Portable Amateur Radio Operations

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Introduction: In the not too-distant past, HF rigs were large and heavy. Portable operation with these transceivers (or separate transmitters and receivers) was cumbersome and difficult. Today, HF transceivers are very small and are inherently portable. (Example: ICOM IC-706 MkIIG.) The main issues with portable HF operations have become not issues of the transmitting and receiving equipment itself but of providing power and antennas.

Power: Nearly all modern HF transceivers require 12vdc at approximately 20 amps to generate a 100-watt signal. Traditional linear (transformer-based) power supplies are bulky and very heavy. In contrast, modern switching power supplies that don't require a heavy transformer are small and extremely lightweight. For hotel/motel/condo operations, a switching power supply plugged into the wall outlet is all that's needed. For field operations where commercial power is not available, some other means of generating power must be used. For operations at 100 watts, one might rely on a gasoline-fired generator. Very small, lightweight, fuel-efficient, and quiet generators are now available from companies such as Honda. (For example, the Honda 2000i weighs just 46 lbs and produces noise at only 59dB while generating 2000 watts.) Instead of a generator, one can use batteries, possibly supplemented with photo-voltaic (PV) panels, to power a station. However, the battery capacity needed is a function of the load's current requirements and a transceiver that draws 20 amps on transmit and over an amp on receive will require large batteries and, if being used, a larger solar array to keep the batteries charged while in use.

For field HF operations at QRP levels (5 watts) using radios with low receive-current requirements, batteries and PV become reasonable. Modern QRP multi-band HF transceivers can be found that draw as little as 35mA on receive and an amp on transmit. (Example: Elecraft KX1 and K2.) Lead acid batteries in a gelled-electrolyte configuration (gel cell) sufficient to power such a rig for many hours are small and light enough to easily carry. One can also use NiCd or NiMh batteries that are lighter but more expensive than gel cells. Small PV panels sufficiently large to charge the batteries while they are in use are both small enough and light enough to be easily carried.

Antennas

Radios and power sources might be small these days, but the same laws of physics apply today as did in the past. These laws of physics require that well-performing antennas for the HF bands be relatively large. The antenna selected for portable use will be a compromise. The antenna deployed will be determined by the operating location (in the field, in a hotel/motel/condo, at an emergency shelter), by the required performance (gain, angle of radiation), by the weight and volume of *stuff* one is willing to carry, and how many people will be available to erect the antenna. A 100' tower with mono-band beams on 10m, 15m, and 20m can be erected in the field and might be the perfect choice for a well-sponsored and well-manned DXpedition but for a weekend camping trip would very probably be overkill and it won't fit in the family car and two adults and two pre-teens can't erect it. A 20m dipole is not the antenna of choice for the aforementioned DXpedition but might be just what's needed for the weekend camping trip and it fits nicely in the family car and the it can be erected by two adults and two pre-teens.

Portable antennas will usually fall into two categories: horizontal wires and verticals constructed of either wire or rigid metal.

Wires: Probably the simplest single-band HF antenna is the 1/2λ dipole fed with coax. For QRP levels, this coax can be the very small but lossy RG-174 if lengths are kept short; for use at the 100 watt level, RG-58 or RG-8X is recommended. The dipole can be supported at the two ends or it can be supported at the center as an inverted-vee with the ends sloping and tied off at the ground. When used on the band it's cut for, no tuner is generally needed with this sort of antenna.

For multi-band use, a doublet as short as a 1/4λ on the lowest frequency of interest and fed with twinlead or ladderline through an antenna tuner can work well. Even at 100 watts, inexpensive TV-type twinlead should work well. For QRP levels, such an antenna can be made with one continuous length of "zip cord": separate the conductors for one-half the required radiator length and either knot it there or use a nylon wire-tie to prevent it from separating further. The resulting "zip cord" feedline will be lossy but is very lightweight and inexpensive and the antenna, since it is one continuous length of wire, will be very strong. The antenna tuner required for this sort of antenna can be manual or automatic. If trees aren't available, a fiberglass mast can be used to support such a doublet in the center as an inverted-vee. (See below for more about fiberglass poles.)

If one is willing to carry an antenna tuner, a single end-fed wire can be pressed into service. In general, one should hang at least a 1/4λ of wire for the lowest frequency of interest and results improve if at least one radial is laid on the ground. (Note: at 100 watt power levels, such an antenna might allow RF at the mic or key to be a problem.) A specific variation of the end-fed wire is the W3EDP antenna. The W3EDP is a variation of what used to be called a "Zepp" antenna and consists of an 85' radiator and a 17' counterpoise. The counterpoise is used for 15m, 20m, and 40m and is left off for 80m and 10m. The 85' length was chosen because it allows easy tuning on the traditional (non-WARC) HF bands and places the high-current nodes well away from the operator.

For single-band use, one can construct a 1/2λ end-fed wire. Like the traditional 1/2λ dipole, the 1/2λ end-fed is resonant and needs no counterpoise or radials. However, the 1/2λ end-fed presents a very high impedance to the transmitter. A very small and lightweight single-band tuner for use at QRP levels can be built for use with the 1/2λ end-fed wire.

Verticals: The classic HF vertical is a 1/4λ of conductor supported vertically and operated over some sort of ground that provides the second-half the circuit. (The 1/4λ vertical can be thought of as half of a 1/2λ dipole, with the high-conductivity earth, salt water, a ground-plane, or a radial system providing the other half.) Full-size mono-band verticals for 10m, 15m, and 20m are relatively small and can be lightweight whether made of wire or aluminum. Full-size verticals for 40m and 80m are, in general, too large to be easily erected for portable use. Vertical antennas can be shortened using added inductance.

For portable use, one can use any of the available mono-band or multi-band HF mobile antennas and operate them against some sort of ground or radial system. Because of the wind-speeds mobile antennas are expected to encounter, these antennas tend to be rugged and, as such, heavier than is required for stationary use. It is important to remember that as an antenna is physically shortened, useful bandwidth decreases; this can become a problem when mobile antennas are used for 40m or 80m.

For portable use, one can also use multi-band trap verticals that are primarily intended for use at home stations. The Hustler 4/5/6-BTV antenna is probably the smallest and least complex antenna of this sort and can easily be pressed into portable service. A base for this sort of antenna can be fashioned that allows the vertical to be self-supporting even without guy wires. If this sort of antenna is to be used near a car or camper, a base that requires the car or camper tire be driven onto it can be used to keep the antenna vertical.

Vertical radiators don't have to be made of rigid aluminum. Copper wire of the appropriate length can be suspended from a tree branch or from a lightweight fiberglass mast and fed against wire radials lying on the ground. The W6MMA vertical uses a 20' *Black Widow* crappie pole to support a length of lightweight wire as the radiator and a low-mounted coil to shorten the antenna enough that even 80m can be covered. (Unfortunately, W6MMA no longer sells the loading coil but something similar can be home-brewed by the enterprising amateur.)

Several fiberglass masts are available commercially that are both longer and more rigid than the above-mentioned *Black Widow* crappie pole. Below are examples from Jacktite and MFJ. Note that the 33' length of the MFJ mast is sufficient to support a full-length 40m 1/4λ wire without any sort of loading. Jackite offer shorter versions of these masts and they are also available in high-visibility orange.

31’ Jackite fiberglass pole:
collapses to 46”

33’ MFJ fiberglass pole, MFJ-1910:
collapses to 46”

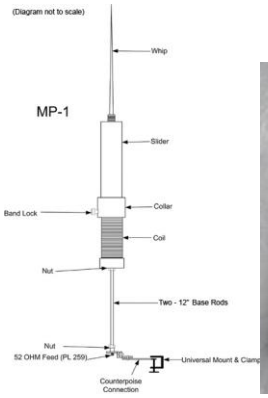
Several commercial portable vertical antennas are offered, three of which are shown below. The 5-BTV home-station antenna is shown for comparison.

Commercial vertical antennas:

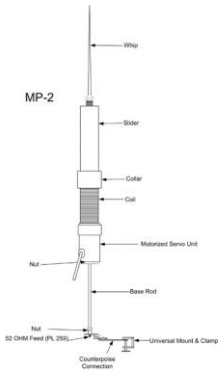
Hustler 5-BTV
80m-10m; 25’ tall; 17 lbs
handles full-legal limit CW/SSB

Pacific Antenna PAC-12
60m-10m; less than 1 lb;
breaks down into 12” sections
handles 100 watts

W6MMA MP-1
40m-6m
handles 300 watts



W6MMA MP-2
40m-6m; motor-driven tuning
handles 300 watts



A hybrid-type product is the BuddiPole system. The BuddiPole can be configured as either a self-standing vertical antenna or as a self-supporting dipole.

BuddiPole portable vertical/dipole system
40m-6m; dipole or vertical configuration
collapses to 22”
handles 250 watts
weighs less than 2 lbs

Resources:

Honda (generators): http://www.hondapowerequipment.com/gen.asp

Elecraft (KX1, K2 transceivers): http://www.elecraft.com/

Jackite (fiberglass poles): http://www.jackite.com/

MFJ (fiberglass poles): http://www.mfjenterprises.com/

New-Tronics (Hustler 4/5/6-BTV): http://www.new-tronics.com/main/index.html
DX Engineering (Hustler 4/5/6-BTV): http://www.dxengineering.com/

Pacific Antenna (PAC-12): http://www.pacificantenna.com/

W6MMA (MP-1 & MP-2): http://www.superantennas.com/

BuddiPole (vertical/dipole): http://www.buddipole.com/