Antennas

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RADIO AMATEURS, unlike most commercial stations, normally use the same antenna for HF transmitting and receiving. While this is good practice on the upper frequency bands when using a beam antenna, it may not be the best solution on the lower bands. Vertical and loop antennas close to the house are liable to pick up electrical interference together with television line and switched-mode PSU noise. There are low-noise antennas for the LF bands, such as the Beverage; however, this antenna needs to be at least one-wavelength long on its lowest operating frequency, which rules it out for most suburban gardens.

Another solution to reducing receiver noise is to use a small loop antenna, orientated so that the null is in the direction of the QRM source.

The latest weapon in the QRM battle is the 'EWE' antenna, which was first described by Floyd Koonz, WA2WVL [1, 2]. The general configuration of the antenna is shown in **Fig 1**.

Stewart Cameron, GM4UTP, suffered QRM from a neighbour's television set. In the course of seeking a solution he came across the EWE antenna. [3]. GM4UTP notes "I cannot recommend it highly enough as a receiving antenna. It has put paid to the Bush TV EMC problems. The noise level is cut by two-thirds on a noisy 80m band and the signal-to-noise level has been improved by one S-point."

Provided that the antenna is electrically small it will produce a directivity pattern similar to that shown in **Fig 2**. The GM4UTP EWE antenna for the 3.7MHz band has a total length of 12.08m; 3m vertical (L1) at each end with 6.08m horizontal (L2). The antenna is terminated with a 600Ω non-inductive resister (carbon or metal film) at one end to ground connection. The diagrams shown in Fig 2 are for the GM4UTP antenna.

A similar antenna has been constructed by Jim Smith, VK9NS [4]. His antenna is designed for 160m; the length of L1 is 3.1m (10.1ft) and L2, 21m (68.9ft). The lengths were chosen so that they are supported with the poles of his 40m four-square array. I should mention that Jim has four EWE antennas that can be switched to provide 360 degrees of coverage. The antennas are terminated using with two 2.2k resistors in parallel (1.1k). He also uses a pre-amplifier to overcome the loss of the EWE antenna.

Laurie Mayhead, G3AQC, also uses the EWE antenna to good effect on 136kHz. On the south coast of the UK there is considerable interference from the Loran station at Lessay in

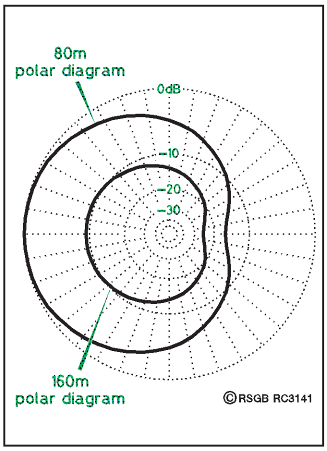

Fig 2: Polar diagrams for the EWE antenna at 80m and 160m. The zero dB scale is around -22dBi. The polar diagram is remarkably similar over a wide range of frequencies with an increase in gain and loss of directivity as the frequency is increased.

northern France, which is less than 100km away from Laurie's QTH. Spectral lines from this station seriously degraded reception when he uses his large omni-directional inverted-L transmitting antenna on receive.

By using an EWE antenna G3AQC is able to orientate the antenna with the null in the direction of Lessay and he reports that a deep null can be obtained by adjusting the values of the terminating resistor. A variable capacitor in series with the terminating resistor has also proved beneficial in this respect. His antenna is orientated NE / SW with its maximum response towards northern Europe and Scandinavia. Signals have been received on 136kHz from OH1TN at 579. The G3AQC EWE antenna dimensions are L1 6.1m (20ft) and L2 106m (350ft). This antenna has a front-to-back ratio of over 13dB. When the dimensions of this antenna are scaled into the 160m band they are L1 just 460mm and L2 8m!

The EWE antenna is reported to have a feed impedance of between 600 and 2000Ω. Most of the antennas I looked at were about 800 -jX400. Matching is not all that critical on receive and the standard method seems to be to use a 3:1 transformer, which gives a 9:1 impedance ratio, ie 450Ω to 50Ω or 75Ω to 675Ω.

The transformer can be wound on a toroid core as shown in **Fig 3** using enamelled covered wire or even thin plastic covered wire, which allows colour coding. VK9NS wound his transformer on a short length of ferrite rod.

FURTHER READING

[1] 'Is this EWE for You', Floyd Koonz, WA2WVL, *QST*, February 1995.

[2] 'More EWEs for you', Floyd Koonz, WA2WVL, *QST*, January 1996.

[3] *Antenna Toolkit* (pages 83 to 86), Joe Carr. Available from RSGB Sales, price £21.24 (members) inc free CD-ROM.

[4] 'EWE "four" me', James Smith, VK9NS, *The ARRL Antenna Compendium, Vol 5*. Available from RSGB Sales, price £15.29 (members). ♦

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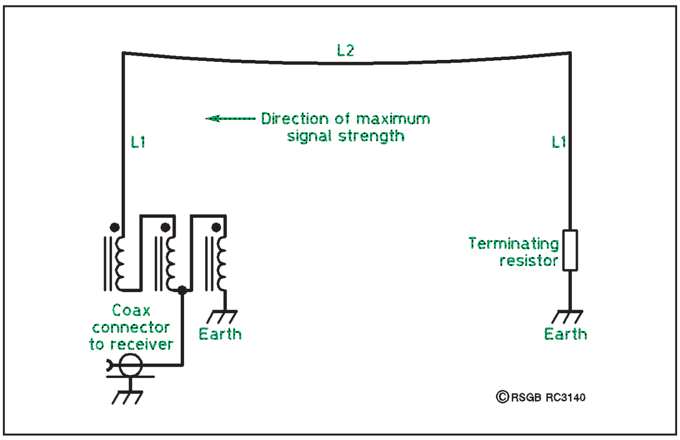

Fig 1: The EWE antenna. The terminating resistor value is not critical and any value from 700 to 2000Ω seems to work although different values affect the front-to-back ratio but not the gain. For dimensions L1 and L2 see text. Maximum directivity is away from the termination.

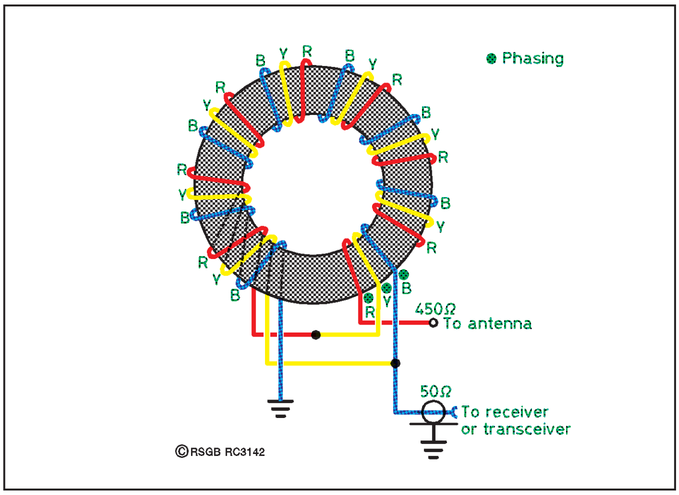

Fig 3: Suitable matching transformer for the EWE antenna. In practice around 12 turns trifilar-wound on a T50 core are required. The wires are shown colour-coded to clarify the connections.

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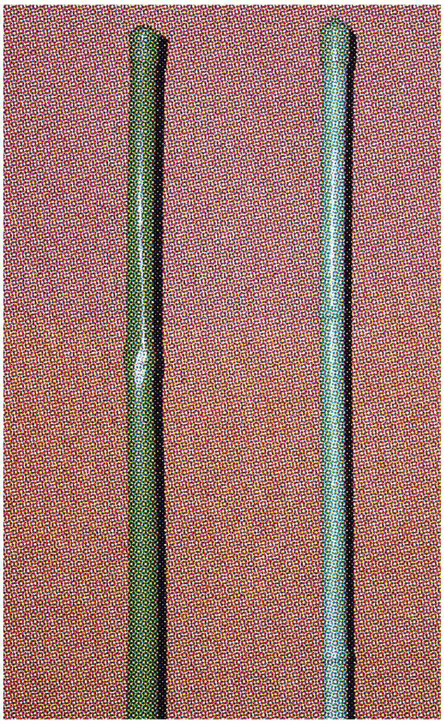

On the right, plastic-covered aluminium tube to be used as a durable alternative to cane for horticultural purposes. It even has annular ridges that make it look like cane. To the left is plastic-coated *real* cane.

PETER Martinez, G3PLX, e-mailed me with some interesting facts about the EWE antenna [1] of which I was unaware. He says: "Your item on the EWE antenna was most interesting. I had never heard of it before under this name, but recognised it immediately. If you scale it right down in size to a few millimetres high and a few centimetres long, it's the sensor element in one of the classic SWR bridge designs. It's therefore possible to think of such an SWR bridge as being a directional antenna rather than a directional power sensor - it's just DFing the electromagnetic field within the coaxial cable in which it's placed! The plug-in sensors of the well-known Bird Thruline power meter is one of these, so it's really a tiny DF antenna that you poke into the line to see which way the energy is 'radiating' inside the line.

"If you scale it up it becomes a proper Beverage antenna. At an intermediate size you can make it square and balanced rather than build it over a groundplane, and have the resistor halfway along the back edge and the feedpoint halfway along the front edge. You could probably therefore improve the performance, particularly the front / back ratio, by adding a counterpoise wire between the two earth-points as shown in Fig 1 [1]. You can replace the resistor with a second feedpoint and bring a second feeder back into the shack, via a matching transformer of course, and then swap the resistor and the receiver between the two feeders to reverse the direction."

G3PLX adds: "If you do the maths, the required value of the resistor (and indeed the feed impedance, which is the same), is equal to the characteristic impedance of the wire above the ground. You can therefore make this lower by having more wires in parallel. If, instead of a wire you had a flat plate of width D and placed it at a height of D above the ground, the characteristic impedance becomes equal to that of free-space, namely 377Ω. From this you can see that practical versions of this antenna are always going to be rather high impedance.

"I recently saw this same principle used in a set of field-strength measuring antennas made by R&S. The Radiocommunications Agency field engineers have recently been issued with them. They are square loops made of broad flat sheet. Incidentally, because the directivity depends on the electric field and the magnetic field being in a specific amplitude ratio (the magic 377Ω number again), these antennas will only give a sharp null in the far field where this ratio holds true. I note reports from various people who suggest that loops are much better at rejecting local QRM than whips, which might mean that local QRM is predominantly E-field. If this is the norm, then I doubt if an EWE antenna could ever be very effective in nulling-out local QRM, and the same imbalance would apply if the local QRM field was predominantly magnetic."

MOXON RECTANGLE MATERIAL

"HELLO DEAR, I've bought you a present - could you help me unload the car?" XYL Erica had been on a retail therapy session at a local garden centre. Amongst the hanging basket construction kits, flower pots, potting compost and other miscellaneous bits was my present, a bundle of green canes. These turned out to be 8ft (2.4m) canes coated in green plastic. Cane is often suggested as a material for any antenna that uses non-conducting wire element support structures, such as a quad or a Moxon Rectangle. While cane is cheap, lightweight and strong, its main disadvantage is that it is affected by weather unless adequately protected. On the face of it plastic-covered cane will overcome this disadvantage.

But beware. Some years ago I constructed a Double-D antenna [2] using what I thought was plastic-covered cane. I found it impossible to tune the antenna for either low SWR or directivity. I later discovered that the material was plastic-covered aluminium tube. The antenna performance (and my sanity) was restored when cane element supports were substituted.

As you can see from the photo there is very little visible difference between the two types of material. However, there are several clues. Plastic-covered cane is very rarely perfectly straight and the diameter tapers along its length. Plastic-covered tube *is* straight, has a constant diameter and gives a metallic sound when dropped on a hard surface.

The plastic-covered tube, shown in the photo, has languished in my antenna material junk pile for many years in all weathers and shows hardly any sign of deterioration except that it has become lighter in colour. This implies that the plastic-covered cane should make a durable wire element support.

I am constructing a Moxon Rectangle using this material and will give details of how it worked out in a later 'Antennas' column.

I have also included some construction and information on this antenna on my website (see WWW. below). Other references to this antenna are to be found at [3] and [4].

Plastic-coated bamboo canes were available in two of the many garden centres in my locality and from what I can gather they are imported from China. My canes were obtained from Country Fayre, Littlehampton Road, Ferring, West Sussex BN12 6PN (who regret they have no facilities for shipping canes). They were priced at £2.50 for a bundle of five canes, 8ft long. A rather more posh emporium, less than a mile away from my source, is selling the identical product for £4.99. Before you buy, inspect the canes to ensure that there is no damage to the plastic coating and that the end caps are securely in place.

REFERENCES

[1] 'Antennas', *RadCom* January 2002.
[2] *The Antenna Experimenter's Guide* by Peter Dodd, G3LDO (RSGB).
[3] 'A Superbeam Experience on 24MHz', Vic Westmoreland, G3HKQ, *Practical Wireless* October 1996.
[4] 'The VK2ABQ Antenna Revisited', Vic Westmoreland, G3HKQ, *Practical Wireless* August 2000. ♦

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