THE "MEF" ANTENNA

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Miniature Electromagnetic coupled Fox hunting Antenna

Have you been on a fox hunt? If not you have missed one of the most enjoyable experiences in amateur radio. The thrill of the chase, friendly competition and skill are only part of the story.

Some of the most amusing incidents and experiences told by amateurs have occurred on a fox hunt. With fox hunting you have the opportunity to build or modify equipment, use it, and modify it again. Interpreting your own findings and experience into your equipment gives you personal satisfaction. Fox hunting has been enjoyed by amateurs for over 40 years, starting on the lower frequencies and now mainly undertaken on two metres.

Maybe you have built one of the many two metre direction finding antennas and used it on a hunt, you have more than likely run into trouble on the last exciting stages when you are closing in on the fox. You are passing through bushes and trees in hot pursuit, only to have your beautiful antenna bent and battered by the branches in the heat of the chase. Have you suffered from proximity while swinging your antenna in a building when the fox is hiding deep in a underground parking lot? While driving have you tried to point to that moving two metre jammer while in traffic? Like all difficult problems mine was solved after many hours with this very simple "Mef" antenna.
If you want a challenge try reducing the size of a two metre antenna while keeping the same gain and lobe pattern.

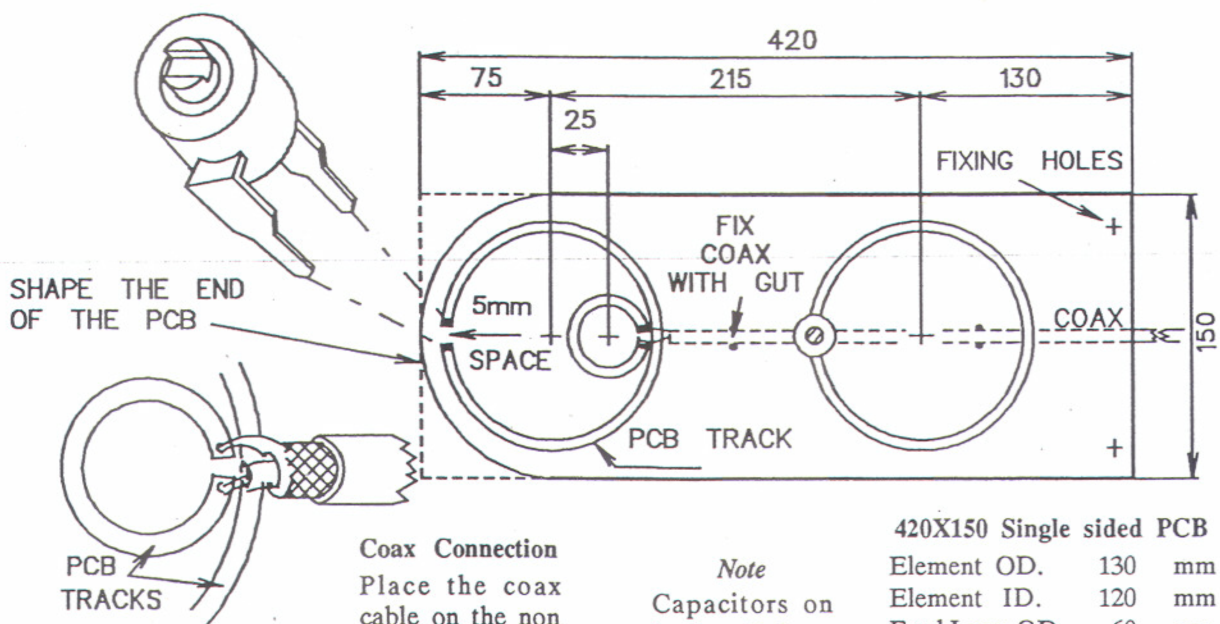
The "Mef" antenna specification calls for small physical size, a distortion free symmetrical gain pattern, immunity to hand capacitance, and a very good match to the receiver.

The match is required in order to achieve high isolation at the receiver, to make sure only the antenna signal is seen. Obversely the efficiency of the element devised will have to fall if we make it smaller. This is not a problem as the specification for the antenna calls for working in high RF field strengths, and is not intended for use far out from the fox. Loading the antenna elements with inductance makes strange field patterns about the elements. This leads to out of phase currents in adjacent elements, giving rise to a reactive match. Capacitive loading of a straight element seemed to be the answer but this led to a low Q and again strange fields. After investigating ferrite and other field condensing methods the best compromise was found to be a symmetrical circular inductor brought to resonance with a capacitor.

The theory behind the "Mef" is to produce a resonant circuit with enough aperture to act as an antenna. The elements are electromagnetically coupled to form the phase relationships needed to give a sharp beam.

In order to couple the driven element to the receiver an isolated loop was used. The loop was evolved in an attempt to balance the resonant circuits against the feeder cable and to provide a means of reducing hand capacitance.

A problem can be the quality of the capacitor and its availability. Small amounts of inductance in the capacitor affect the field pattern at the ends of the inductor. The field is to be kept as uniform as possible, and you must obtain a capacitor with small metal parts.



Coax Connection
Place the coax cable on the non copper side of the board

Note
Capacitors on both Driven and Non-Driven Elements 1-10pF each

420X150 Single sided PCB

Element OD.	130	mm
Element ID.	120	mm
Feed Loop OD.	60	mm
Feed Loop ID.	50	mm

Fig.1.

The capacitor required is a variable dielectric type with a value of minimum 1 pf and a maximum of 10 pf. The air spaced capacitors have too great an inductance, and bee hive capacitors are not recommended. You can find these small capacitors in the short wave circuits of many scrap domestic receivers. Capacitors type VC210 can be purchased together with the PCBfrom Vidiquip 764-1439.

Construction

The antenna was designed to complement and mechanically attach to the "Def" receiver forming a gun shaped assembly. The "Def" receiver is a fox hunt sniffer receiver with high immunity to RF break through.

Build the antenna very sturdily as small mechanical changes will affect the stability.

The "Mef" antenna is best constructed on printed circuit board but most fox hunters will make it from what they can best find and will substitute the tracking with copper wire. Use a wire diameter not less than 2.5 mm. for predictable results.

Fig. 1 shows the sizes which are critical for best results. The dimension between the loops is very important and should be checked carefully.

The printed circuit board is a single sided glass laminate. The two capacitors and the coaxial cable are the only components to be fitted. Preheat and tin the board before mounting the capacitor.Use the minimum amount of heat and time when soldering in the capacitor. Too much heat will lower the Q of the capacitor and render it useless.

Make sure that the outer braid of the coax does not touch the element when you have completed the connection to the coupling loop.

Alignment.

First complete the assembly including the coax cable and fitting. Test and align the antenna at least one metre away from any metal structure. You will need a Dip Oscillator to adjust and test each circuit.

With the Dip Oscillator, first tune the driven element by turning the capacitor with an insulated trimming tool to your fox frequency. Place the dip oscillator coil close to the element on the opposite side of the loop to the capacitor. A very deep dip should be found with the oscillator 40mm or so away from the element. If you get no dip, or a very shallow dip, this is an indication that your capacitor is of an inferior type or you have damaged it when attaching it to the inductor. Tune the non-driven element to 1.5 MHz. below your fox frequency.

Before plugging the antenna into your receiver, switch on, and without an antenna make sure that you cannot receive the transmitter that you will be testing with.

Connect the "Mef" to the receiver supporting it at the fixing end. Point the "Mef" exactly at the transmitter. Now move the driven element capacitor very slightly in order to peak the S meter of the receiver. Repeat this procedure with the non-driven element. Go back and forth between each element until maximum signal strength is obtained.

If you are using a long coax on the antenna move the coax and the signal should not change. If it does change you have something wrong.

When you have completed and tested the antenna it must be protected from water, humidity changes and being knocked. Covering the board with Solarfilm as used to cover model aircraft will make a nice job.

In the field

The antenna will detect the polarisation of the fox very accurately. You will be able to tell at what angle the fox antenna is lying as soon as you receive the signal, good information if you don't know what your fox looks like. First turn the antenna to find the axis of the fox polarisation. Then turn with the antenna to find the direction of the signal. Recheck the polarisation as you are turning to find the direction. If you do not have the antenna optimised for maximum polarisation you will get a slight error when sighting the direction. Do not forget to lift the antenna up and down, you never know, he could be in a tree.

When you don't use the "Def" receiver make sure your receiver is not listening through its case, check by removing the antenna. If it does break through do not expect it to give you a correct heading. There is no known commercial receiver that will go close to a fox and not receive a signal when the antenna is removed. Next month you should build the "Def" receiver.

Many thanks to the Johannesburg Branch of the SARL for their monthly fox hunts, which have given us all the opportunity to seek and find not only the fox but interesting solutions as well.

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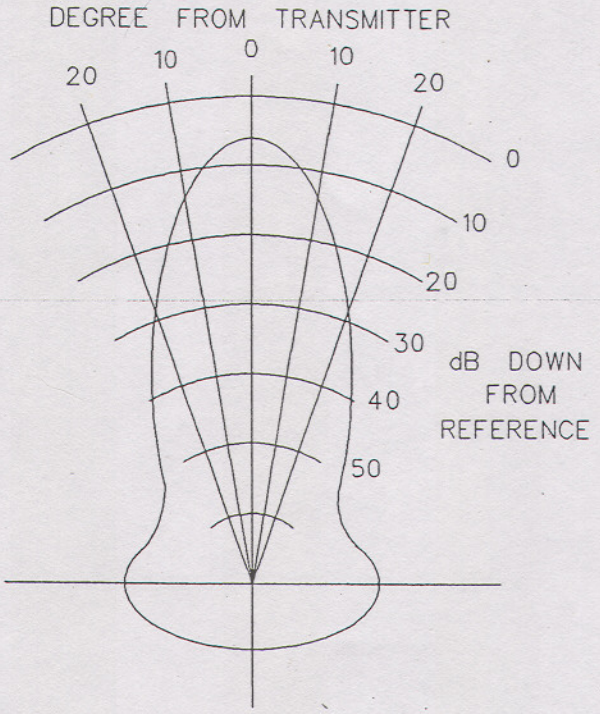

The antenna was tested using a 200 mW transmitter and a 60 dB attenuator in series with the "Def" receiver. The level of the S meter was adjusted back to the same value for each 5 degree of rotation.

Fig. 2