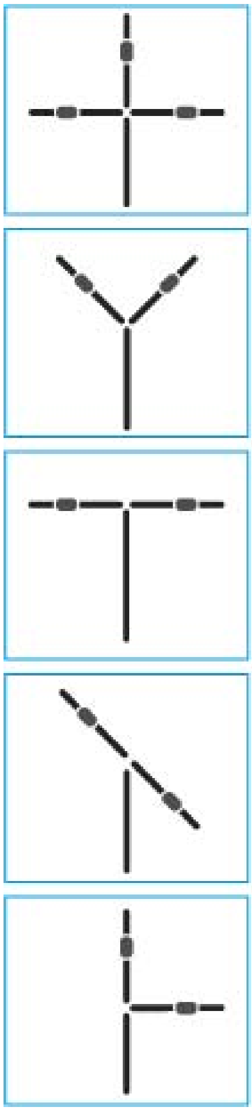
Effective use of Buddipole™ Configurations*



BUDDIPOLE ANTENNAS

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* Note: This report has been condensed and revised by Mr. Michael Babineau – VE3WMB – based on the earlier modeling work on the Buddipole by Mr. L.B. Cebik.

BUDDIPOLE™ CONFIGURATIONS

Introduction

Using the accessory *Rotating Arm Kit* the Buddipole™ may be erected in a number of different configurations, the most useful being the Horizontal Dipole, Vertical dipole, L and Upward Vee antennas. The purpose of this document is to assist the Buddipole™ user in making decisions on the usage of these different configurations, depending on the antenna support height, the chosen band of operation and the operating objectives (working DX, domestic contacts or short range NVIS contacts).

For low height antenna applications antenna elevation angle (sometimes referred to as take-off angle) is often a more important factor than gain in determining success in DX communication. Under the right propagation conditions lower angle signals will propagate further as the resulting skip distance of the reflected signal is greater. The reader should note that take-off angles of less than 30 degrees are preferred for DX. For most of the Buddipole™ configurations there is significant radiation at these low angles even when the maximum gain of the antenna is at a much higher radiation angle, thus it is possible that a user may make distant contacts even though the selected Buddipole™ configuration may not be optimal for working DX on the chosen band.

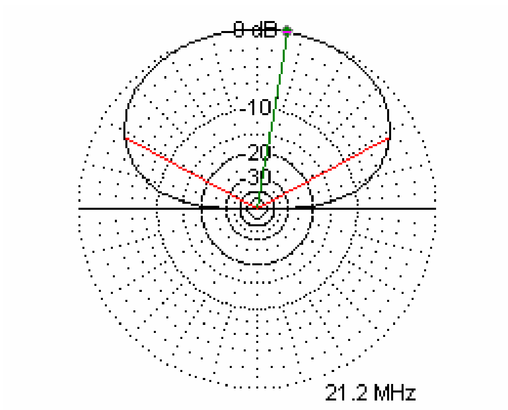
The antenna radiation plots used in this document show the vertical plane radiation pattern of the antennas as viewed broadside. For example, in the plots for a horizontal dipole the antenna itself would extend horizontally across the page. The solid horizontal line represents the earth and the plotted values are normalized so that the maximum value, represented as zero db, coincides with the outer edge of the chart. Note that true antenna gain is not shown. Refer to the ARRL Antenna Book for a more in depth explanation of Antenna Radiation pattern plots.

The following sections provide an overview of each Buddipole™ configuration at typical field and temporary home installation heights of 10ft and 25ft for the antenna center. Tables 1 and 2 in the appendix provide a tabular summary of this information that can be referred to when making Buddipole™ configuration decisions.

Horizontal Dipole

The most used configuration for the Buddipole™ is the Horizontal Dipole. The horizontal dipole, however, is most effective when its height above ground is at least 3/8 of a wavelength. This height is likely impractical in field use except from 12 through 6 meters.

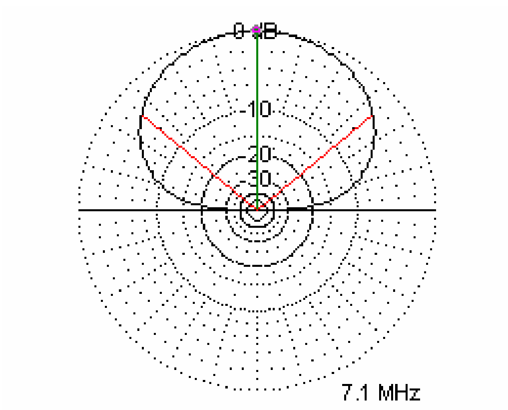
On 15 through 20 meters, the higher angles of radiation will often limit communications to domestic contacts within the first-skip region. The distance will vary according to the frequency and the propagation conditions.



Radiation Pattern of a Horizontal Buddipole™ on 21.2 MHz with a center height 10 feet and a resulting take-off angle of 80 degrees.

This antenna configuration is best suited for medium range Domestic contacts.

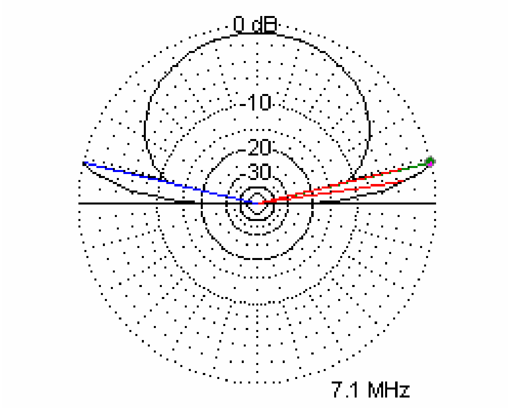
On 30 and 40 meters, the antenna at a field height of 10 feet is likely to function mostly as an NVIS (Near Vertical Incidence Sky wave) antenna with effective propagation up to about 300 miles.



Radiation Pattern of a Horizontal Buddipole™ on 7.1MHz with a center height 10 feet and a resulting take-off angle of 90 degrees.

This antenna configuration is best suited for short-range NVIS contacts.

The user can take advantage of hilltop locations to significantly improve the DX potential of the Buddipole™ in a horizontal dipole configuration. Note the resulting low angle lobes in the pattern as compared to the same antenna over flat ground. The resulting radiation pattern is similar from 6 meters through 40 meters.



Radiation pattern of a Horizontal Buddipole™ on 7.1 MHz with a center height of 10 feet at the crest of a hill with the earth sloping away in all directions.

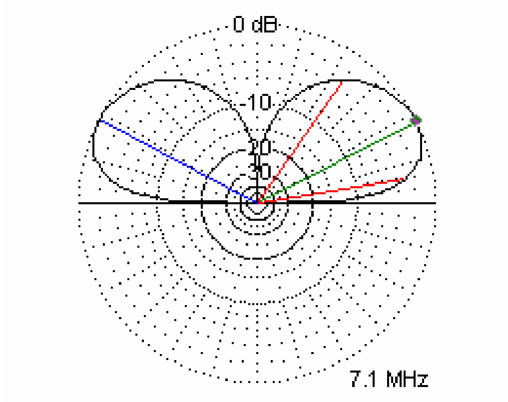
The resulting take-off angle is 13 degrees. This pattern offers excellent potential for mid-range and DX communications.

Vertical Dipole

The Vertical Dipole has less gain than its horizontal counterpart but it does provide omni-directional coverage. It has a lower angle of radiation than the horizontal dipole, for the same antenna center height, making it generally more suitable for DX contacts. Verticals tend to be more sensitive to man-made noise, however in most field settings man-made noise may not be a concern.

For effective performance the vertical dipole should be positioned such that the lower end is at least one foot above the ground. It is important that the supporting mast be non-conductive. Coupling between the lower half of the dipole and a conductive mast will degrade performance.

On 40 meters this antenna configuration offers reasonable DX performance with a take-off angle of 27 degrees for a center height of 10 feet.

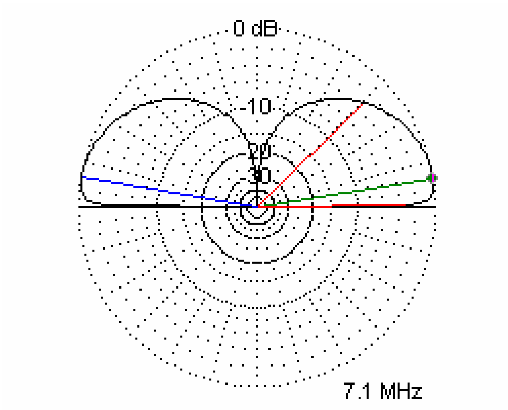


Radiation pattern of a Vertically Oriented Buddipole™ on 7.1 MHz with a center height of 10 feet.

The resulting take-off angle is 27 degrees making this configuration suitable for both DX and Domestic contacts.

At higher frequencies the user can expect similar radiation patterns with increased gain and even lower radiation angles.

In a salt-water environment, at a seaside location or on a boat, the performance of a vertical dipole is enhanced, resulting in higher gain and a lower take-off angle. The resulting radiation pattern is very similar from 6 meters through 40 meters with slightly lower radiation angles at the higher frequencies.



Radiation pattern of a Vertically Oriented Buddipole™ on 7.1 MHz with a center height of 10 feet over salt water.

The resulting take-off angle is 13 degrees making this an excellent performer for DX contacts.

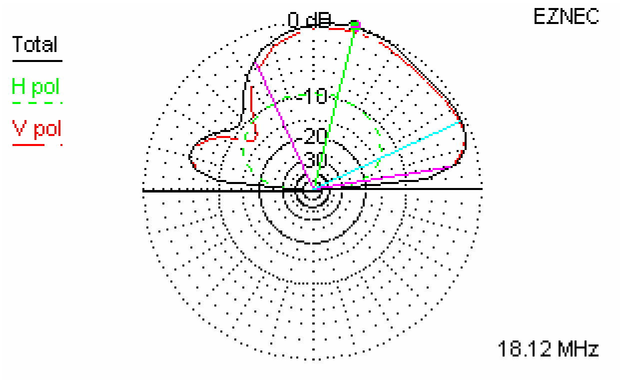
Upward Vee

The performance of the Upward Vee configuration is very similar to that of the Horizontal Dipole except that it has lower impedance, which under some circumstances may provide a closer match to 50 ohms. The performance of this configuration is very similar to the horizontal dipole. Because of these similarities this configuration is not discussed in detail here. The user should refer to the information on the Horizontal Dipole when considering use of the Upward Vee Buddipole™ configuration.

L Antenna

The L antenna configuration for the Buddipole™ is a good compromise between the horizontal dipole and the vertical dipole in that it exhibits both low angle vertical radiation and higher angle horizontally polarized radiation, making the antenna suitable for medium range domestic contacts as well as some DX work. This combination of vertical and horizontal polarization may make this particular antenna configuration less susceptible to signal fading (i.e. QSB) which often results from a shift in polarization in a signal as it is reflected by the ionosphere.

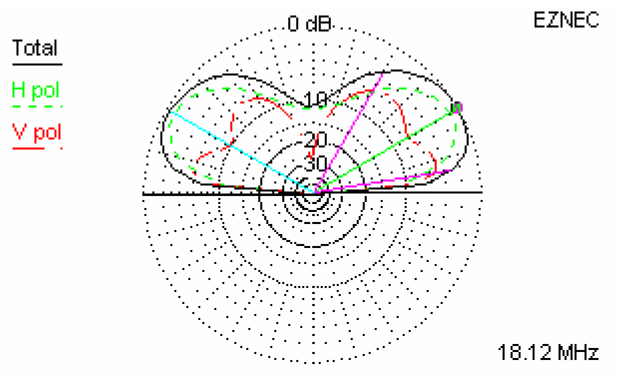
At a 10-foot center height this antenna configuration begins to show some directivity in the direction of the horizontal arm for frequencies of 18 MHz and below.



Radiation pattern of an L oriented Buddipole™ on 18.12 MHz with a center height of 10 feet.

The resulting take-off angle is 75 degrees making this antenna best suited for medium range domestic contacts. Note that the major radiation lobe is in the direction of the horizontal arm.

With a center height of 25 feet the radiation pattern is omni-directional with reasonably low angles of radiation, except for 7Mhz where the directivity starts to become noticeable. Note how significant the change in radiation pattern is resulting from an increase in center height of only 15 feet.



Radiation pattern of an L configuration Buddipole™ on 18.12 MHz with a center height of 25 feet.

The resulting take-off angle is 30 degrees making this a reasonable performer for DX contacts.

Summary

For the Buddipole ™ configurations discussed, generally raising the antenna center will result in better antenna performance with higher gain and lower radiation angles. However this improved performance must be weighed against the practicality of mounting the Buddipole™ at an increased height. This is especially true for field or pedestrian mobile use where the use of guys or a heavier antenna support may not be practical. Instead it may be more useful to consider using a different antenna configuration at the same height to help achieve a similar operating objective (i.e. Domestic contacts, or DX). Note that in the case of NVIS, low antenna height with horizontal polarization is desirable.

Nearby conductive objects and the conductivity of the underlying soil impacts the performance and impedance of an antenna system. The Buddipole™ is not exempt from this rule. The impedance will also vary considerably as a function of the antennas orientation with respect to the earth. Because of these factors it is recommended that the user refer to the Buddipole™ antenna manual as a starting point for tuning the Buddipole™ in these different configurations, with a realization that some tweaking may be necessary to achieve a good match. The use of an antenna analyzer is recommended.

APPENDICES

How to use the following tables

The following two tables summarize Buddipole™ performance at typical field and temporary home installation heights of 10ft and 25ft for the antenna center.

To use these tables:

- Choose the table that most closely matches your mast height. Table 1 is for an antenna center height of 10 feet and Table 2 is for a height of 25 feet.
- Pick the table row that represents the chosen band of operation.
- Look across the selected row to view performance data for each of the antenna configurations.

Interpreting the table data

The sub-columns titled "**Best Suited for",** under each antenna configuration, summarizes the operating objective that the Buddipole™ is most closely suited for on the chosen band, as follows:

- **NVIS** – Near Vertical Incidence Sky wave propagation. This is a short-range propagation mode utilizing very high radiation angles and it can be very effective on 10.1 MHz and frequencies below for distances ranging from 0 to 300 miles.
- **Med –** Medium Range Domestic contacts utilizing single hop propagation with moderate radiation angles. Distances will vary according to band and propagation.
- **DX –** Long Distance contacts, possibly intercontinental via single or multi-hops. Distances will vary according to band and propagation.

Note that the values in this column reflect overall antenna radiation pattern and not just the angle at which the greatest antenna gain is realized.

TO Angle - Take-Off angle or elevation angle. This is the angle of maximum signal radiation as measured up from the horizon. Most amateur communication utilizes angles between 10 and 60 degrees. Angles of 30 degrees and less are preferred for DX communications and angles between 30 degrees and 60 degrees are most suitable for Domestic contacts. NVIS contacts utilize radiation angles in the 60 to 90 degree range.

TABLE 1: BUDDIPOLE ™ WITH A CENTER HEIGHT OF 10 FEET*T

	Horizontal Dipole		Vertical Dipole		Upward Vee		L Antenna	
Band	**Best suited for**	**TO angle (deg)**	**Best suited for**	**TO angle (deg)**	**Best suited for**	**TO angle (deg)**	**Best suited for**	**TO angle (deg)**
40M	NVIS	90	DX	27	**	**	Med/DX	30
30M	NVIS	88	DX	27	**	**	Med/Dx	30
20M	Med	90	DX	25	**	**	Med	80
17M	Med	87	DX	23	**	**	Med	75
15M	Med	80	DX	22	**	**	Med/DX	30
12M	Med	60	DX	20	**	**	Med	60
10M	Med	50	DX	18	Med	40	Med	50
6M	DX	27	DX/Med	13	DX	24	DX/Med	26

TABLE 2: BUDDIPOLE ™ WITH A CENTER HEIGHT OF 25 FEET*

	Horizontal Dipole		Vertical Dipole		Upward Vee		L Antenna	
Band	**Best suited for**	**TO angle (deg)**	**Best suited for**	**TO angle (deg)**	**Best suited for**	**TO angle (deg)**	**Best suited for**	**TO angle (deg)**
40M	NVIS	88	DX	22	**	**	NVIS/Med	80
30M	Med	56	DX	19	**	**	Med	55
20M	Med	39	DX	16	**	**	Med	40
17M	Med/DX	30	DX	14	**	**	Med/Dx	30
15M	DX/Med	22	DX	13	**	**	DX/Med	25
12M	DX/Med	22	DX	13	**	**	DX	20
10M	DX/Med	19	DX	18	DX	18	DX	18
6M	DX/Med	11	DX	8	DX/Med	10	DX	10

* Above normal terrain with average soil conductivity.

** Very similar to Horizontal Dipole configuration.