



The FVR Spitfire Array

(A “poor man’s 4-square” for Top Band)

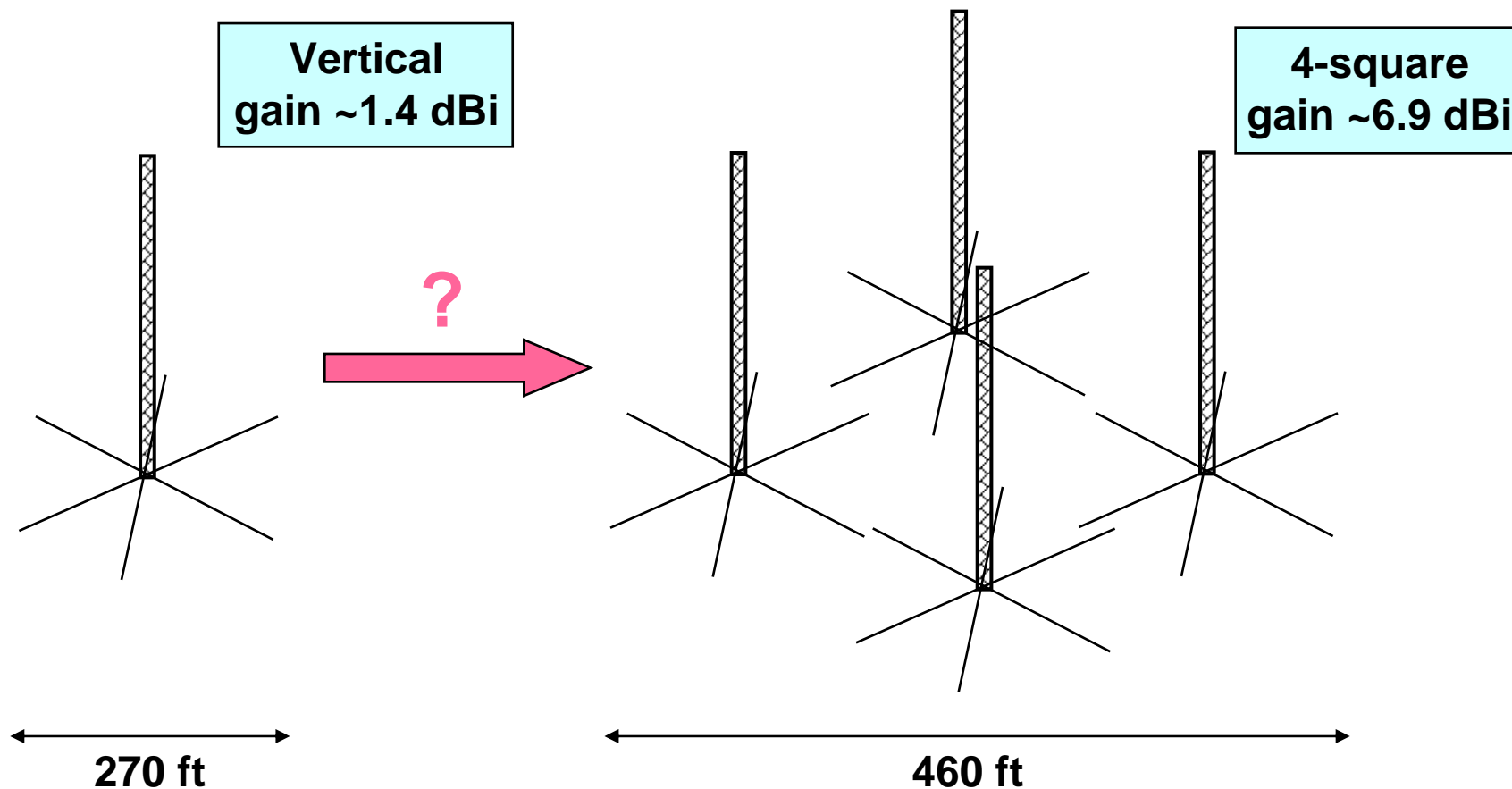
John Kaufmann W1FV
Fred Hopengarten K1VR

Copyright 1998 W1FV and K1VR. All rights reserved. May not be reproduced in any form without permission. So please ask!



Adding Gain to an Existing Vertical

W1FV
K1VR

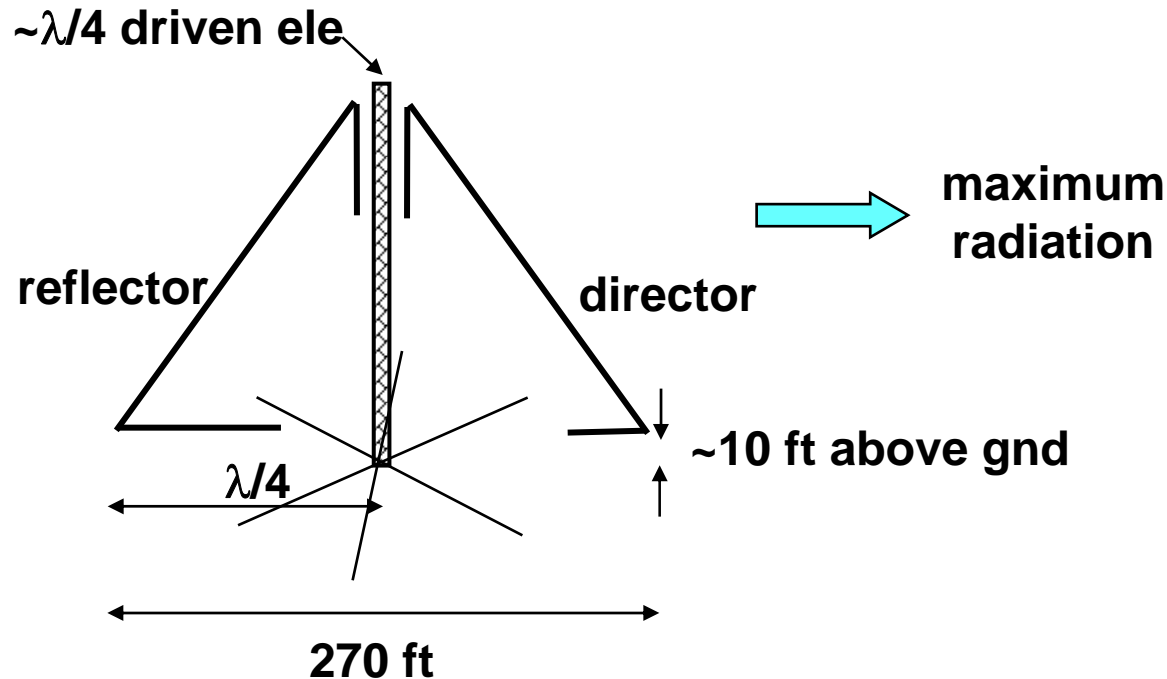


- Alternative concepts: WW2Y, K3LR, K4ERO, KB8I, K8UR, ON4UN, others



FVR Spitfire Array (2 switching directions)

W1FV
K1VR

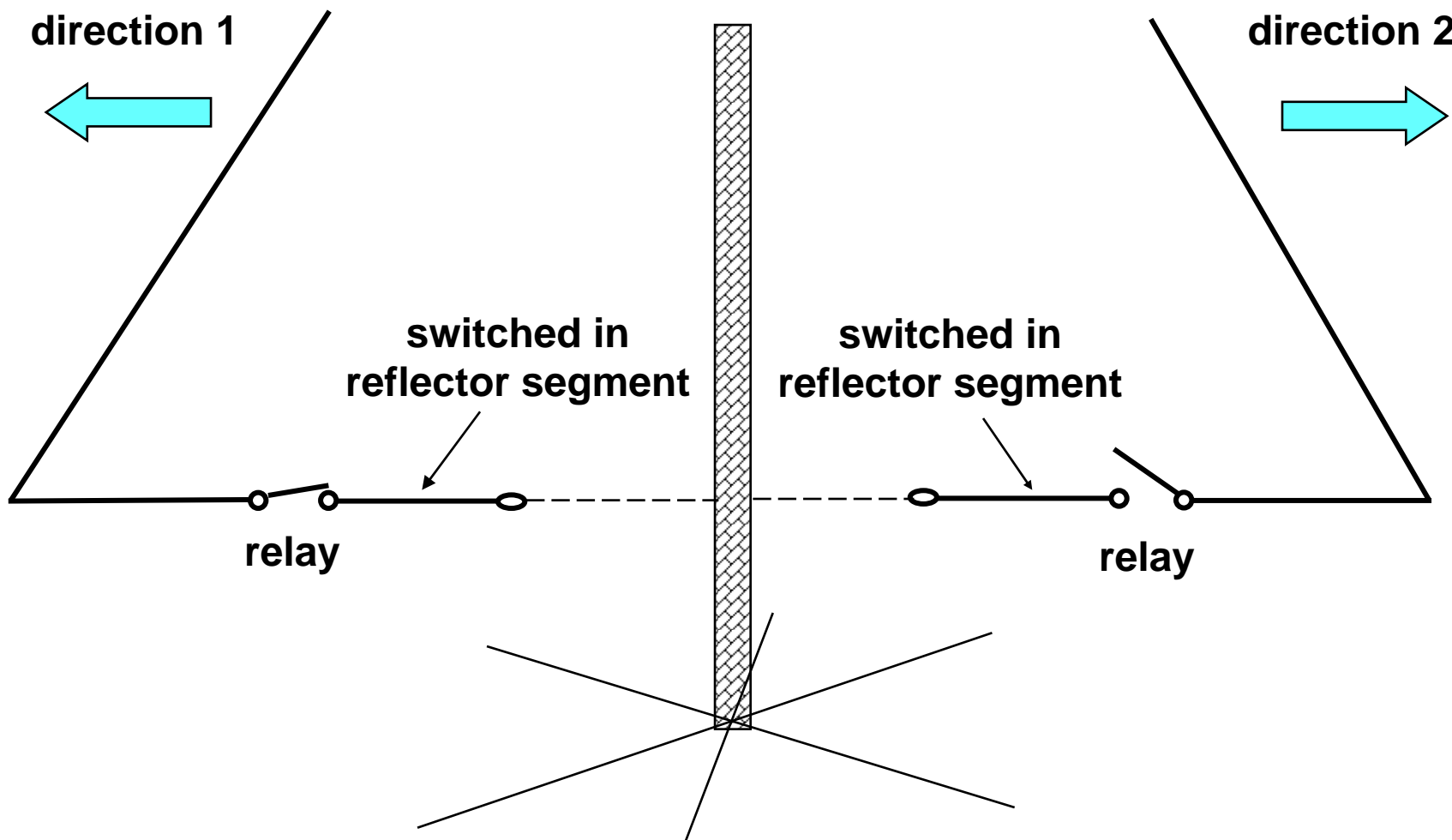


- 1/4 wave grounded tower as driven element and support for wire elements
- 1/2 wave *ungrounded* folded parasitic wire elements
- Conventional 1/4 wave radial system for tower driven element
- No additional radial system needed for 1/2 wave parasitic elements
- Avoids ground current loss in parasitic elements
- Inexpensive upgrade to existing tower
- 2-direction switching, expandable to 4 directions



Direction Switching Details

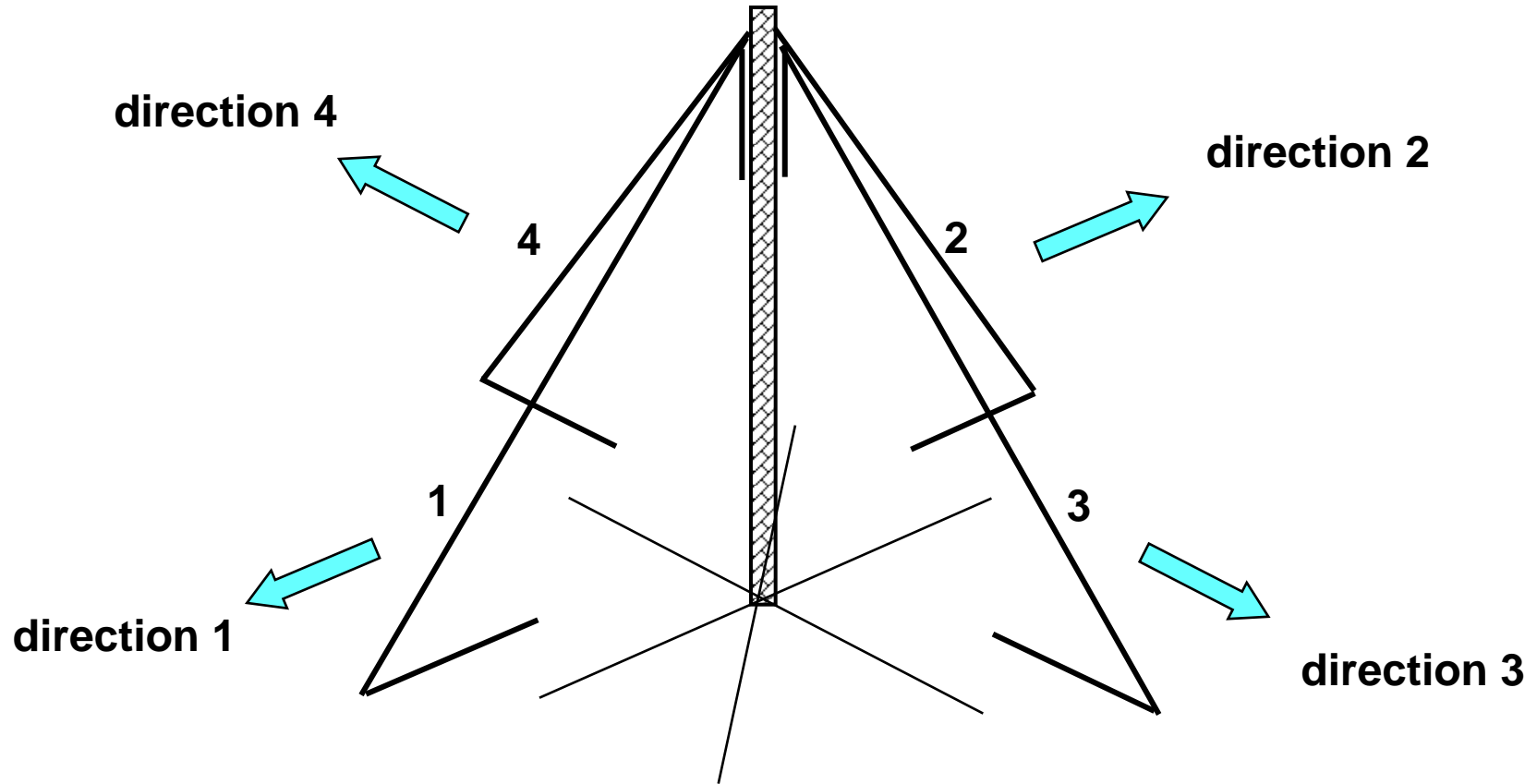
W1FV
K1VR





FVR Spitfire Array ("Poor man's 4-square")

W1FV
K1VR



- Tower always driven
- 2 parasitic wires "active" at a time, i.e. 1 & 2 (or 3 & 4)
- Other 2 wires grounded until activated
- Fits in circle of 270 ft diameter

Spitfire Elevation Pattern

W1FV
K1VR



Poor man's 4-square

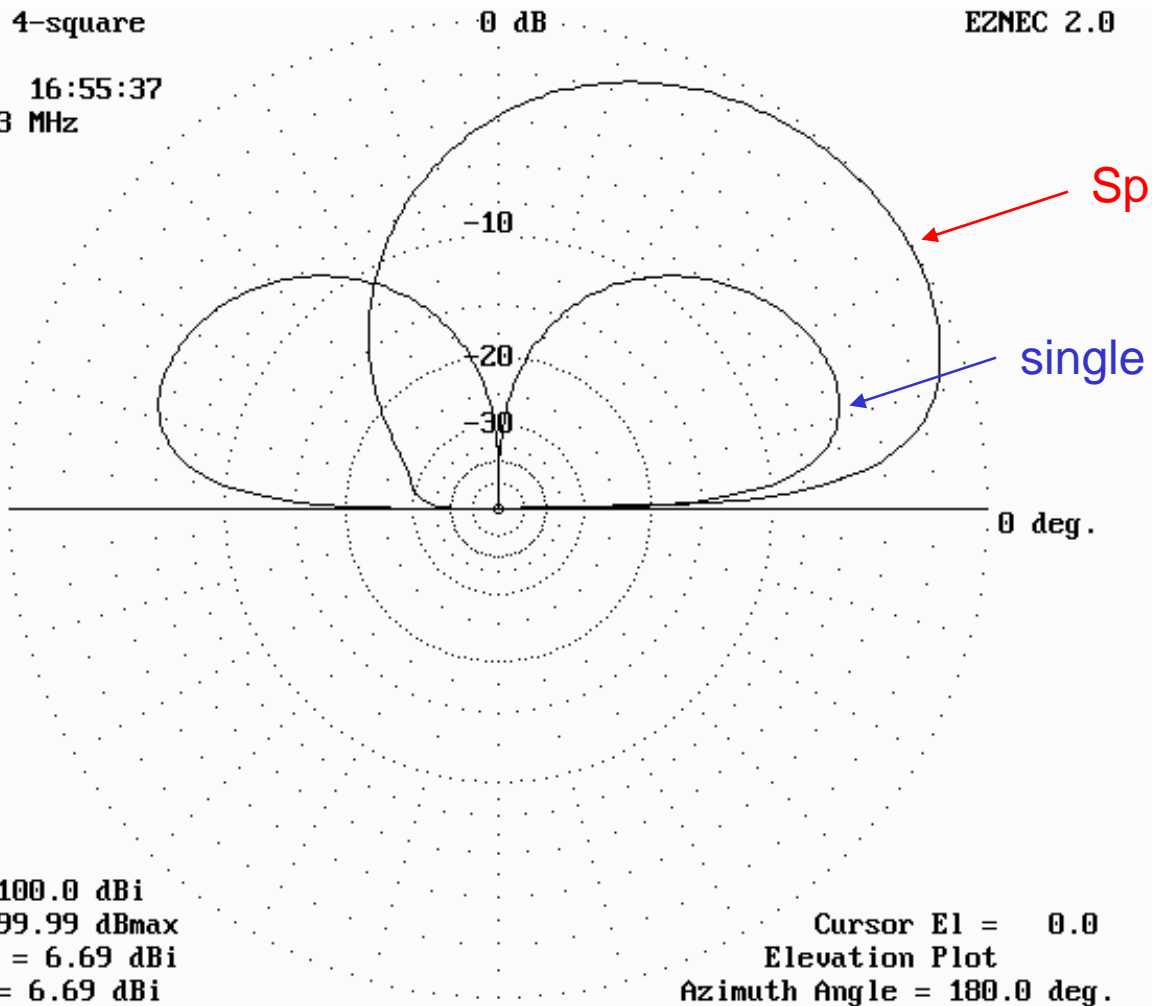
0 dB

EZNEC 2.0

05-03-1998 16:55:37

Freq = 1.83 MHz

PM4SQEL



Spitfire

single vertical

Cursor = -100.0 dBi
= -99.99 dBmax
Outer Ring = 6.69 dBi
Max. Gain = 6.69 dBi

Cursor El = 0.0
Elevation Plot
Azimuth Angle = 180.0 deg.



Spitfire Azimuth Pattern (25° elevation)

W1FV
K1VR

Poor man's 4-square

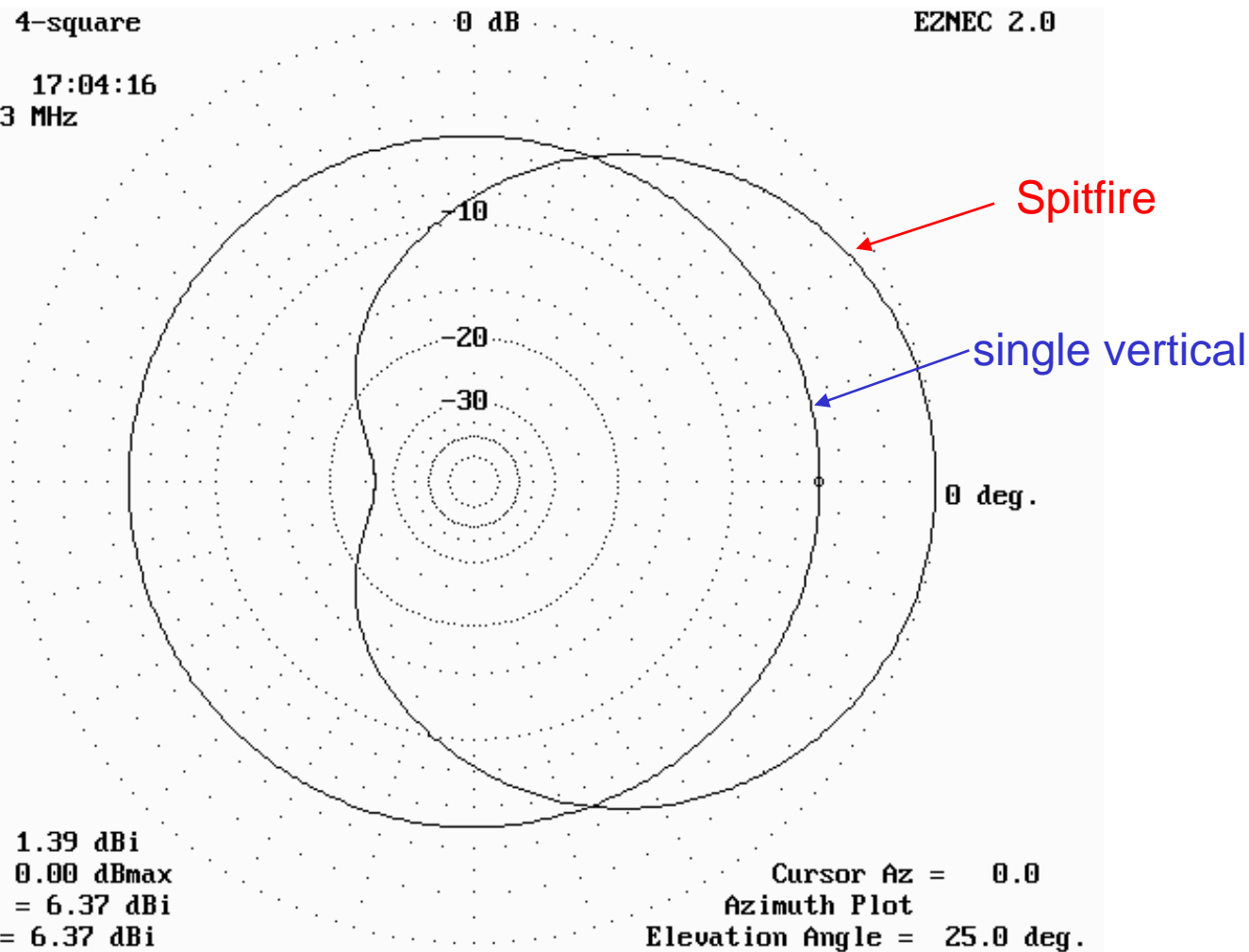
0 dB

EZNEC 2.0

05-03-1998 17:04:16

Freq = 1.83 MHz

PM4SQAZ



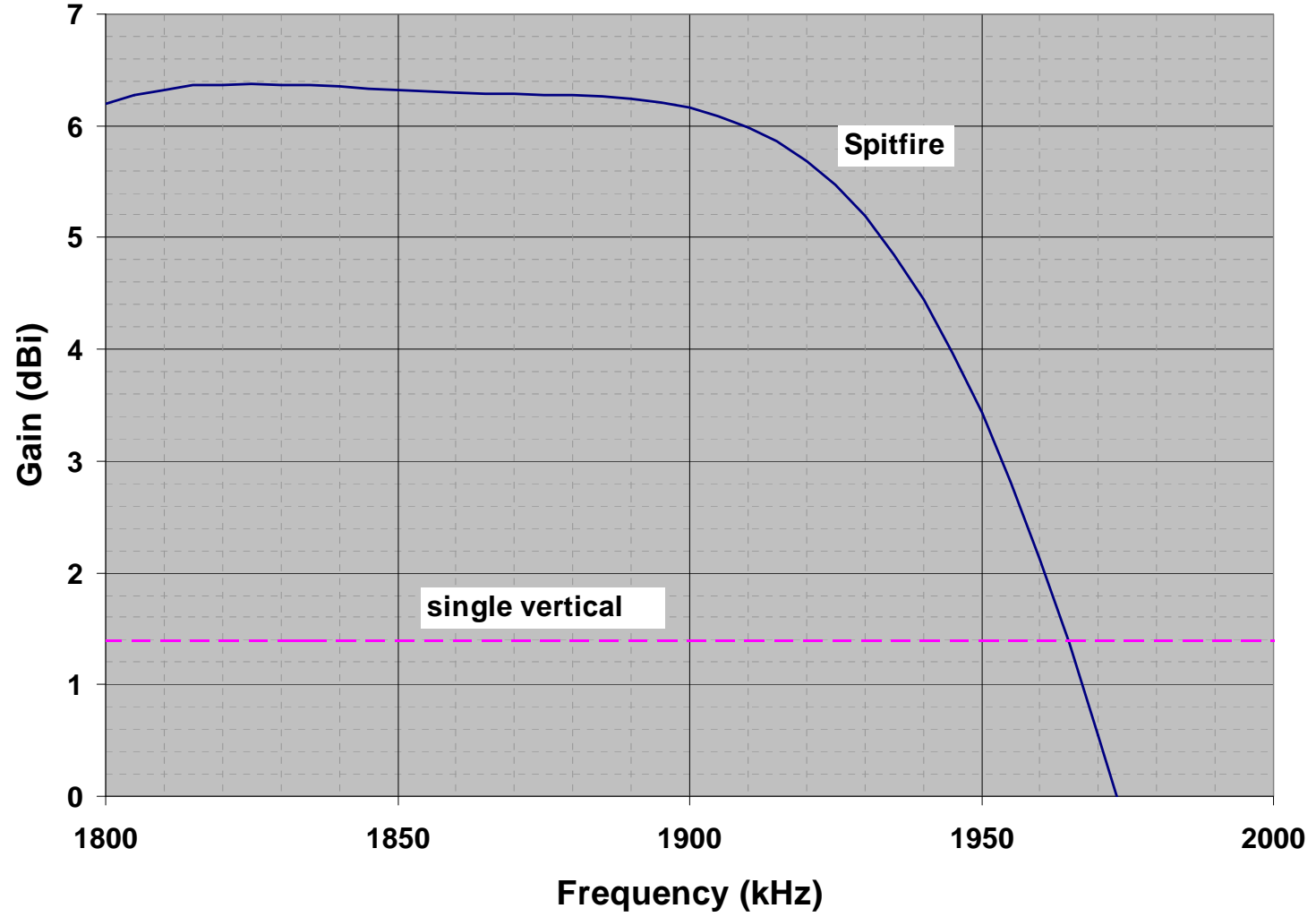
Cursor = 1.39 dBi
 = 0.00 dBmax
 Outer Ring = 6.37 dBi
 Max. Gain = 6.37 dBi

Cursor Az = 0.0
 Azimuth Plot
 Elevation Angle = 25.0 deg.



Computer Model Gain

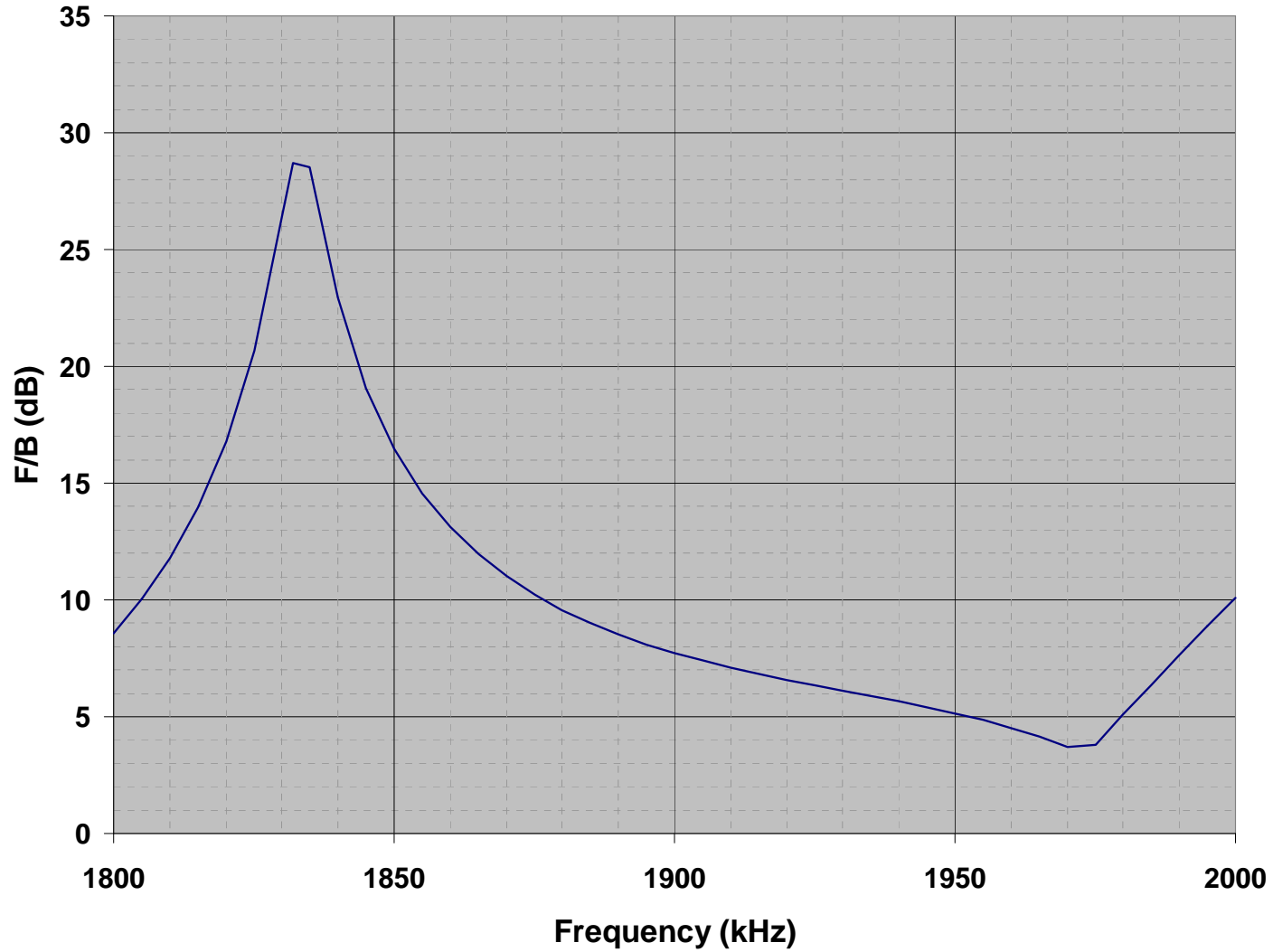
W1FV
K1VR





Computer Model Front-to-Back Ratio

W1FV
K1VR





Spitfire vs. 4-square

W1FV
K1VR

160 m 4-square

0 dB

EZNEC 2.0

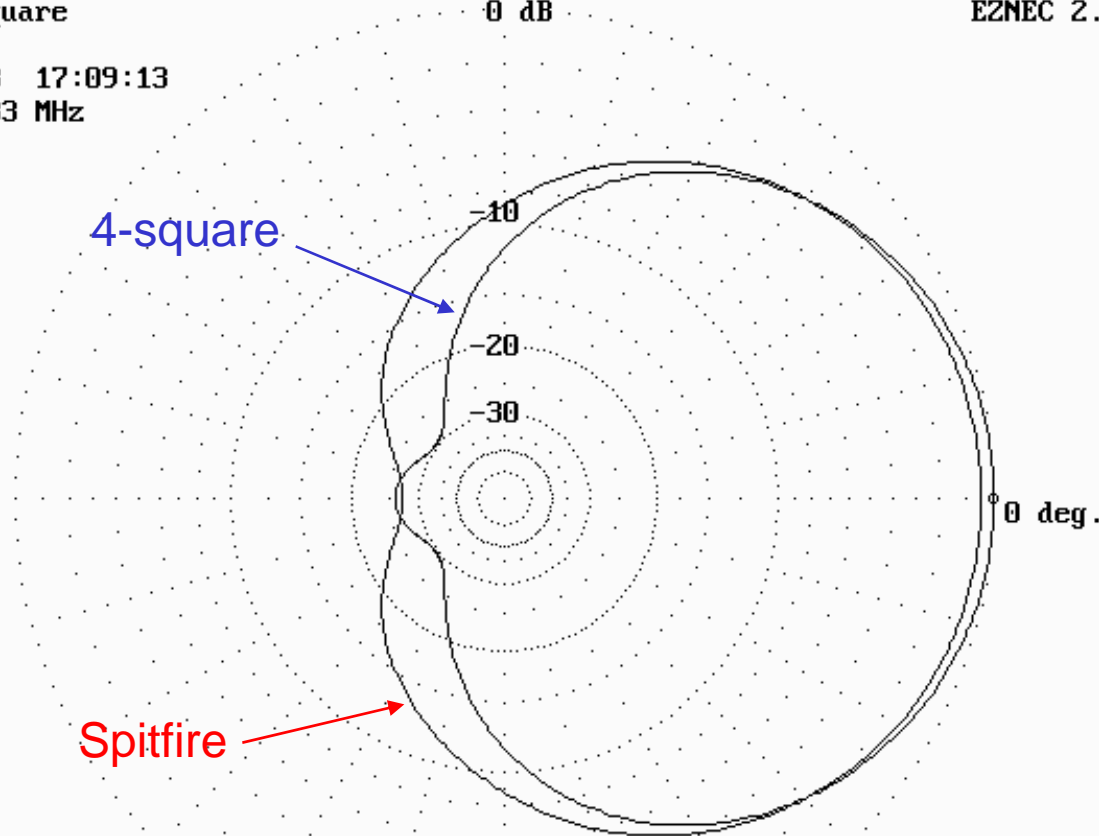
05-03-1998 17:09:13

Freq = 1.83 MHz

PM4SQAZ

4-square

Spitfire



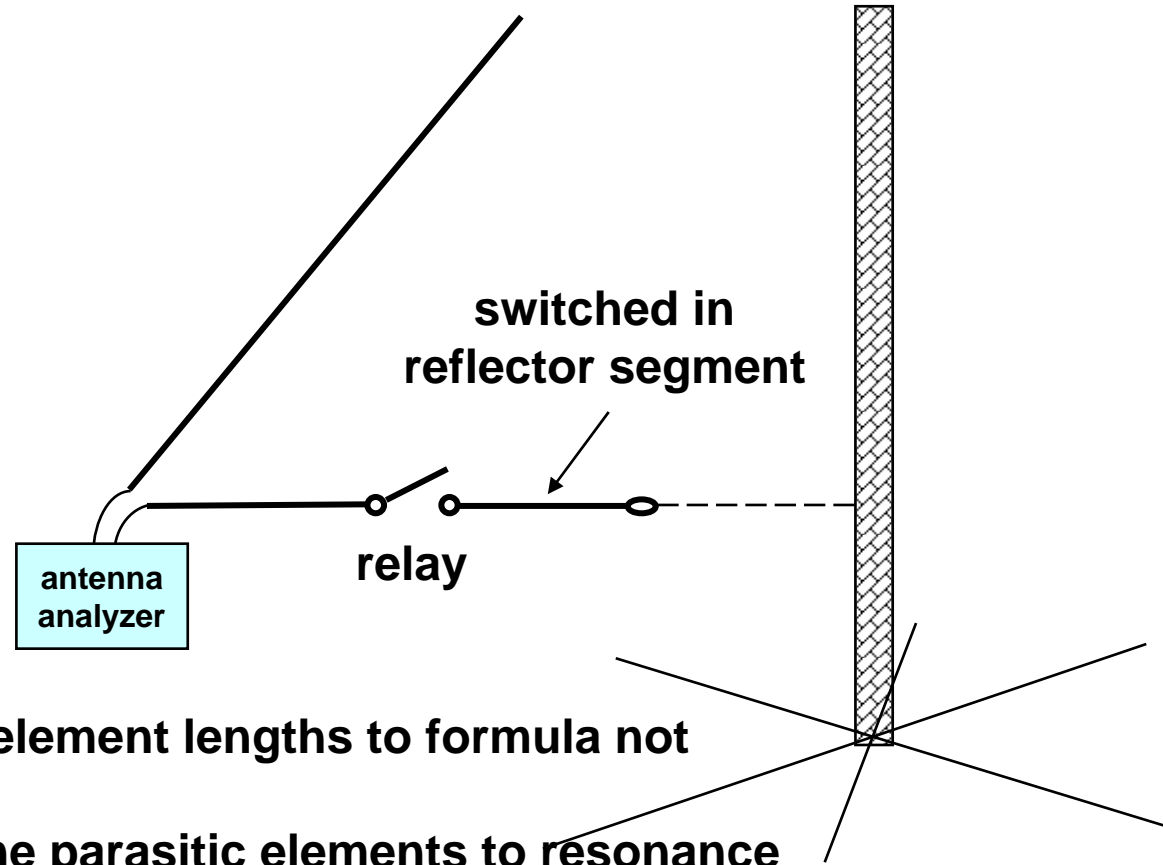
Cursor = 6.83 dBi
= 0.00 dBmax
Outer Ring = 6.83 dBi
Max. Gain = 6.83 dBi

Cursor Az = 0.0
Azimuth Plot
Elevation Angle = 155.0 deg.



Parasitic Element Tuning Procedure

W1FV
K1VR



- Cutting parasitic element lengths to formula not accurate enough
- Measure and prune parasitic elements to resonance with antenna analyzer (MFJ-259, etc.)
- Other elements must be decoupled during tuneup
- Director resonance @ 2.00 MHz
- Reflector resonance @ 1.90 MHz



Parts List

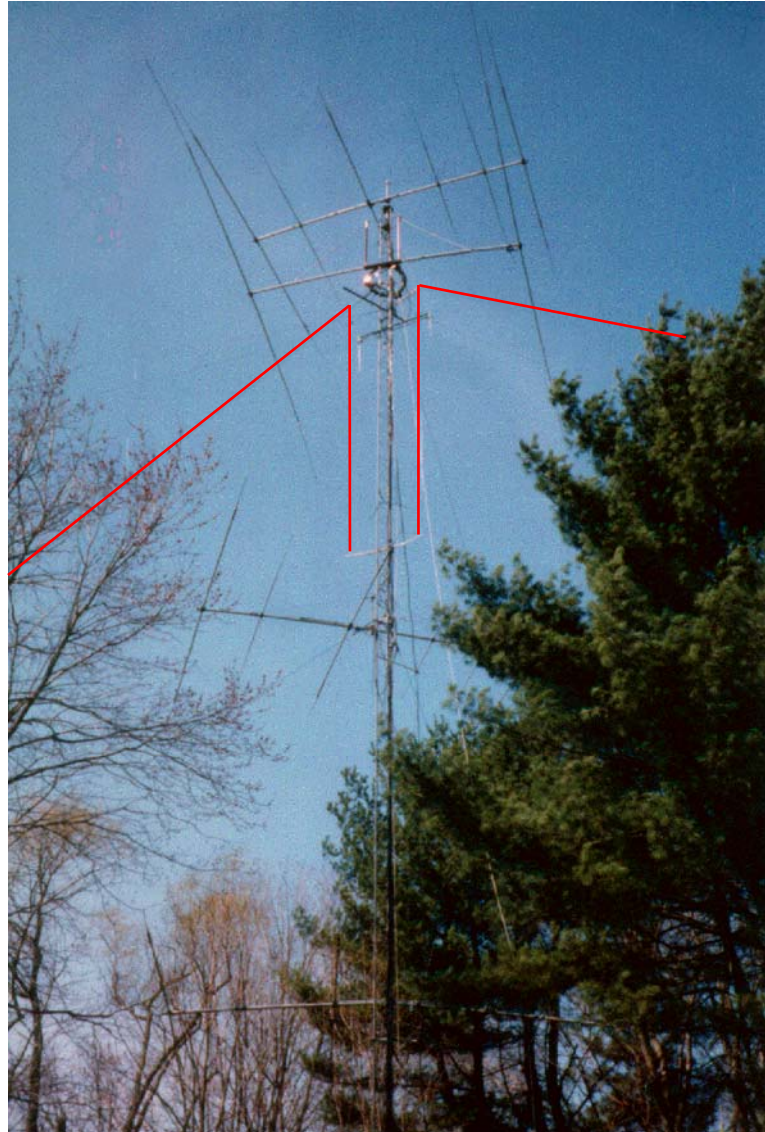
W1FV
K1VR

- ~1000 ft wire (#12 THHN)
- 24 insulators
- 8 DPDT relays
- 4 2"x4"x16' wood posts
- Rope
- DC control cables
- Test equipment: antenna analyzer
- Total cost = *cheap*



K1VR Spitfire Installation

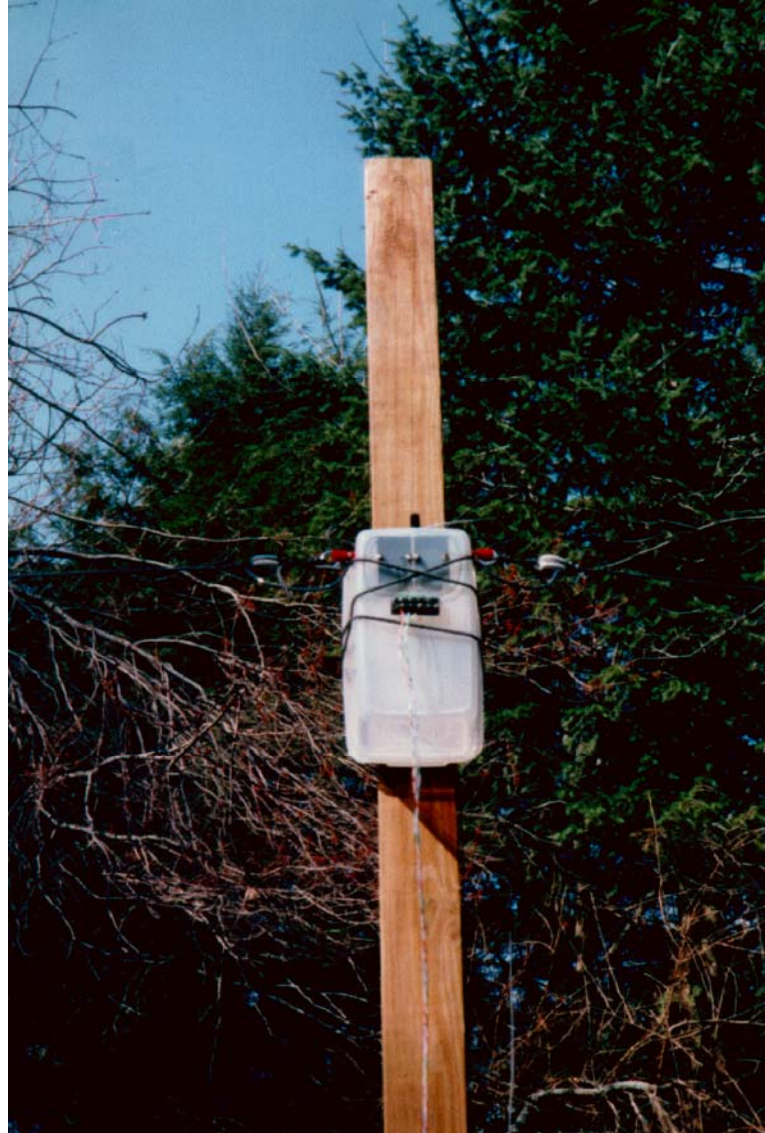
W1FV
K1VR





K1VR Relay Switch Box Installation

W1FV
K1VR





Spitfire Variations

W1FV
K1VR

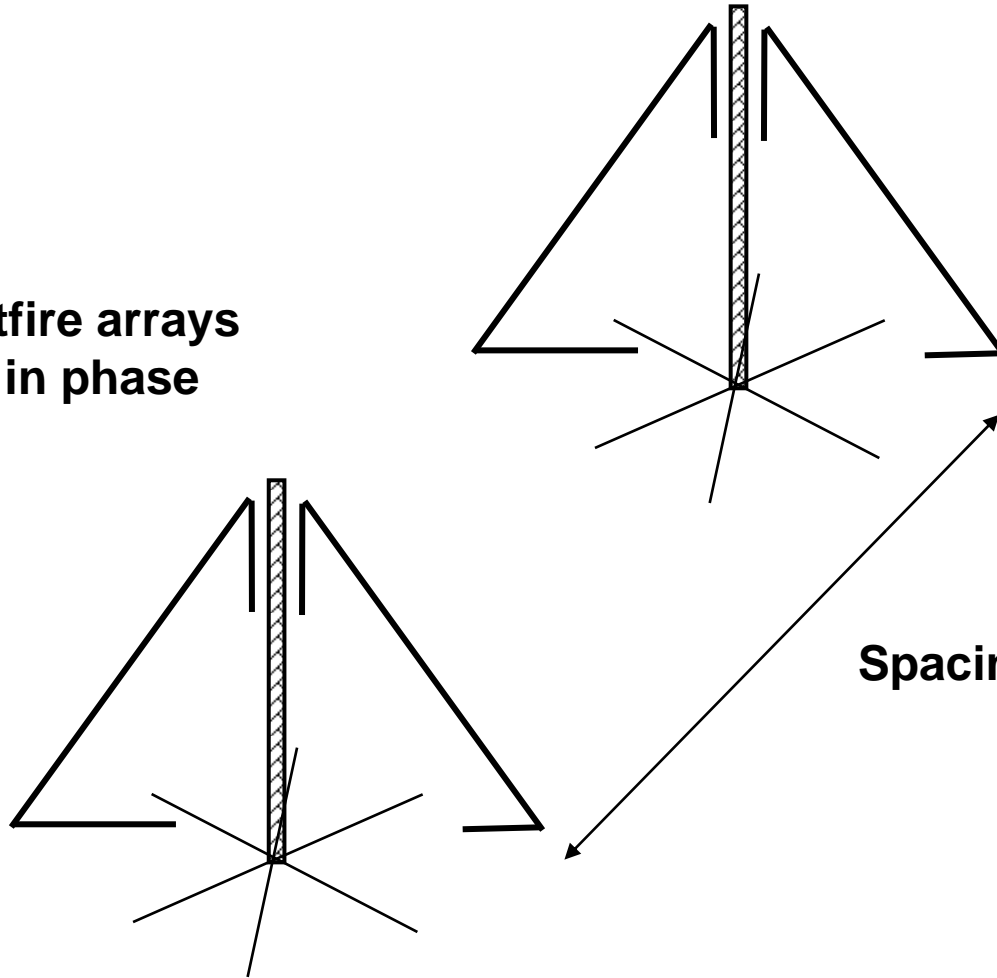
- **2 or 4 switching directions**
- **Adapts easily to nonresonant towers (i.e. not $\lambda/4$)**
- **Scales to other bands (80, 40)**
- **Space-saver single-wing (reflector) Spitfire in development**
- **More gain with arrays of Spitfires. . .**




Spitfire Broadside Array

W1FV
K1VR

2 Spitfire arrays
fed in phase



maximum
radiation


Spacing = 270 - 335 ft
(not critical)

Broadside Array Azimuth Pattern

W1FV
K1VR



Spitfire broadside array

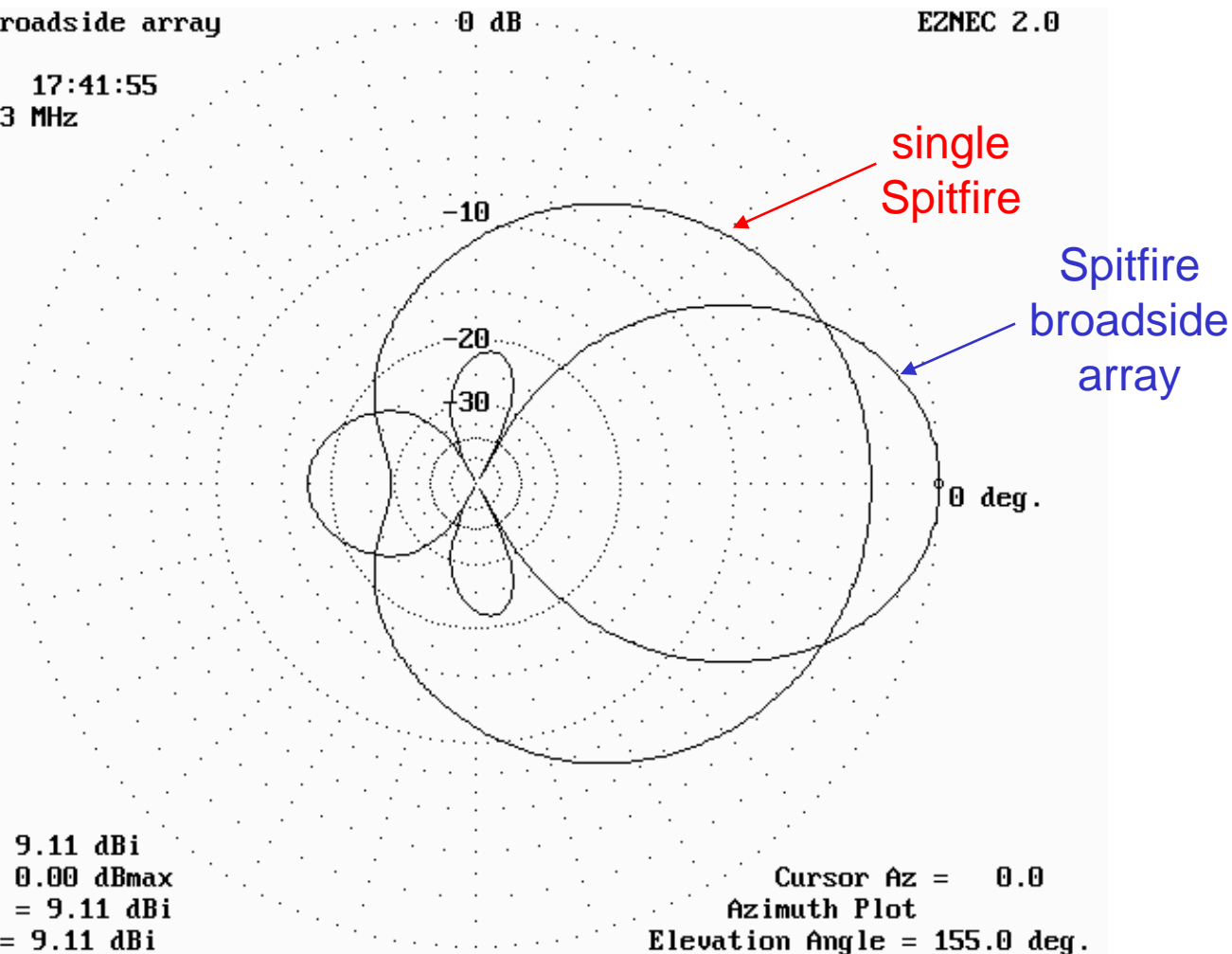
0 dB

EZNEC 2.0

05-03-1998 17:41:55

Freq = 1.83 MHz

PM4SQAZ



Cursor = 9.11 dBi
= 0.00 dBmax
Outer Ring = 9.11 dBi
Max. Gain = 9.11 dBi

Cursor Az = 0.0
Azimuth Plot
Elevation Angle = 155.0 deg.



Array Status at K1VR

W1FV
K1VR

- **2-wire version in place since December '97 (4-wire version to be completed this spring)**
- **Biggest technical challenge: need for careful tuning of parasitic elements**
- **Observed gain: ~ 1 S unit over tower alone**
- **Observed F/B: ~ 15 dB on DX (may improve with more fine tuning of parasitic elements)**
- **First 160 DX QSO with new array: VK6HD . . . on long path!**
- **Magazine publication in works**



W1FV
K1VR

The FVR Spitfire Array

(A poor man's 4-square for Top Band)

John Kaufmann W1FV <kaufmann@LL.mit.edu>

Fred Hopengarten K1VR <k1vr@juno.com>