THE G3EFY EMPIRICAL ASYMMETRICAL ANTENNA

G3EFY

The initiative that prompted the writer to commence this experiment originated from reading articles and advertisements, relating to the Californian Windom type antenna. The WWW has several sites that have information on the Californian and other Windom variations. The use of a vertical radiator section in the construction of the Californian Windom, antenna and the claims made for the added DX possibilities, intrigued me. Further information on the capabilities of vertical radiator sections as part of an antenna system are to be found in that most useful publication for amateurs keen to experiment, namely :

"Amateur Radio Techniques" written by Pat Hawker G3VA – one of our RSARS Members.

On pages 270 and 271 of the 7th edition are details of the G3VA vertical-Tee antenna. The vertical radiator of this antenna consists of a single wire. The Californian Windom employs a coaxial vertical radiator, and these facts prompted me to explore the possibilities of using these features in an experimental antenna system. Additional information on page 296 of the afore-mentioned publication relates to horizontal aerials, the various positions of the feed-point, and the resulting diagrammatic radiation patterns. The length of a wire antenna also affects the radiation pattern, and for good world coverage from the UK the one and a half wave-length type with six lobes was my preferred choice for DX experimentation, with an asymmetrical feed point at a current maximum at the short end of the system.

The use of a 21 MHz antenna for this project, was two-fold. First the available space for the project without resort to dismantling the station's main G5RV antenna for the duration of the testing period had to be considered. Accordingly a one and a half wavelength asymmetrical system was erected. And secondly, the 21 MHz band is usually a good choice for DX contacts.

In descriptions of the Californian Windom the coaxial cable section connected to the feed point of the antenna is entitled as the vertical radiator, and will be referred to as such in this monograph. I assumed – because of lack of other information - that the radiator section used in the commercial antenna is of 50 ohms impedance. In addition, and with regard to the different lengths of coaxial cable used for vertical radiators in the construction of the various models of the Californian Windom; I assumed that a velocity factor of 0.67 was used to determine the length of the radiators – in the special version being 10 feet in length, and in the Californian Windom 80 being 22 feet in length and that the resonant frequencies of the two vertical radiators could be calculated by this factor.

Using the usual formula quoted in many publications on antenna features, and allowing for the velocity factor of coaxial cable, I concluded that the 22 feet radiator was a half wave in the 14 MHz band, and the 10 feet radiator was a half wave in the 28 MHz band.

The impedance at the centre of a dipole is, according to articles on the subject, 70 ohms. It is also possible to connect a number of half wavelength additional wires to one end of a dipole. Thus any antenna consisting of a number of half waves can be fed with a feeder connected to point a quarter wavelength from one end of the antenna thus forming an asymmetrical system. In practice a 75 ohms feeder either of twin or coaxial formation can be used. The writer prefers to use 75 ohms balanced twin feeder instead of coaxial cable for connecting to an antenna of the dipole configuration. However, on considering the claims for the use of the radiator section in the feeder system of the Californian Windom, I inserted in the feeder of a full wave asymmetrical antenna – as shown in Fig 1 – a short section of 75 ohm coaxial cable, The length was calculated for a quarter wave length by using a velocity factor of 0.67 : The choice of a quarter wave radiator instead of a half wave was solely owing to the constrictions on the height that the antenna could be erected at my QTH. A half wavelength radiator would have rested on the ground.

In my antenna the impedance at the point of connection of the radiator is the same as the impedance of the radiator itself and there seems, logically, no reason to use a balun at this junction. In the case of the Californian Windom there is a matching unit at the top end of the radiator where it joins the antenna wire. At the lower end of the radiator there is an "isolating unit" – not a balun - which forms a junction with the coaxial feeder leading to the transceiver equipment. Although the impedance of both the radiator and the coaxial feeder to the transceiver etc. is the same, - 50 ohms - the reason for the use of this "isolating unit" in the Californian is to solve ground loop problems. In the case of the this empirical antenna the twin feeder and the coaxial section are of the same impedance, only in this case 75 ohms - a home constructed trifilar balun is used at this junction of balanced to unbalanced components. This item is constructed from a ferrite rod 5 cm long and 12 mm in diameter, upon which is wound 10 turns of 20 SWG enamelled wire in a trifilar formation. The 75 ohm feeder used is – fortuitously – 11 feet 6 inches in length. This is approximately a quarter wavelength at 21 MHz. Whether this has any significance on the performance of the antenna is possibly open to conjecture as, the total length of the feeder and the coaxial radiator is also approximately a half wavelength at 21 MHz.

The results of several weeks using this antenna on the 21 MHz band have been reasonably rewarding – especially as the band conditions for DX working during the testing period were so poor. The antenna is at its highest point only 18 feet above ground level, and bent to fit the space available, not ideal. The 11 feet end of the antenna is very close to the gable end of the bungalow, and the vertical radiator section approximately three feet from the gable end, and the far end a few feet above head height. No doubt if erected without bends at a higher level and the radiator section clear of the bungalow wall, results may be rather better. With an ASTU – in this case a standard double coil "Z" Match – a 1:1 SWR has been obtained. Although the initial project was for a monoband one and half wavelength antenna, on reducing the length to one wavelength, i.e. reducing the 55 feet part to 33 feet, Fig 2, an intriguing secondary bonus is that the antenna could then be loaded satisfactorily on the 7 MHz and 14 MHz bands including 21 MHz the design frequency, again at SWR of less that 1.5:1 with reasonably good performance.

The commercial Californian Windom matching transformer and line isolator units are according to comments given by users of that antenna, rather heavy and can cause a pronounced sagging in the middle of the antenna which because of the weight of these units require stout supporting methods. In the writers antenna the joint at the point of connection of the radiator section to the antenna is contained in a light weight plastic 35 mm film container, and at the point of connection of the feeder at the lower end of the coaxial radiator is contained in a plastic pill container. Both containers are suitably modified with plated brass waterproof glands for the feeder and the coaxial radiator. These items were originally designed for through coaxial cables in metal chassis and have rubber insert gaskets that proved useful as waterproof seals. To accommodate the diameter of the coaxial cable used for the radiator, the glands were drilled to the size required. The joints between the lower end of the radiator and the twin feeder are soldered to the trifilar balun. All parts used in the construction of this empirical antenna are from junk box material.

Some of the CW QSOs – that have resulted from the use of this experimental antenna have been with: The Antilles - Argentina – Australia – Brazil – Canada – China – Cyprus – India – Indonesia – Japan – Kazakhstan – Kyrgyzstan – Philippines – Sultanate of Oman - Thailand – Turkmenistan – Turkey – U.S.A. – Uzbekistan - Vietnam.

Many European stations have also been worked using this antenna which seems to have promise. It is also conceivable that a half-wave length coaxial radiator section could be used with the possibility of better DX contacts. However, the experiment has given me great pleasure. As with many antennas of this type, the long version can be used on 3.5 MHz by shorting the ends of the 75 ohm feeder at the station end and connecting to an ATU of the L and C type, sometimes known as an L-network. The L section can be a tapped coil or as in my case, a “roller coaster” salvaged from a WW2 surplus equipment.

Finally, trap dipoles usually have 50 ohm coaxial cable as a feeder, although text book information states that the impedance at the centre of a dipole is 70 ohms. The writer logically postulates that if the centre of a trap dipole, or a simple monoband dipole, was connected to a 75 ohm coaxial vertical radiator and continued to an ATU via 75 ohm flat twin feeder; then possibly the DX capabilities of the system could be increased. The length of the radiator could be calculated for a DX band of the user’s choice. Having no traps to construct a suitable antenna of this type I have no experimental evidence of the efficacy – or otherwise – of this latter suggestion. If any Member does construct or modify their present trap or monoband dipole to include a vertical radiator, I would welcome any information as to results obtained.

Author’s Notes:

I am indebted, and extend my thanks, to the authors of the following publications for information on which this article is based : “Amateur Radio Techniques” by Pat Hawker G3VA; “The Amateur Radio Handbook” in the section entitled H.F. Aerials, and published by the RSGB.

Fig 1. 21 MHz Monoband Antenna One and a Half Wave.

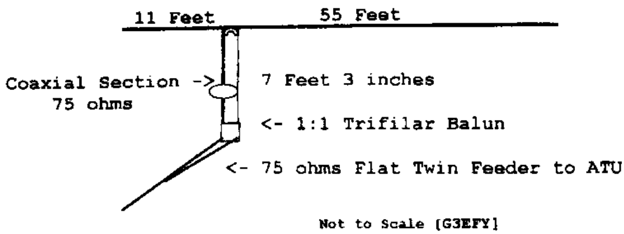

Fig 2. 21 MHz Monoband Antenna One Wavelength.

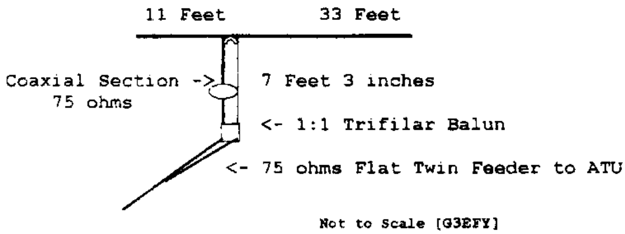

Fig 3. Suggested Modified Trap Dipole to include a vertical radiator