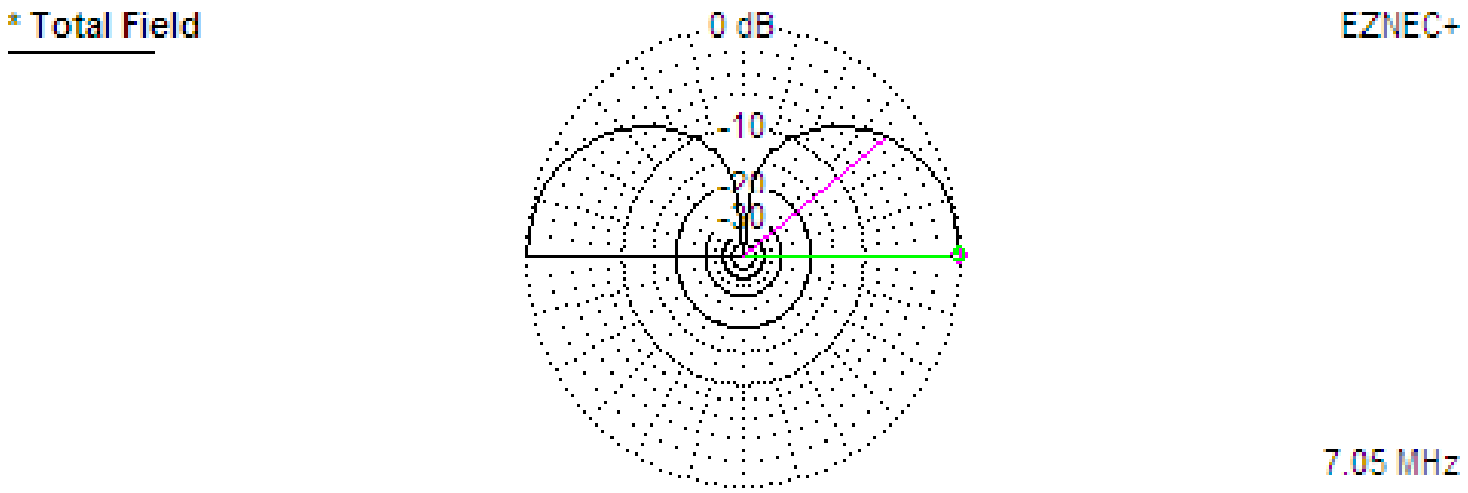
Vertical Antenna Myths

How do Vertical Antennas really work ?

What are your beliefs.

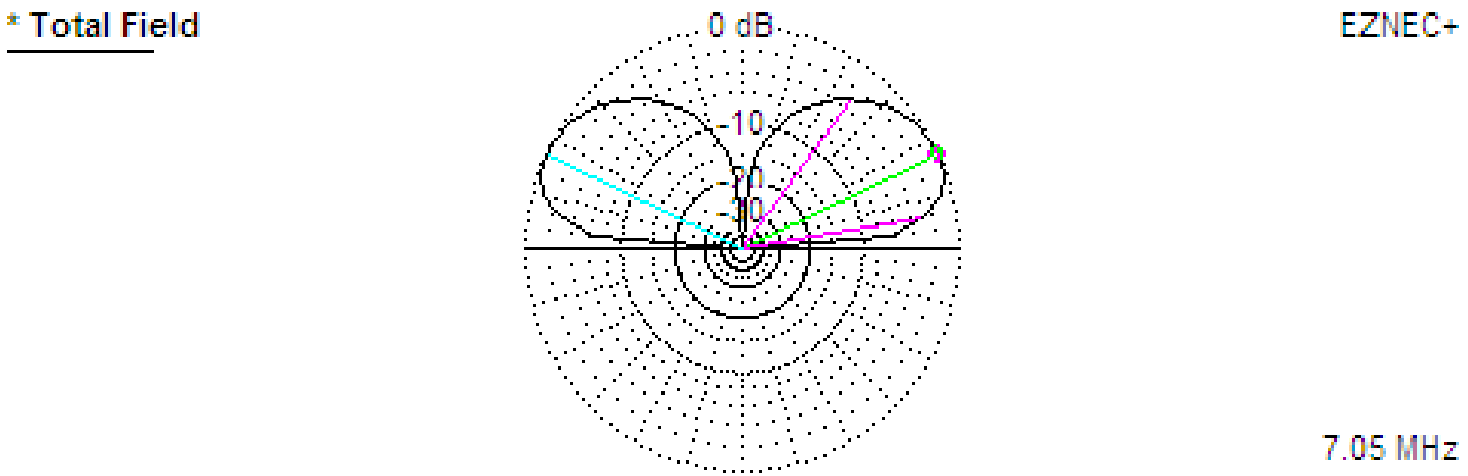
- Vertical Antennas are good DX antennas.
- Vertical Antennas with a 1:1 VSWR when fed with 50 Ohm coax are efficient.
- Vertical Antennas need very small spaces for efficient installation.
- Conclusions.

Are Verticals good DX Antennas?



Classic Book antenna Vertical Antenna pattern

Vertical Antenna In Real World



Note: Take off angle

Don’t be mislead

- The Antenna texts normally show the antenna pattern over a perfect ground. The closest approximation of a perfect ground is sea water.
- The higher take off angle is due to the ground loses of a vertically polarized wave at the distance of the first reflection of the signal from the ground (the frenel zone)

Antenna Feed Point Impedance

EZNEC+ ver. 4.0

Vertical over real ground 10/6/2006 2:49:11 PM

---------- SOURCE DATA ----------

Frequency = 7 MHz

Source 1 Voltage = 36.48 V. at 2.96 deg.
Current = 1 A. at 0.0 deg.
Impedance = 36.43 + J 1.886 ohms
Power = 36.43 watts
SWR (50 ohm system) = 1.377 (75 ohm system) = 2.060

Feedpoint Impedance

- The feed point impedance of a 1/4 wave vertical over real ground is 37 Ohms.

- If the feed point impedance as seen in a real world installation is 50 Ohms the missing 13 ohms must be made up of losses in the antenna system.

Antenna Efficiency

- This means that if 5 watts from a transmitter is fed to the antenna that 3.7 watts will be radiated and 1.3 watts will be lost in the antenna and ground resistance losses.
- This calculates to loss of 26 %. Only 74% of the transmitter power will be radiated.

Antennas Shorter Than 1/4 Wave

EZNEC+ ver. 4.0

Vertical over real ground 10/6/2006 1:55:58 PM

---------- SOURCE DATA ----------

Frequency = 7 MHz

Source 1 Voltage = 14.53 V. at -24.66 deg.
Current = 1 A. at 0.0 deg.
Impedance = 13.21 - J 6.062 ohms
Power = 13.21 watts
SWR (50 ohm system) = 3.846 (75 ohm system) = 5.717

What about antennas shorter then a physical 1/4 wave

- For a antenna length of 1/8 wave which is the approximate length of many of the commercial multiband trap verticals the feed point impedance becomes 13.21 Ohms.
- If the antenna has a 1:1 VSWR the missing 36.79 ohms must be made up of ground losses and resistive losses in the traps or loading coils.

1/8 wave vertical efficiency

- This implies that with 5 watts from the transmitter that 1.321 watts will be radiated and 3.679 watts will be lost in the resistive losses of the antenna or 26.42 % of the applied transmitter power will be radiated.

How is this corrected?

- One way is to reduce the ground losses by elevating the antenna and using a counterpoise or if the antenna is ground mounted add radials to the under the antenna. The more and longer the better. They do not have to be resonate because the coupling to the ground will detune them anyway.

- The smallest effective number and size of radial is 20 with a length of 0.2 wavelengths at the lowest frequency of use for the antenna.
- There are limits to how far you can take this; however it doesn’t take very much to make a significant efficiency difference.
- This will lower the ground losses however the impedance will be 36 Ohms at the feed point. (A matching method will be required)

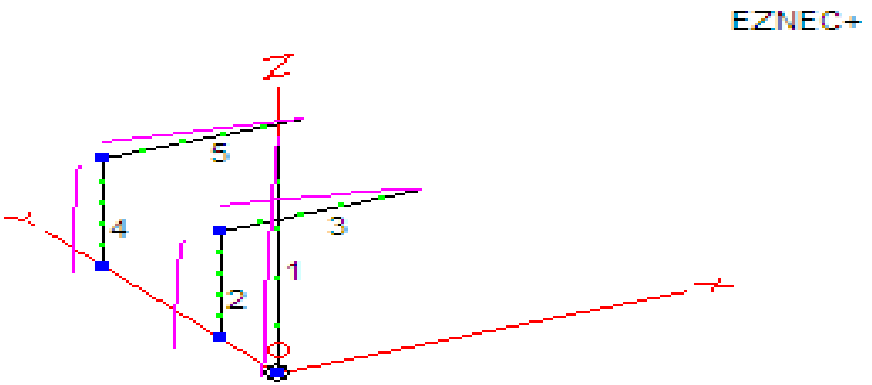
Other Loss Considerations

- The next thing that must be done is to decrease the losses in the traps or loading coils.
- Finally make sure that there are minimal losses in the matching network.

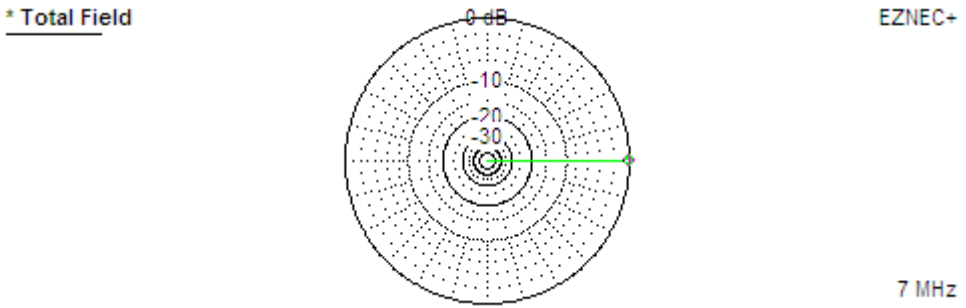
Verticals need very small space for installation.

- We have already seen that for 40 meters that the area required for the radials for an efficient antenna is a circle with a diameter of 54 feet.
- Next we will look at some of the effects of placing the antenna near a house or other building.

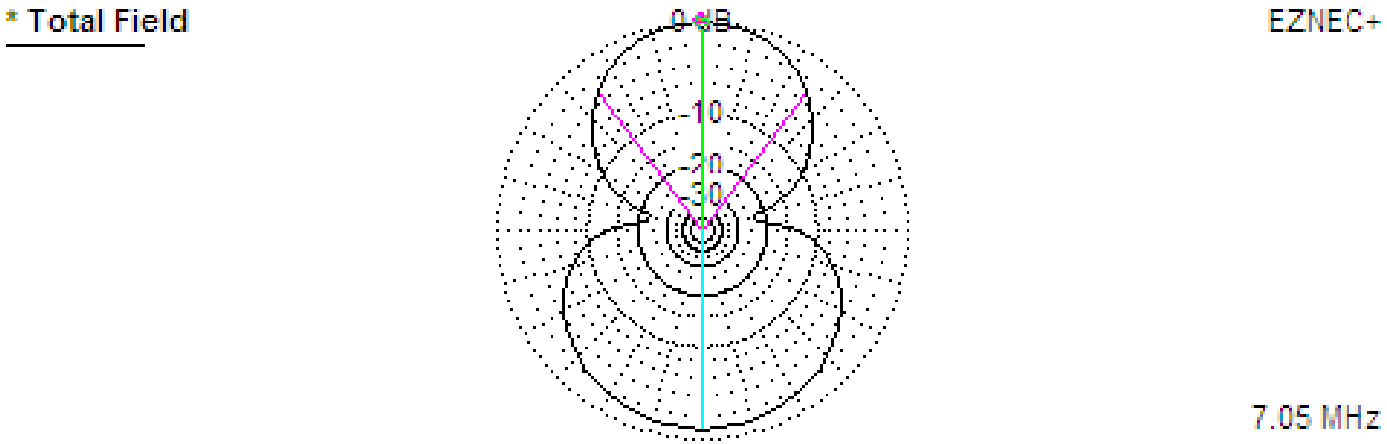
House gutters Added



Azimuth Pattern with nothing near the antenna.



Effect on radiation pattern.



Conclusions

- Vertical antenna require much more space the most people assume.
- Careful installation can optimize vertical antenna performance if you are aware of the true requirements of vertical antennas.
- Will verticals work without taking these things into account.

- Verticals do work. If you cannot take these things into account when installing them they will still work but will not be very efficient.
- Do the best that you can but understand the trade off.
- Always remember a poor antenna is better than no antenna.