Non Resonant Antennas

WHY ?

How

WHY WOULD YOU WANT A NON-RESONANT ANTENNA?

It may fit in the available space

It may be horizontal or vertical

It will work on multiple bands

No need to prune to resonance

No traps or suspended BALUN

Light weight and low visibility

SOME CHALLENGES

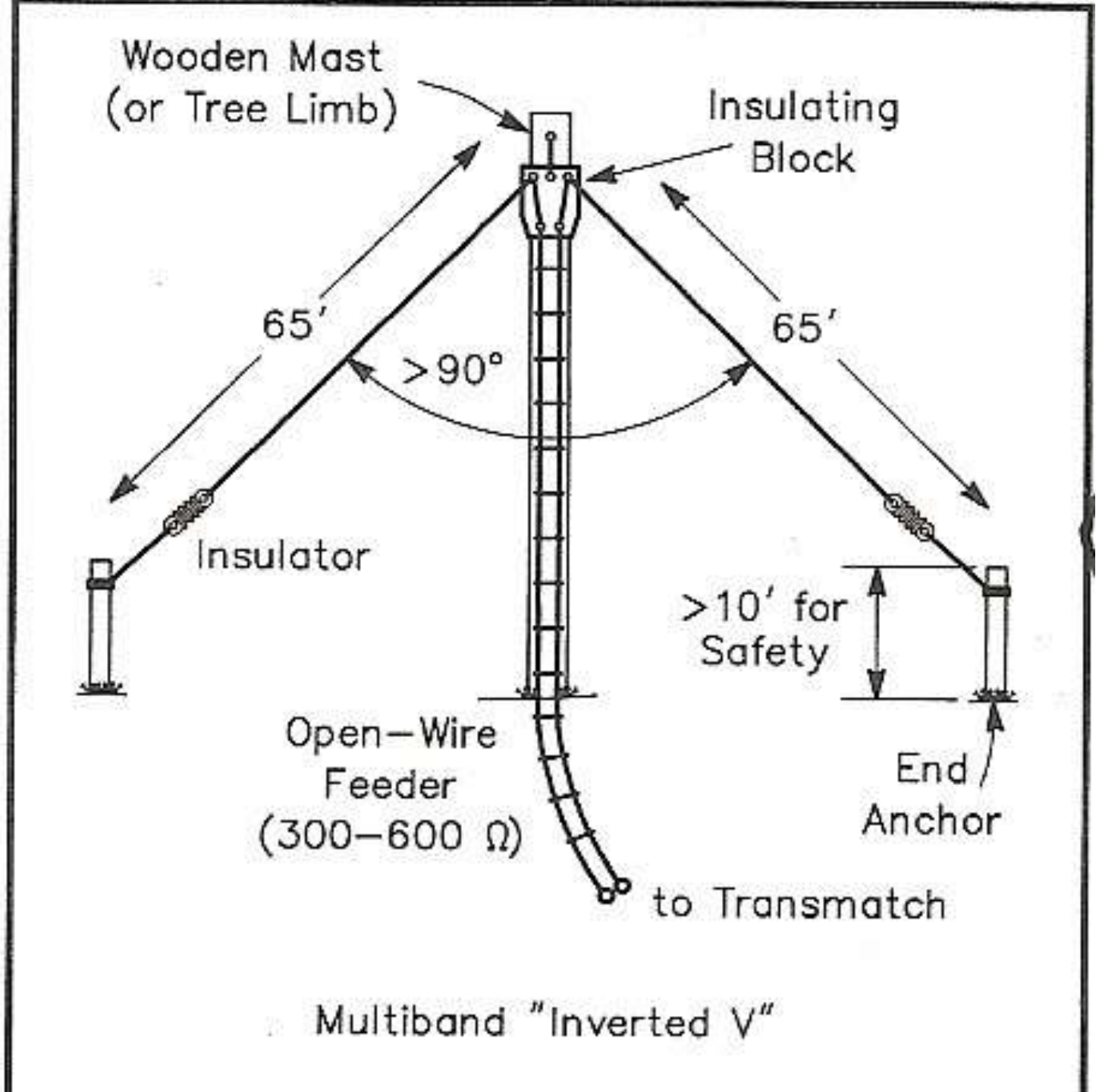
An impedance matching device will be required

The pattern of radiation will be different on each band

Two wire parallel feedline is the only reasonable feed

There are some routing issues with parallel feed line.

EMP protection of parallel feed line.



Multiband "Inverted V"

HORIZONTAL WIRE

What is the right length?

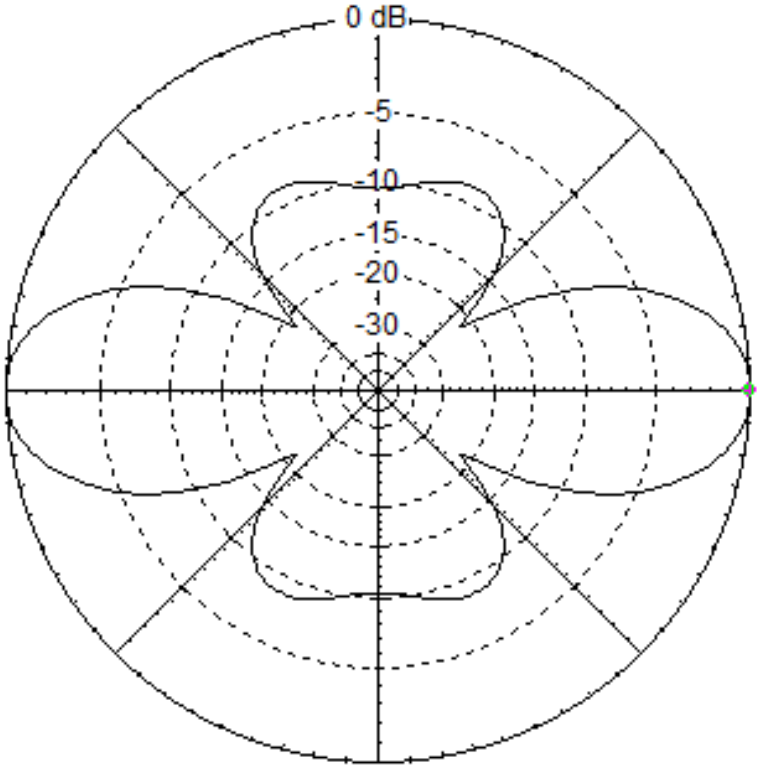
That depends on:

Maximum space available

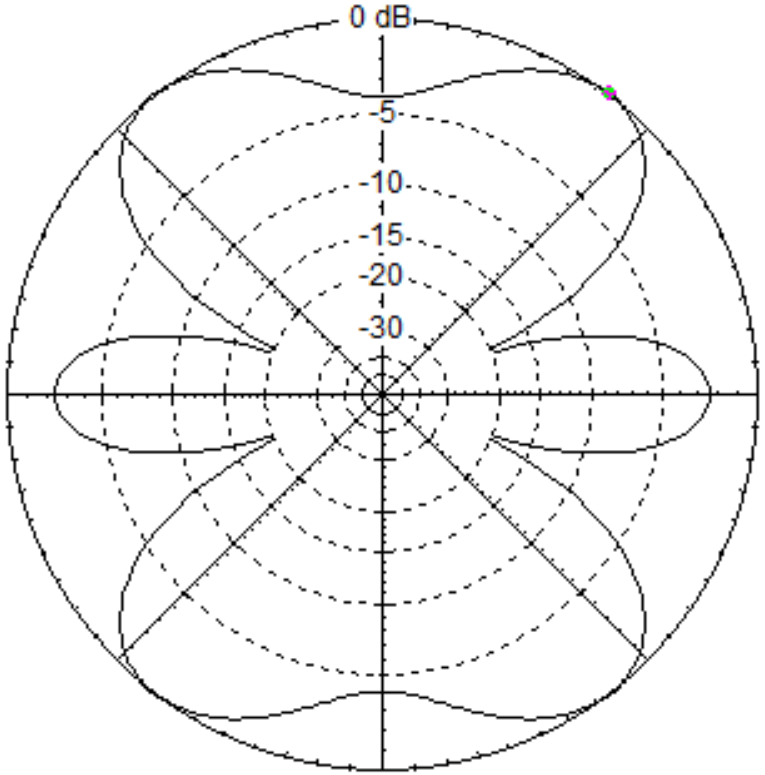
Pattern considerations, 135 foot, 102 foot 88 foot.

I shortened my antenna to move the 20 meter lobes

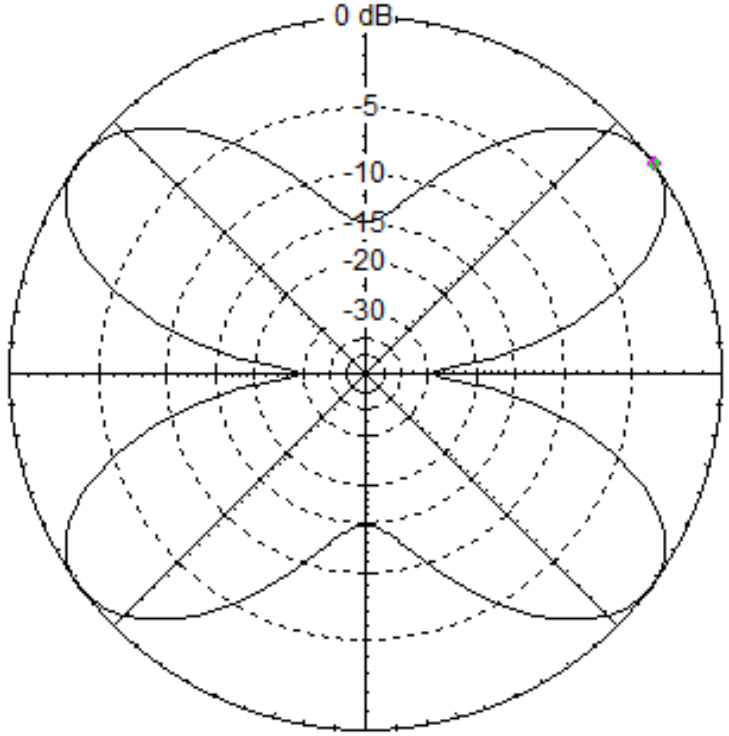
20 METER PATTERN AT 25 DEGREES ELEVATION



88 FEET

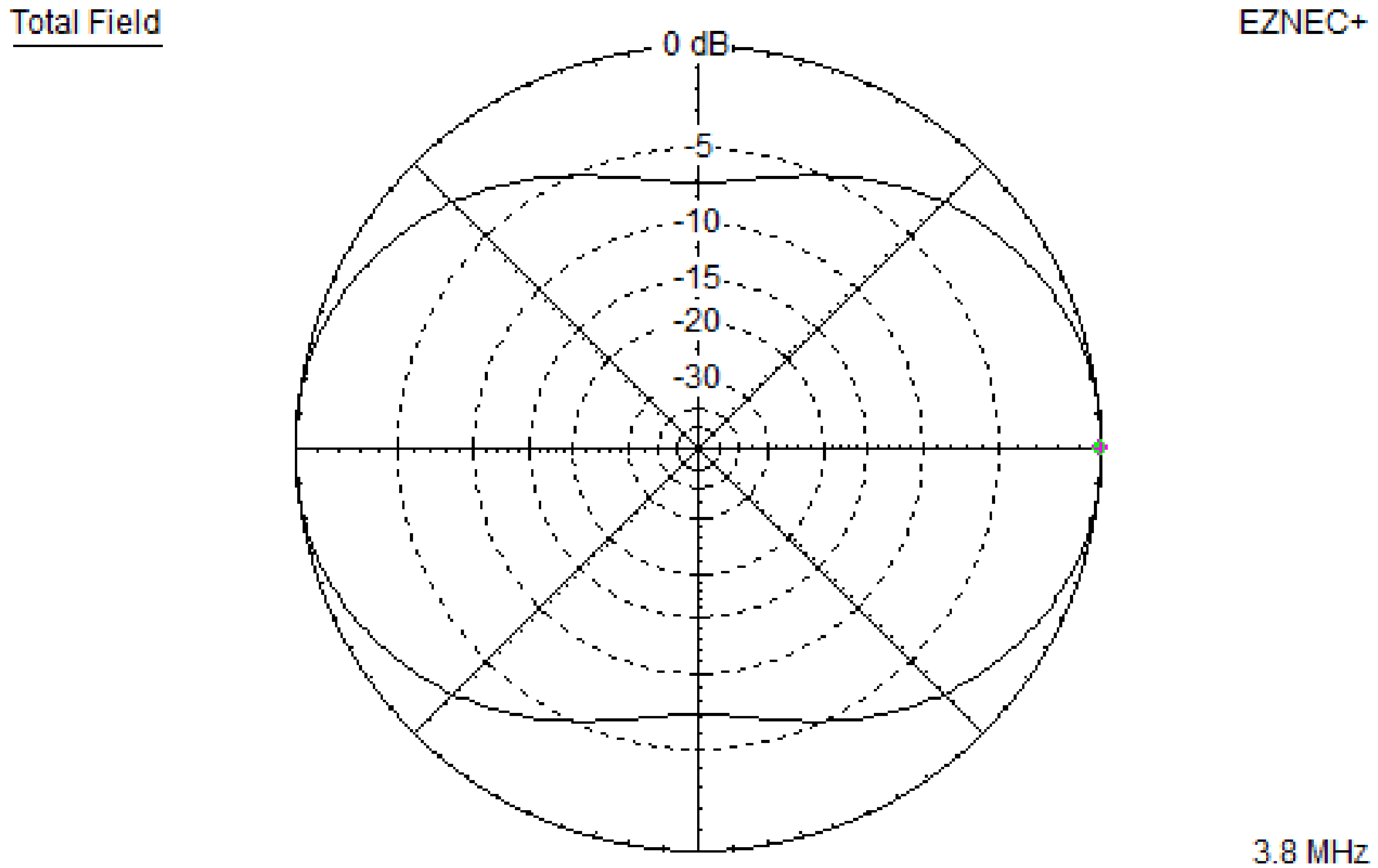


102 FEET



135 FEET

102 foot antenna on 80 meters



CONSTRUCTION CONSIDERATIONS

Wire tension is not high, I use an 8 pound weight on 125 feet with a hanging feed line

“Soft Drawn” is weakest, but #12 has a breaking strength of over 100 pounds

Copper weld is strongest, but difficult to work with, and there are hysteresis considerations

Hard Drawn copper is in between in strength

Flex Weave would be nice for portable use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CONSTRUCTION CONSIDERATIONS

Stretch is not important, so “house” wire is fine.

I had a #12 130 foot “house” wire up for years.

National or local electrical codes may specify minimum requirements.

Center insulator needs to provide torsional resistance

Solid feed line more likely to fatigue off

CONSTRUCTION CONSIDERATIONS

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FEED LINE TO USE

Why parallel line?

ALL transmission line is balanced, that is the definition of transmission line.

High impedance and minimal dielectric in the field result in lower loses

Why Parallel Line?

High impedance USUALLY reduces SWR

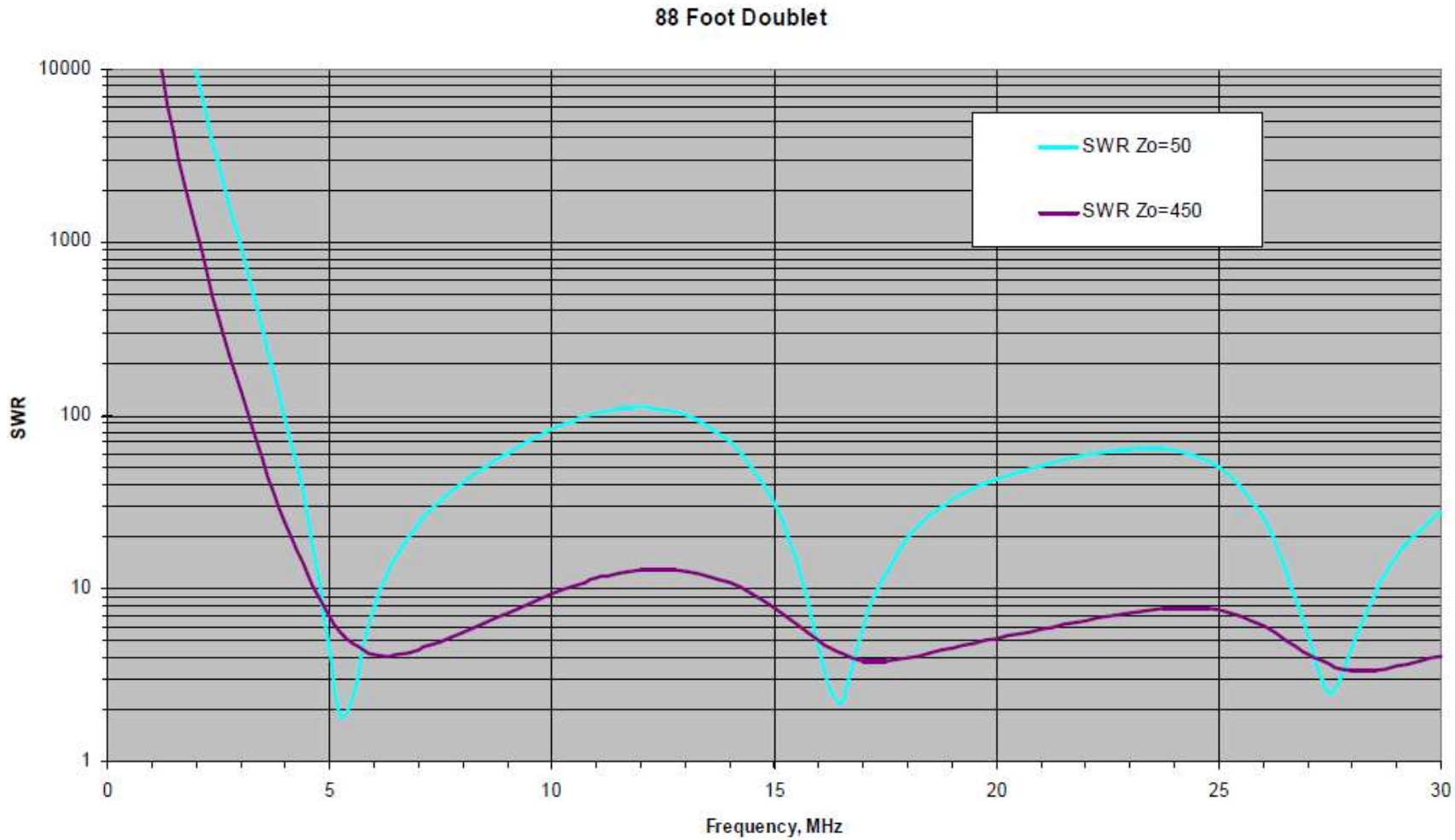
1,000 ohm antenna, 50 ohm line = 20:1 SWR

1,000 ohm antenna, 450 ohm line = 2.2:1 SWR

50 ohm antenna, 450 ohm line = 9:1 SWR

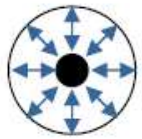
Less dielectric in the field result in lower loses

SWR - 88 foot doublet

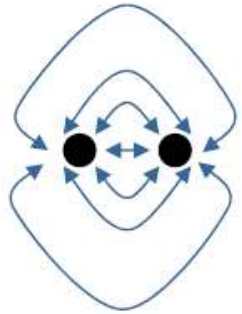


Feedline

- Feedline has loss.
  - Ladderline usually has lower loss than coaxial cable.
  - Ladderline requires more care in routing than coax.



Coax: electric field is completely inside the dielectric (assuming no common mode current).



Ladderline: electric field is mostly within 4x conductor spacing. Separation from other conductive objects needed.

- If the SWR on the line is low, the loss is lowest.
  - As the SWR increases, the line loss increases.
  - Both coax ***and*** ladderline can have catastrophic losses under high SWR conditions.

Common types of parallel line

Common “zip cord” ???

Similar to the old 72 ohm TX line?

A matched loss of 7 dB / 100 feet at 30MHZ.

1 foot piece = .07 dB loss.

Close spacing limits field and coupling
Space it an inch from metal objects

Disadvantages of Parallel line

Separation from other conductors 3 to 4 x D

Wall penetration

EMP protection

Rain, dirt, ice can increase the loss

If antenna is not symmetrical to the feed line there may be common mode current just like coaxial line

Routing to avoid conductive objects

Routing to avoid conductive objects

Wall penetration is not difficult

EMP PROTECTION

There are some devices available but an
Unmatched line can have areas of very high voltage

Spark plug type units would take thousands of volts to arc over

Should ground outside the house

Knife switch is a positive ground WHEN USED

Grounding can be done by DPDT switch

MATCHING A 50 OHM UNBALANCED TRANSMITTER TO AN UNKNOWN BLANCED LINE

Unbalanced tuner followed by balun - need to stay within limits of the balun

Balun followed by balanced tuner / link coupled tuner - balun is operating at 50 ohms

VERTICAL NON RESONANT ANTENNAS

33 foot were popular for years. Resonant on 40

Currently the 43 foot is popular. Resonant on 60

Think of it as similar to the 88 foot dipole

Radials are required

COMPARE ANGLE OF RADIATION

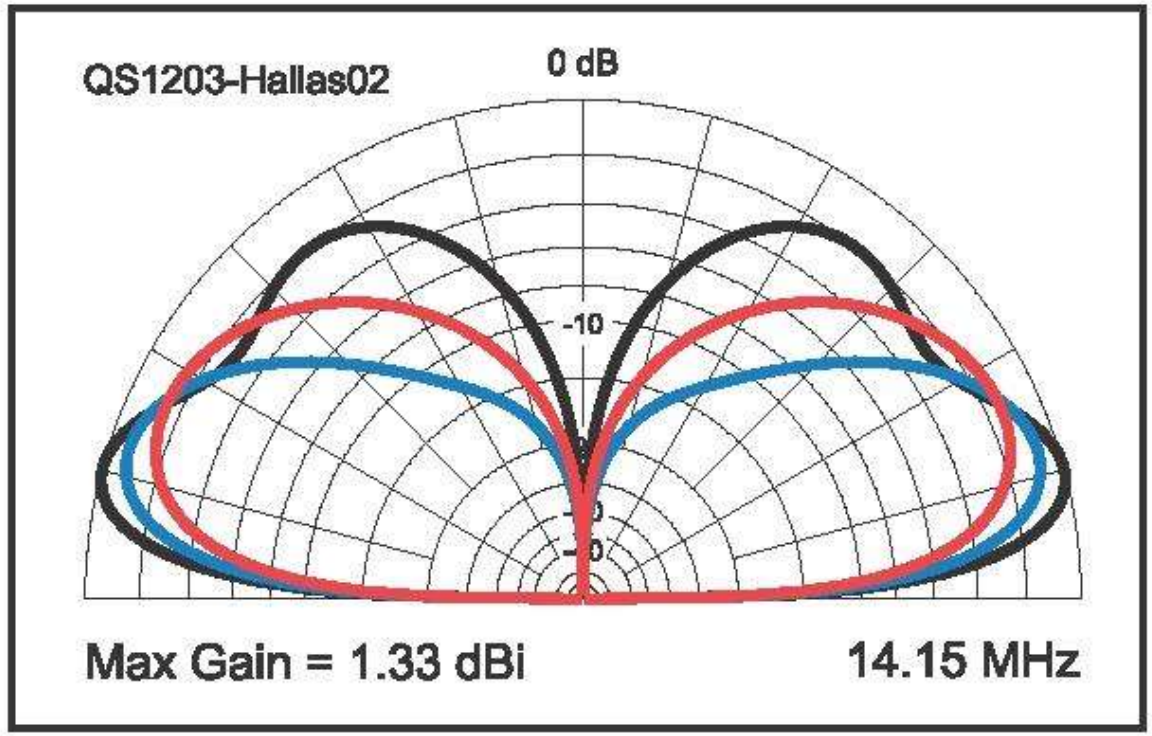


Figure 2 — *EZNEC* elevation pattern of ⅝ wave long ground mounted monopole on 20 meters above typical ground (black) compared to ¼ wave (red) and ½ wave (blue). The azimuth pattern for each is omnidirectional.

43 FOOT VERTICAL ANGLE OF RADIATION

Not as desirable
On higher bands

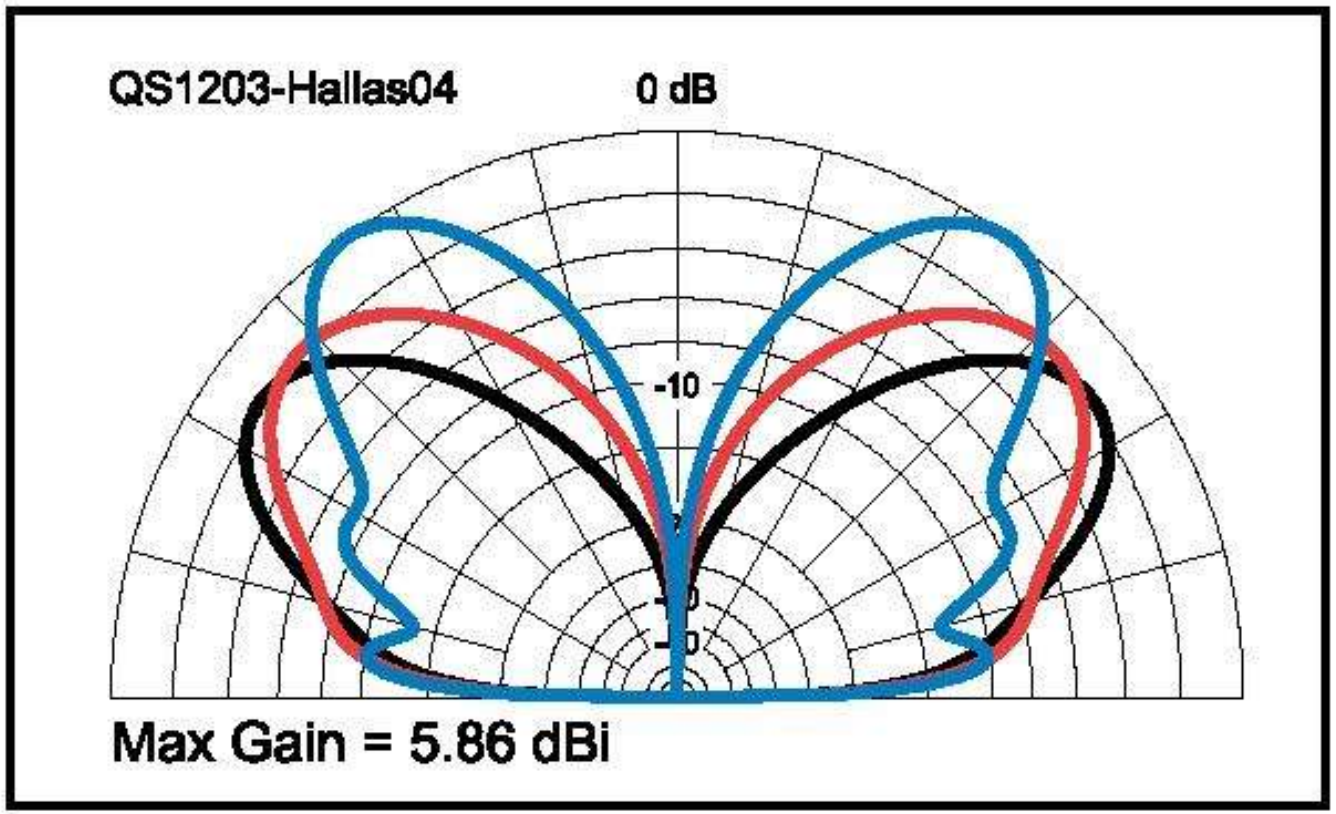


Figure 4 — *EZNEC* elevation pattern of 43 foot ground mounted monopole on 17 meters (black), 15 (red) and 10 meters (blue).

Table 1
Gain and Angle of Peak Gain of 43' Monopole on HF Bands

Band (Meters)	Peak Elevation Angle (°)	Gain (dBi) Max	5°	10°
160	24	–2.4	–7.2	–4.1
80	25	–0.33	–5.0	–2.9
60	24	–0.28	–6.2	–2.5
40	23	–0.26	–6.1	–2.4
20	15	1.2	–2.9	0.5
17	42	4.2	–6.1	–2.8
15	35	4.0	–8.0	–4.2
12	29	4.0	–7.0	–3.8
10	54	5.9	–5.3	–4.8

CQ-CW-160 1/27/2017 43 FOOT VERTICAL

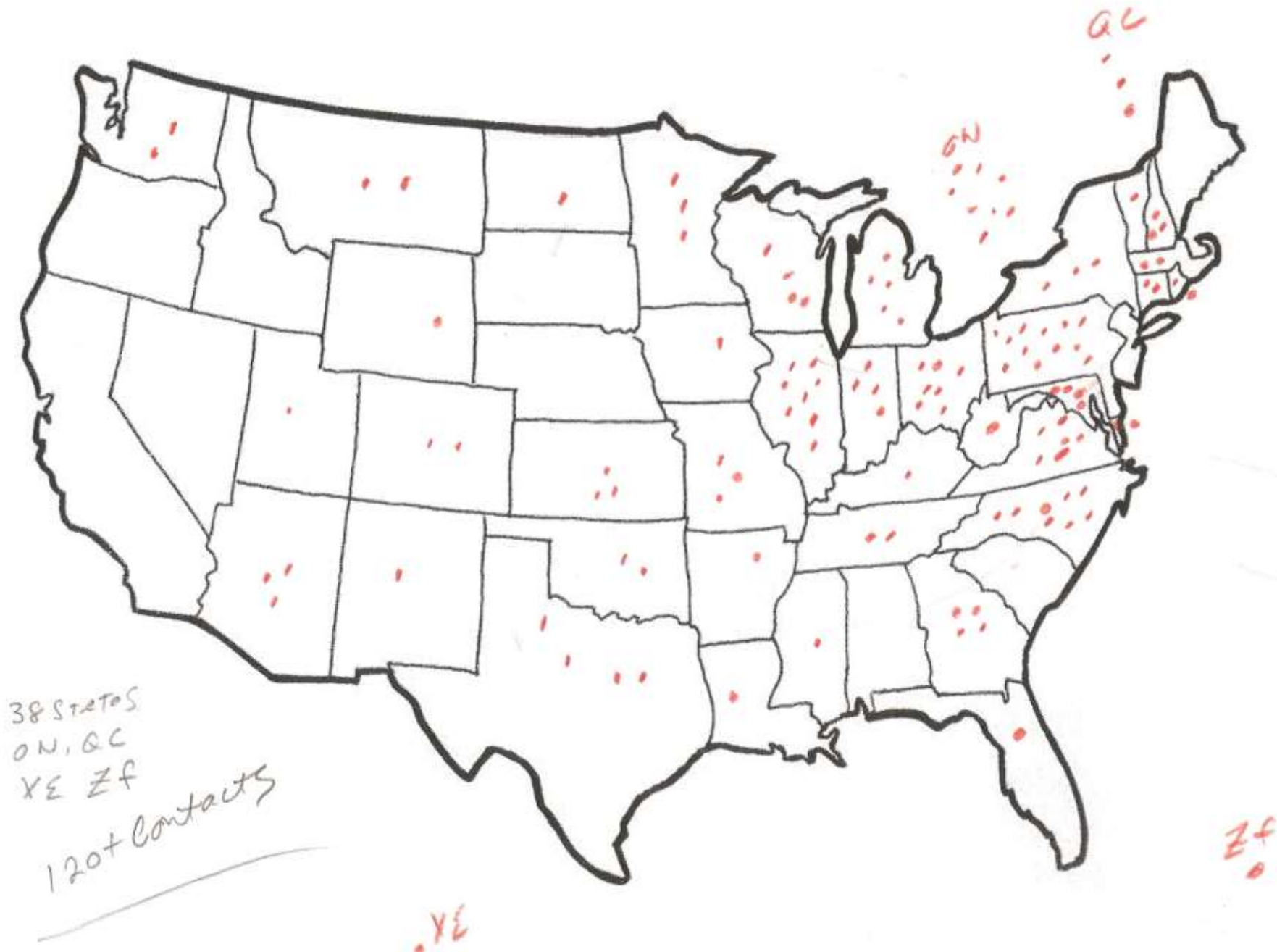


Table 2
SWR and Coax Loss of 43' Monopole on Each Band in 100' of Coax

Band (Meters)	SWR	Coax Loss (dB)		
		LMR-400	RG-213	RG-8X
80	81:1	5.8	6.7	8.8
60	1.7:1	0.3	0.5	0.9
40	15:1	2.0	2.7	4.1
30	54:1	5.1	6.9	8.7
20	9.9:1	1.8	2.8	4.0
17	5.8:1	1.3	2.1	3.1
15	33:1	4.9	6.7	8.4
12	41:1	6.0	8.0	9.7
10	1.5:1	0.7	1.3	2.0

MUST MATCH FEEDLINE TO THE ANTENNA

Many remote antenna tuners are available and cost less than an “aluminum tree”

MY 43 FOOT VERTICAL

Note the fence rail 5 feet above the ground and the shrubbery to the left which support the radials

RADIALS:

Replace the bottom of the dipole

Should be equal and opposite

Best if they are the same length as the vertical element

RADIALS:

Lots of articles in QST, QEX, and others on the number and arrangement of radials, or use EZNEC

All agree that elevated radials are the more efficient and fewer are needed

(I have 2, and work Europe on 20 meters)

RADIALS:

An antenna with 3 or 4 elevated radials is called a ground plane antenna

Ground plane antennas are common on 10 meters and shorter wavelengths but can be on any frequency

SUMMARY

Non Resonant antennas radiate all the power you send them

They will have a lobed pattern on higher bands

A single antenna may fit your space

A non resonant antenna may be relatively inexpensive

Sources used for this presentation

Color graphics for vertical antenna: QST June 2012 pg 30, The 43 foot monopole, whats the magic; W1ZR

B&W graphics of patterns for horizontal dipoles, W9MU / EZNEC

Color Graphics of Feed line SWR; N5EG from his PPT presentation

B&W graphic of Inverted Vee. ARRL Handbook 1998 edition page 20.6

Photographs by KA9CAR