

Compact VHF Linear Loaded Beams[©]

While working on the design of linear loaded dipoles that are smaller and fit on urban lots it became apparent that it was possible to design very compact and inexpensive VHF beams using the same ladder line approach. These designs are probably *not* suited mechanically except for the most benign environments or temporary utilization. They can however, be constructed quickly and are suited for portable operation such as field day or emergency situations.

The following beam designs below utilize linear loaded *equal physical* length elements. (*i.e.* the overall length (L) of each element is identical and the length of the cutback (LR, LDE, or LD1) is used to tune the respective element. The following definitions are for Figure 1 and the 6 and 2 Meter beams shown below.

L = all element half lengths
S1 = reflector to driven element spacing
S2 = reflector to director spacing
LR = reflector cutback length
LDE = driven element cutback length
LD1 = director element cutback length

6 meters,

L=38 inches for all element half lengths
S1 = 40.7 inches
S2 = 72 inches
 $LR = 1.68F_{MHz} - 77.8$
 $LDE = 1.7F_{MHz} - 77.44$
 $LD1 = 1.74F_{MHz} - 77.17$

2 Meters

L = 12.5 inches for all element half lengths
S1 = 16 inches
S2 = 24 inches
 $LR = 0.048F_{MHz} - 2.44$
 $LDE = 0.182F_{MHz} - 21.31$
 $LD1 = 0.161F_{MHz} - 17.15$

Substitution of the desired center frequency of the beam, the appropriate cutback lengths can be determined for each element.

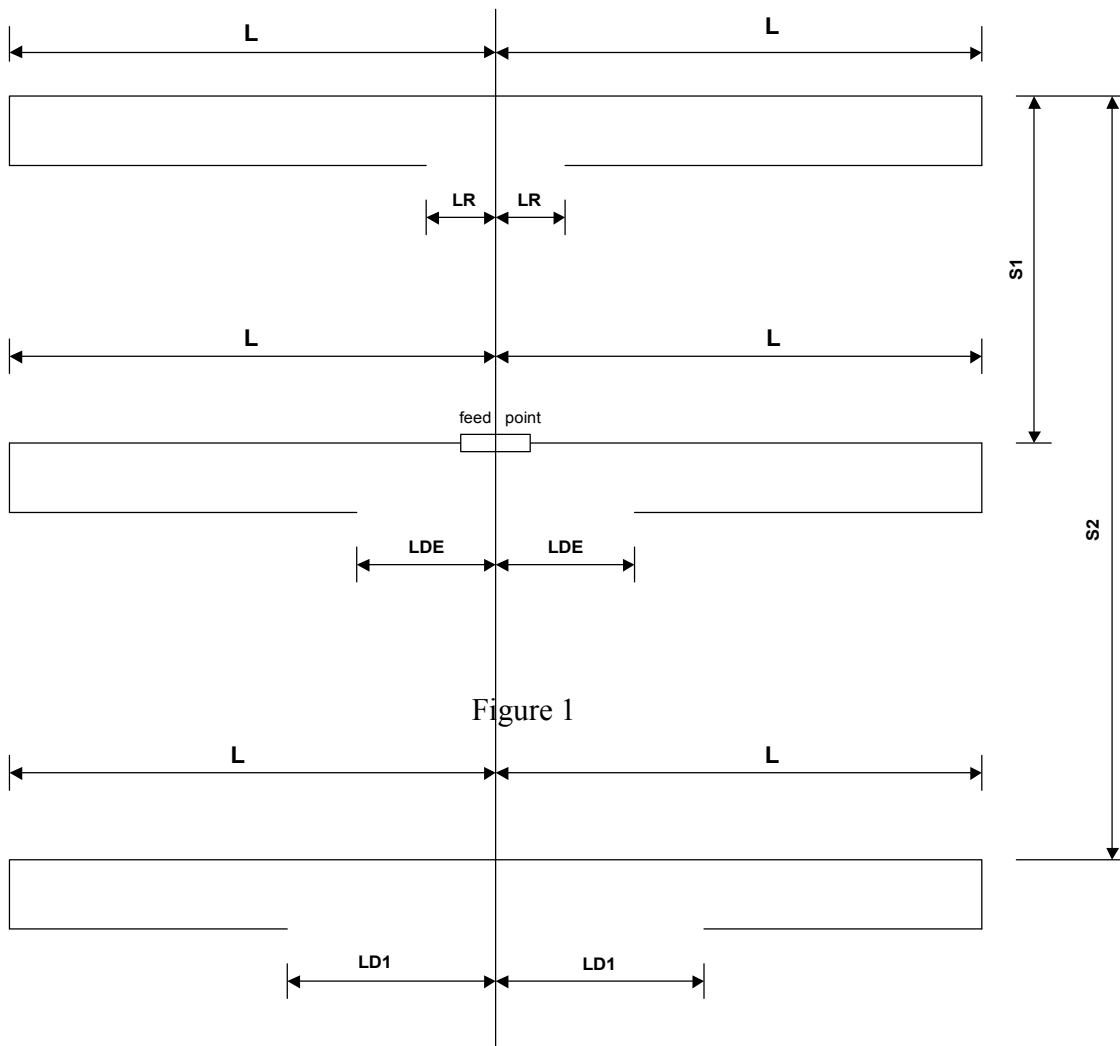


Figure 1

The design of these beams yields a feed point impedance of approximately 15 ohms. In order to transform this impedance to 50 ohms a length of 25 ohm feed line is inserted at the beam feed point. This impedance transformer can be constructed from two equal lengths of 50 ohm cable connected so as to provide a length of 25 ohm line.

At 6 meters the line should be approximately 38 inches long which will provide a good match to 50 cable.

At 2 meters, the line should be approximately 13 inches long again providing a good 50 ohm match.

The following is an example of calculations and resulting data along with predicted performance.

Frequency 146 MHz

L=12.5 inches

S1=16 inches

S2 = 24 inches

LR = $0.048 * 146 - 2.44 = 4.57$ inches

LDE = $0.182 * 146 - 23.31 = 5.26$ inches

LD1 = $0.161 * 146 - 17.15 = 6.36$ inches

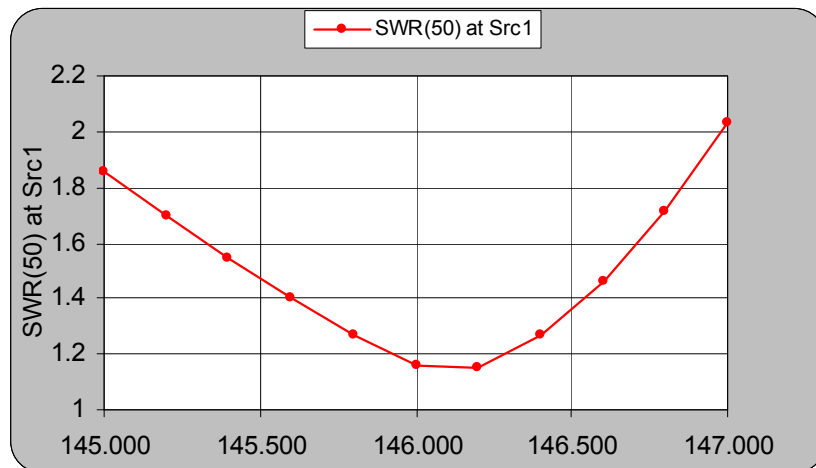


Figure 2 VSWR

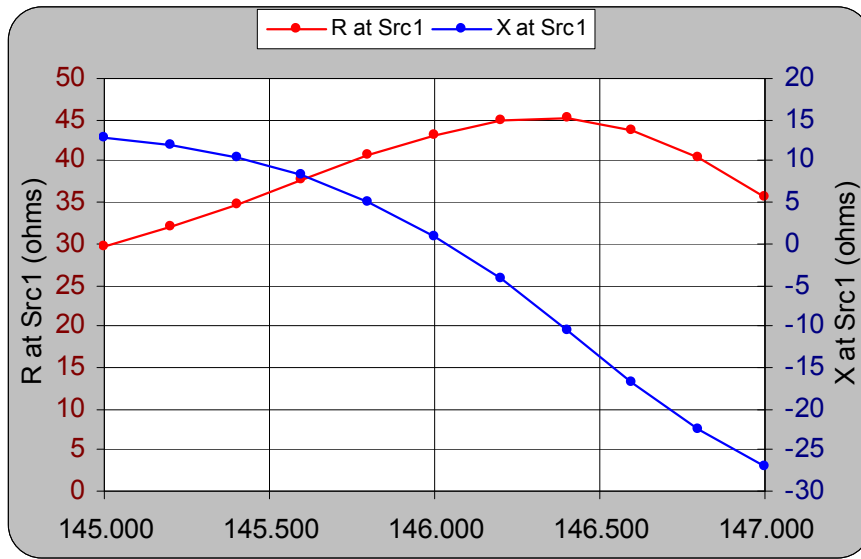


Figure 3 R & X at end of coax xfmr

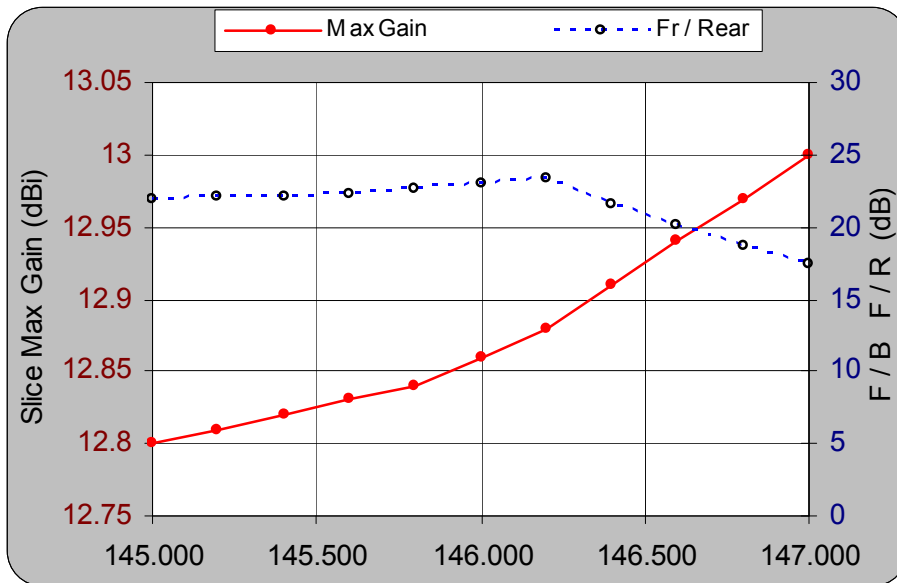


Figure 4 Gain and Front to Rear Performance at 10 feet Over average earth

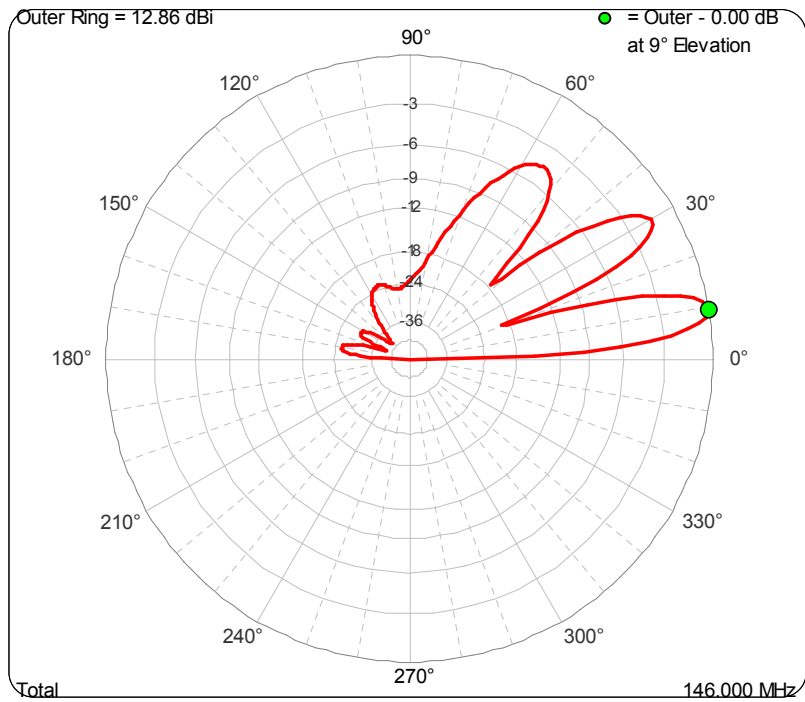


Figure 5 Far Field Elevation Plot at 10 feet height
Over average earth

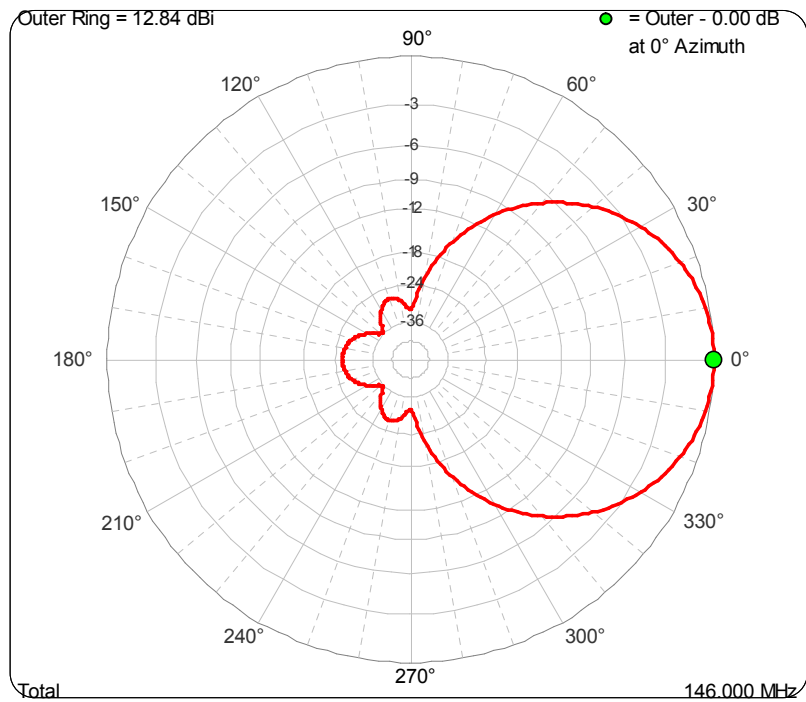


Figure 6 Azimuth Plot at 10 feet height
Over average earth