

How many radials do I need for a vertical antenna?

This document covers the topic of ground mounted radials and how to maximise the antenna's performance through the radial bed that sits at the bottom of the antenna.

Ground Mounted Radials don't need to be tuned. They lie directly on the ground, or just under it, and there is a relationship between numbers of radials, radial length and efficiency.

My research is based on both real-world experience, rather than scientific based measurements. However we are very fortunate to be able to rely on Ruby Severns, N6LF (see bottom of document for link) who documented the effect of varying radiator lengths and radials numbers and lengths.

His research seems to mirror my own personal real-world experience. In the past, I used to build ground mounted verticals with between 8 and 16 $\frac{1}{4}$ wavelength radials. I never found much difference between them other than getting a very slight difference in impedance matching. In the main, my SWR has always been better than 1.3:1 SWR, normally better.

The graph on the right is from Ruby's document. Refer to the second solid line up from the bottom, this is for a $\frac{1}{4}$ wave radiator, and compares the change in signal improvement between zero (just the coax feed) and 64 radials.

You'll note that the signal improvement between 10 and 30 radials is less around 0.5 dB, possibly not noticeable. Bearing in mind that 1 S point on your radio is 6 dB, even going from 10 to 64 radials would only still only achieve less than 1 dB increase in signal strength. Noticeable?

Rudy also experimented with lengths of radials. In one experiment, he swapped out a number of $\frac{1}{4}$ wavelength radials for half-sized version (17 ft) radials. He says in his paper, "*.. comparing sixteen $\frac{1}{4}$ λ (33 ft) radials versus thirty two $\frac{1}{8}$ λ (17 ft) radials. In line with the modelling and also calculations, the signal strengths were almost the same*".

To conclude therefore, once you install 15 or so radials, you're not going to achieve any noticeable difference by increasing the radial bed. In my case, I run 30 "half" sized radials for 40m. This gives me genuine $\frac{1}{4}$ wavelength radials on 20m - and even longer for those frequencies above that. I achieve remarkable results, ideally suited to running a nested multiple $\frac{1}{4}$ wavelength element vertical.

Refer also to Rudy's document at

<http://www.astrosurf.com/luxorion/Radio/qex-ground-systems-part-4.pdf>

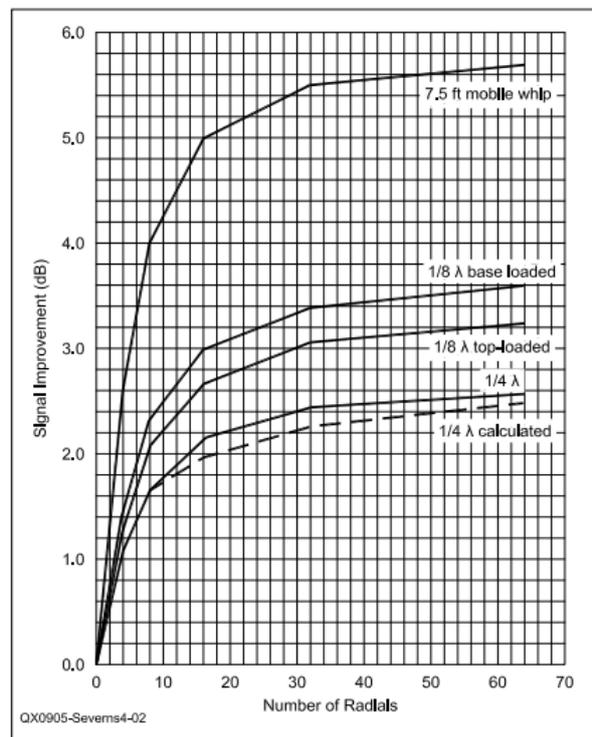


Figure 2 — Typical improvement in signal as $\frac{1}{4}$ λ radials are added to the basic ground system (a single ground stake).