

The TFH Antenna

by Richard Q Marris, G2BZQ

The TFH (Top Fed Helical) is a multi-band HF TX antenna only 2 metres long, designed for indoor, discrete outdoor, portable or holiday use.

THE CONVENTIONAL short vertical helical HF Antenna is well documented. It is usually 6-8ft high and helically-wound. Invariably it has an umbrella type top hat, of several feet diameter, and an elaborate groundplane system is required. There is an even distribution of voltage/current throughout its length, and it is a very efficient short radiator.

However, you do not get something for nothing, so let us look at the drawbacks:-

- 1 It is invariably a single band affair.
- 2 It is very narrowband, but very efficient within that narrow band.
- 3 Having a very low impedance it requires a matching unit located at its base.
- 4 It requires an extensive $\lambda/4$ diameter radial groundplane system, which usually means a lot of digging up of lawn and garden to accommodate it.
- 5 Since the antenna with its ATU must be situated in the middle of the groundplane, it will be located out of doors, whilst you are comfortably located indoors with the Tx/Rx, the two being joined together with coax.
- 6 Because of 4 & 5, above, any ATU adjustment means rushing out of doors, and back indoors repeatedly to make normal loading adjustments.

So what is the answer? Well, the ideal seemed to be a short vertical helically-wound HF antenna, between six and eight feet high, using a normal ground system, usable over several HF bands, not narrowband, and with loading adjustments carried out near the operating position. In addition, an even current/voltage distribution throughout the whole antenna, which the conventional short vertical has proved to be effective.

The TFH fulfils this specification. It is a multi-band antenna; can be used indoors on a single simple base, or discreetly erected on the wall outside, with wall pipe clips. It is ideal for portable use or can be taken on holiday, with a small rig.

Fig 1 shows the antenna configuration. L1 is the short helical winding, and L2 is the single wire feeding from the ATU. The ATU,

(Fig 2) is an 'LC' type. It is invariably used in the configuration shown, with the option in certain cases of reversing it to CL configuration. The ground system I use is a convenient waterpipe. A metal window frame has been used as an experiment.



CONSTRUCTION Antenna

The antenna is wound on a 2m length of 2in inside diameter (i/d) (2.25in outside diameter (o/d)) grey polypropylene downpipe using 106ft of single strand 1/0.6mm grey PVC-covered 1.2mm o/d wire.

At the top of the pipe, fit a 4mm socket as shown in Fig 3a. Drill a small hole adjacent to the socket, push through the wire end and solder to the socket. Wind the wire, evenly spaced, to a total winding length of 45in using approximately 4 turns per inch. It is convenient to put pieces of tape around the coil at intervals to hold the wire temporarily. The last few turns at either end should be secured to the pipe with cyanoacrylate adhesive. *This adhesive should be handled with extreme care, as it sets in about 3 seconds, with an indestructible joint.* After final testing, the pieces of tape are removed, and the turns coated with a clear lacquer.

The simple wooden base (Fig 3a) is made of 12in x 12in x 0.5in heavy wood with a 12in long square section 'prong' on which the antenna pipe can be slipped. For outdoor use, the wire turns should be coated with marine varnish, and the 4mm socket replaced with an insulated hard soldered connection. For mounting on a wall outside a window (Fig 3b), two plastic pipe brackets are used, making an inconspicuous antenna.

The ATU

The ATU consists of a tapped coil and 500pF

variable capacitor as Fig 2. This is mounted inside a convenient metal case.

The inductance L3 is wound on a 4.5in length of 1.25in o/d paxolin tube using 95 turns of 18 gauge enamelled copper wire, tapped at 12 - 12 - 12 - 12 - 20 - 12 - 5 - 5 - 5 turns. The taps on the prototype are adjusted with a clip, but a rotary switch could be used, or the tap soldered for monoband use. Good clearance is required between the coil and the metal box, but otherwise the layout is not critical. A short length of RG58 50Ω coaxial feedline connects the ATU to the Tx/Rx.

The feedline L2 is a 10ft length of PVC covered 24/0.2mm stranded wire. One end is terminated with a 4mm plug (to antenna), and the other a coaxial plug (to ATU).

OPERATION

THE ANTENNA SHOULD BE located clear of metal objects, and electricity supply wiring. It should be in a position to enable feedline L2 to be taken in the clear to the ATU, eg the centre of the room. If mounted on pipe brackets outside the window, as Fig 3b, it should be kept clear of any metal pipes or in-wall metal-work.

The antenna is usable on 80, 40 and 20m over the whole of each band. It has been loaded successfully on 160m though not tried on the air.

It is essentially a low power device (up to 25W or so), and in the interests of safety it is suggested that a maximum of 10W output should be used indoors.

In operation, connect the ATU in the LC mode; select the band, and then adjust L3 tap and C1 for maximum received signal strength. Only a minor adjustment of C1 may be necessary on transmit for Tx loading.

The antenna has been used mostly on 80m CW, obtaining excellent results with a 10W transmitter using a Pi output.

Setting up at 3550kHz gives a usable bandwidth of over 100kHz, from 3500 to 3600, without readjustment of C1. Further small adjustments of C1 enable the whole

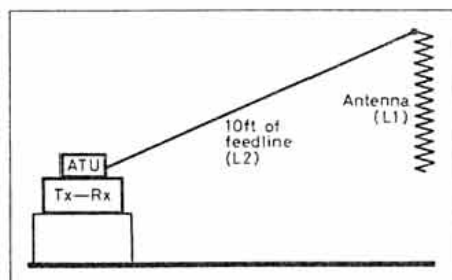


Fig 1: Basic configuration of the top loaded helical antenna.

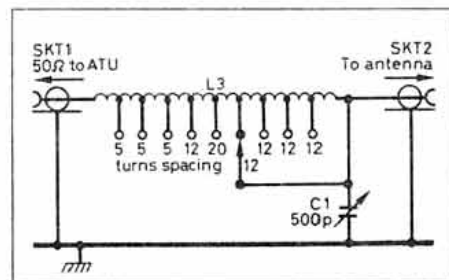


Fig 2: A simple 'LC' or 'CL' aerial tuning unit, which is invariably used in the configuration shown.

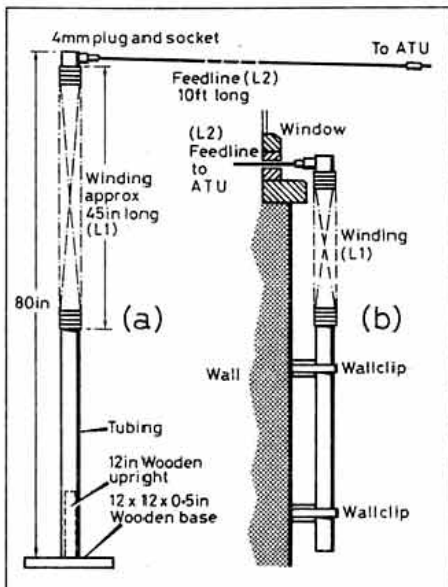


Fig 3: Construction details of the TFH antenna (a) self supporting or (b) wall mounted.

band 3500 - 3800kHz to be used in approximately 100kHz segments. No harmonic content or TVI has been detected.

Careful checking indicated that the voltage/current distribution on the helical coil L1 is even over the whole length, as per target specification, and this holds good on 80, 40 and 20m. On 160m, the ATU should be tried in both the LC or reversed CL modes.

The antenna is a very low cost, convenient, transportable device breaking down into Helical L1; wood base and plug-in feedline L2, plus ATU. It takes only a couple of minutes to set up or break down. High rise building dwellers, with antenna restrictions or difficulties, should find the configuration of Fig 3b useful, with the rig and ATU just inside the window. If the window frame is metal, it can be tried as the ground (it worked at this QTH), or a convenient water pipe could be used. Otherwise, a $\lambda/4$ insulated counterpoise lying on the floor would suffice. Metal gas pipes or electric conduit should not be used as a ground. An existing good HF all band ATU can be tried in lieu of Fig 2.

PARTS LIST

- L1 Single strand 1/0.6mm PVC covered 1.2mm o/d wire. (eg 1 kV RMS, 1.3 amps - grey - Marco Trading CBL/EW1/Grey) wound on 2m of polypropylene downpipe 2 inch i/d, 2.25in or 57mm o/d, (eg grey - OSMA 20MF282 or similar)
- L2 10ft of 24/0.2mm PVC covered stranded wire 2mm o/d
- L3 18-gauge enamel covered wire, wound on 1.25in o/d x 4.5in long paxolin former
- C1 Airspaced good quality 500pF variable capacitor with knob
- Optional Wall Clip Pipe brackets, (eg grey OSMA 20MF281 or similar)
- SK1/SK2 Coaxial sockets (Identical)
- 4mm plug and socket.



Book Reviews

WIRELESS THE CRUCIAL DECADE (History of the British wireless industry 1924-34)

by Gordon Bussey.

Volume 13 in the IEE's History of Technology series. Published 1990 by Peter Peregrinus Ltd, 125 + x pages (hard covers). Price £29.

THIS NEW BOOK well outlines (but without circuit diagrams) the development of domestic wireless sets, primarily for medium and long waves, from a time when crystal sets, earphones, ebonite panels, triode valves run from accumulators and HT batteries, with readily available (if high cost) components encouraging home construction, through a decade to an era of mass-produced sets with a stamped out metal chassis, selective receivers based on superhet circuitry (though many British and European firms were still marketing 'straight' sets in 1934), multi-electrode valves, moving-coil loudspeakers (often mains-energised) running from the electric supply mains (still often DC mains). The author is well-known in the growing volume of nostalgic publications featuring early (rather than vintage) radio sets. In this volume, he draws very heavily on the editorial and advertisement columns of the once-weekly Wireless World. Virtually all the illustrations consist of advertisements reproduced from that publication.



Gordon Bussey shows clearly that most of the important developments came to Europe from America, gradually forcing down the very high prices of equipment produced in garage-type workshops paying (or avoiding paying) the original 'BBC' patent royalties, until, by the mid-1930s, production was in the hands of the large electrical firms with wooden cabinet furniture firms as sub-contractors. Surprisingly, no reference is made to the restrictive influence of the then all-powerful BVA (British Valve Association) which kept the retail price of British valves so high - and led us in the following years to welcome, as soon as import restrictions were lifted, the appearance of American valves and American communications receivers at more reasonable prices. There is disappointingly little on the commercial history of the industry.

He does, however, show that in 1926 the average price of a four-valve (triodes) battery set was £38, with a replacement valve costing say £1.50, at a time when a skilled worker was lucky to earn perhaps £5 per week.

For those of us who first became aware of the wonders of wireless in this crucial period, this book (despite its very high price) provides an interesting and informative read. It is perhaps fitting, in view of the recent history of the late-lamented British radio-manufacturing industry that this book has been printed (to high standards) in Singapore. **G3VA**

UHF COMPENDIUM Parts 3 and 4

Edited by Karl Weiner, DJ9HO

403 pages, published by DARC Veriag, ISBN 3-88692-010-0

THE UHF COMPENDIUM is a monumental effort by DJ9HO to compile the best of West Germany's amateur VHF, UHF and microwave knowledge into print. Originally a private venture, publication has now been taken over by DARC, the West German National Radio Society. The series appears initially in German as UKW-Unterlage, with subsequent English translations. The combined Parts 1 and 2 have been available for some years, and the latest English-language volume combines parts 3 and 4.

The UHF Compendium does not contain instructions for building exact duplicates of complete items of equipment. With a few exceptions, it is primarily a source of ideas for circuit modules based on the direct experience of the original developers. Although there is plenty of information in the form of circuit diagrams, sketches, photographs, PC layouts and text, you are still expected to work out the less important details for yourself. This is a realistic approach, because most experimentally-inclined amateurs like to use materials that are to hand, and seldom attempt to duplicate a design in exact detail.

Newcomers to VHF, UHF and microwave construction would probably feel in need of a little more information than the UHF Compendium provides. Even so, the series is well worth buying as a source of information, and for its many examples of electronic and constructional techniques. From the photographs, it soon becomes clear that equipment doesn't need to look pretty to work well!

The most enjoyable way to read this book is to flip the pages until something catches your attention. Among the huge variety of VHF, UHF and microwave designs and ideas, notable items include: a large family of power amplifiers for 144MHz and particularly 432MHz, based on the 2C39 and similar triodes in ones, twos and threes; many ideas for pre-amplifier transverters and power-amplifier chains for the middle microwave bands; equipment for receiver intermodulation testing on 144MHz and 432MHz; a relatively simple spectrum analyser for 0-1.8GHz; a trailer-mounted mini-shack (why not?); and an astonishing 10GHz SSB transverter built into the battery compartment of an IC202.

We British are often unaware of technological developments in countries using languages other than English, so it is a particular pleasure to see such a mine of information coming from a country other than Britain or the USA. Unfortunately, the English-language volumes of the UHF Compendium appear 2-3 years after the original versions in German, and thus are not quite so state-of-the-art. As a result, many British amateurs who have become fans of the series are already struggling through UKW-Unterlage Teil 5, German-English dictionaries in hand - and a good thing too. After having caught up with Parts 1-4 in English, you may want to do the same. **G3SEK**