G4CFY aerial development history

On 30th October 2006 Spectrum Communications acquired G2DYM Aerials. That business had run for exactly 30 years selling Trap Dipoles mainly to the Amateur Radio fraternity. Richard Benham-Holman G2DYM the previous owner had just had his 84th birthday and due to failing eyesight so was unable to continue running the business.

The G2DYM Trap Dipole was based on the W3DZZ trap dipole design using a 7MHz dipole comprising two inner sections of 32 feet each, with 7MHz traps then a further 21 feet 7 inches beyond each trap. As standard it was supplied with 70 feet of 75 ohm twin feeder. A 1:1 balun was then used to convert to the unbalanced feed of the transceiver.

Design equations show that the G2DYM coax traps have a higher L to C ratio than used in the W3DZZ design and need to be used with an inner wire length of 33 feet and an outer wire length of 19 feet 7 inches to resonate in the middle of the UK amateur bands. This is 2 feet shorter overall than as sold by G2DYM. The trap potting compound and trap frequency accuracy were significantly improved. As standard the full size dipole with G2DYM traps was supplied with 20 metres of low impedance twin feeder, and the half size aerial with 16 metres of low impedance twin feeder.

Chronology

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In 25 January 2007 I found an article from Technical correspondence in QST August 1976 written by Wes Hayward W7ZOI about applying the equations created by Gerald Hall K1PLP to the design of inductance loaded antennas. This determined how much wire would be required beyond the loading coil (or trap) on any aerial wire. These equations were tried for the W3DZZ dipole and gave the correct wire lengths for the middle of the American amateur bands. I then created an Excel spreadsheet to calculate the top wire lengths for known trap inductance and capacitance.

Measurements of the 7MHz coax traps revealed an inductance of 12uH. The effect of connecting the inner from one end back to the outer at the other end effectively shorts out the inner to outer capacitance at low frequencies. At 7MHz the isolating effect of the intervening inductance allows the capacitance to total around 42pF. The equation run for the coax traps and UK amateur bands revealed the G2DYM 80/40m trap dipole had inners 1 foot too short each and the outers to be 2 feet too long each. Hence the G4CFY 80/40m dipole came into existence.

8 August 2009. The twin core single strand low impedance feeder was liable to fracture at the cable grip on the centre-piece. It was also difficult to make-off and required time consuming work with sleeves, glue and heatshrink. Permanoid had ceased production and stock obtained with the purchase of the business was running low fast.

No multistrand low impedance twin feeder could be found Worldwide, so I designed my own feeder. It is made using twin cores of 24/0.2 individually sheathed in polyethylene then with a solid moulded outer sheath of polyethylene. The solid construction avoids water ingress and it has good flexibility.

When measured by a customer using a virtual network analyzer the characteristic impedance was measured at 110 Ohms, which was a bit higher than intended, but still acceptable.

The close spaced cores ensure virtually no differential noise pick-up. Unlike coax it picks up noise identically on both cores so has no noise differential voltage at the shack end. On transmit the signal in the cores are equal amplitude but opposite in phase and cancels out any emitted field, thereby minimising TVI. It must be used in conjunction with a 1:1 Balun. Characteristic impedance is now known to be 95 Ohms, 2kW power handling, 0.04dB/m loss at 10MHz (much the same as solid dielectric coax), weight 27gm/m.

5 October 2009. New traps were perfected for 14.15MHz for use with a half size dipole. Top wire lengths were calculated and several aerials were sold using those length. Results were very encouraging but resonance was slightly higher than desired. Addition of 4 inches to each inner brought the resonance into the middle of the bands. The total length is now 54 feet.

26 March 2010. A new version of the 1:1 Balun was manufactured. It included switching to join the twin feedline wires so the aerial can be tuned against ground as a Marconi T. This means the 80 to 10m trapped dipole can now be loaded up on 160m, and the 40 to 10m trapped dipole can be loaded up on 80m. Using an aerial in Marconi-T configuration requires that the twin feeder is well away from support masts and has no long run close to ground.

20 October 2014. A new design of trap was developed with a lighter tube as well as small and lighter winding. This was now enclosed in an adhesive heatshrink with low dielectric constant and good heat characteristics. New versions of trap for any frequency are now relatively easy to produce and initially I have produced traps for 28.5MHz, 14.175MHz, 7.1MHz and 3.65MHz. The new L-C ratio of these traps is slightly higher and requires the length of the outers to be reduced by another 9”each.so the popular 80/40m trap dipole then became 103 foot 3”.

2014-2020. Over the next 6 years further traps have been perfected so there is almost the full set, 80, 60,40, 30, 20, 17, 15, & 10m. Though I don't like coax cable for balanced antennas for HF it seems to be a good solution for unbalanced whips and verticals and the Inverted-L antennas. From 30MHz to 500MHz it is too lossy and foam dielectric or semi-airspaced is a better solution. That is why UHF TV and satellite TV use semi-airspaced and honeycomb insulators.

In February 2020 I designed a new type of coax cable 0.5mm smaller in diameter than RG213 and with foam dielectric. Pre-production samples of this cable have half the loss of RG213 and RG8-SuperXX at any frequency. It is hoped that the final version will be created and tested before the end of August and stock can be received in October. It will be better compatible with standard PL259/9 connectors than any presently available types of RG213 and will be compatible with standard N type connectors. It is expected to retail at £2/m.

In the spring of 2020 I designed and built a time domain reflectometer and was able to measure the twin feeder characteristic impedance to be precisely 96 Ohms.