Shakespeare VHF Style-5215 - 36' 3db

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Surrey Amateur Radio Club

Why is a 5/8-wavelength vertical antenna better than a 1/4-wavelength

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Back to Basics

This 'Back to Basics' may be of particular interests to you off-roaders...

The Canadian Basic Question Banks asks:

B-006-10-4 Why is a 5/8-wavelength vertical antenna better than a 1/4-wavelength vertical antenna for VHF or UHF mobile operations?

A. A 5/8-wavelength antenna has less corona loss
B. A 5/8-wavelength antenna has more gain
C. 5/8-wavelength antenna is easier to install on a car
D. A 5/8-wavelength antenna can handle more power

An ordinary 1/4 ? (wavelength) vertical is smaller and resonant without any loading coil or matching network. What's the advantage to a 5/8 wavelength vertical? Why 5/8 in particular, and not something longer or shorter?

Indeed, why? A 5/8? isn't resonant where a 1/4? or 1/2? would be.

The reason is the radiation pattern. The pattern for a 1/4? monopole is essentially a doughnut, a pretty good pattern especially for a VHF antenna used primarily for local work. Extending the antenna changes the current distribution. This flattens out the pattern, removing power from the useless (for VHF purposes) vertical dimension and giving more horizontal gain and at a lower angle. See the illustration lower left from the late L. Cebik. The 5/8? antenna focuses energy somewhat better towards the horizon (lower radiation angle) than a regular quarter-wave antenna.

Depending on the source, they will quote anywhere from 1 dB to 3 dB gain over the 1/2? design [3dB is a doubling!]. There has also been some discussion that in some areas (urban and mountainous terrain) the lower angle of radiation is a detriment and a standard 1/4? or 1/2? antenna is to be favoured.

So, why 5/8?? Why not long longer? After all more gain is better right? Well, inspecting the figure below, you will notice the appearance of high angle lobes. As you lengthen the antenna past 5/8? these lobes become more pronounced and break up the pattern in undesirable ways. Making it shorter maintains a good pattern, but the gain is less. So, 5/8? is about optimal for this style of antenna.

You may have noticed a pattern developing here. A quarter wave ground plane antenna has a radiation pattern that produces maximum gain at about 25 degrees and a half wave antenna drops that angle to 20 degrees, and the 5/8 wave antenna further drops that angle to 16 degrees. So why not just keep extending the antenna out to one full wave? Well it would be nice if it worked but unfortunately the wave pattern begins to create very high angles of radiation beyond 5/8?.

So we've reached the maximum gain at this point and extending the antenna any further just reduces the gain where we want it (low angles). Of course if you are interested in very short skip, extending the antenna will produce nice gains over a dipole.
All antenna lengths depend on various factors. Some of these factors are:

§ the height above ground;

§ the diameter of the wire;

§ nearby structures;

§ the effects of other antennas in the area; and

§ even the conductivity of the soil.

If we calculate the length of a 5/8? antenna for our SARC repeater (147.360 MHz) the formula is 178.308/147.36 which equals 1.21m (3.97 feet).

The answer to our question therefore is 2. A 5/8-wavelength antenna has more gain.

Our next Basic Course starts September 15th.

~ John VE7TI
08-03

Shakespeare Ant: Antennas

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View Enlarged Image

Mfg Part # 5215

Availability:
In Stock

Condition:
New

List Price:
$79.95 USD

Your Price:
$43.18 USD

Or

Shakespeare Vhf 3ft 5215 3db

DESCRIPTION

QUICK SPECS

Shakespeare Style 5215 SQUATTY BODY® VHF Marine
36" LENGTH, 3dB

END-FED 1/2-WAVE STAINLESS STEEL WHIP

A favorite with Sailboat owners, this lightweight, low profile, stainless steel antenna is specially designed for masthead mounting.

Hermetically sealed, tin-plated copper wire coil
Stainless steel body and whip
SO-239 connector - cable sold separately
Mount: Stainless steel "L" bracket supplied, for mast mounting
One section
Shakespeare Limited Warranty: 2 years

technical Specifications:

Frequency:
VHF Marine band
Bandwidth:
7 MHz
SWR:
1.5:1 @ 156.8 MHz
Impedance:
(Ohms): 50
Gain:
3 dB
Max Input (Watts):
50
DC Ground:
NO
Termination:
SO-239 connector
Height (feet):
3
Polarization:
Vertical
Radiation pattern:
Omni-directional