Improving 2-Meter HT Performance in Pedestrian-Mobile Applications

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Introduction

Hams generally don't buy HTs to use exclusively with 14-element yagis mounted atop 75' towers. Hams buy HTs because they need to be able to have a station they can carry in their pocket, briefcase, or glove box; because they need to communicate while away from their hamshack or car; and because they need to be able to communication while in bipedal-motion. Modern HTs are miracles of technology and packaging. However, let's face it—the cute, short, convenient, easy to carry helical "rubber duck" antennas that come with most HTs are miserable performers. According to tests performed by the National Bureau of Standards, the typical rubber duck antenna is 5dB down when compared to a ¼-λ whip held at shoulder height. This means that the effective radiated power of a 5-watt HT driving a rubber duck is about 1½ watts, and received signals are degraded by a similar amount. However, it's possible to get improved performance from an HT without severely reducing the HT's convenience and utility. This article will look primarily at improving the performance of 2-meter (VHF) HTs, although the methods discuss easily be extended to UHF HTs.

Add a Counterpoise to the Stock Rubber Duck

Because a rubber duck single-band HTs is usually a helically-shortened ¼-λ whip that relies on capacitive-coupling to the operator's body for the missing second half of a ½-λ dipole, one way to slightly improve its performance is to provide the second half of the dipole by operating the rubber duck against a wire counterpoise or "tiger tail". A tiger tail is simply a ¼-λ length of wire connected to a point at ground-potential on the HT; such a counterpoise can be clipped to the outside of the BNC or SMA connector or it can be attached to a case screw that connects to ground. For 2-meters, a wire counterpoise is about 19" long. Commercially-produced tiger tails are available, but they are also very easy and inexpensive for the average ham to build himself.

The ¼-λ Whip

A ¼-λ whip mounted on an HT is actually half of a ½-λ center-fed dipole and when used by itself is a considerable improvement over the stock rubber duck. However, because it's only half a dipole that relies on capacitive coupling to the operator's body for the second half of the dipole, the addition of a counterpoise transforms the ¼-λ whip into a full-size center-fed ½-λ dipole and improves performance by about 5dB over the stock rubber duck. For 2-meters, a ¼-λ whip is about 19" long and the wire counterpoise is the same length. Many commercially-produced ¼-λ whips are available. Most are made of flexible "whippy" material. A home-made ¼-λ whip can be made of hook-up wire inside small-gauge "whippy" plastic tubing.

The ½-λ End-Fed Whip

Unlike the stock rubber duck or the ¼-λ whip described above, the ½-λ end-fed whip is a "complete antenna". Because it operates independently of a ground-plane, the ½-λ end-fed is often the antenna chosen for applications when a good ground-plane isn't available such as on wooden or fiberglass boats,

or on automobiles with fiberglass or plastic bodies. When used without a counterpoise, the ½-λ end-fed whip performs much like a ¼-λ whip with counterpoise; this makes sense since both antennas are ½-λ antennas and will have similar radiation patterns. When used against a ground-plane or counterpoise, the ½-λ end-fed whip provides about 2dB gain over the ¼-λ whip operating against a counterpoise. For 2-meters, a ½-λ end-fed whip is about 36" long. Commercially-produced ½-λ whips tend to have extendable radiating elements; when the whip is collapsed performance is about the same as with a rubber duck.

Because the ½-λ end-fed whip is a complete antenna, it's the best choice for remote-mounting when a ground-plane isn't available. For instance, the ½-λ end-fed whip can be hoisted into a tree or suction-cup mounted to a window and fed with small coax from the HT.

Directivity with the Counterpoise

An additional benefit of using wire counterpoise with a rubber duck, ¼-λ whip, or ½-λ end-fed whip is that the resulting antenna can be made directional. Simply extending the wire counterpoise in the direction of the other station should markedly increase signal strength in that direction.

Don't Leave the HT on the Belt!

Regardless of the antenna chosen for use with an HT, it's important to keep in mind that the signal of an HT hanging on the operator's belt can be reduced in strength by as much as 20dB when compared to the same HT operated at face level. Additional improvement can be had by holding the HT at arm's-length above the head and speaking into a remote microphone.

Notes & Sources (updated 2018-06-16):

Tiger Tail Antenna (W3ATB)
https://w3atb.com/tiger-tail-antenna/

Build a Tiger Tail HT Counterpoise (W1CAR)
http://chadrudolph.ipower.com/projects/tigertail.htm

HT Antenna Modification for Increased Performance! (KE4SKY)
http://www.hamuniverse.com/htantennamod.html

Santa Clara County ARES/RACES – Emergency Operations and Your HT
http://www.scc-ares-races.org/emergency_operations_and_ht.htm

High-Efficiency HT Antennas (K0NR)
http://www.k0nr.com/blog/2006/07/k0dk-high-efficiency-ht-antennas.html