40M – 6M End Fed Antenna

Ham Com 2013

WB5CXC & W5WF

This project is to construct an End Fed Long Wire Antenna. The antenna is an inexpensive, multiband, end fed HF antenna. It has a matching network consisting of a toroid core and an antenna lead of 30'.

The matching network is a 1:9 UnUn trifilar wound transformer using a T106-2 iron toroid core. UnUn is a transformer for Unbalance to Unbalance devices. This provides matching the 50 ohm coax to the high impedance of the end fed antenna. It will handle a 100 watt transmitter and ***will require an antenna tuner to achieve satisfactory SWR on all bands***. The normal internal antenna tuner should be able to tune the antenna from 40M to the 6M band.

End Fed Matching Assembly – 1 ½" Cap & 1 ½" Slip Plug

End Fed Matching Assembly – 1” LR Electrical Fitting

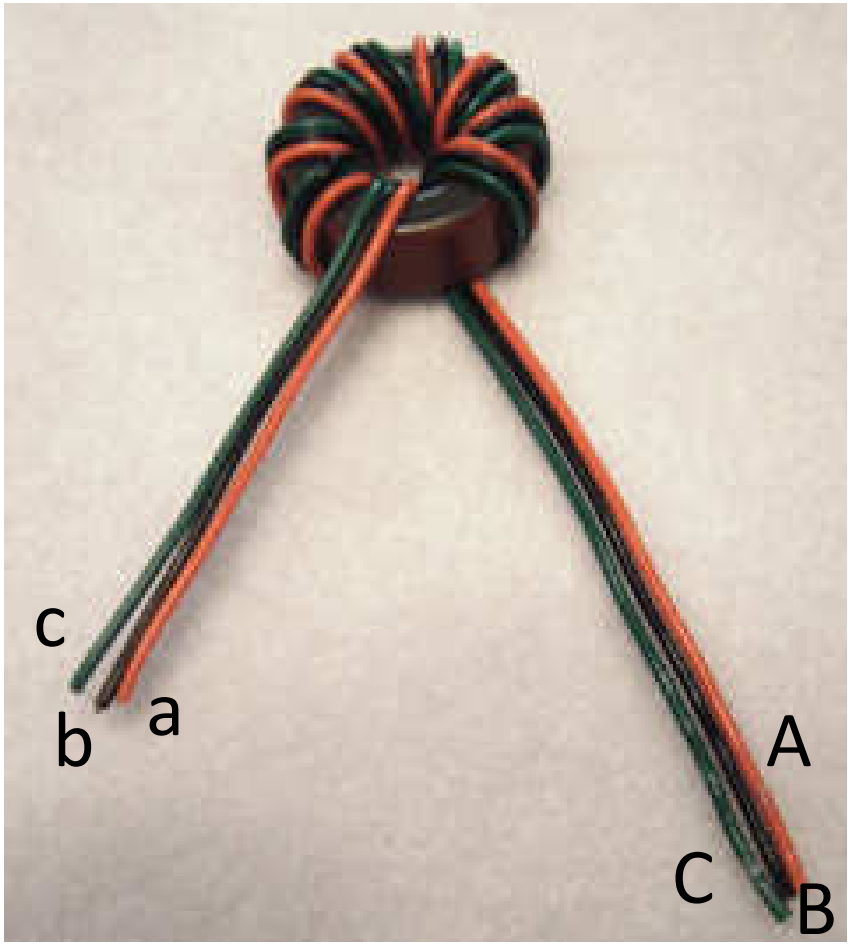


Figure 1 - Toroid windings

We will wind a T106-2 toroid core with 9 turns of trifilar winding. Trifilar means that there are three wires. We will use three different colors of wire so we can tell which wire to use later. Notice that there are letters, these are important because they have to be connected properly to work.

This is a 1:9 UnUn. This means that the device is going from **un**balance circuit to another **un**balanced circuit and has a ratio of 1:9. Coax is 50 ohms, input so the output will be 450 ohms. (If you were going from coax to a dipole you would use a Balun – **Bal**ance to **Un**balance (Balun)– the dipole is balanced and the coax is unbalanced.)

The toroid is a T106-2. This is a powered iron toroid. The T106 means that it is 1.06" in diameter. The -2 means it is a #2 mix. This defines the frequency etc. for the toroid, they come in other mixes also T106-6, etc. The toroid can be purchased from various vendors for $1.05 - $ 1.80 + shipping depending on vendor. (Other toroids have been successfully used – T130-2, FT140-43, FT140-61.)

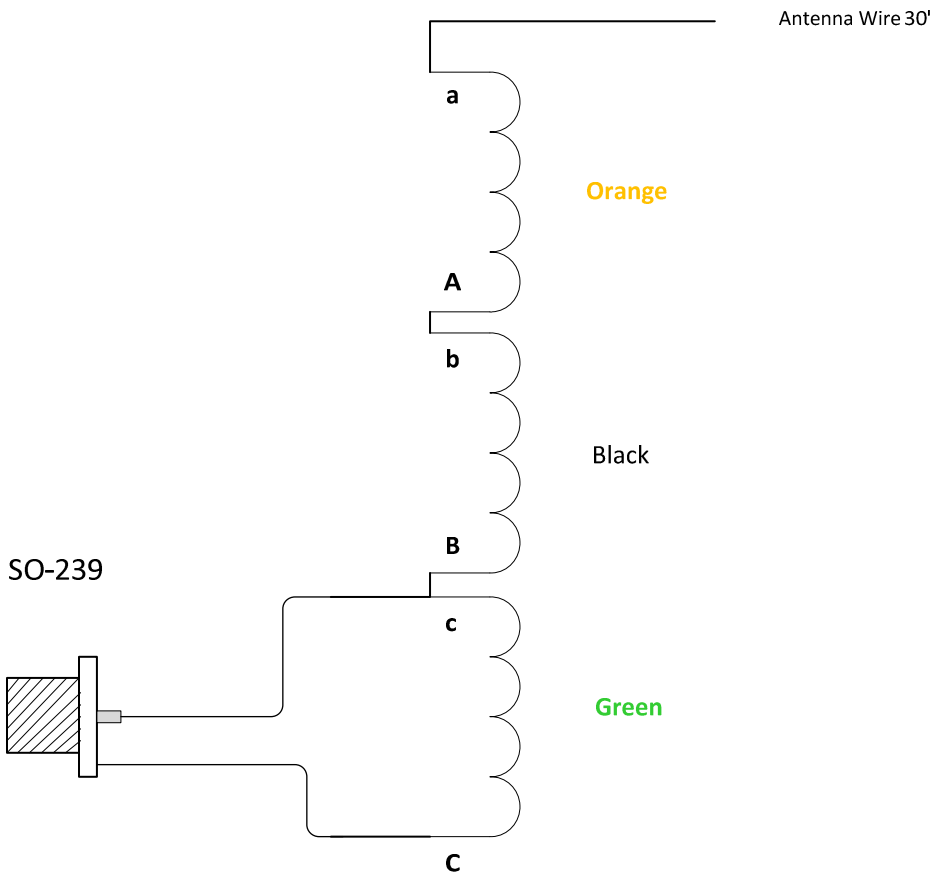


Diagram of the Matching Network

Notice the Letters of the winding. If you get them backwards then the impedance would really be crazy.

We will start with ~ 2' of each color of wire. Start winding the toroid. Leave 2" of spare wire at the start. This will be required to connect it in the circuit.

This is a 1:9 UnUn. You will notice that there is 1:3 step up windings. For impedance transformation, it is the square of the turns ratio, so the impedance is $3^2 = 9$.

Refer to Figure 1.

Connect the Black wire on the left side (b) to the Orange wire on the right side (A). Strip the insulation off each wire and solder.

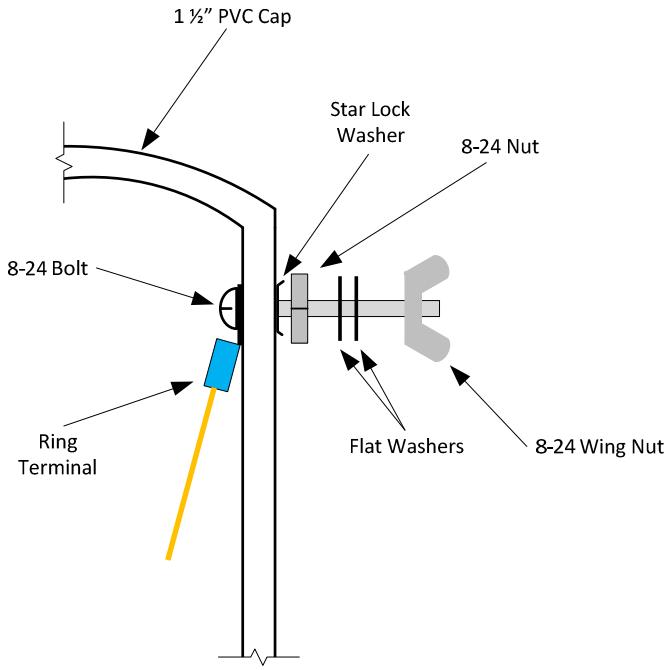
Now twist the Green wire on the left side (c) with the Black wire on the right side (B). Remove the insulation on the end of the Green and Black wire about ¼". We will solder it to the center of the SO-239 during the assembly process.

On the Green wire (C) on the right side, solder a lug on the end. This will be secured under the screw holding the SO-239.

On the Orange wire (a) on the left side, solder a lug on it. This will be secured under the screw for the antenna wire.

Place the wires for the SO-239 through the hole for the SO-239 connector. Solder the wires to the (Green & Black) center of the SO-239.

Mount the SO-239 on the drilled 1 ½" PVC plug. There is one threaded 6x32 hole on the plug, this is used to make mounting the SO-239 easier. Install three of the bolts to secure the connector. Place bolt in the last hole of the connector and place the lug (Green wire) on the bolt and secure with a nut.

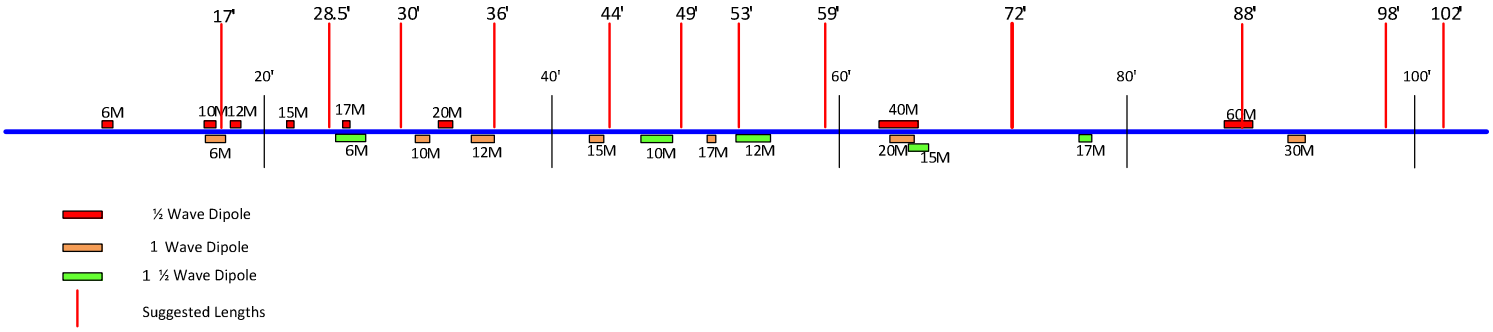


Place a 10X24 screw through the lug on the Orange wire and place it into the hole on the side of the PVC Cap. Install a 10X24 nut on the outside of the PVC Cap and tighten the bolt.

Ensure that the network is correctly wired, and then glue the top cap on the PVC plug. (Installation in a 1" LR Electrical fitting is similar.)

Install a lug on the end of the 30' piece of wire. Place a washer on the bolt on the side of the network, then place the lug of the antenna wire, then another washer and then secure it with a wing nut.

This Network can be used with different lengths of wire. For all band operation, the wire can't be a ½ wavelength or multiple ½ wavelength on any frequency you intend on using. This limits the lengths of wires you could use. Some of the lengths that should be acceptable are: 36, 44, 49, 53, 59, 72, 88, 98, and 102. The longer the antenna wire, the better.



This antenna requires the use of at least 30’ of coax for the antenna to operate properly.

We mounted the antenna using an MFJ 1910 (33’ fiberglass pole than lets down to ~ 4’). We were looking for a temporary easy setup and take down. You can put one of these up in approximately 5 minutes. This will be a very good installation for portable operations or HOA problems etc.

The performance of this antenna is very good.

Materials List:

1	1 ½” PVC Cap
1	1 ½” Slip Plug
1	powdered iron toroid T106-2
3	24” pieces of 22 or 20 gauge solid insulated copper wire in orange, green, and black
4	6-32 x 3/8” machine screws
4	#6 nut (for SO-239 connector)
1	SO-239 panel mount connector (4 hole)
2	10-24 x ¾” machine screw and nut
4	#10 flat washers
2	#10 lock washer
2	#10-24 wing nut
3	#10 wire lugs
2	#6 wire lug
1	30’ #14 AWG (16, or 18 gauge will also work) insulated stranded wire - antenna

1” LR Electrical Fitting & 2- 1” PVC Plugs

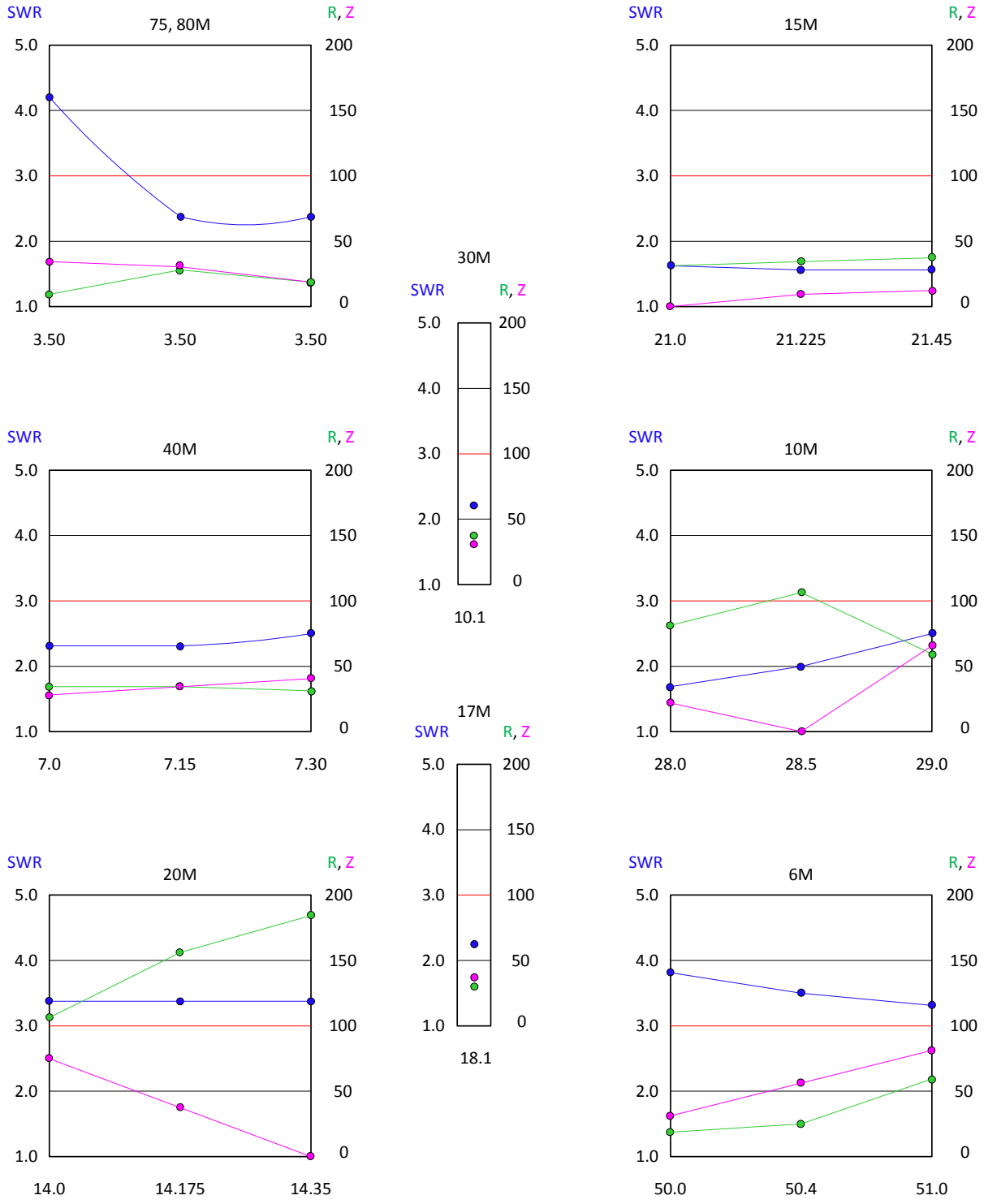
T130-2, FT140-43, or FT140-61 Torrid

Toroids can be purchased from: http://kitsandparts.com/ and other Internet sites.

Videos on End Fed Antennas

http://www.youtube.com/watch?v=uWkpQ785Pjo&feature=related
Video on using End Fed Antenna with MFJ 1910 33’ fiberglass pole

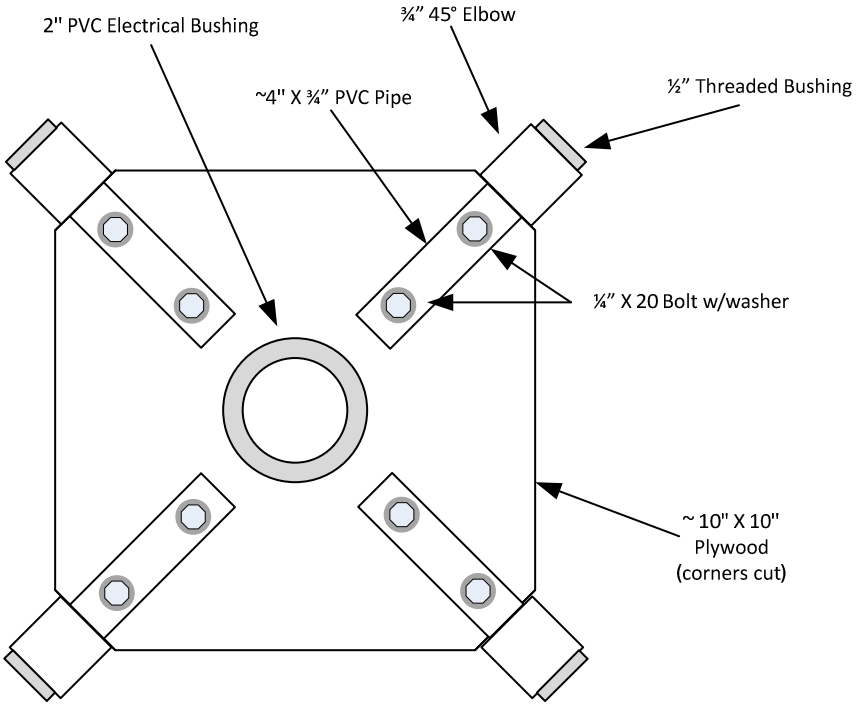
http://www.youtube.com/watch?v=yrgU5IMXlQY&feature=related Video comparing a PAR end fed dipole antenna to other antennas



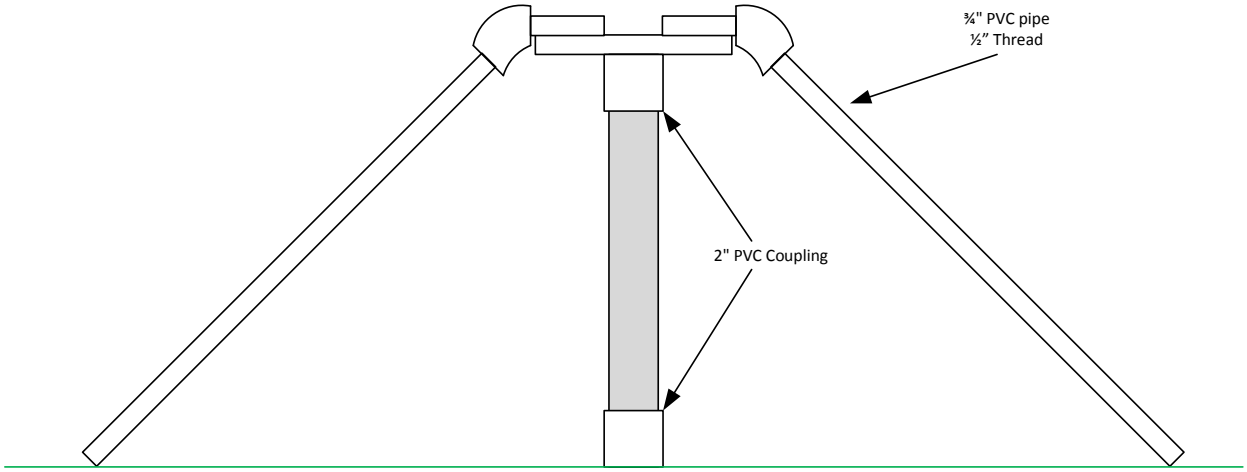
Most on-board Automatic Antenna Tuners, will tune a 3:1 SWR or less (Red Line).

This is Charles **W5WF** letting the MFJ 1910 down. Each section twists to unlock it and it just slides down into the outside tube. It takes about 2 - 3 minutes to raise the antenna up to 33'.

Quad-Pod for MFJ 1910
33' Fiberglass mast



Quad-Pod Plate

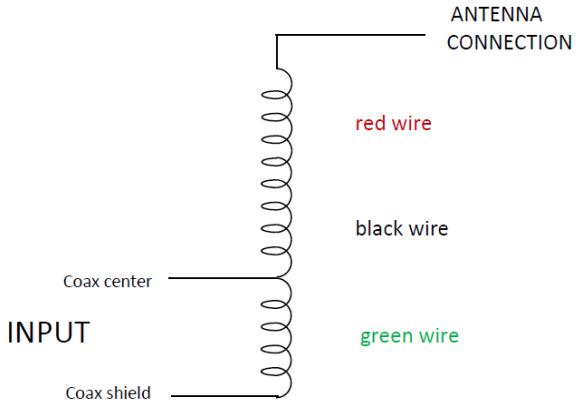


Quod-Pod
Antenna Stand

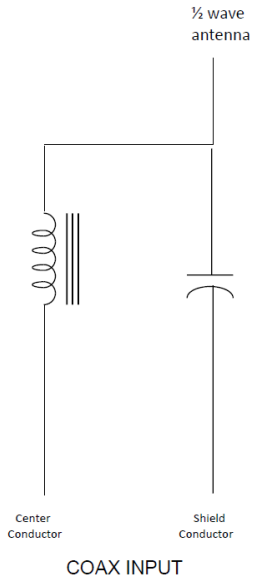
Back Ground information:

These End Fed Antennas come in two types. The first type is a Long Wire and uses a transformer matching network (usually 1:9), and the other type is End Fed Dipoles and they use a LC matching network.

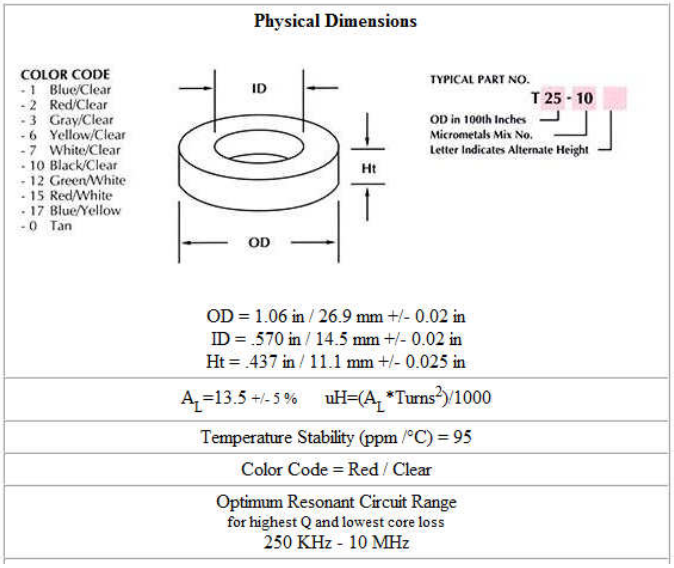
The End Fed Antenna (long wire) is a multi-band antenna and can be tuned to different bands using an antenna tuner (it is not resonant on any amateur band). The End Fed Dipole is resonant on that band and usually will not require an antenna tuner (on that band).



End Fed Antenna



End Fed Dipole



Physical Dimensions

COLOR CODE
- 1 Blue/Clear
- 2 Red/Clear
- 3 Gray/Clear
- 6 Yellow/Clear
- 7 White/Clear
- 10 Black/Clear
- 12 Green/White
- 15 Red/White
- 17 Blue/Yellow
- 0 Tan

ID, Ht, OD

TYPICAL PART NO. T 25 - 10
OD in 100th Inches
Micrometals Mix No.
Letter Indicates Alternate Height

OD = 1.06 in / 26.9 mm +/- 0.02 in
ID = .570 in / 14.5 mm +/- 0.02 in
Ht = .437 in / 11.1 mm +/- 0.025 in

A_L=13.5 +/- 5 % uH=(A_L *Turns^2)/1000

Temperature Stability (ppm /°C) = 95

Color Code = Red / Clear

Optimum Resonant Circuit Range
for highest Q and lowest core loss
250 KHz - 10 MHz

T106-2 Toroid Data

Data sheet from: http://kitsandparts.com/