PackTenna Mini

Dipole Wire Antenna

Owners Manual

Introduction

Over the last few years, there has been a significant increase in the number of radio amateurs interested in portable operating. This is due to multiple factors including the availability of high quality portable radio equipment, limitations to putting up large HF antennas at home, and the desire to travel and enjoy the great outdoors. In most cases, portable operations impose some basic challenges, not least of which is the need to run modest power and keep the size and weight of gear as low as possible.

Every year our club operates on Field Day and many of us enjoy taking our gear to the park or hitting the hiking trail to operate far from the home station. Over the years, we have tried many different antennas. We found that most commercial antennas are either too bulky and heavy to be easily hauled around or are two small to be efficient, so idea of the PackTenna was born.

The challenges for coming up with the design for PackTenna included the following, somewhat conflicting goals.

- Full size, no compromise performance, especially given the limitations of a quick portable setup.
- Small enough when packed up for trail use (think SOTA) and air travel.
- Quick to setup and take down.
- A modular design that can evolve over time as your needs change.
- An open design that makes it easy to make modifications and add your own options.

With these goals in mind, we decided to base the design on using wire elements and fiberglass telescoping poles for the support. This combination allows us to construct full size antennas in many configurations including horizontal dipoles, inverted vee, ground planes, long wires and resonate wires to name a few. The rest of the PackTenna design includes all the hardware to make the system work.

We selected antenna hardware designed for backpacking which keeps the size and weight down and then designed a unique feed point system that allows for quick setup and improved performance. We hope you enjoy using the PackTenna as much as we enjoyed designing it.

73 de George Zafiropoulos KJ6VU

The PackTenna System

The complete PackTenna system includes fiberglass support masts, wire antenna elements, base mounting hardware, feed points and accessories. This section describes each piece of the system and how it is used.

- **10 meter (32') fiberglass mast**
- **4x 20m quarter wave wire elements**
- **1:1 Feed point balun rated for 100 watts**
- **Guy rings, guy lines, S-clips, ground stakes, mini bungee cords**
- **Coax and carry bag**

10 M (32') Telescoping Fiberglass Support Mast

All antenna configurations require raising the antenna up in the air. The PackTenna mast telescopes out to a maximum length of about 32 feet. When collapsed, the mast is only 26 inches long. This makes it just the right size to stow in your luggage or strap to your backpack. Mast sections stay in place by gently twisting the sections together when extended. It is important to not pull the elements too hard so they don't pop out the ends. If this happens, just unscrew the bottom and insert the sections back where they belong.

The mast tapers to a very small diameter solid fiberglass rod at the tip. The top ¼ of the antenna, about the last 8 feet are too light to mount a coax feed point but is normally used for the end of a quarter wave ground plane wire or end-fed wire antenna.

TIP: An easy way to attach the wire to the tip of the mast is to remove the very last mast segment, the 4mm solid dowel, and slip the end of the wire element (with the female banana socket) into the end of the last element tube. The crimped ferrule forms a natural bend in the wire and makes a great way to secure the wire without any additional hardware.

When using the coaxial feed points, mount them ¾ the way up the mast. This is at about 21 feet above the ground. At this point the mast diameter is about ½" and easily supports the coaxial balun feed point.

TIP: If you are taking the mast on the trail and want to cut more weight, consider what antenna configuration you need and only take the mast sections necessary. If you are using an inverted vee, you can take out the last 4 or 5 sections because they cannot support the feed point balun anyway. If you

are using the mast to support the end of a wire element and don't need the full 10 meter length, you can remove the necessary mast sections and leave the larger, lower sections at home.

Wire Antenna Elements

The standard PackTenna elements are 16' 10" and are designed to be a quarter wave on 20 meters. The wire elements have strain relief loops and banana connectors on each end. The loops are attached with S-clips which are in turn connected to the balun feed point, other elements or ground stakes. The basic PackTenna is a linked dipole design. This makes it easy to clip multiple elements in series allowing for easy band switching. The S-clips take the strain of the antenna and banana connectors. The banana connectors are used to make the RF connection.

The banana connectors have a high surface area and are gold plated to make excellent RF connections.

For 20 meters, a pair of antenna elements can make a dipole, inverted vee, ground plane, etc. For 40 meters, simply clip two 20 meter elements in series. The high end that connects to the feed point uses a male banana connector. The opposite end has a female banana connector. This makes it very easy to tune the antenna in the field, if needed, by plugging in a short pigtail wire and trimming the length. This way you can precisely tune the antenna while not cutting the 20m wire element. The antenna will work reasonably well on 15m as well when configured as a 40m dipole or vee because 15m is the 3rd harmonic of 40m.

A DIY antenna parts kit is also available with the same hardware to make it easy for you to make your own antennas in any configuration you like for any band.

Base Mounting Hardware

The fiberglass mast must have a solid base to support the antenna. The PackTenna system includes a guy kit for ground mounting the antenna. The guy system includes 8 guy lines. Each guy line is 10' long and has a line tensioner, and an S-clip. 3 guy lines are used to hold the base in place making the mast self supporting. An additional four guy lines are included for the ends of the wire elements providing 20 feed of guy line on each side. One spare guy line is included because, well, you can always use more hardware. . The guy kit includes 6 light weight ground stakes. Three for the mast support guy lines, two for the wire element ends and a spare.

When using the PackTenna on hard ground, like an asphalt parking lot, it is much easier to use a portable tripod mount. The PackTenna mast can be attached to the tripod with mini-bungee cords included with the system. Just put at least two bungees around the mast and tripod center support. Additional guying may be required depending on the antenna load and weather conditions.

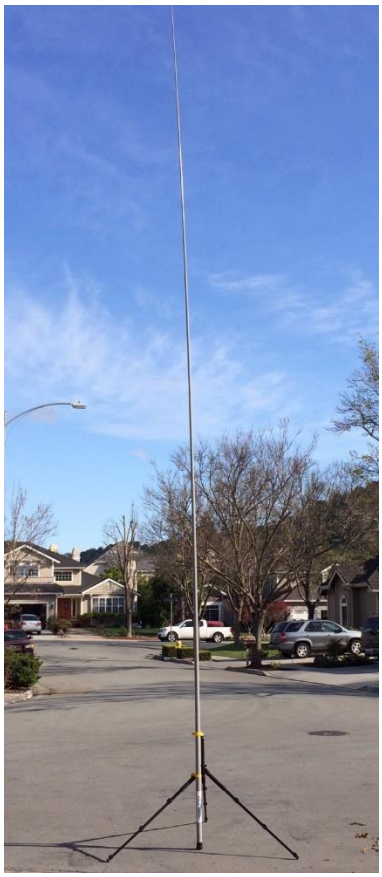
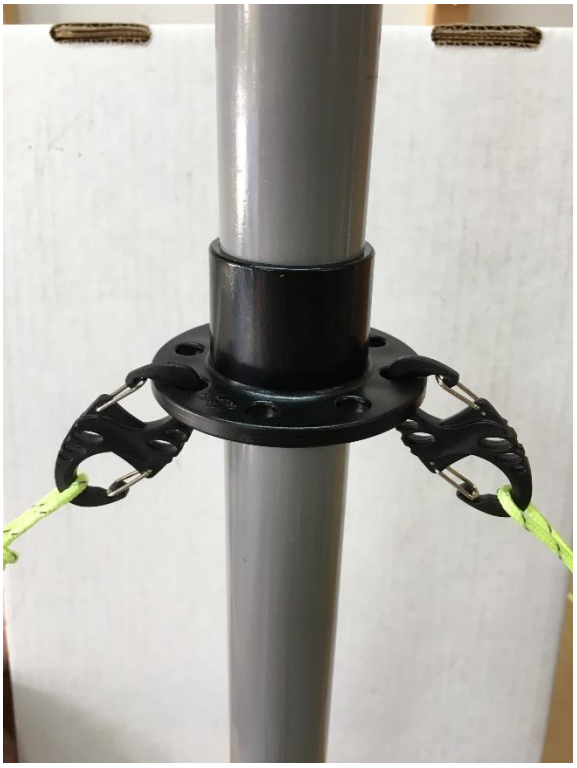


Photo tripods or speaker stands can make good base mounts.

Guy Ring

The guy ring will rest at about 9’ above the ground and provides an excellent guyed base. When deploying the PackTenna in the inverted Vee configuration, the antenna wire elements provide additional guying capability.



Guying configuration

Guy line tensioner

3 sided aluminum ground stake with paracord loop

1:1 Feed Point Balun

A resonant antenna, like a half wave dipole, inverted vee or ground plane uses the balun to ensure there is no common mode current flowing back down the coax shield to the transmitter. These antennas do not require a tuner because the antenna is resonate for the band desired. The balun reduces or eliminates RFI at the radio and helps make the antenna more efficient.

Standard PackTenna 1:1 Feed Point Balun

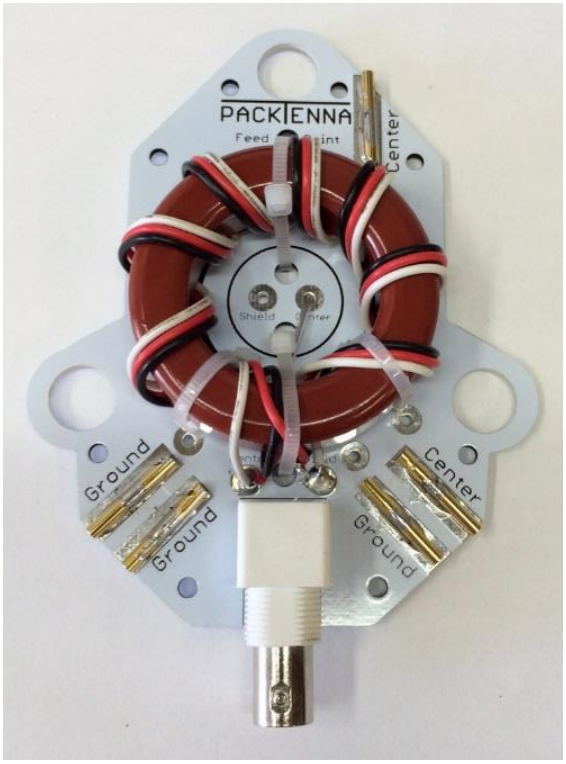
PackTenna feed points include multiple banana sockets to connect the balun to the wire antenna elements. These connections are labeled “Ground” or “Center” The ground connections are connected together and the center connections are connected to each other. S-clips connect to the side lobes or top lobe and take the stress of the antenna element wire. The pigtail coming off the antenna wire element plug into the banana sockets.

TIP: When fielding an inverted vee or dipole, plug one wire element into a ground jack and one wire element into a center jack.

TIP: When setting up a long wire, sloper, or vertical, connect the vertical radiator element to the center socket on the top and ground radials to one or more of the ground sockets.

9:1 UNUN

This type of feed point is used to match the coax to an end-fed high impedance antenna. These can be either ½ wave resonate wires or random end fed wire antennas. The UNUN brings the feed point impedance down closer to the transmitter's 50 Ohm output impedance. A tuner is required to make these types of antennas work.



Mounting the Feed Point

The feed point can be mounted to the mast using mini bungee cords. This method allows you to attach the board tightly to the mast without crushing the mast material. The bungees also grip the mast so the feed point does not easily slide down the mast. There are six small holes that make convenient places to

attach the bungees. Connect one end to the PCB, wrap the cord around the mast several times and connect the remaining end into another attachment point.

Three large holes and loops are provided on the sides and top to allow the S-clips to connect to the board. The S-clips provide a mechanical connection from the wire elements to the feed point.

The wire elements plug into the feed point using mini banana plugs. There are 5 mini banana sockets mounted to the feed point board. Three of them are bussed together to ground and two are bussed together for the center wire of the feed line. The balun or UNUN on the feed point is between the feed line and the wire element banana sockets. The wire loops at the end of the wire elements clip into the S-clips and the male banana plugs plug into the sockets.

The coax cable from the radio connects to the BNC connector at the bottom.

Coax Cable

We recommend 25' lengths of LMR195 or RG-316 coax with BNC connectors. Use one length of coax when operating near the bottom of the mast. When operating farther from the mast, add another 25' section of coax with a BNC/BNC barred connector. Of course any 50 ohm coax will work. For general portable operations, we recommend LMR195 or RG-316 because they more robust than the thinner RG174 and they are smaller and lighter than the larger RG8X. For backpacking, we recommend the thinner RG-316 cable

S-Clips

The S-clip is a universally useful piece of hardware. These non-conductive clips are true multi-taskers. They are used to quickly connect wire elements to our feed points, connect guy lines together, and suspend feed points from a tree limb. Your imagination is the limit. Notice the holes in the side… these are very handy places where you can thread antenna wire in and out for quick setups or manually tuning. You can also thread paracord through the hole and tie it off in a knot. Super light weight and strong, these clips are a great addition to your portable station.

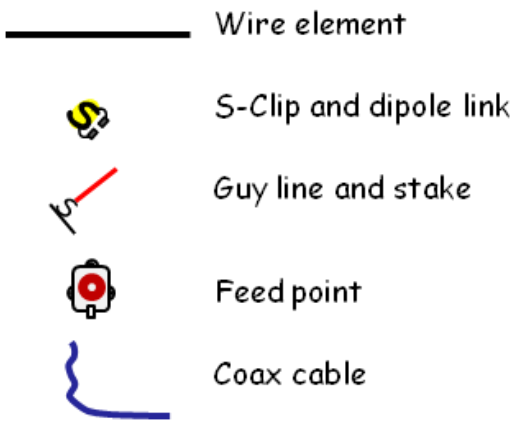
BNC Barrel Connector

We recommend using 25’ segments of RG58 coax with male BNC connectors on either end. The barrel connector is used to link multiple 25’ segments together

Antenna Configurations

The PackTenna system can be used to build many different antenna configurations. This section shows some of the most popular antennas used in portable operations. The diagrams are provided to explain the components needed and how to assemble them. These diagrams are not to scale but will give you the general idea.

All the configurations only show the antenna components. It is assumed that there is some sort of base support. This would be a low set of guy lines, typically at the top of the second or third mast section. A ground stake or tripod can also be used as a base support. The base support method is not shown to keep the diagrams from getting to cluttered.



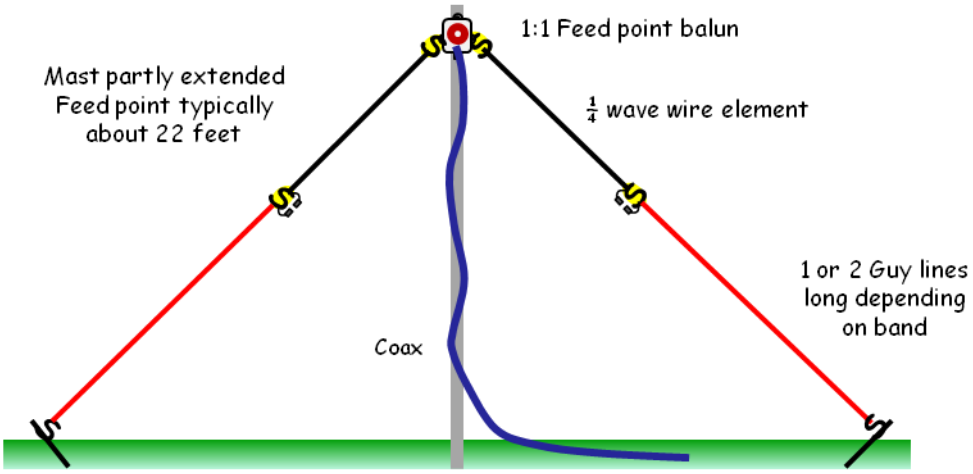
So, which configuration of antenna is the best one? Every antenna configuration has pros and cons and many books have been written to explain the differences in great detail. For the portable operator, here is a very short set of recommendations

1. Horizontal antennas (dipole, inverted vee) are lower noise than verticals. Elevation will determine the angle of radiation. With a PackTenna the feed point will be at about 22 feet. For 20 meters and higher frequencies, this will provide good overall performance for both DX. On 40m with the antenna much closer to ground you will tend to have more local or regional communications because the radiation pattern will be higher.

2. A quarter wave ground plane will have a low angle of radiation so it will perform well as a DX antenna but tend to be noisier than a horizontal antenna. PackTenna is large enough to build a full size quarter wave ground plane for 20m and higher frequencies. You can also make a quarter wave ground plane for 40m but the feed point will be at the ground level. This will not be as efficient as a raised feed point on the 20m configuration. You can overcome some of the ground losses by adding several more ground radials on the ground itself.

3. End-Fed antennas, both the half wave and the non-resonant random wire have the big advantage of being the easiest antenna to set up quickly and have a very small foot print. It's easy to see how these antennas are very popular for portable operations where quick setup and take down is desirable. The disadvantage of these antennas is that they tend to be less efficient as compared to a tuned resonant antenna. These antennas tend to induce common mode current down the feed line back to the station. This is usually no problem at QRP levels but can be a problem at higher power levels. Adding an in-line common mode current choke can reduce this interference.

Inverted Vee



An inverted vee is a half wave dipole antenna with a single center support and the ends angled towards the ground. This type of antenna performs similar to a traditional dipole in that it is horizontally polarized with a fairly omni-directional pattern. Because of the horizontal polarization, the inverted vee is typically quieter than a vertical.

Inverted Vee's are popular for portable ops because, unlike a dipole, it only has one physical support mast required. The angle of the V is typically between 90 and 120 degrees and care must be taken to keep the ends of the elements off the ground by at least 2 to 3 feet and higher is better.

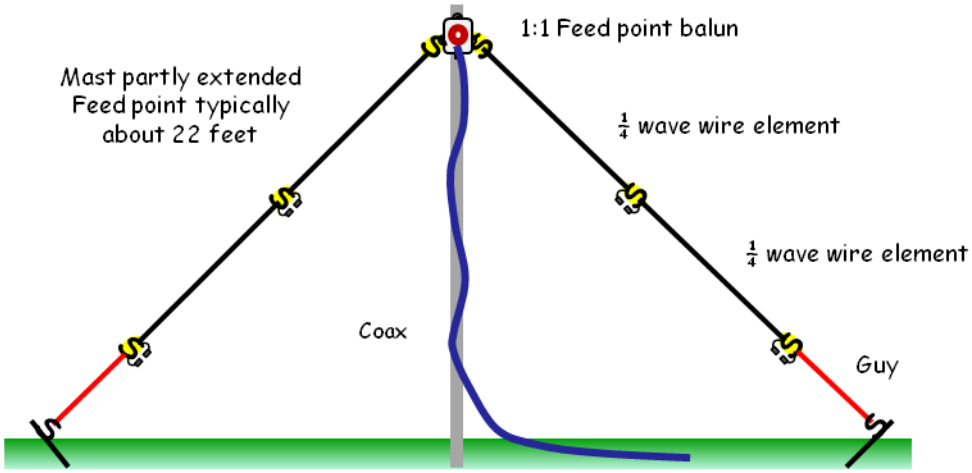
A 1:1 balun is recommended at the feed point to ensure an efficient coupling to the antenna elements and to keep common mode currents from flowing back down the coax shield.

When setting up the inverted vee, extend the mast to about 22'. This is the point where the feedpoint will be attached. This elevation works well on 20m and higher frequencies with little ground interaction. It is also the point where the mast is still large enough to hold up the feed point and coax.

The antenna elements will act as a high level guy lines as well to keep the antenna in position.

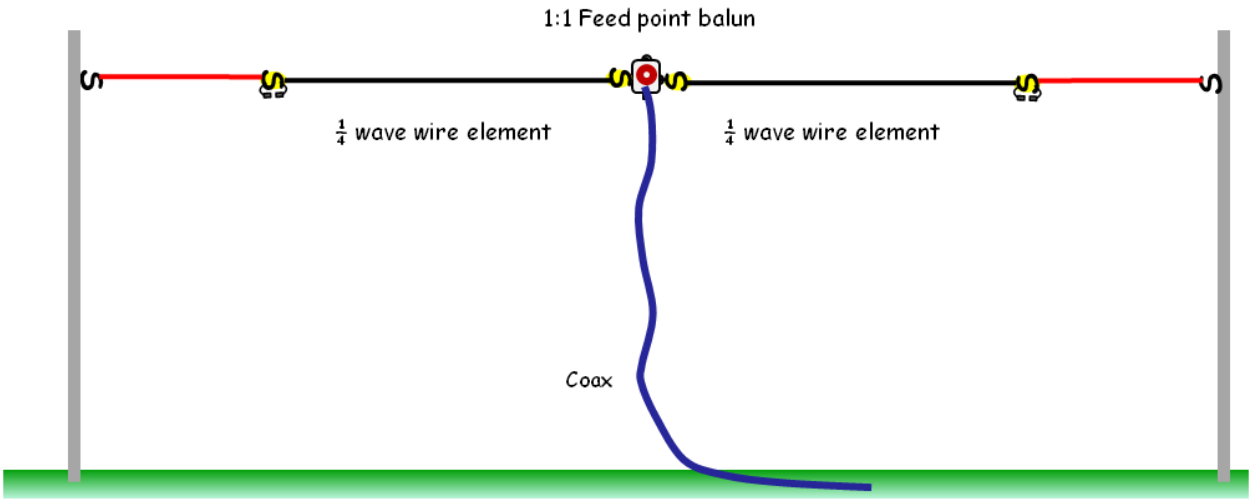
The PackTenna elements are pre-cut as a quarter wave on 20 meters. On advantage of using a full size half wave antenna is that they tend to be fairly broad band. This means if it's tuned for the middle of the band it will work pretty well across the whole band.

If you really want to tune the antenna even closer to your desired frequency you can add a tuning whisker. The wire elements have a male banana plug that goes at the end closest to the feed point. The opposite end has a female banana socket. This socket is used to link to another wire segment. You can make a simple tunig wire by soldering a male banana plug onto about one foot of antenna wire. Plug the short tuning wire at the end of the antenna and snip off an inch at a time until the antenna is perfectly tuned.



The inverted vee configuration is also very good for a multi-band 20/40 antenna. In the diagram above, you can see how putting two standard 20m quarter wave elements on each side and connecting the dipole links between them wil make it easy to swtich between a full size 20m or 40m inverted vee.

Half Wave Dipole



The half wave dipole is the most common antenna found in ham radio and certainly the reference against which just about all other antennas are measured against. A dipole must be suspended at either end. This means you must find two strong anchor points. In addition to being a rather large antenna compared to other configurations, dipoles are not as popular in the field as other configurations. The PackTenna certainly can be deployed in a dipole configuration using the balun feed point and wire elements. Two PackTenna 30' fiberglass masts could be used to support a dipole as high up as about 22 feet. Beyond that point, the mast is too thin to provide enough support. The mast must be guyed very close to the point where the dipole connects to the guy ring to avoid bending the mast.

We recommend that if you want to use the PackTenna in a dipole configuration you use a very rigid anchor point for the ends of the dipole such as a tree or building.