

Home Made HF Antenna Balun

A simple but high performance 1:1 HF antenna balun can be constructed by using ferrite cores and coax. The balun converts the 50 ohm un-balanced coax impedance to the antenna balanced impedance by presenting a high impedance to common mode current in the coax shield, but passing the differential current of the center conductor and shield without loss. This type of balun is sometimes called a "current balun", as opposed to a transformer type balun sometimes called a "voltage balun".

Two suitable ferrite cores were selected, a 1/4 inch hole (Kemet ESD-R-14S) and 1/2 inch hole (Kemet ESD-R-26S). Both cores have similar single turn impedances of about 70 ohms at 80 m, and >100 ohms at 40m through 2 m. Since it is desirable to maintain balun impedance > 500 ohms, construction is accomplished by using either multiples cores strung on the coax, or winding the coax through the core three times. The 500 ohm goal is based on achieving a 10:1 impedance ratio between the coax impedance and the balun blocking impedance, which will reduce the coax shield current induced by the balanced antenna to 1/10 - which is only 1% of the power that would otherwise occur without the balun.

Using three turns through a core provides a minimum impedance of 800 ohms at 80m and above, and is still usable with 400 ohms impedance at 160m (small core, ~330 ohms for large core). When stringing multiple cores, the low frequency performance is determined by the number of cores (Impedance = single core single turn impedance times the number of cores in series).

<u>Lowest band</u>	<u>Number of Cores</u> (to achieve 500 ohms minimum)
20m	3
40m	5
80m	7
160m	12

Can fewer cores be used at lower frequencies ? The above design goal was to achieve 99% effectiveness at blocking coax shield current. If a slight reduction in performance can be tolerated, the five core design still provides good performance at 80m and usable performance at 160m.

Impedance of 5 core balun and reduction of coax shield current compared to not using a balun:

10m-2m	1000 ohms	99.7%
20m	700 ohms	99.5%
40m	500 ohms	99%
80m	350 ohms	98%
160m	200 ohms	93.7%

The core configurations also determine maximum power which is limited by coax size and core heating. Estimated power is based on CW with 50% key down duty cycle, and SSB with 50% TX.

Low power balun (50w CW / 250w SSB) three turns of RG-174 size coax through the small core.

Medium power balun (200w CW / 1kW SSB) string multiple small cores over RG-58 size coax.

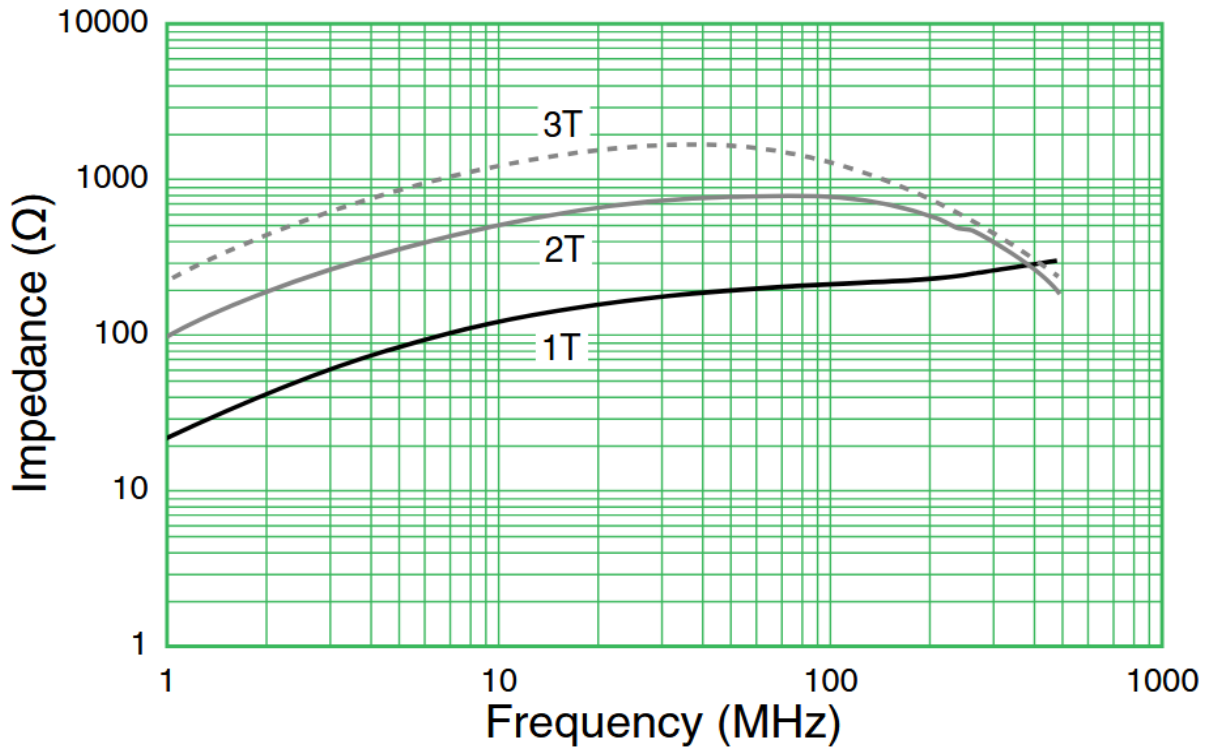
Medium power balun (200w CW / 1kW SSB) three turns of RG-58 size coax through the large core.

High power balun (2000w CW / 10kW SSB) string multiple large cores over RG-8 size coax.

Mechanical Packaging

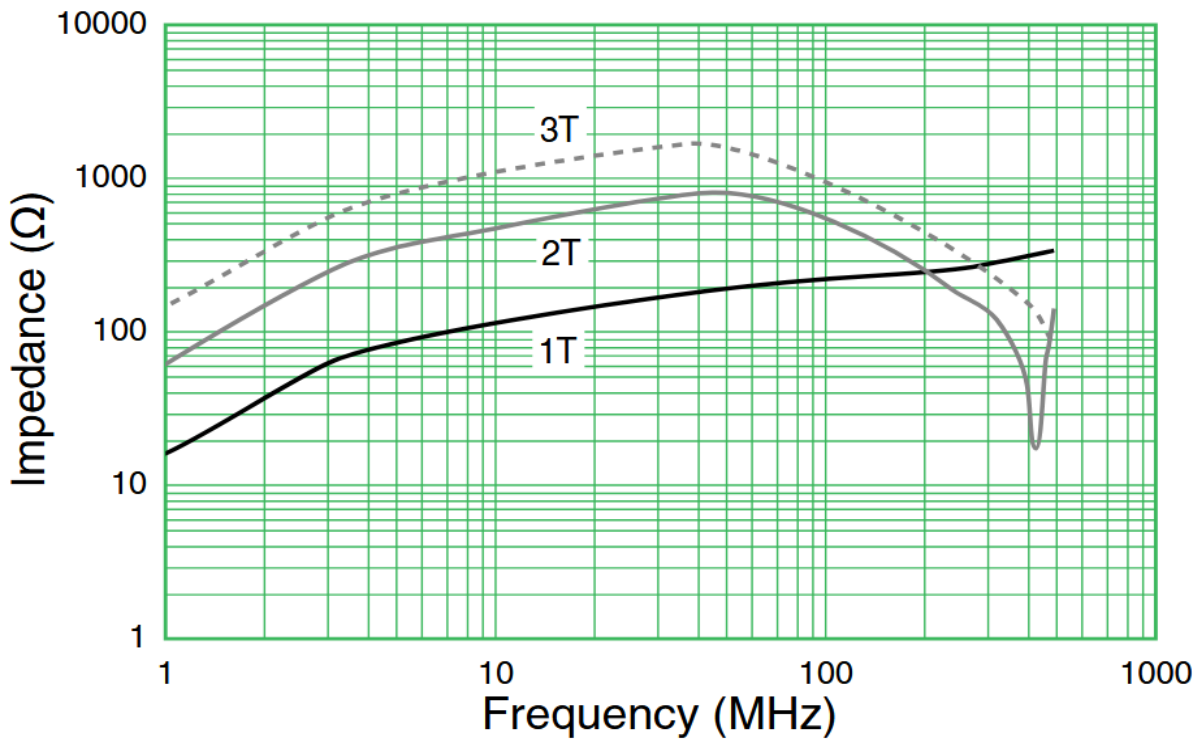
The multiple core configuration can be housed in a piece of PVC pipe with the coax connected to a connector at the bottom end and the to the two dipole wires at the top end. The beads can also be strung on a feed coax and connected directly to the dipole and secured using heat shrink tubing or tape.

ESD-R-14S



1/4 inch ID Core Impedance for different number of turns

ESD-R-26S



1/2 inch ID Core Impedance for different number of turns