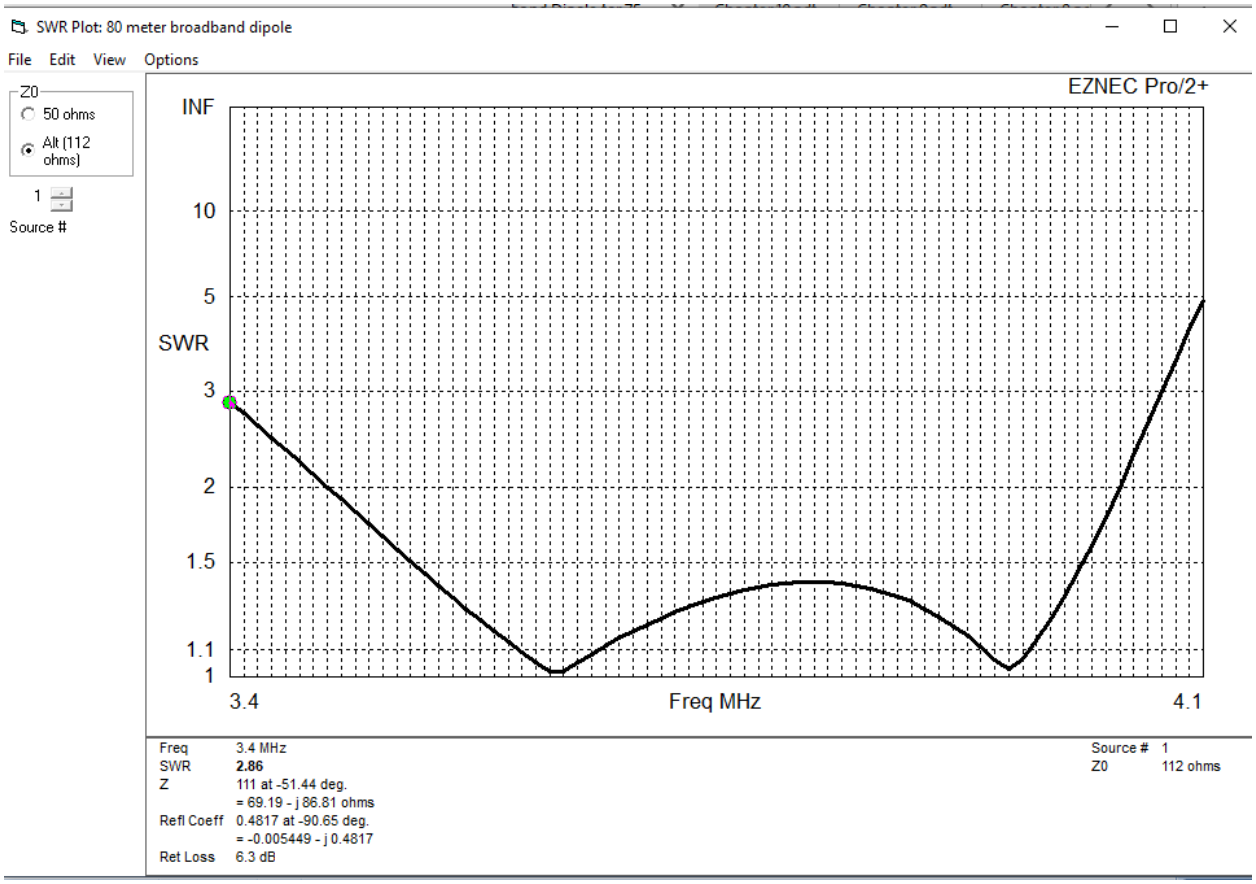
Wideband Coupled Resonator Dipoles and Verticals compared to Dipoles and Inverted Vees with Integrated Step Tuning

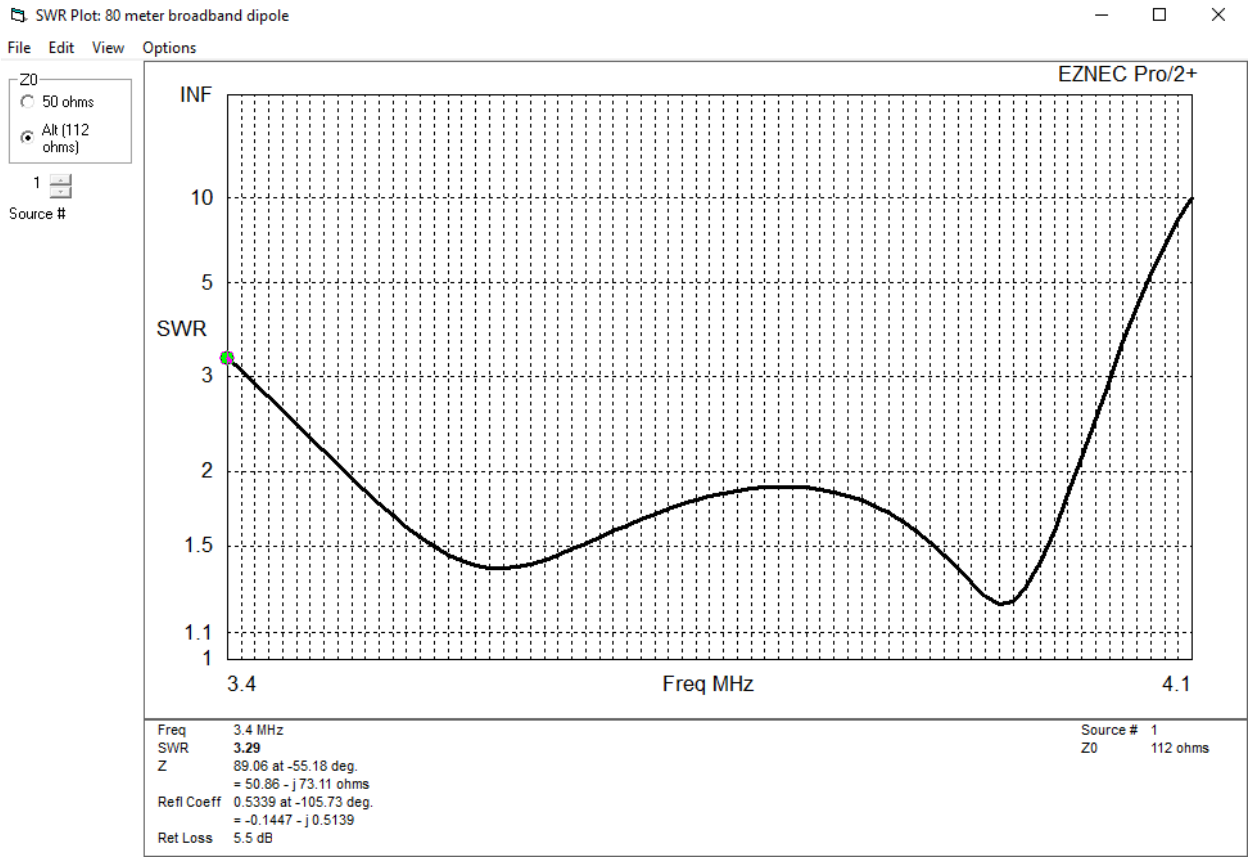
QST of March, 2013 contains an article “A Wideband Dipole for 75 and 80 Meters” by Ted Armstrong, WA6RNC. This dipole covers the entire 3.5 to 4.0 MHz band with an SWR of less than about 1.5. This approach uses a technique called a Coupled Resonator which was developed by K9AY, and in this case uses 2 parallel wires for the antenna with one resonant near the bottom of the 80 meters band and one resonant near the top of the band. Only the element resonant near the bottom of the band is driven, and the other element is spaced by 15 inches. The longer element has a length of 134 feet and the shorter element has a length of 118 feet. The antenna height is set at 70 feet or about ¼ wavelength. The drive impedance is set to 112 Ohms which can be matched to 50 Ohms either with a ¼ wave 75 Ohm transmission line transformer or with an RF toroid based transformer.

Using EZNEC, these results are readily duplicated. Here is a plot of the SWR

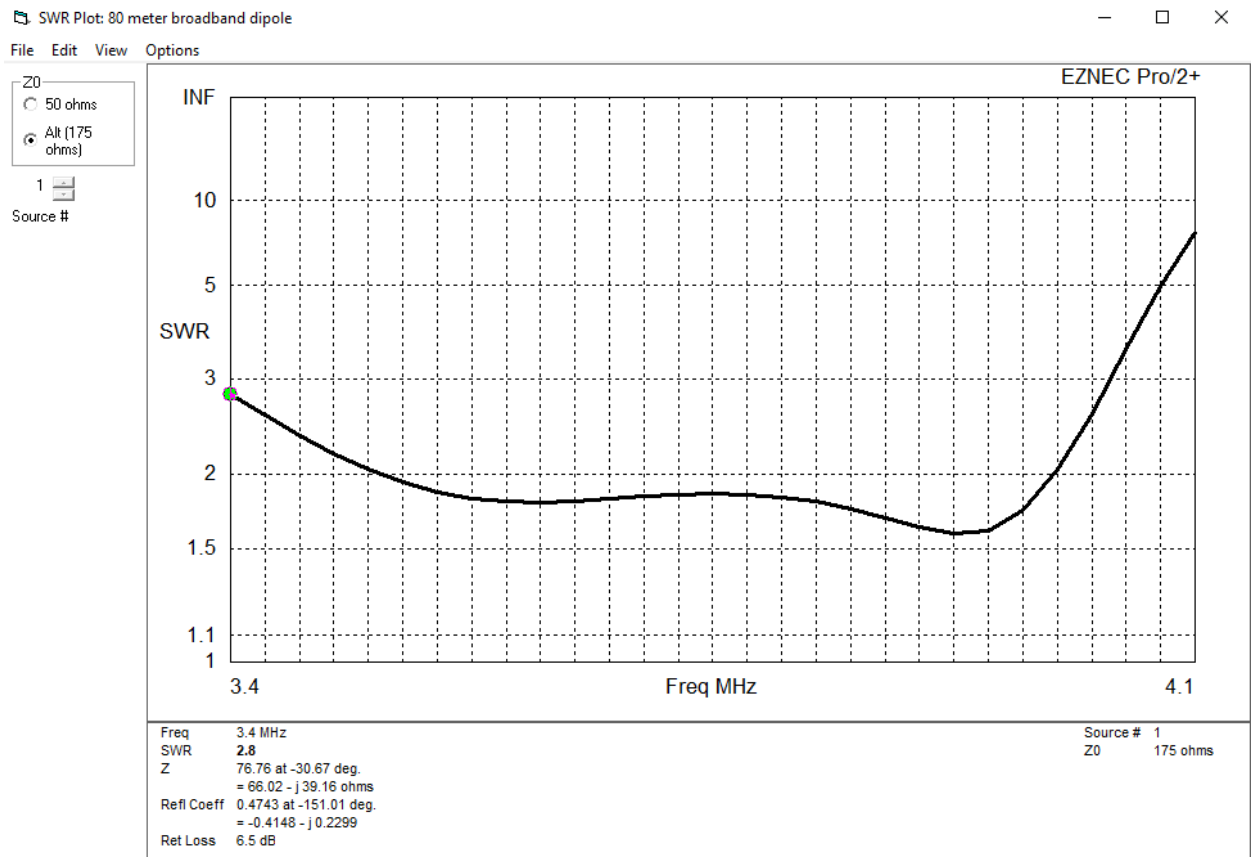


The article indicates that the SWR will rise to about 2 to 1 if the antenna height is reduced to 40 feet. What happens also in the case of an inverted vee arrangement with a center height of about 40 feet and ends at about 20 feet on 80 meters. The dipole at 70 feet requires 2 moderately tall supports, but an

inverted vee at 40 feet requires only 1 fairly short support. Of course the lower antenna is a bit less effective at lower angles of elevation for DX.



By increasing the short element by ½ foot on each side, it is possible to achieve 1.8 SWR or less across the band as shown in the Figure for an antenna dipole height of only 40 feet and with an antenna impedance of 112 Ohms, however, this indicates that lower height reduces the effectiveness of the broadbanding, at least somewhat.



With an inverted vee at 40 feet in the center and the 4 ends at 20 feet, the results are shown in the above Figure for a matching impedance of 175 Ohms. The SWR varies from about 1.6 to 2.0 , with most of the band around 1.8. The longer element was placed on the top and had 68 feet length on each side and the shorter element was 15 inches below the longer element with a length of 60 feet on each side. The elements are about 1 foot longer on each side than for the dipole.

These results are fairly good, but the inverted vee arrangement and the lower height does compromise the achieved SWR from the 1.1 to 1.5 range for the dipole at 70 feet to the 1.6 to 2.0 range for the lower inverted vee. The inverted vee higher compromise impedance is probably best matched with an RF toroid transformer.

For the 80 meter inverted vee with integrated tuning with 8 steps, the SWR results run between about 1.1 to 1.5 across the band, but is does require selecting the best of 8 tuning settings.

Here are tradeoffs between these 2 approaches:

Wideband Coupled Resonant Dipole (WCRD)

Dipole with Integrated Step Tuning (DIST)

- WCRD requires 2 wires spanning the antenna length – may be more subject to wind damage
- DIST requires loading inductors & relays in a center antenna box, and remote control switching
- WCRD is fully transparent with no selection or tuning
- WCRD may be more challenging to adjust & sensitive due to the coupling between resonators
- Both WCRD and DIST generally require an impedance match to 50 Ohms
- DIST has better performance for lower height inverted vees
- DIST can be easily extended for better performance by adding a 4^{th} inductor for finer grain steps