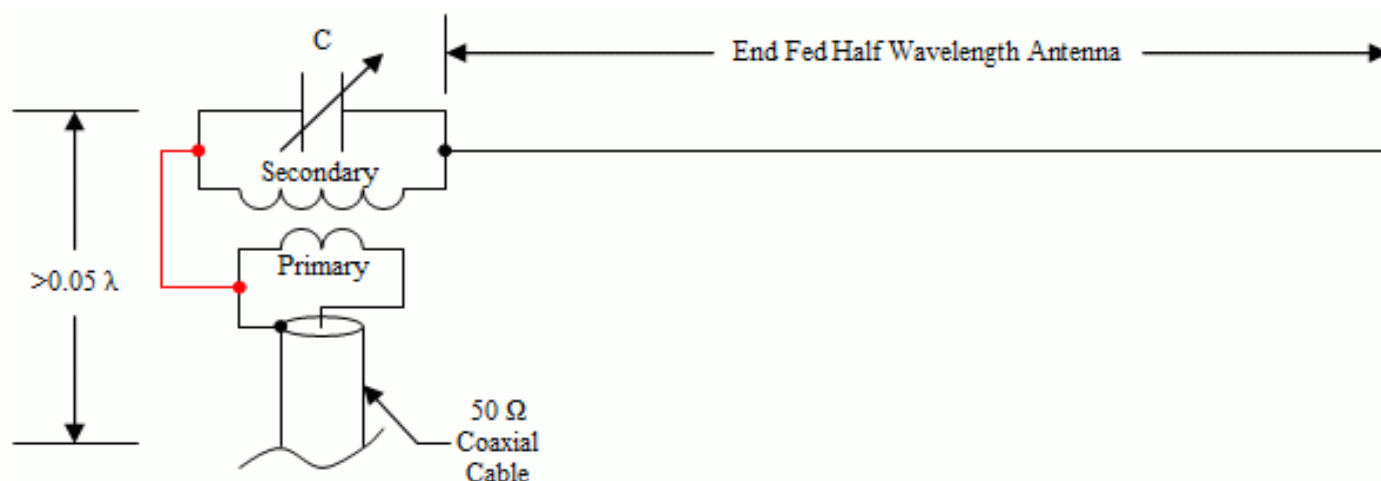


# GOKYA's HF End Fed Half Wave (EFHW) antenna – construction details



## Introduction

The EFHW monoband matching unit (inspired by AA5TB) allows for a half wavelength of wire to be connected, giving a 50 Ohm impedance match to the transmitter (without a ground plane or ATU) at the frequency of operation. The SWR is likely to be below 1:1.5 and when used as an omnidirectional vertical the low angle of radiation (typically with a maximum at about 20 degrees) will give good results on DX, outperforming a G5RV, doublet or similar by up to 2 Spts.

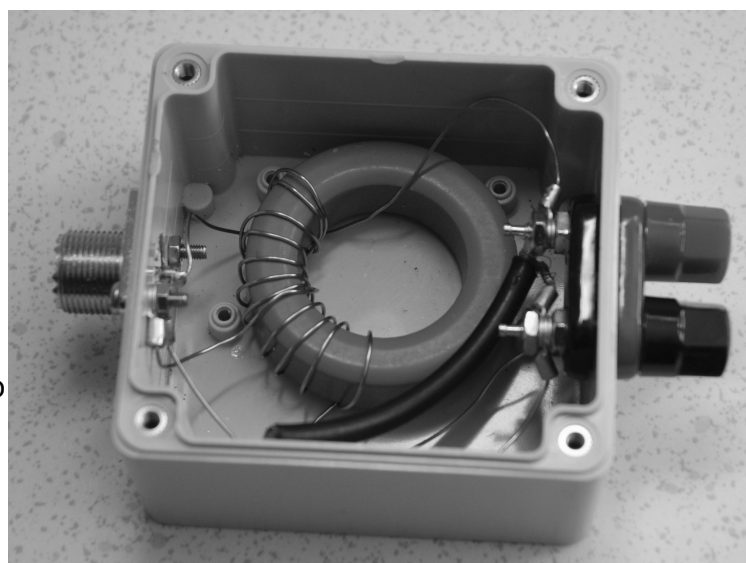
## The mounting box

Start by putting two pieces of masking tape on opposite sides of the mounting box. Carefully mark the centre of one side and drill a 15mm hole for the SO239 socket.

Note: If you haven't got a big enough drill use a Dremel tool or file to make the hole big enough.

Holding the SO239 in place, use it as a guide to drill two 3mm holes diagonally opposite each other for its mounting bolts.

On the opposite side of the box drill two 8mm holes for the antenna connection post and optional earth. Fit the two posts.



## Winding the matching toroid

Using the enamelled copper wire wind 13 turns on the toroid. Each time the wire passes through the toroid counts as one turn. This is the secondary winding. Don't overlap the turns, but keep them quite close together – we may need to space the windings out later when we get to the tuning phase.

Now wind two turns over the existing winding. This is the primary winding. Scrape or burn some of the enamel off the ends of the primary winding and also cut another short piece of enamelled copper wire (about 5in/130mm long) and scrape the enamel off the ends. This is the secondary to primary earth shorting wire which allows the antenna to work without radials or a counterpoise (see diagram). Using a solder tag connect one side of the primary winding and the earth shorting wire to one of the SO239 earth mounting bolts. Connect the other end of the primary winding to the centre of the SO239.

## The coax capacitor

Now cut the coax capacitor to the length shown in the table below, depending on the band you are designing the matching unit for. Once tuned, the overall length of the coax capacitor will probably be about 1-2 inches shorter than this.

Bare the wires at one end of the coax and leave the other end as it is – you will be snipping this with cutters to tune the antenna later.

<b>Band</b>	<b>Starting coax capacitor length (you will cut approx. 1-2in shorter than this to tune)</b>	<b>Length of half wave antenna (assuming insulated wire)</b>
20m (14.175MHz)	35.5cm (14in)	10.05m (32ft 11.6in)
17m (18.1MHz)	24.5cm (9.5in)	7.87m (25ft 9.8in)
15m (21.225MHz)	19cm (7.5in)	6.72m (22ft 0.2in)
12m (24.9MHz)	15.25cm (6in)	5.72m (18ft 9in)
10m (28.5MHz)	13cm (5 ins)	5m (16ft 5in)

## Wiring up the secondary/coax capacitor/earth shorting wire

Connect one end of the secondary and the inner of the capacitor coax to the red antenna terminal using a solder tag. Connect the other end of the secondary, the braid of the coax and the earth shorting wire to the green terminal using another tag.

## Tuning

*Caution: This is best done with an antenna analyser.* Arrange for the half wave antenna wire to be supported vertically outdoors, well away from any metallic object (a fibreglass fishing pole is ideal). Connect the antenna to the red EFHW connection and connect the analyser to the SO239. Sweep and you will find a resonant point, probably BELOW where you expect it to be in terms of frequency.

If this is the case space out the secondary windings until the antenna is resonant at the bottom of the band you require. At this point you can snip away the coax (quarter of an inch at a time) to shift the resonant point upwards slightly. Do not remove more than one inch.

Shortening the coax will move the resonant point up in frequency, as will spacing out the turns. Compressing the turns will move the resonant point downwards.

This is a very sensitive procedure and may require many iterations. Once you have the resonant point where you want it in the middle of the band use a hot melt glue gun to hold the windings in place and the toroid firmly in the box. Make sure that the end of the coax capacitor cannot short out (Check for stray copper wires and cover the end with PVC tape).

## Problem solving

The antenna is designed to work without a ground plane or counterpoise – it uses the outer of the coax as the return path for the minimal antenna currents. If you do have RF problems you can connect an earth or short (1m) counterpoise to the earth (green) terminal.

This may be required if using the antenna as a horizontal end fed dipole with a short length of coax.

If you cannot get the antenna to tune, check the wiring first. Do not cut the capacitor any shorter than 2in less than the starting length. If the antenna resonates lower in frequency than you require remove a secondary winding and try again. If higher add a winding.

## DIY Shopping List for Steve G0KYA EFHW antenna kit

**Most parts below as purchased for the NARC issued kit – re David G7URP any query:**

### Main Ferrite Core

- Ferrite core – Type T200-2 is recommended by Steve G0KYA Available from Jabdog ([www.jabdog.com/cores.htm](http://www.jabdog.com/cores.htm)) or sometimes from ebay sources (NARC bought theirs in bulk from German trade supplier)

**Other main materials** items exactly as supplied in NARC kit:

- Case: Rapid 30-1412
- Red Terminal : Rapid 17-2698
- Green Terminal: Rapid 17-2697
- SO239 RF socket Rapid 16-0150
- Enamelled copper wire Rapid 05-0245 \*Note this is for a large 500g reel – try & beg or share!
- M3 screws Rapid 33-1510 (Pack of 100 - only 4 needed)
- M3 nuts Rapid 33-1710 (Pack of 100 - only 4 needed)
- M3 washers Rapid 33-1760 (Pack of 100 - only 4 needed)
- M3 solder tags Rapid 33-1810 (Pack of 100 - only 2 needed)
- M3 tags with buckets Rapid 33-0200 (Pack of 100 - only 2 needed)

**All the above from Rapid electronics** [www.rapidonline.com](http://www.rapidonline.com)

Note web & catalogue prices are plus VAT but free delivery on orders over £30 +vat

- Coax RG58 - only small length required. (Rapid can supply but in 100m reels Part 02-0220)

### Other useful sources:

**Fishing poles - Fibreglass** (sometimes called Roach poles)

Shop, Market or ebay – advantage with a shop or the market is you can assess quality first.

\*Beware of carbon fibre poles, although stronger, they can be conductive

### Antenna Cable

There are many different sources of cable of course, from regular PVC covered cable to specially designed and 'drawn' cable like Flexweave. Bear in mind that when the cable is covered it will slightly affect the velocity ratio, re Steve's talk.

### Ground screw stake – to support fishing pole in ground

Mail order catalogues or now the new Clas Ohlson Shop in Chapelfield Norwich, currently £8.49  
[www.clasohlson.co.uk/Product/Product.aspx?id=134859471](http://www.clasohlson.co.uk/Product/Product.aspx?id=134859471)