An Antenna Configuration For Portable NVIS Operation

by Charles Preston KL7OA 3-6-09 Version 1.1
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I've been experimenting with a center fed dipole approximately 100' long with an antenna coupler for portable NVIS operation. Several of the important factors for my use are: good radiation efficiency for use with low power under very low sunspot conditions; speed of deployment on almost any surface from snow to pavement in completely open, brushy or forested environments; fast multiple frequency operation; no manual tuning in the field; compact size when packed; and weight less than 20 pounds including the transceiver.

The most successful arrangement I've tried uses the Buddipole tripod [1] and telescoping 16' mast for a center support, with staked legs[2] instead of guys, and two 16' $10 telescoping fiberglass Crappie fishing rods (a suggestion from Budd, W3FF). The fishing rod end supports mean that a fairly efficient 160, 80, and 40 meter antenna can be deployed by one person in about 10 minutes. The center is about 19' high, with the ends about 12' unless trees are available. Although this height is lower than the NVIS ideal height over ground with medium or high conductivity, with low to very low conductivity ground the performance difference is probably less. At the same time, the modeling and measurements I've seen indicate that antenna height lower than this would almost always produce lower NVIS signal strength. In many locations this height and type of antenna isn't readily noticed.

The fishing rods are very versatile. They can be put over a branch in 30 seconds, where they act as a counterweight for tension on the dipole. They can be propped against a bush, taped to any upright support like a fence post, stuck in a one foot deep 1" hole, or cable-tied to another tripod, where they supply tension and help keep the wire from breaking.

In portable operations the antenna configuration and nearby objects will change the tuning with each antenna deployment. Also, I want to preserve the opportunity to have low VSWR at the antenna on almost any frequency from 1.8 MHz to 10 MHz, as well as higher frequencies. I'm using an SG-237 Smartuner. The primary mode of operation is digital for low-power efficiency, with the capability for CW and SSB.

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[1] Initially I assumed that the tripod would fail under any wind load or other load, but staking the legs was attractive due to greater deployment speed, especially for one person. I used this method in different conditions, and compared it to guying the same tripod and mast. I found that the 16’ mast and tripod could withstand snow and wind that bent the mast like a fishing rod, with no apparent damage.

[2] Long plastic T-section tent stakes work well in normal and soft ground, and cable ties or tape can be used to bind them to the tripod legs after driving the stakes in. In frozen ground, MSR Ground Hog Stakes can be used. These aluminum T-section stakes can be driven without breaking about 2 out of 3 times without making a hole first. An easier way is to get a long cold chisel at a surveyor supply store and make most of the hole first.

Here are the positive and negative points I can think of regarding an antenna coupler/tuner at the antenna terminals. Use of the Buddipole aluminum mast as the center support for a dipole with equal sides and a balun equivalent (the tuner) should not adversely affect antenna operation to any extent, compared with using a nonconductive mast. The tuner can be fastened to a nonconductive standoff like a plastic food container or a couple feet of PVC pipe at the top of the mast.

Positive points for this approach

- Simplicity for the operator - compared with adjusting and cut and try in the field
- Very fast setup for multiple frequencies - less than 5 minutes initial tuning
- Lower coax loss due to low VSWR at the antenna end
- Limited coupler loss of around 10-20% for 100' dipole at 80 & 40 meters, which is much lower than a broadband resistance-terminated antenna for 160-80-40 meters
- Very fast frequency changes. Matches in less than 1 second after initial tuning
- Good chance of a usable match at any frequency in 10-20 seconds
- Immediately adaptable to a wide range of antenna configurations if necessary - loop, long wire, vertical
- 40 watt continuous power rating matches most highly portable amateur transceivers

Negative points for this approach

- Expensive compared to single wire or fan dipole
- Complexity means higher failure rate than passive matching
- Extra power drain may be significant in battery powered operations [3]
- Can't be used to match frequencies for receiving without transmitting
- Higher weight and size than wire dipoles trimmed to frequency [4]
- Adds wind load and weight to the top of a center support mast, although ladder line can be used from a low-mounted tuner to the top of the mast
- Probably would not survive strong EMP (no data either way)
- SG-237 often cannot be tuned by a Yaesu FT-817ND, since approximately 5 watts is required for tuning, and the higher SWR during tuning causes the FT-817ND to reduce its maximum 5 watt output power.

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[3] The SG-237 uses 0.3 A continuously during operation.
SGC makes a 20 watt (continuous) coupler with AA battery life of years, now out of production.
Elecraft has a T1 autotuner with a 20 watt limit with latching relays and long internal battery life.

[4] Buddipole counterpoise wire (#20 stranded, Teflon insulated) on spools or kite winders works well for a dipole. With care in rigging (low tension,light bungee cord on the ends) the antenna lasts for weeks, even with wind, ice and snow. Stranded, insulated steel core copper wire can be used for higher strength. Wireman #532 works well. It is lightweight and the high density polyethylene insulation slides through foliage without much resistance. The insulation on these wires will work without breaking in very cold weather.