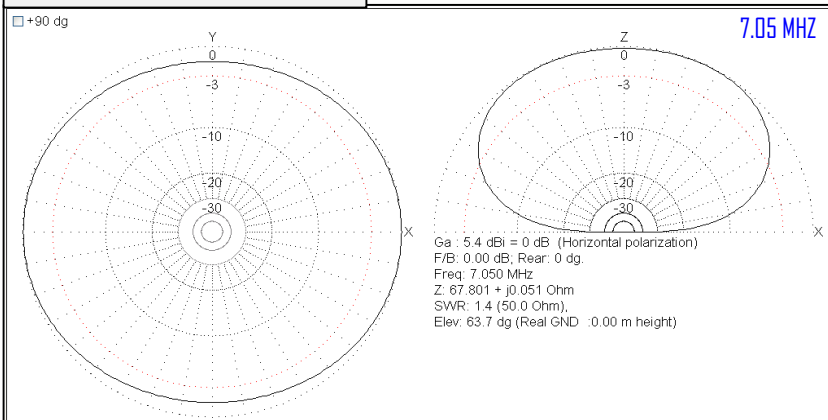
Inverted Vee Dipole dimensions - 10m mast & Antenna Apex Angle 120 degrees							
MHz	7.05	10.12	14.05	14.2	18.12	21.2	24.9
One side of the dipole (feet)	31.5	22	15.8	15.7	12.3	10.5	8.9

# "SAFARI" INVERTED V ANTENNA - G3RWF

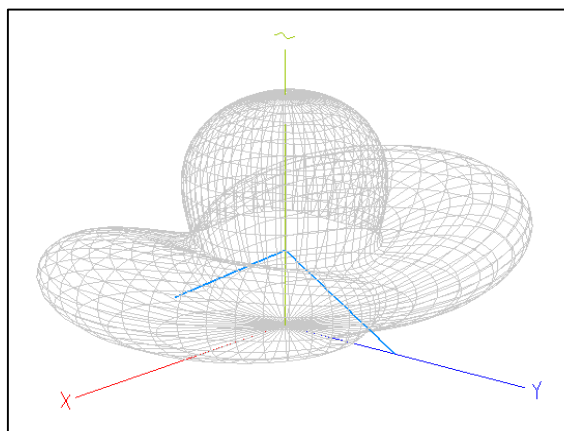
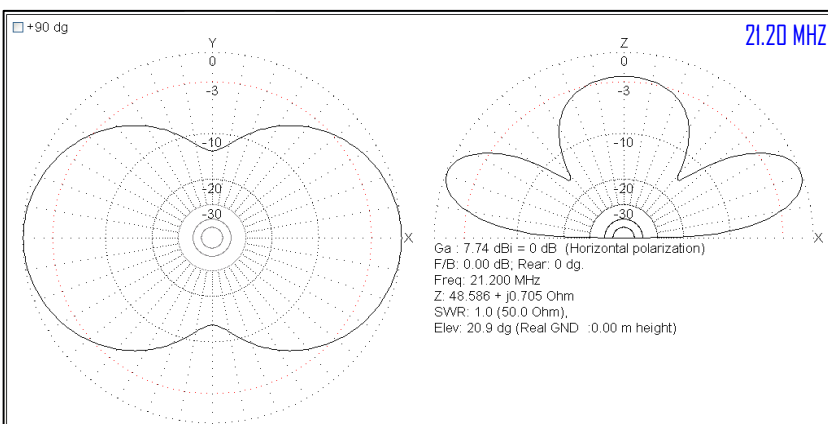
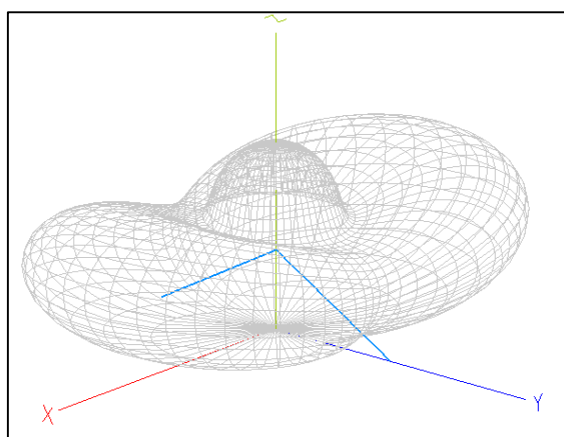
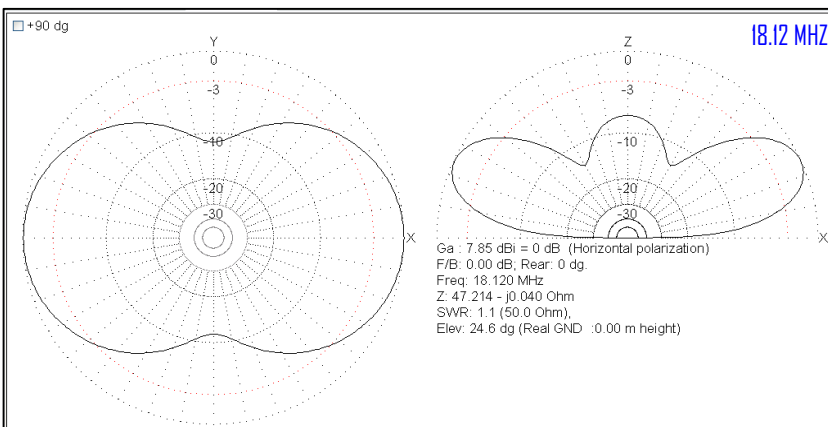
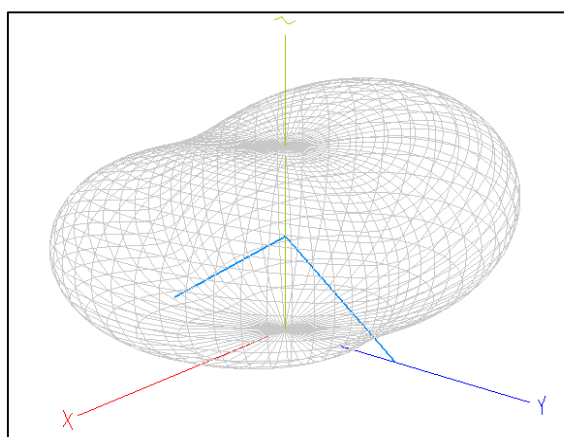
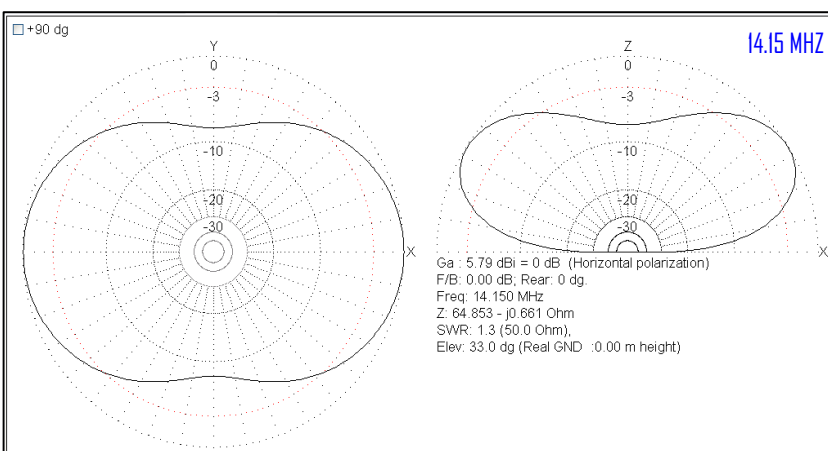
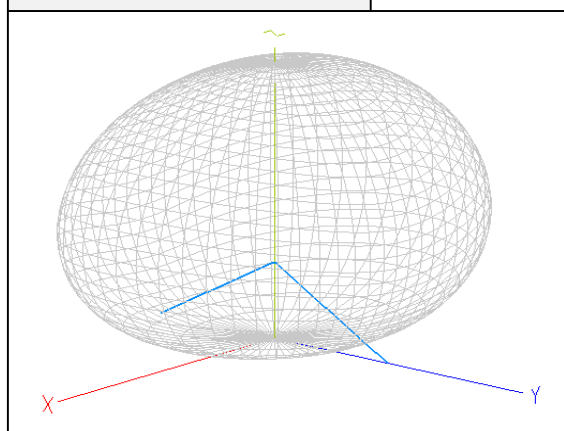
## MMANA-GAL MODEL



### Far Field Total Radiation Patterns



### 3D Far Field Total Radiation Patterns



Antennas all modelled with the apex at 10m, over "real" ground = 5mS/m & dielectric =13 the apex angle set to approx 120 degrees.

# “SAFARI” INVERTED V ANTENNA - G3RWF

<http://www.rsars.org.uk/ELIBRARY/docsants.htm>



## Properties of the inverted V antenna

In theory, the gain of an inverted V is similar to that of a dipole at the same height, since this is where the high-current is concentrated. Antenna modelling programs like the free MMANA-GAL software, predicts maximum gain of 2.15 dBi for the dipole and 1.9 dBi for the inverted V.

However, in practice, height above the ground and its conductivity, as well the ends being closer to the ground considerably reduce the efficiency of the inverted V compared to the dipole. Elevating the antenna higher above ground helps to reduce the disparity.

### The main advantages of this antenna are;

1. Only requires a single support
2. Smaller footprint than a horizontal dipole.
3. Low angle radiation for DX operation with centre's height  $> 0.5 \lambda$  and improves with more height.
4. NVIS is possible on 40, 60, 80m bands. The optimum high angle radiation is obtained at  $1/4 \lambda$  above ground, going lower lowers efficiency loss.

In practice  $0.25 \lambda - 0.15 \lambda$  heights are used for NVIS with the apex angle bent gently -- approx 120 degrees or more.

Inv Vee $\lambda / 4$ feet = $(234 / F \text{ MHz}) \times 0.95$		
metres = Feet $\times 0.3048$		
Frequency MHz	$\lambda / 4$ feet	$\lambda / 4$ metres
3.55	62.62	19.09
3.65	60.9	18.56
3.75	59.28	18.07
7.05	31.53	9.61
7.15	31.09	9.48
10.12	21.97	6.70
14.05	15.82	4.82
14.15	15.71	4.79
18.08	12.295	3.75
18.12	12.27	3.74
21.05	10.56	3.22
21.2	10.49	3.20

The table above shows the wire lengths for each side of the dipole of the inverted V with arms set at  $45^\circ$ . The formula is same as for a horizontal dipole  $\lambda/4 = (234 / F \text{ (MHz)})$  less 5%. These lengths may have to be adjusted slightly to obtain the best SWR and match the transceiver's 50 ohm output. It is best to start with a slightly longer wire length and fold it back on its self to shorten the antenna.

For dipole arm angle settings less that  $45^\circ$  adjust the lengths as follows,

- Use 4% reduction for  $37^\circ$  formula less 4%
- Use 3% reduction for  $30^\circ$  formula less 3%
- Use 2% reduction for  $22^\circ$  formula less 2%

These will provide values that are not an exact length and they do not take into account environment factors for the antenna e.g. trees, condition of the ground etc

The graph to the left, shows that the height of the antenna's centre above the ground measured in wavelengths also affects the antennas impedance, hence the SWR, and is most pronounced on the lower HF bands 40 & 80m.

The variation in Radiation resistance vs Height at resonance can be seen on the adjacent graph.

### Additional reference :-

*Proceedings of the Institute of radio Engineers Volume 20, Number 6 - June 1931 CIRCUIT RELATIONS IN RADIATING SYSTEMS AND APPLICATIONS TO ANTENNA PROBLEMS by P S CARTER - RCA Communications Inc.*

