IDEAS FROM ABROAD

# Eurotek

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**A magnetic loop for 80m mobile** was described by **Loek d'Hont, PA2JBC**, in the Angry-Nine magazine Q-Five (NL) of 12/92.

THE ANTENNA IS to be transported on the roof rack of the car and eventually used mobile. Its diameter must be limited to 2m and it must be in two pieces capable of being easily re-joined. Best performance and available materials led to the octagon of **Fig 1.**

Using 22mm copper tubing, the electrical characteristics in the table were calculated. They closely correlate with measurements of the finished product. Conclusion: the soft-soldered (rather than brazed or silver soldered) 45° elbows and the compression couplers do not spoil the Q. Flowing solder all around each joint requires a lot of heat so do not use a soldering iron; use a blow torch and do not be afraid of getting the joints good and hot. Compression joints do not take kindly to frequent undoing and tightening; soldering the 'olive' to the tubing helps.

As RF currents only flow in the surface layer of a conductor - the skin effect - the surface of the tubing should remain unmarked. According to PA0SU, the drawn surface conducts better than one restored by polishing.

Tubing of 28mm would raise the Q and efficiency but it would also reduce the bandwidth; fine for CW, but too narrow for 80m SSB! As it is, the loop must be re-tuned for every QSY.

## THE TUNING CAPACITOR

THE TUNING CAPACITOR is assumed to be practically loss-free, true only if all precautions are taken. To cover 3.5 - 3.8MHz, the required capacity variation is small: 300pF to 360pF. It was made up of a fixed capacitor of 260pF and a 100pF maximum variable in parallel. Making only a small part of the capacitor variable has advantages: variables are more expensive and bigger per pF, only a fraction of loop current passes through the variable and band-spread eases tuning.

Even a 100pF variable at 100W must handle up to 9kV peak and 13A RMS. A wiper connection to the rotor would be suspect at 13A so a 2 x 200pF split-stator capacitor was used. Even then, the current path between all rotor plates must be low resistance, preferably soldered or brazed; the same goes for the stator plates and their connections to the loop tubing. At 9kV, conservative design requires 9mm between plates, or 4.5mm in a split-stator (each half takes 50% of the voltage). Indoors and using only 85W PEP,I got away with 2 x 2mm! An insulated shaft coupling is used and tuning can be motor-driven or by hand.

The fixed capacitor was home-made from 51 x 0.3mm copper strips interleaved with slabs of dielectric. **Fig 2**. Polyethylene works well as a dielectric and is inexpensive; if it gets hot, it is not polyethylene! The capacity can be set by adjusting the meshing of the two sets of copper 'plates', but the dielectric must extend beyond the copper by at least 6mm. After adjustment, the capacitor was wrapped with glass-fibre-reinforced tape. Four parallel 3mm copper wires connect the fixed capacitor to the loop tubing. The 3mm-thick polyethylene is barely adequate for 100W. At 180W, it eventually broke down.

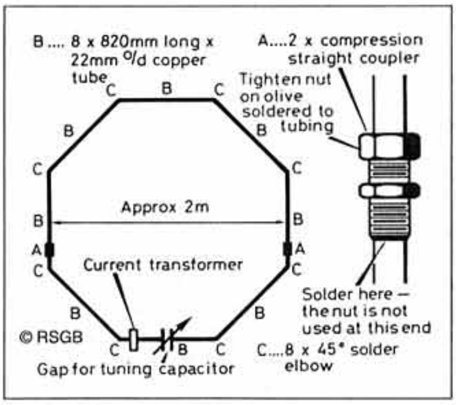


**Fig 1: The 80m magnetic loop antenna which can be taken apart at A for transport on a roof rack.**

| | |
|---|---|
| L: | 5.8uH |
| Loaded Q: | 1273 |
| Resistance: | 7.4mΩ |
| Loss resistance: | 46mΩ |
| Efficiency: | 14% |
| Bandwidth -3dB: | 2.94kHz |
| C at resonance: | 314pF |
| Capacitor voltage: | 8.3kV peak |
| Loop current: | 43.3A RMS |

**Table: Calculated data at 100W and 3.74MHz**

## LOOP-TO-FEEDER COUPLING

I COULD NOT GET a gamma-match to work; a coupling loop also proved unsatisfactory as its shape had to be adjusted when changing frequency. The solution was a current transformer. This transformer must match the 53mΩ loop to a 50Ω coax, an impedance ratio of 940:1 - a turns ratio of $\sqrt{940} \approx 30:1$, in which the '1' is the loop tubing stuck through the hole of the toroid. The coupling of the transformer is not 100%, so with the loop at resonance the feeder sees inductance. By increasing the transformer winding to 36 turns and adding a series capacitor a 1:1 SWR can be obtained anywhere in the band. This capacitor is a receiver-type air-dielectric 250pF variable. A 1:1 balun keeps the outside of the coax 'cold' (**Fig 3**).

Construction of the current transformer is not trivial; 6 x 6 turns of 1mm PTFE-insulated copper wire gave the best results. Ferrite (Philips 4C6, violet) and iron powder (Amidon, red) both work (**Fig 4**). The transformer can be placed anywhere on the tubing, eg next to the capacitors where they and the coupler can be in a weatherproof box.

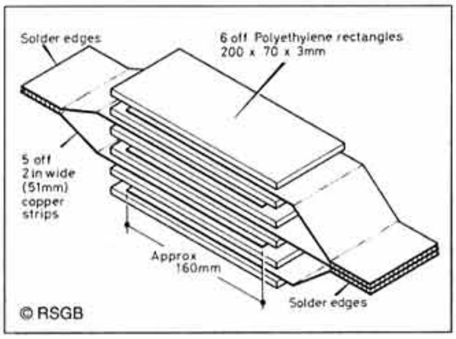


**Fig 2: This fixed 260pF home-made capacitor is good for 8kV @ 40A.**

## OPERATION

THE ANTENNA IS in my loft 3m agl and above all wiring. Being close to wooden rafters and clay roofing tiles does not noticeably affect the Q of the loop, even when the roof is wet. The loop is supported on good insulators; wood will not do! For outdoor use, the loop should be de-greased and painted. **WARNING: Loops can give nasty RF burns even on low power!**

With 100W PEP, of which only 14W is being radiated from indoors, the results are astounding. Best SSB DX was the Ukraine with 5-9 both ways. The high-Q also helps to beat all but adjacent-channel QRM and reception is much quieter also in man-made and atmospheric noise.

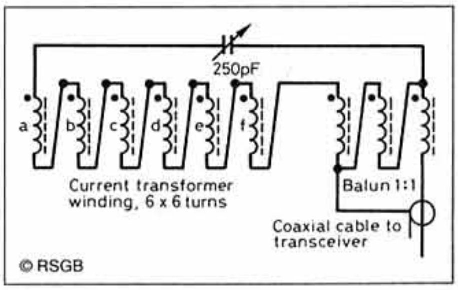


**Fig 3: A current transformer couples loop to feeder. The balun keeps RF off the outside of the coax.**

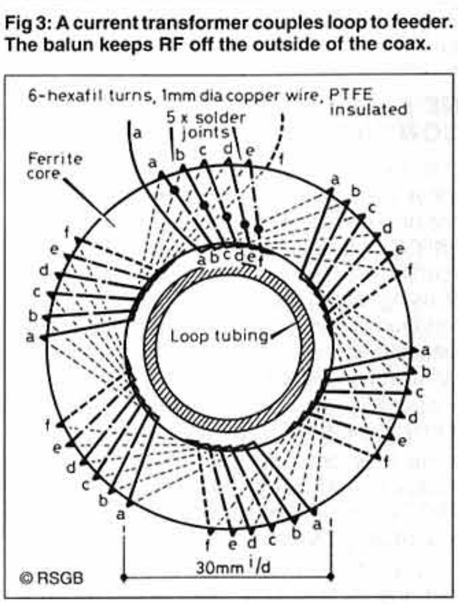


**Fig 4: The construction of the current transformer.**