ENIGMA 2000 'COVERT' LOOP ANTENNA

Design Notes

The idea for this antenna was prompted by the need for an easily erected antenna that would give reasonable results without being obtrusive and be useable in areas where it is not possible to mount a full length antenna.

The resultant antenna can be mounted on a suitable window, or, like the prototype, on the back of a door allowing movement of the antenna for the best signal.

The design frequency of 4.2 to 18 MHz is easily obtained in two ranges, 4.2 to 6.25 MHz [with an additional 220pF capacitor switched across the variable capacitor] and 6.0 to 18 MHz.

The 470nF capacitor in the smaller coupling loop removes the possibility of placing a physical short across the antenna input of the receiver to which it is connected. Receivers, such as the Yupiteru MVT-7100 do not react well to such a short and cease to give a satisfactory performance after such treatment.

There will be some variation in the coverage of individual loops due to component tolerances.

The prototype loop values were calculated against a standard capacitor at frequencies generated by a gate-dip oscillator and measured by a calibrated Marconi 2431A Frequency Meter. The standard capacitor value being checked by a calibrated AVO B183 LCR meter.

The loop value was calculated, finally, as 2.69uH, allowing easy calculation of the working frequencies should other variable capacitors, other than that recommended, be used.

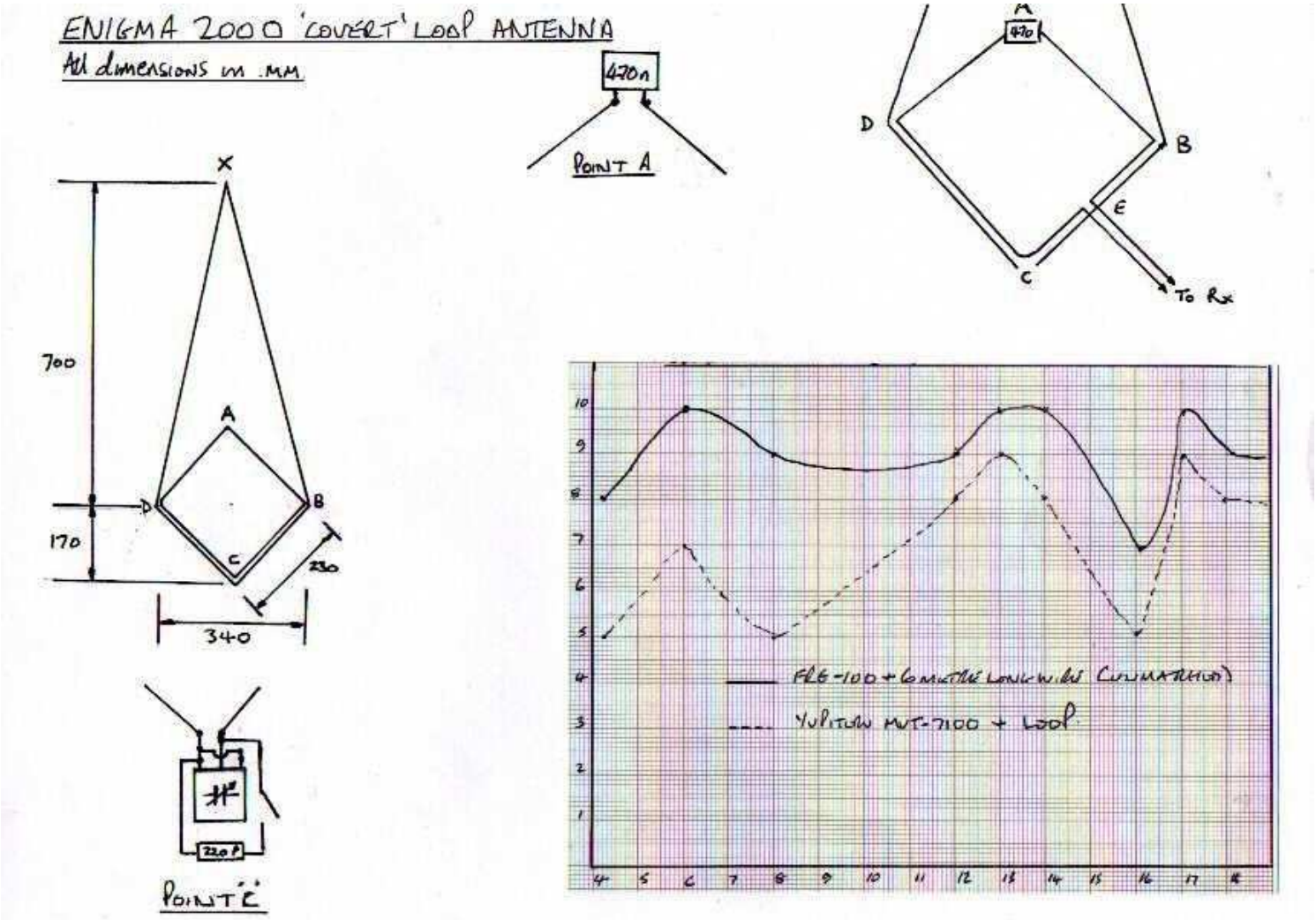
In practice it was found that the actual upper and lower working frequencies of each range were in slight variation to those calculated.

Components

1pc	Ribbon Cable 2Metres long	
1	220pF capacitor	poly or ceramic
1	470nF capacitor	poly or mica
1	Dual gang Variable Capacitor 141.6/59.2pF, Maplin FT78K or similar.	
3	2.5M screws to fit FT78K if mounted [must be cut to size].	
1	Knob to fit above	
1	Switch, small, Maplin FF77J or equivalent.	
1pc	Blu-tack	
1	Plastic Box, [Maplin KC91Y suitable] to mount variable capacitor and switch and a 4 way connector for loop connection, should 'professional' look be desired.	

Construction

First consult the line drawings.



Take a 2metre length of ribbon cable and remove all but four conductors. This length is folded in half producing a 1metre length, the apex is point ‘X’.

Using Blu-tack fasten the 1metre length to a flat surface. From the apex, ‘X’, measure down 540mm.
Lift a single conductor, at point ‘X’, and pull down the previously measured 540mm. At this point cut away the unwanted 540mm length, leaving 460mm on either limb of the length.

From the newly cut ends strip each side back a further 230mm. Clean sufficient sheath away from each end to permit soldering to the 470nF capacitor. [That is point ‘A’].

The conductor next to the 230mm sq coupling loop will form the main loop, which will be terminated to the variable capacitor.

The variable capacitor has two gangs, each with a tag and the central common tag. Join the two gangs together by soldering a short length of wire between the two relevant tags.

In addition, a 220pF capacitor is soldered between one of the gang tags and the central common tag, via a switch. It is this switch that will permit the changing of frequency range.

Carefully strip back sufficient sheath from the free ends of the main loop and solder one side to the gang connection tag, the other to the central common tag. That makes point ‘C’.

Two conductors remain unused and will form a connection to the wireless. Strip the two conductors from one side of the main loop, ensuring that the two conductors remain together, to the other leaving 1900mm free as a lead out. From the remaining 100mm attached, pull back 30mm and strip enough sheath back to permit connection to the ends of the coupling loop. [Point ‘E’].
A plug suitable for connection to the radio intended for use can be fitted to the free end of the 1900mm cable from the coupling loop.

The antenna is now ready to be mounted, a vertical length of 870mm and maximum width of 340mm is required, the prototype being mounted on a wooden door, although a suitably sized window would suffice. Remember to avoid large areas of metal.

First fasten the apex, point ‘X’ of the large loop and then point ‘C’ [Blu-tack already in place on the back of the variable capacitor] 870mm lower than point ‘X’.

Measure up 240mm up from point ‘C’ and fasten the 470nF capacitor, connected to the inner coupling loop, by the same means. That is point ‘A’.

Take hold of the two points ‘B’ and ‘D’ and pull them horizontally apart, approx. 340mm, and fix with Blu-tack, completing the mounting.

Obviously a small plastic box can be used to mount the range switch and variable capacitor in if a more professional approach is required. Small suction cups could be used to support the box and loop if mounted on a glass surface.

Use

Assuming that construction is correct the receiver is set to a frequency where a reasonable signal is known to exist [BC stations are good for this]. Setting the antenna to the correct frequency range upon the slow rotation of the variable capacitor an increase in signal strength will be apparent as the loop reaches resonance for that frequency.

Performance

The prototype loop was used in conjunction with a Yupiteru MVT-7100 receiver and compared with the existing 6M long wire [unmatched] fed into a Yaesu FRG-100. Comparison curves were produced and given the small size of the loop antenna it can be seen that the performance is only 3 ‘S’ points down [at LF] from that produced by the long wire antenna, whilst at mid-range to HF the difference varies between 1 or 2 ‘S’ points.
The FRG-100 ‘S’ meter and MVT-7100 bargraph were in no way calibrated for measurement purposes, the signal sources being derived from actual steady transmissions detected using the FRG-100.
Apart from transmissions used for comparison purposes, it was discovered on subsequent signals detected by the FRG-100, where signal strength was low, the

bargraph on the MVT-7100 did not indicate any signal strength. However the resultant audio remained intelligible.

ENIGMA 2000 would be pleased to receive comments on the design and performance of this short project, written with the needs of those who cannot erect an ‘obvious’ antenna in mind.