HF bike mobile 2

More technical information on this way of operating

PHOTO 1: General view of the bicycle mobile system's latest incarnation.

INTRODUCTION. After reading my original article on bike and pedestrian mobile in the March *RadCom* several people asked me for a more technical description of my HF bicycle setup. I've done my best to oblige.

FUNDAMENTALS. The basic requirements for bike or pedestrian mobile are similar. These are an antenna system suitable for operating whilst on the move, a stable and efficient ground system and sufficient DC power to run it all. Then there are additional considerations for getting the best performance while on the move.

ANTENNAS. Several different homemade antennas are used on the bike. I usually carry at least three in a long red bag on the side, the choice depending on upon the bands I want to use and the expected propagation. The bag is quite evident in **Photo 1**.

On 10m the antenna is a full sized quarter wave. Monoband centre- or top loaded antennas cover 15, 17 and 20m. Centre and top loading is used to reduce induced RF losses into the frame of the car, bike or backpack and to minimise body capacity effects. It also gets the aerial current higher up the antenna. The antennas are generally 2.5 metres long, constructed in two pieces for easy transport on the bike. The total parts cost for each antenna is around £10.

The lower part of the antenna is constructed from a 1.2 metre long piece of 10mm hollow aluminium tubing, which is available from large DIY outlets. This is permanently attached to the centre loading coil. I chose my coil diameters to provide maximum Q whilst not being too top-heavy. The coils consist of 5mm insulated stranded wire wound onto 75mm diameter plastic drainpipe and covered with heatshrink to keep the weather out. On 15m I use 8 turns; the coil is 75mm long. For 17m it's 12 turns and 90mm long. The 20m version has 20 turns and the coil is 100mm long.

The top section is a stainless steel whip, which is threaded onto the coil section and is removable. The complete antenna weighs only a few ounces and hence is ideal for operation whilst on the move. It has very low wind resistance, too, so is suited to adverse weather conditions.

When weather conditions permit, I can also operate with a top loaded vertical, which is more efficient, however it is a total of 3.6 metres long and can be difficult to control in windy conditions! The construction is identical to the centre-loaded vertical but uses an additional 1.2 metre length of aluminium tubing at the base, which is threaded together to the centre loaded vertical. The top section of stainless steel whip is slightly shorter to maintain resonance. This antenna is shown in **Photo 2**.

The lowest sections of the antennas have a piece of 3/8" threaded bar inserted into the hollow aluminium tubing. This is crimped and a locknut fitted to prevent it coming loose. The antenna then screws into a standard antenna mount fitted to the bicycle (**Photo 3**). Immediately below the mount is a two way aerial switch. The other side goes to a 6m telescopic fishing pole that is permanently fitted to the bike and carries a centre loaded wire for 40 and 80m. I only use it on calm days.

SETTING UP THE ANTENNA. Tuning a newly-built antenna is important for best performance, but this is not done on the bike or portable. Instead, I set the antenna up over an ideal ground plane of four raised, resonant radials. I use an antenna analyser and adjust the length of the top section and/or remove or add turns to the coil until I get the best 50Ω match at my desired operating frequency. Once this is done, the antenna doesn't need further adjustment.

GROUNDING. The ground plane is the 'other half' of an antenna system. It can be thought of as the mirror image of the vertical. The complete radiated beam only forms several wavelengths from the antenna so a large ground-plane like the sea is ideal – it certainly increases the performance dramatically. The antenna will also have a very low angle of take off, which is very beneficial when working DX.

Our problem is to create an effective mobile ground plane for the vertical antenna to work against. The frame of the bike or trolley is very limited in size and of course has to be truly mobile. It is impossible to create a full size ground radial system or indeed have a fixed earth of any description on either a bike or a pedestrian trolley.

A few years ago I came up with a simple solution. The frame of the bike, backpack or

PHOTO 2: The centre-loaded 20m antenna is typical of my construction. Inset left: detail of the antenna mounting screw.

PHOTO 3: Aerial switch located immediately underneath the main aerial mount.

PHOTO 4: The primary pair of 7AH batteries that provide power to the radio.

trolley is resonated and produces a capacitively coupled ground plane to the surrounding area. This is very effective when operating over a high conductive ground like the sea shore. This method of frame tuning also ensures a more stable antenna match whilst on the move and eliminates RF feedback/instability even at very high power levels.

GROUND TUNING UNIT. The GTU is used on all bands with all the antennas. It is essential for good performance, as it creates the 'other half of the antenna'. It consists of an adjustable series-resonant LC circuit and is capable of covering all the HF bands.

By the nature of its inherent adjustability, the precise design of the GTU isn't critical. My original used switched capacitors and a roller-coaster inductor but **Figure 1** shows an equivalent using a tapped coil and variable capacitor. The coil is 24 turns of 5mm wire on a 2.5" (63.5mm) plastic former, tapped every other turn. The 300pF capacitor provides fine tuning.

The GTU is placed between the braid of the coax cable at the aerial end and the frame of the bike, backpack or trolley. A simple RF sampling circuit (**Figure 2**) is used to feed to a small meter to measure the ground or frame current. It is loosely coupled to the earth feed to the frame, and the GTU is adjusted for maximum current reading on the sampling meter.

IN USE. The VSWR and input impedance can be near ideal over high conductivity ground, eg near to salt water. The performance of the system is very dependant upon location.

When operating close to the sea the ground current is very much higher than it is over average ground. Adjustments to the GTU have to be made depending on the terrain.

POWER SUPPLY. The Alinco DX-70TH that I use requires 12V DC at up to 20A peak on SSB. In order to provide sufficient current for at least two hours' continuous use, I have two pairs of parallel-connected 12V 7AH gel cell batteries. The primary pair is attached to the crossbar (**Photo 4**); the second is in a metal box on the rear of the bike. These can be switched in to extend operating time.

MORE POWER. Additional RF power (if required) comes from a dedicated trailer, see **Photo 5**. This has an Italian KL-500 linear amplifier that outputs around 250W PEP. A 12V 80AH battery on the trailer provides power for up to 4 hours.

CHOICE OF EQUIPMENT. When on the move it is essential to have simple but efficient radio equipment. A simple headset means you can keep your hands free to ride. Simple-to-operate equipment like the Alinco DX-70TH is ideal, as it has very few two-function buttons or menu operation to contend with. Low standby power consumption can also be an important consideration.

BEST PERFORMANCE ON THE MOVE. There are a number of key factors for getting the best performance when using portable systems. Location is crucial. Being very close to the sea can give a 15-20dB

PHOTO 5: Inside the trailer there's a 250W amplifier and (under the wooden cover) 80AH of battery power.

increase to receive and transmitted signals. Use centre- or top loaded monoband antennas for maximum efficiency; large, high Q coils help minimise losses. It's important to optimise your ground and antenna current too. There is no substitute for knowing band and what time to work a certain area, so use propagation prediction programs such as *VOA prop* for guidance. Greyline propagation is your friend; use it.

MORE INFORMATION. Several clubs have been kind enough to invite me to talk about my bike and pedestrian mobile operation. There is a description of my latest endeavour – a completely solar-powered pedestrian setup – in this month's QRP column. You can also find more information on my exploits on the web at www.qrz.com/db/g4akc.

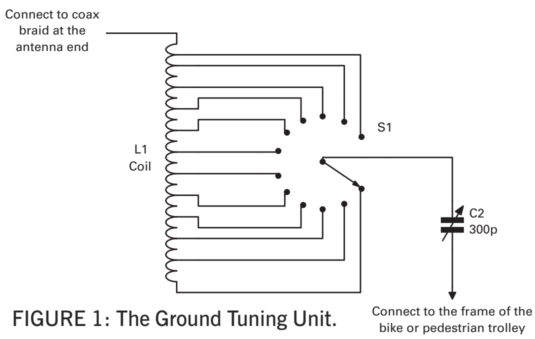

FIGURE 1: The Ground Tuning Unit.

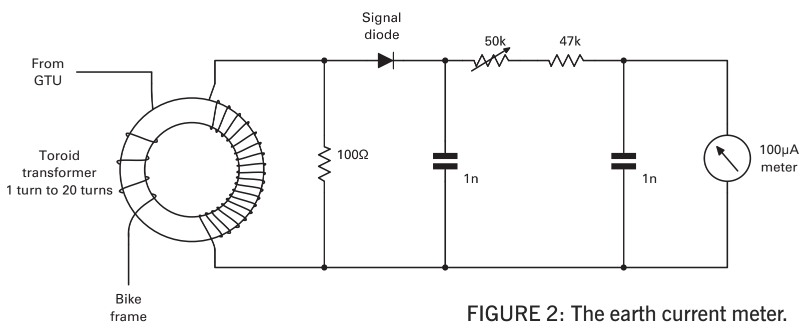

FIGURE 2: The earth current meter.