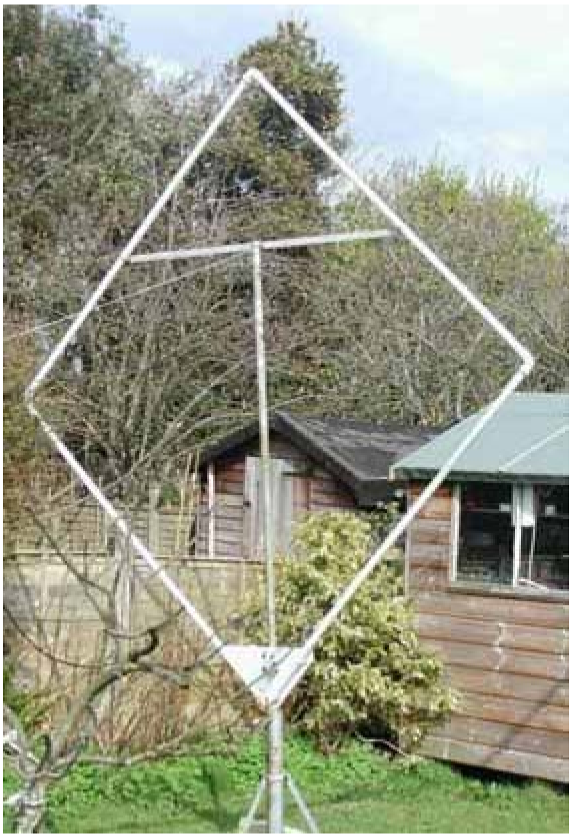
Superloop receiving antenna for 136kHz

By Peter Dodd, G3LDO, e-mail g3ldo@ukonline.co.uk, Web <http://web.ukonline.co.uk/g3ldo>

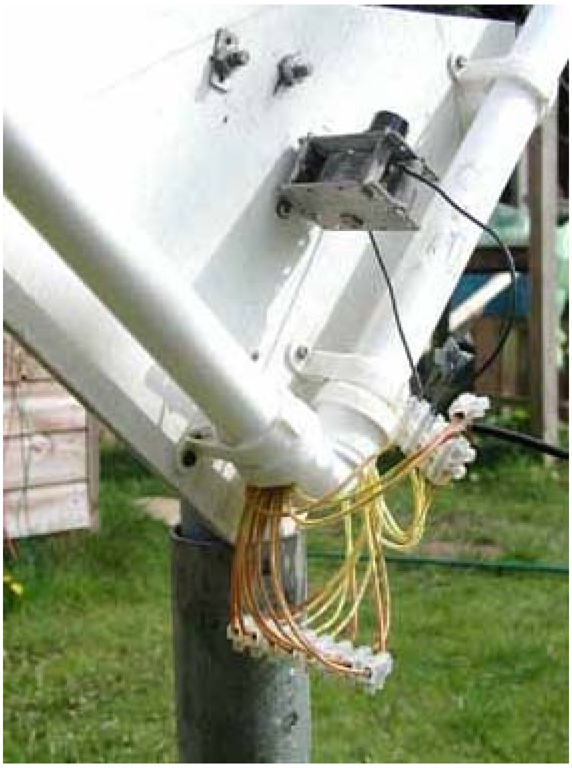
About a year ago I made a receiving loop for 136kHz using computer ribbon cable housed in plastic waste pipe. It wasn't very successful. It would appear that the low Q caused by the construction of the ribbon cable was the problem. I have since made the G3LNP loop although I had difficulties with the amplifier. I finished up using a low impedance pick-up loop without the amplifier - this worked reasonably well but it did lack sensitivity.

I decided to redesign the plastic waste pipe special because if its inherent weather resistant structure This time I made it twice the size and used Litz wire from the Crawley club source. This antenna turned out to be very good and outperformed all other loops built previously. Furthermore, this design does not need an amplifier. A description of its construction follows.



The loop housing comprises 34mm plastic waste pipe forming a square loop, 2m per side as shown on the right. The corners are joined using 90 degree elbow joins. The structure is held in place with an aluminium T section comprising a 45mm pole and an angle top piece.

The loop itself comprises 10 turns of 2.5mm Litz wire and a single turn pick-up loop. The loop is assembled by cutting 11 x 8.3m lengths of wire and feeding them through a single 2m length of waste pipe. One 90 degree elbow is fixed to the end of the first 2m length of pipe after first feeding the wires through. The wire bundle is then fed through the second section of pipe and a second joint added. The third section of pipe and joint are then added. Construction should be done with the plastic pipes laying on the ground - at this stage the whole structure is very floppy.



The wires are then fed through the fourth length. This is where it gets a bit tricky. The final 90 degree elbow should have two slots cut in it on the outside part of the elbow so that the wires can be fed through and still be clear of the pipes when they are fixed in. When the wires are fixed in place the first and the fourth lengths of pipe can be pushed into the elbow joint.

The fourth elbow forms the bottom part of the loop (shown right) is strengthened by fixing it to a piece of weather-proofed plywood using standard waste-pipe wall-mounting brackets. This plywood base also provides a method of fixing the loop to the support mast.

The loop is fixed to the support mast and the top T section using appropriate sized U bolts.

Peter, G3LDO

Each of the wires has now to stripped of insulation and tinned. They also have to be identified using a multimeter so that they can be connected together to form a continuous 10 turn loop. The 11th turn, the pick up loop, is connected to the receiver coax feed. I used connector blocks in the prototype because of the rather experimental nature of the project. They are sprayed with spray grease to prevent corrosion. You could solder the wires together with a shrink wrap cover.

The main loop is resonated with a mixture of 6 x 150pF fixed capacitors and a 500pF variable (meshed about two-thirds) giving a resonating capacity of around 1200pF. The whole of the bottom of the loop is wrapped in plastic sheet, held in place with clothes pegs, to keep out the rain

If you can't find Litx wire you could use PVC insulated wire. The Litz wire used here has a wire diameter of approximately 1.5mm; the diameter including the insulation is 2.5mm. If you use electrical wire check that it has an insulating thickness of at least 0.5mm because, with this construction the insulator material determines the wire spacing. The wire should also be fairly soft and flexible to ease construction.

Additional from Peter to the article: I find that Litz wire for the loop was not as good as I thought at first. The performance of Litz wire can be badly affected by damp and humidity. Moisture can be trapped in the plastic tubing and I have found that electrical wire with as thick as insulation as possible is best. You could reduce the number of turns and increase the capacitance if necessary.

Peter also is the author from several excellent books. I want to present the books below. Sure, every one will enjoy these books! I.G.

The Low Frequency Experimenter's Handbook: In the summer of 1996 the frequency band 71.6 to 74.4kHz came available to UK amateurs as an experimental band for a limited period. It was available by special permit (Notice of Variation) until June 1999. (since then the 73kHz NoV has been extended until June 2003). On January 30th 1998 a new low frequency band of 135.7 to 137.8kHz was allocated to radio amateurs in the UK followed by an increasing number of countries throughout Europe and Canada.
To meet the increasing demand for information on LF the LF Experimenters Handbook was produced and is a collection of articles written by individuals (in a similar style the the popular *ARRL Antenna Compenduim* series. The book is divided into several sections, each covering a specific topic; i.e. receivers, transmitters, antennas, specialist modes and measurement. Of the constructional articles shown in this book very few have previously been published.

The Antenna Experimenter's Guide (second edition) is mainly concerned with measurement (impedance, resonance and field strength, including beam pattern measurement) although there are chapters on antenna and mast construction. In addition there are chapters on experimental antennas and antenna modelling and antenna modelling software. The book also includes some computer listings of programs for measuring antenna impedance and antenna polar diagrams.

Backyard Antennas: This is a practical book on antenna construction and how to overcome the limitations of suburban locations. It contains 10 chapters on Centre-fed antennas, End-fed and Marconi antennas for HF and LF, Matching and tuning, Loops and slot antennas for HF, Small rotary beams for HF, VHF and UHF antennas, Antenna materials, construction and supports, transmissions lines and Baluns and Estimating and measuring antenna performance. This book now is due for a reprint, which will include a printed update.

Amateur Radio Mobile Radio: The technology of both vehicles and radio has changed considerable since a book on mobile amateur radio was last published. This book addresses the problems of installing radio equipment in a modern vehicle and finding somewhere to fix the antenna. It also covers Maritime Mobile, bicycle mobile and pedestrian mobile. This book was published early November. See Mobile Addendum for technical updates.

These books are available from the RSGB, see the RSGB Website at: http://www.rsgb.org/ (book sales)

They are also available from the ARRL bookshop at http://www.arrl.org/ (RSGB Publications).

Measuring the earth resistance of an LF-antenna system

By Dick Rollema, PAØSE

There were some requests for info on the way I measured the earth resistance of my antenna system. In 1988 I made an impedance bridge with a noise source. (See the circuit diagram below.) Most bridges of this type have a transformer between the noise amplifier and the bridge circuit. But I found it impossible to make the bridge frequency independent up to 30MHz. By putting the transformer between the bridge circuit and the detector I managed to make the readings reliable up to 30MHz. When the bridge is used at LF only the matter of frequency compensation does not arise.

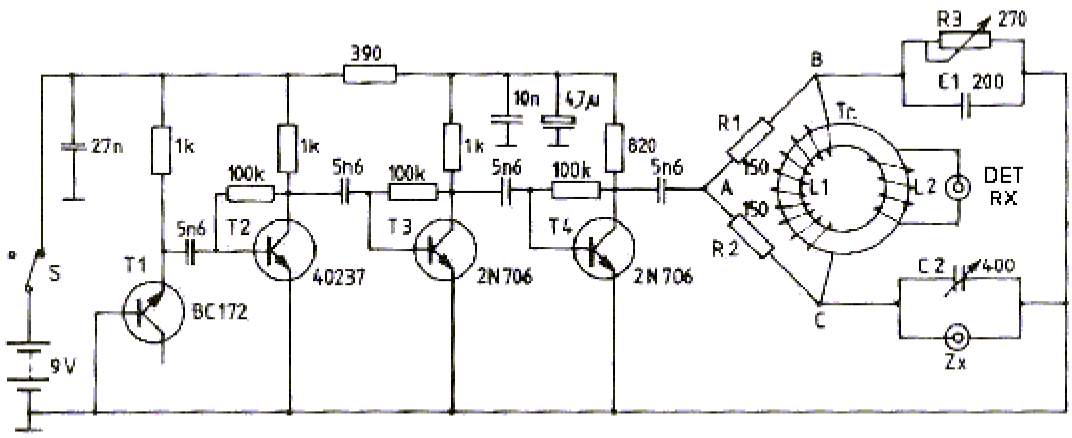
Noise bridge

For measuring earth resistance I connect the bridge between the bottom end of the loading coil and the earth connection, after disconnecting the transmitter from the coil. The X-control is left at the zero (centre) position. (C2 is then equal to C1). The detector is tuned to the frequency f0 where the earth resistance is to be measured and the vacuum capacitor in parallel with the loading coil (or the coil itself) and R3 of the bridge varied for minimum noise. The minimum is so frequency-dependent that it becomes deeper as the bandwidth of the receiver is reduced! The total resistance of the antenna system can then be read from the R-control R3. But for better accuracy I measure the value of R3 using a digital multimeter. From the value so found I subtract the loss resistance of the loading coil. What remains I call the earth resistance. Of course in that value are also included the radiation resistance and the resistance of the aerial and earth wire, But these quantities are negligible as compared to the earth resistance.

In the earth resistance will also be included losses in the antenna insulation and in the capacitance of the antenna to surrounding objects like trees (no trees in my case). But these losses are impossible to separate from the real earth resistance.

Measuring earth resistance at 50Hz has no meaning for the loss at LF because the earth resistance (impedance is more correct) is frequency dependent. At low frequencies the earth acts like a resistor, at high frequencies like a capacitor in parallel with a resistor.

I find the loss resistance of the loading coil as follows. I use my W & G signal generator and tracking selective voltmeter type PSM-5. The generator is connected to a one-turn loop that is positioned at some 35cm from the bottom end of the coil. An oscilloscope probe is connected to the level meter and hung near the top end of the coil. The antenna is replaced by a variable capacitor (broadcast receiver type). The PSM-5 is adjusted to f0 and the variable capacitor tuned for maximum voltage over the coil and its value noted. The PSM-5 is then tuned to the higher frequency f1 and lower frequency f2 where the voltage



over the coil has dropped to 0.707 (-3dB) of the maximum. The frequency difference f1 - f2 = B (I use a frequency counter to improve accuracy; B is rather small). This yields Q = f0/B . The value C of the variable capacitor is then measured. This yields the reactance of the capacitor X = 1/6.28 * f * C ohm. Because there was resonance this is also the reactance of the loading coil in parallel with its tuning capacitor. We now find for the loss resistance of the loading coil: R = X/Q.

My measurements support the findings by Alan Melia. The earth resistance is higher in winter than in summer and is maximum when the earth is soaked with water. When the water freezes the resistance goes down.

I hope this info is of some use.

The First Russian LF expedition

by Ed, RU6LA

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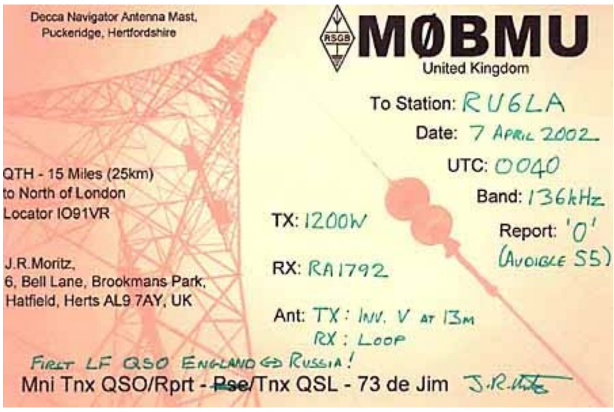
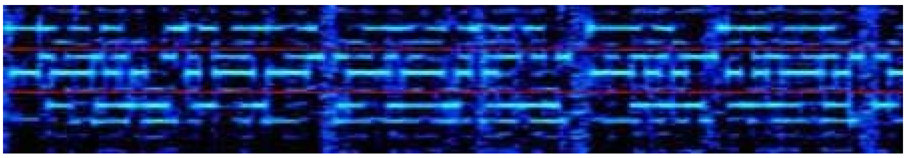
136 kHz by RU6LA

LF QSL



LF input filter

Pileup for RU6LA on 137,7 (received from DK8KW)



LF shack outside

LF shack inside