Build a Basic Beverage Antenna

by **Steve Whitt**

A Beverage antenna is probably one of the simplest and cheapest antennas one can build but it does have one-draw back in that you need a lot of space or a very long thin garden. Ideally the wire-needs to be at least half a wavelength long and for MW that means > 100 metres (ideally you need 200-500 metres). It is undoubtedly the best antenna around for use (for reception only) at frequencies below approx 5MHz, so a scaled down version will still work fine on the 60m and 90m tropical bands if you don't have enough space for MW.

Its nice to live in the countryside where there is more space but even in town the Beverage need not be ruled out if you apply your imagination. For example, if there is a long fence at the bottom of your garden that separates two rows of back-to-back houses and gardens you can run an unobtrusive wire along it. Obviously you have little say in which direction the aerial points but if you are lucky it may point somewhere interesting. Your neighbours need not know about the wire since it can be almost invisible!

Basically the Beverage is a travelling wave antenna made of a length of wire a small height (relative to the wavelength of interest) above earth. It can be terminated for unidirectional reception or left unterminated for bi-directional reception. The schematic of a terminated example is shown in Fig 1:

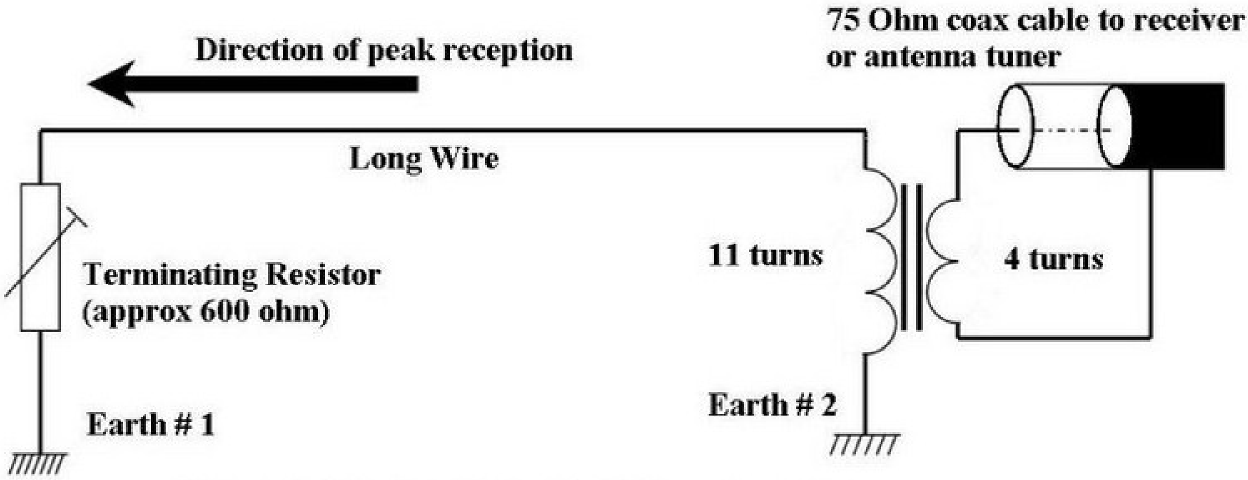

Figure 1: *A basic uni-directional Beverage antenna*

The components are all pretty basic, cheap, non-critical and easy to obtain as discussed below:

Wire and supports: Insulated 7 strand tinned copper wire (or similar) is fine and cheap with a 500metre roll of 7/0.2mm wire available from STC Electronic supplies for under ?12. Anything heavier is likely to sag, and lighter may break in the wind. The wire is best supported on bamboo gardening canes with a slit or split, made with a penknife or small hacksaw, in the top end to trap the wire. Canes can be between 1.5m and 2m long and one is needed every 8-10 metres along the wire. Take care to place the canes in a straight line as you insert them into the ground. Canes don't last for ever as they can rot in the ground (it might be worthwhile dipping the canes in varnish to protect one end) but they cost between 10-20 pence and are quite flexible to the wind. Alternative supports can be plastic support stakes used by farmers for temporary electric fences or anything non-metal that comes to hand. Indeed no support is needed at all if the wire can be unobtrusively slung along a hedgerow or run along a fence. Beverages will even work with an insulated wire just laid directly on the ground BOG - Beverage On the Ground

Terminating Resistor: This resistor can be a fixed value component of around 500-600 Ohms for simplicity. Or you can use a variable resistor which is carefully adjusted to an optimum value that minimises unwanted reception of signals off the back of the aerial. In both cases the resistor must be kept dry in its outdoor environment which is not always an easy task. The task of optimising the termination can be a bit time consuming and for a basic antenna needs two people linked by VHF radio or CB. One person adjusts the resistor whilst the other monitors the receiver. This activity needs to be done on stable ground wave signals since ionospheric fading makes the job nearly impossible. The best time of day is around solar noon but during short winter days late morning is good for westerly pointing aerials and early afternoon is good for easterly pointing antennas.
Earths: Good earths are essential at each end of the long wire and ideally the last bamboo stake, onto which the terminating resistor has been taped, has to be within a metre of the earth. This is to minimise the length of wire that is not part of the actual longwire. Earths can take many forms but I favour 22 mm diameter copper pipe in metre lengths pushed or hammered into wet soil (e.g. floor of a ditch or a stream). To join wires to a pipe like this is difficult. It is best to use very heavy duty copper wire (even thick braiding) clamped very tightly to the cleaned copper pipe using two Jubilee clips (i.e. metal hose clamps). Instead of Jubilee clips you can use purpose designed clamps for domestic mains electrical earths. This heavy duty wire forms the short link from earth to terminating resistor.

Transformer: This is not essential since it is quite possible to connect the longwire straight to your receiver, especially if it has a medium impedance input socket and the aerial wire makes a fairly straight run into the house to your radio. For the first few DX-peditions to Sheigra the antenna wire was connected directly to the receiver and often to several receivers in parallel. However, the transformer is useful if your radio has a low impedance input (often marked Low-Z, 75 ohm or 50 ohm) to avoid loss of signal strength, and it serves an additional purpose in that it helps discharge static build up on the longwire which could damage a sensitive receiver. Many designs for transformers have been published but my tried and tested low loss design uses a Seimens ferrite ring core (Type B6429QK618X830) obtained from Electrovalue (Phone 0784-433603 for catalogue and telephone credit card orders; Electrovalue stock number 2901448K @59pence) wound with the same type of multi-strand wire was used for my aerial. The primary should have 11 turns and, with a separate piece of wire, add four turns for the secondary or receiver side. These turns ratios are suitable for a 75 Ohm receiver input impedance, but the primary can be increased to 14 turns if a 50 Ohm receiver input is in use.

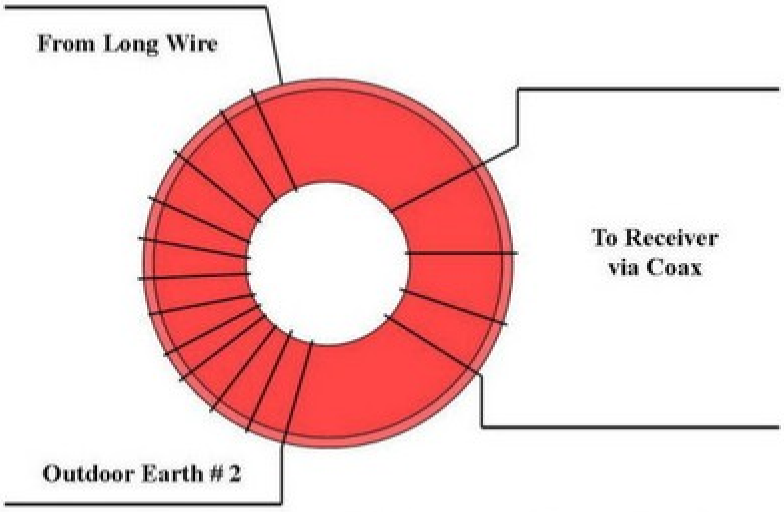

Fig 2: *Transformer Winding Detail (12:4 turns shown)*

The transformer allows the addition of a length of coaxial cable to the receiver which does not (should not!) form part of the receiving antenna. This allows the longwire to keep a straight line and avoids kinks or bends at the house end as you try to bring the wire into the listening post. Ideally the coax run should be short (<20m) to minimise extraneous pickup on it that could disturb the directional pattern of the main Beverage. In the earlier example of an urban Beverage, the use of a dog-leg to reach your listening post is undesirable, so if you build an antenna along a fence it is best to put a transformer at the end of the wire on the fence and then run coax cable hack to the house. (Fig 3)

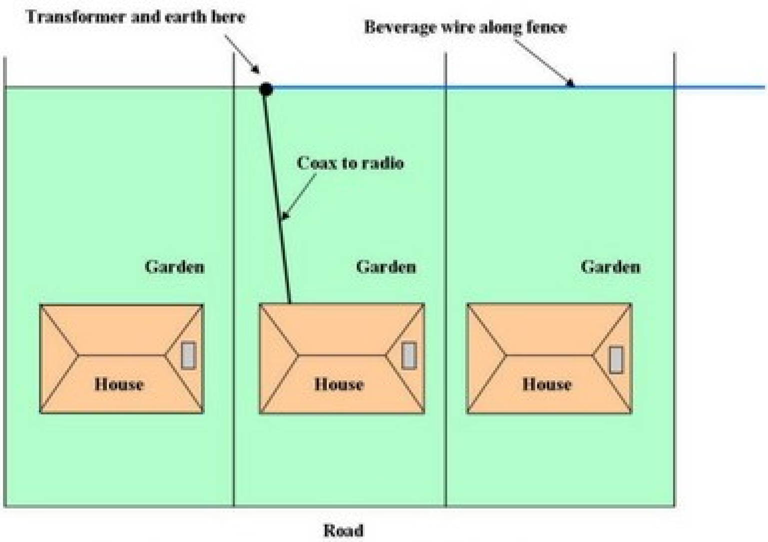

Figure 3: *Example of Urban Beverage Installation; Plan View*

Technical Tip 1:-How to measure earth resistance

Once you've erected your Beverage antenna there is one measurement that is worth doing on fairly regular basis. Since the antenna is outdoors and exposed to the elements it could suffer damage to the wire (e.g. a break due to fatigue damage) or damage to the termination resistor and its connections (e.g. corrosion) or damage to the earth (e.g. corrosion and high earth resistance). A simple continuity test using a pocket multi meter will quickly give a GO/NO-GO indication of antenna health and save you having to walk the line for a visual inspection. Apply your multirneter, set to measure resistance or continuity, to the receive end of the long wire as shown in Fig 4. If you cannot detect continuity, or resistance indicates an open circuit, you have a problem that needs investigation. Actually measuring the DC resistance of the antenna this way is usually difficult and you most likely will find that you can get two different readings according to tile polarity of the connections to your meter (just swap the two meter leads to see this effect). This is caused by corrosion of the earth stakes in the ground acting like a low power voltaic cell or battery. However you can exploit this phenomenon to more accurately measure your earth resistance. Still applying the meter in the same way, switch it to read voltage on a 0-2V scale; this is measuring the potential of the "battery". Record this figure and lets refer to it as "V". Now switch your meter to read current on a 0-2mA scale and record this short-circuit current figure "I".

Now Ohm's law tells us that the ratio of V/I gives us the total resistance of the antenna system "R". However "R" is the sum of the terminating resistor, the two earth resistance and the resistance of the wire itself. The latter is generally negligible unless the wire has been seriously damaged but not yet broken. Since we know the terminating resistance, subtracting this figure from "R" leaves us with the total earth resistance; the lower this is the better. Regular measurement of the earth resistance will indicate if a problem develops with the antenna.

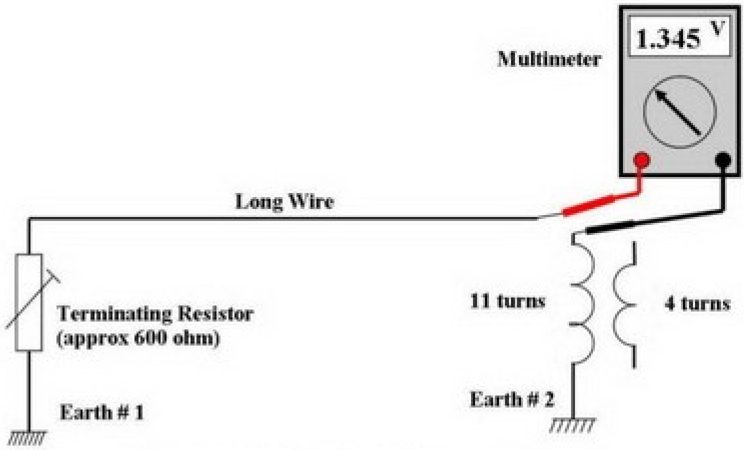

Figure 4: *Earth Resistance Measurement*

As a practical example let's look at the figures from my Beverage; I recorded "V" as 0.56V and "I" as 0.85mA. Thus V/1 =659 Ohms and since I knew that my terminating resistor was exactly 500 Ohms and the wire resistance was about 30 Ohms this gives a total resistance of 129 Ohms for two earths (ie about 65 Ohms per earth), which is not a bad figure for my simple arrangement of copper pipes.

Another reason for knowing the earth resistance is that it allows you to monitor seasonal change as the ground dries out in summer. Since the termination resistor is usually adjusted to minimise reception from the "back" or unwanted direction of the antenna, a significant change in earth resistance could influence its behaviour and could make readjustment of the termination resistor necessary.

Technical TIp 2: - How to avoid signal pick up on coax lead-in.

The length of the coax cable from the transformer to the receiver should be kept short to avoid it acting as an antenna in its own right. Sometimes there is no choice but to use a considerable length of coax and even good coax cable will pick up signals primarily on the outside of the screen. This can still be a problem since these signals may degrade the directional pattern of the main Beverage.

The way to eliminate pickup on the coax is to effectively break its length up with "braid breakers" that will attenuate any signal currents on the outside of the screen of coax but leave the desired signals inside the coax unaffected. There are two practical ways of building a braid breaker. One uses a ferrite tube designed specially designed for this purpose. This tube is slid over the coax cable and one placed every 5 metres or so and then taped in place. If you do locate such a source of tubes take care with them as they are both rare and fragile! Alternatively the coax cable can be wound several times through large a high-permeability ferrite ring of the sort recommended for interference suppression. Examples include Amidon or Micrornetals toroids with a -26 or -40 suffix (eg T68-40).

There are several more sophisticated versions of Beverages but the basic version is so simple and cheap to build and tolerant of design variations that I'd recommend one to anyone with the available space. Browse through any DXpedition report to see what is heard using Beverage antennas (and a good location of course).

Fonte: MEDIUM WAVE CIRCLE