TRAP LOSSES

A trap is either a resonant circuit when on design frequency, or a series load when off frequency. The resonant condition is used to provide an insulator to isolate part of an antenna to a certain frequency The series condition acts as a load to reduce the overall length of the antenna.

My thanks to EZNEC by Roy Lewallen W7EL for his antenna modelling program to indicate the losses caused by traps. Taking the simple system of a trap dipole designed for 40 and 80 meters. The centre section of the antenna will be isolated by the traps, which are resonant circuits on 7 MHz. Various L/C ratios can be used for the traps, and a suitable choice will cause the antenna to have resonances in other bands. On resonance the traps are used as insulators and the L/C ratio will govern their impedance. Impedance values will vary from some 600,000 ohms for a high L, low C trap to 26000 ohms for a low L high C trap.

The end impedance of a half wave antenna is in the region of 2/3000 ohms, (I did actually measure it once) and even a high C trap at 26000 ohms is still a good insulator. From a rather simplistic point of view, where does the power go that gets past the trap? It is still current in a wire and will add to the radiation of the antenna with slight modification to the radiation pattern. What about the losses in the material from which the trap is made? Now we are dealing with relatively low frequencies and very good materials exist as conductors and insulators at these frequencies.

It is possible to make a trap quite cheaply where the conductor is Silver, and the insulation is PTFE. Both these materials are virtually lossless at the frequencies used. Remember skin effect where at HF, current flows in the outer few microns of a wire. Silver plated wire is cheap and provides the requirement for high conductivity.

Thanks to W8NX who thought of traps made from coaxial cable we can wind a trap with RG316 cable which uses silver plated wire and PTFE insulation.

The EZNEC antenna modelling program is very useful for calculating the losses in traps both when on resonance and when used as a load. It is possible to vary the L/C ratio of the modelled traps in order to make the antenna resonate in the required bands and at the same time see what losses the different L/C ratios produce.

Coaxial traps can be connected in different ways to produce useful resonances on an antenna. Taking the example of the 40/80 trap dipole, using coaxial cable traps, the 40 meter traps connected in “series” configuration have an impedance on resonance of 608,500 ohms and overall losses for both traps of .028dB. Unfortunately this trap connection only produces an additional antenna resonance at 17.5 MHz – not much use. Connecting the traps in “Parallel” mode gives an impedance of 26180 ohms and total load loss of .57 dB. BUT this antenna will have supplementary resonances tuneable to most ham bands and is very useful. That .57dB if it actually exists, is less than the thickness of the needle of the S meter. EZNEC also shows the losses of the traps when used as a load, in this case on 80 meters, where the total system load loss is .1dB with both types of connection.

Now are traps lossy ? I don’t think so. Loss has to go somewhere, and I have not been able to even warm up these traps with 400W continuous power. The common method of feeding a multiband antenna with resonant feeders is much more likely to produce losses, and one does have the advantage with a trap dipole, that if a good balun is used the feeder that enters the shack is not radiating or picking up local noise.