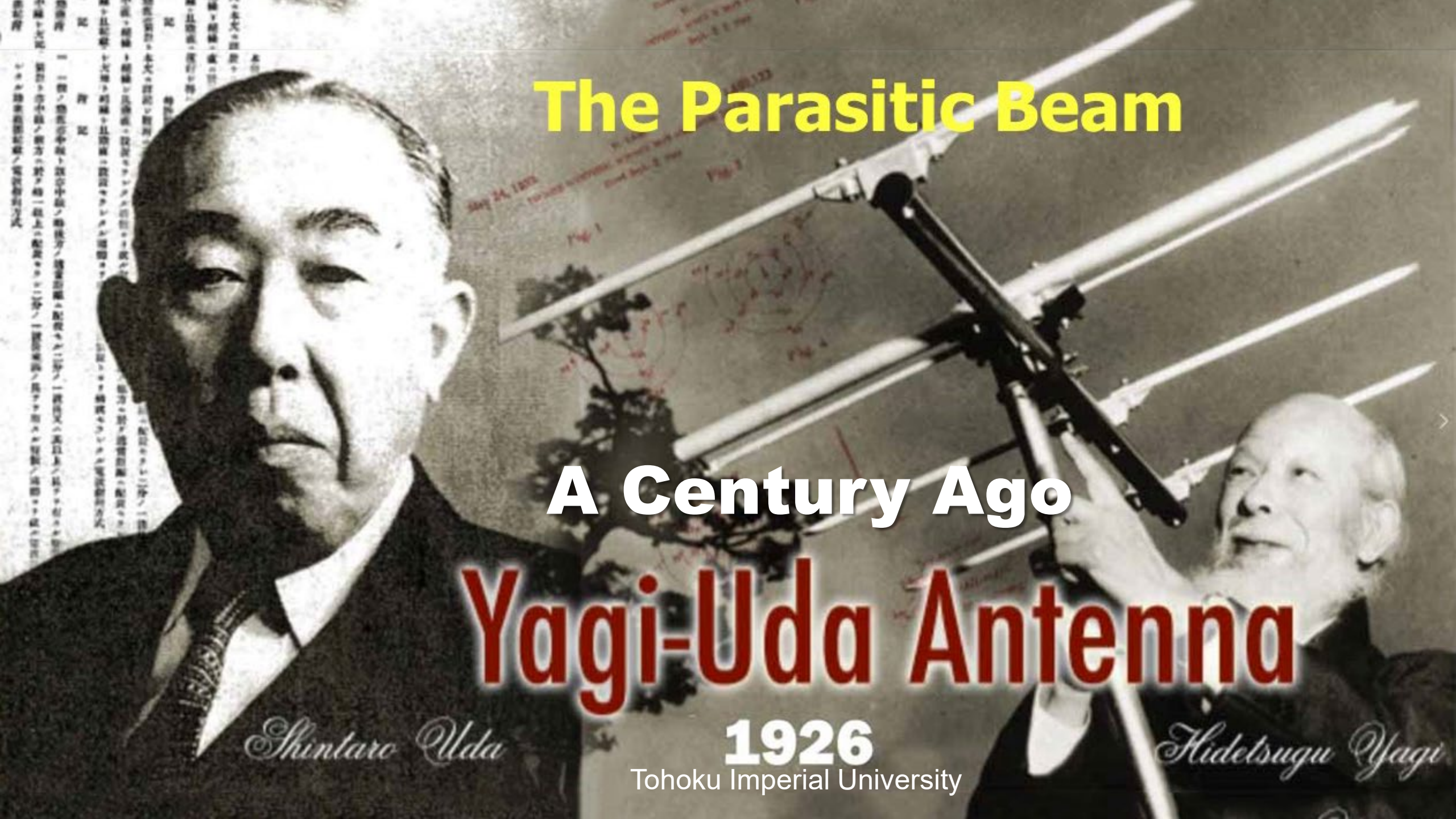
Designing Home-Brew Yagis is Easy

With a Simple Example

w6nbc.com/slides.html


The Parasitic Beam
A Century Ago
Yagi-Uda Antenna
1926
Tohoku Imperial University
Shintaro Uda
Hidetsugu Yagi

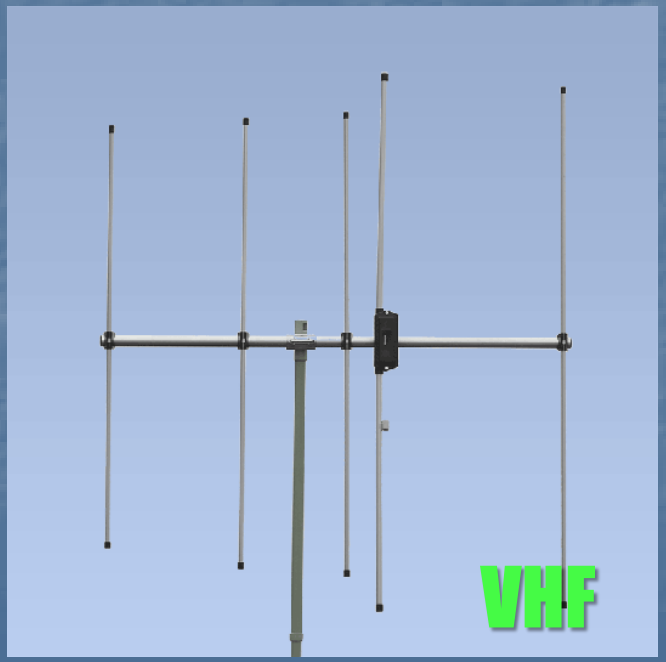

Arrow


UHF

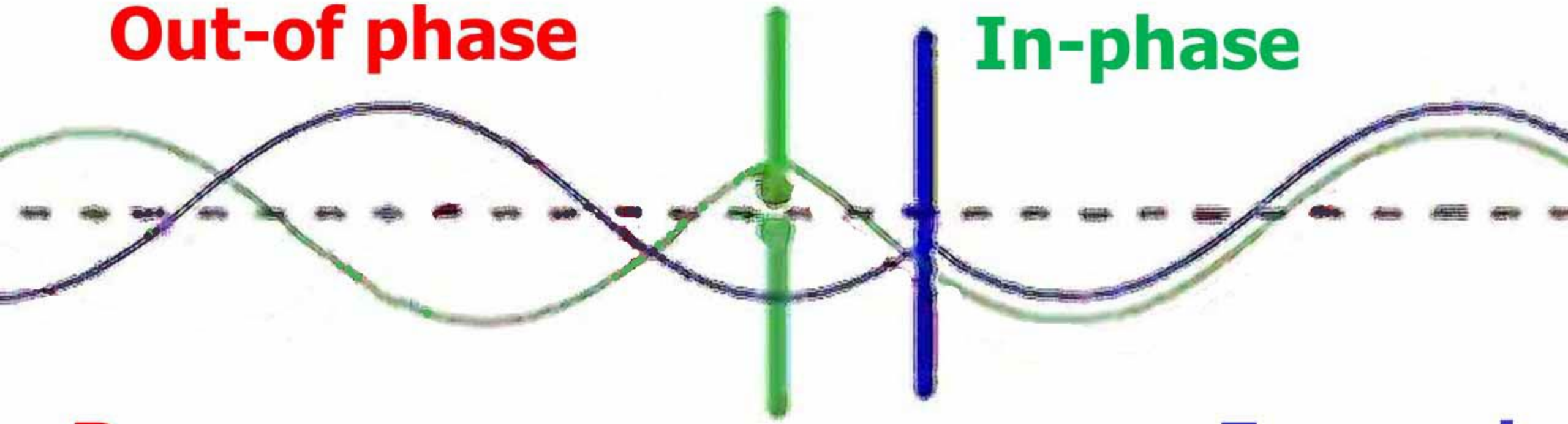

Multi-band HF


VHF

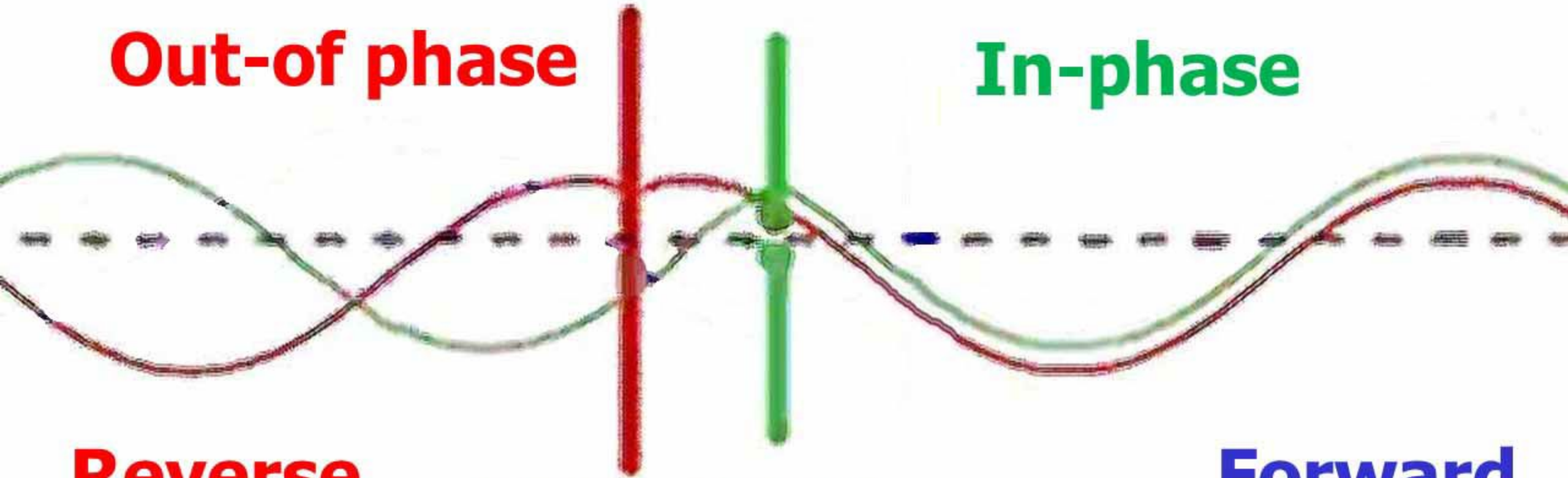

Multi-band TV

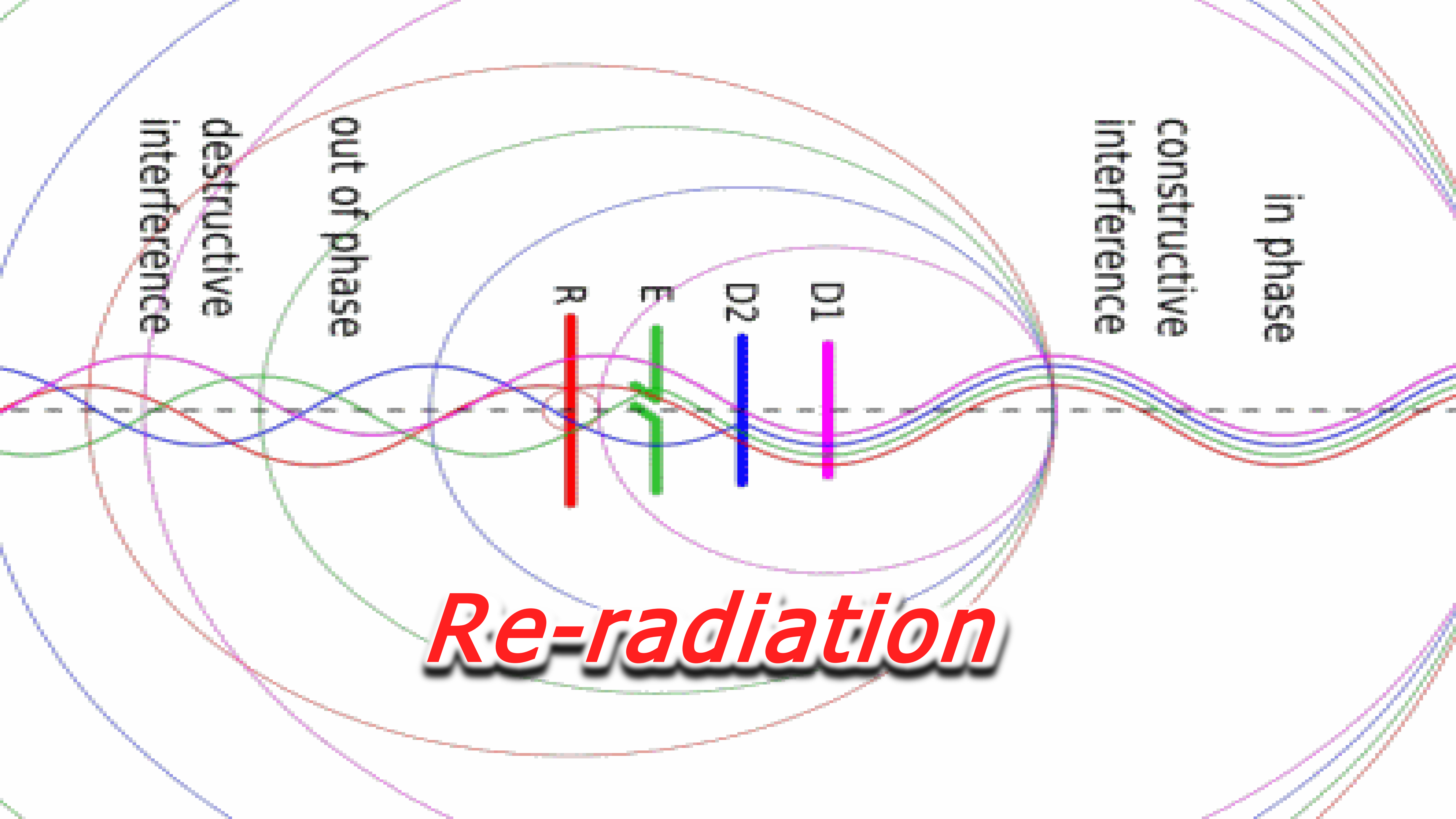

VHF

Parasitic Re-radiation



Parasitic Re-radiation




destructive
interference
out of phase
R
E
D2
D1
constructive
interference
in phase
Re-radiation

From 1926 to 1948,
even professional radio
engineers had only
trial & error for Yagi design

AND TODAY→ STILL NO
SIMPLE DESIGN RULES

Both Hams and some Engineers → Still Afraid of Yagis

Hams especially think, "Only high-powered engineers can design Yagis."

1948 --Test Ranges Sterling VA, Boulder CO

NBS (NIST) 688 Yagi Antenna Design

NBS TECHNICAL NOTE 688

U.S. DEPARTMENT OF COMMERCE / National Bureau of Standards

Yagi Antenna Design

Yagi Antenna Design

Peter P. Viezbicke

Time and Frequency Division
Institute for Basic Standards
National Bureau of Standards
Boulder, Colorado 80302

U.S. DEPARTMENT OF COMMERCE, Elliot L. Richardson, Secretary
Edward O. Vetter, Under Secretary
Dr. Betsy Ancker-Johnson, Assistant Secretary for Science and Technology

NATIONAL BUREAU OF STANDARDS, Ernest Ambler, Acting Director

Issued December 1976

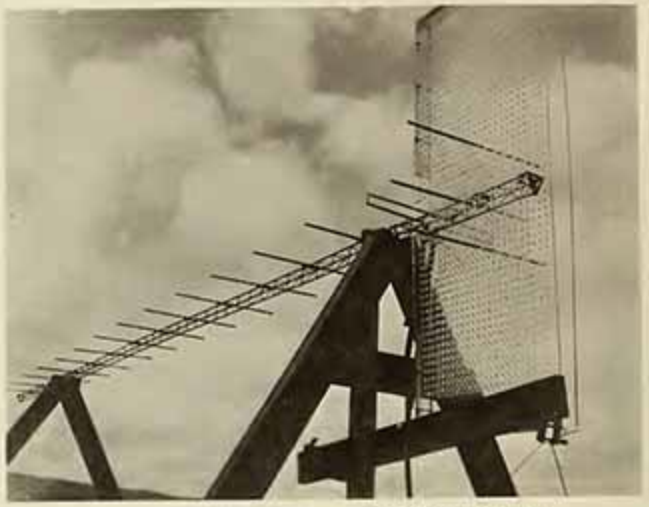


FIG. 3 PHOTOGRAPH OF THE TRIGONAL REFLECTOR EXPERIMENTAL SET-UP USED WITH THE 4.2λ YAGI

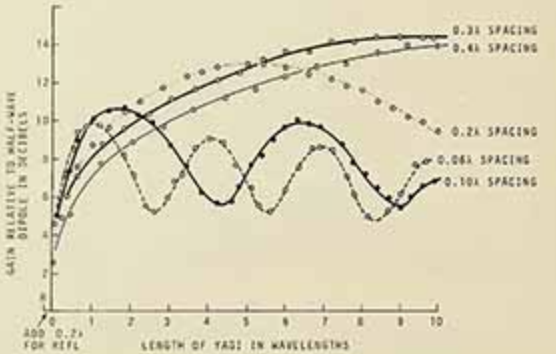


FIG. 4 GAIN OF A YAGI AS A FUNCTION OF LENGTH (NUMBER OF DIRECTORS) FOR DIFFERENT CONSTANT SPACINGS BETWEEN DIRECTORS OF LENGTH EQUAL TO 0.382λ

So TODAY

- **Many on-line calculators**

  BUT

  Considerable disagreement
  Criteria not explained
  Hams confused, which to use ??

- **Detailed graphs/equations**

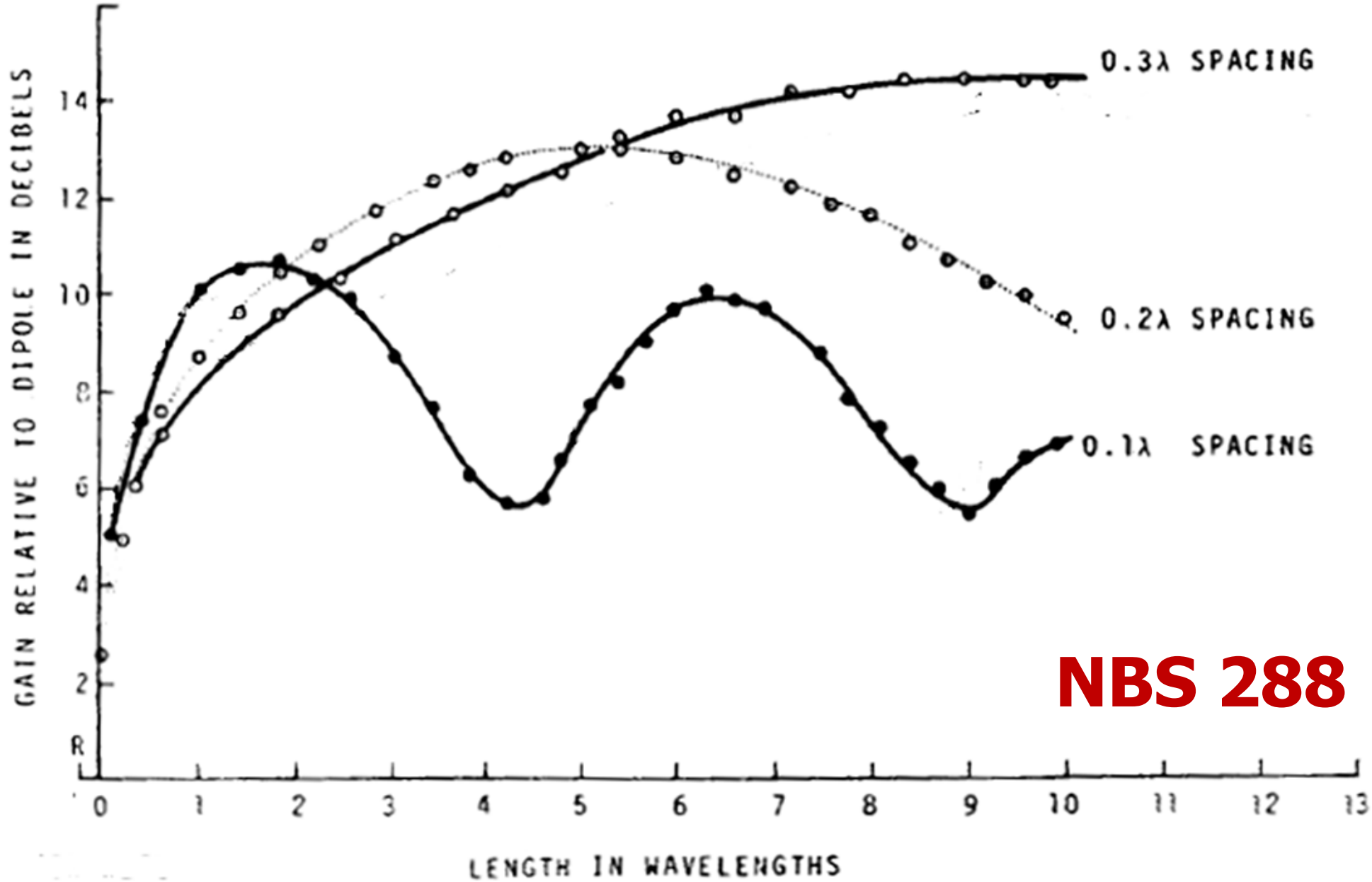
  Many hams can't handle

Need Simplification

1

Only Need 3 Rules

- All Elements 0.2 wavelengths apart.
- All Directors and the Reflector
  5% +/- than Driven Element
- Extra Directors: Equal length/spacing


GAIN RELATIVE TO DIPOLE IN DECIBELS
14
12
10
8
6
4
2
R
0
1
2
3
4
5
6
7
8
9
10
11
12
13
LENGTH IN WAVELENGTHS
0.3λ SPACING
0.2λ SPACING
0.1λ SPACING

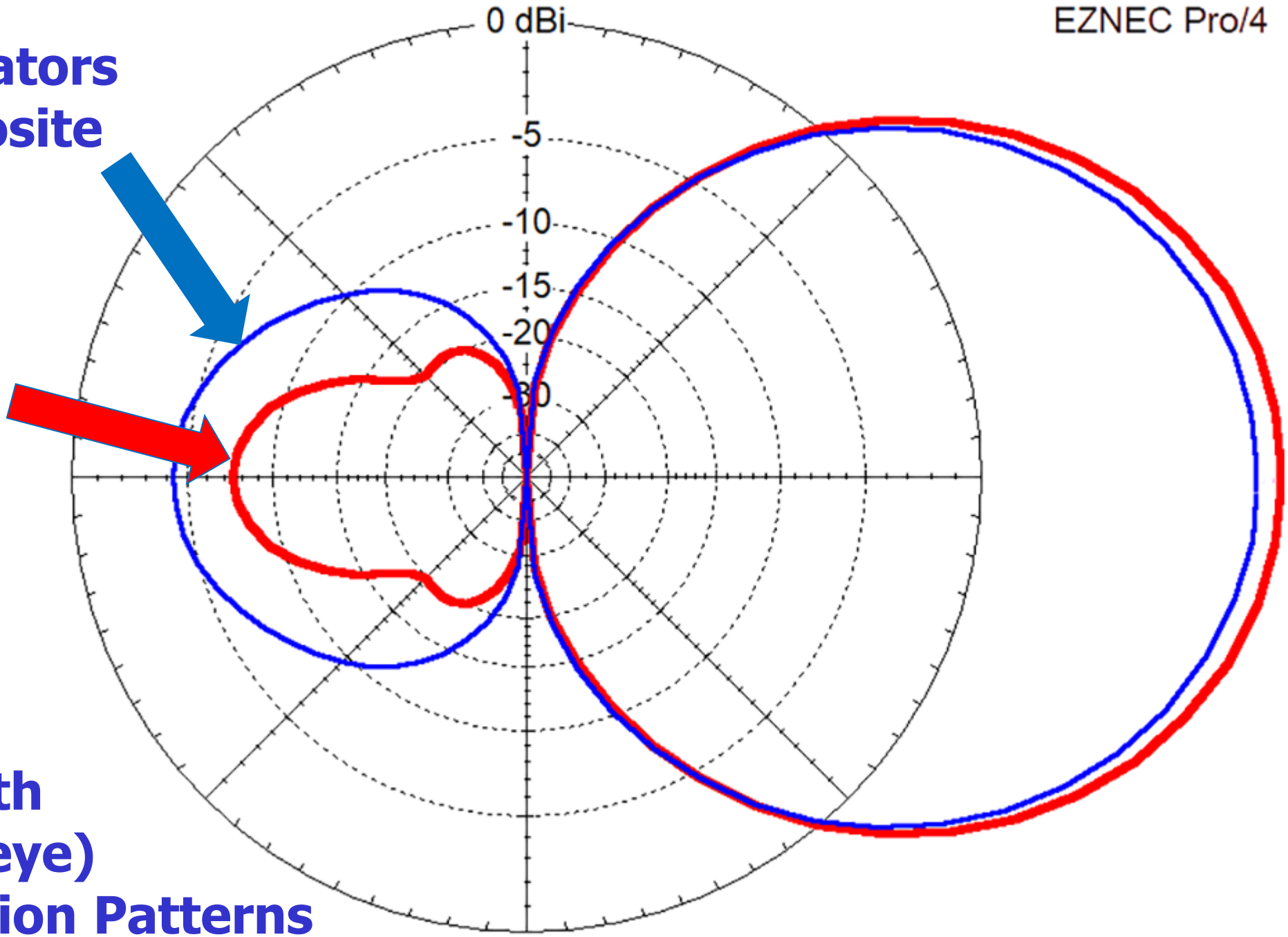
NBS 288


TOO SIMPLE

2

Calculators Composite

3 Rules Yagi



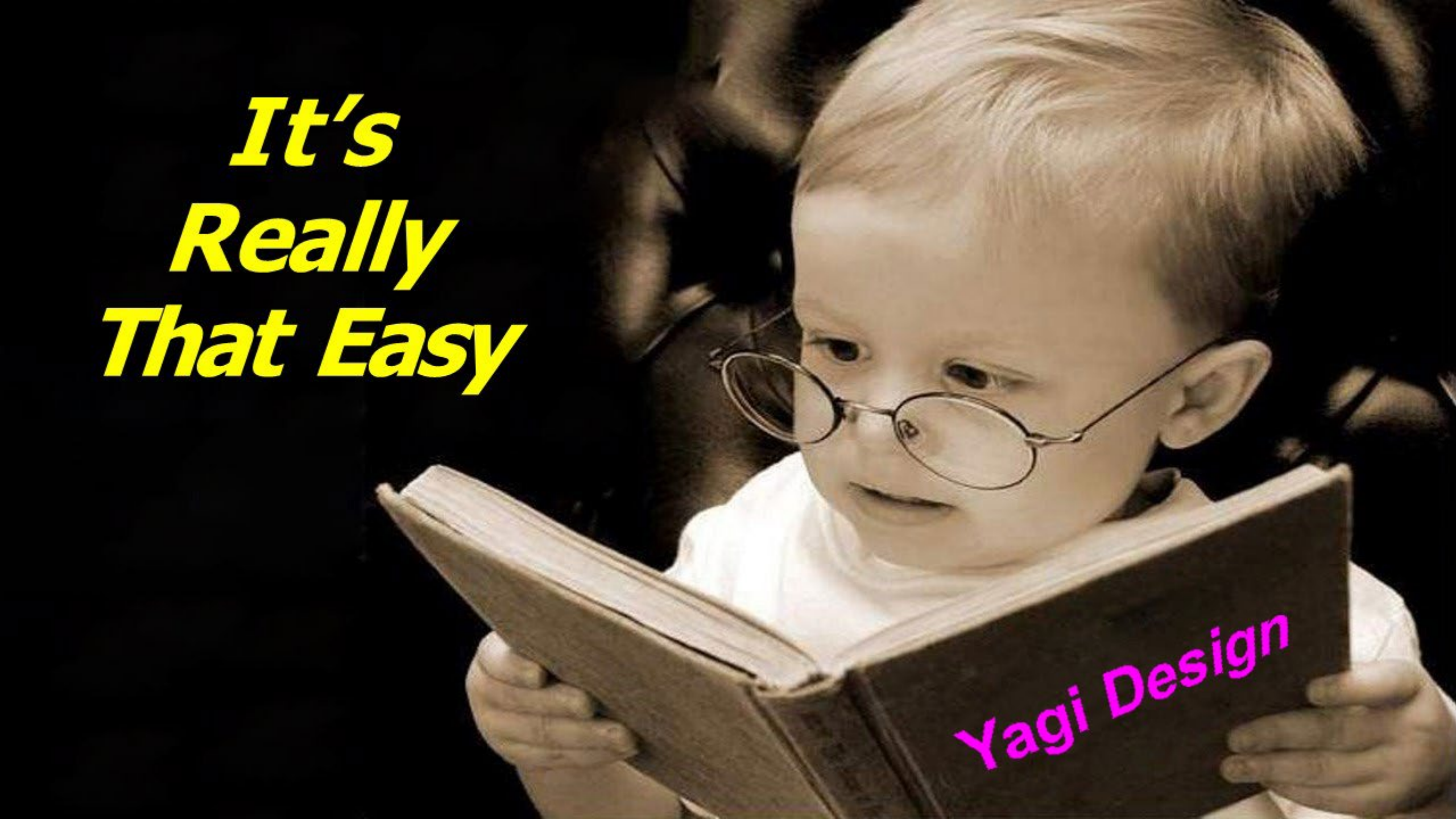
Azimuth (birdseye) Radiation Patterns

Simple Design Steps

1. Mount/tune a driven element
2. Add Reflector and Director(s)

   +/- 5%, 2/10 λ spacing
3. Match feedpoint (SWR) (1)
4. Trim elements equally (Freq.) (2)

It's Really That Easy



Most Common Match Methods

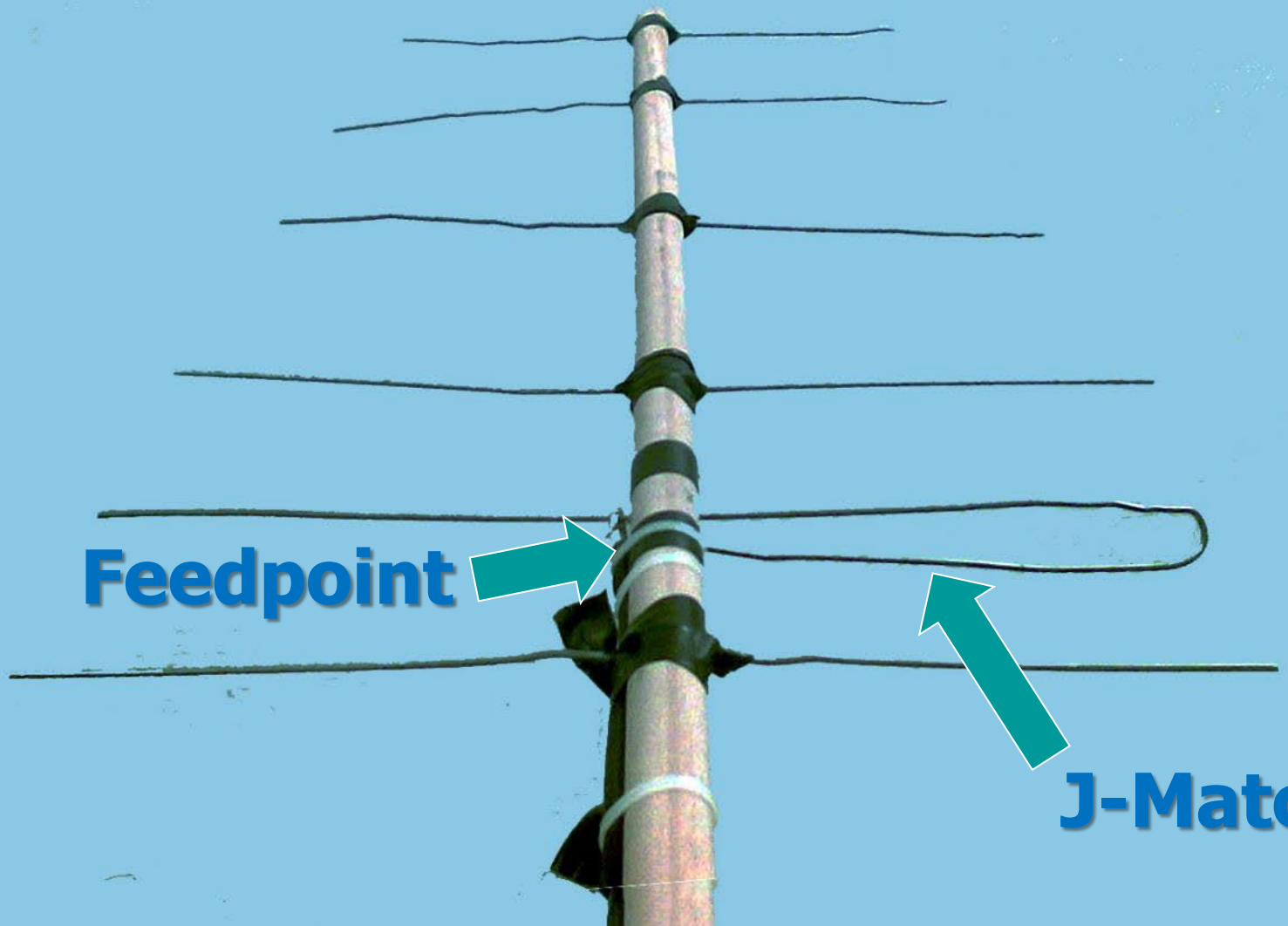
Examples below

- Gamma Match – difficult
- J-match – ½ folded dipole
- Hairpin – easiest

Really Cheap Yagi Example

The Boom

PVC Booms Aren't Handy



Difficult to attach the elements

Rectangular Booms are easier

Difficult to source

Diana Eng

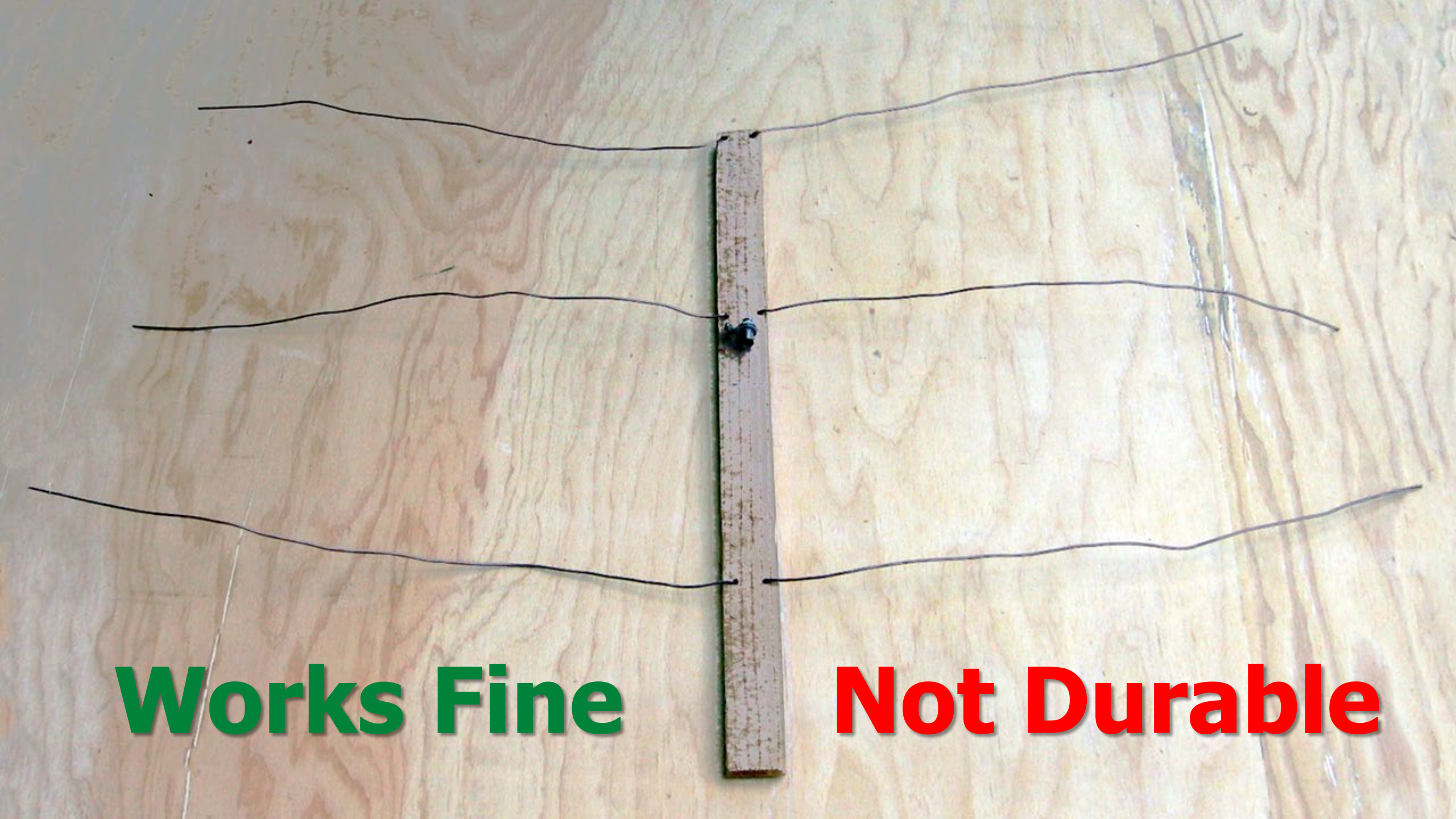
KC2UHB

Really Cheap Yagi Examp;e

The Elements

Soft copper of aluminum tubing

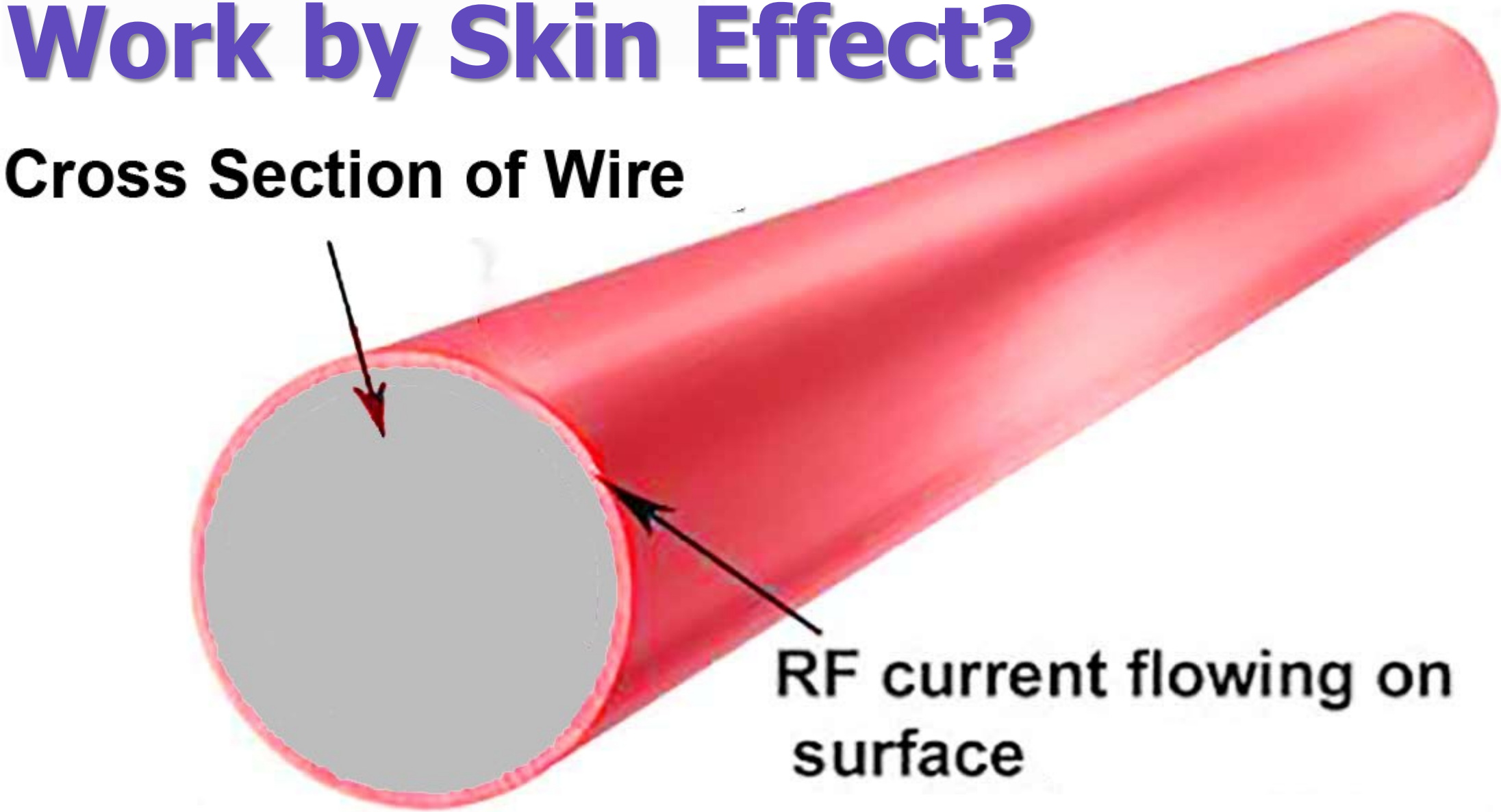
Solid house wire


Works Fine
Not Durable

Aluminum Foil-Covered Non-MetallicElements

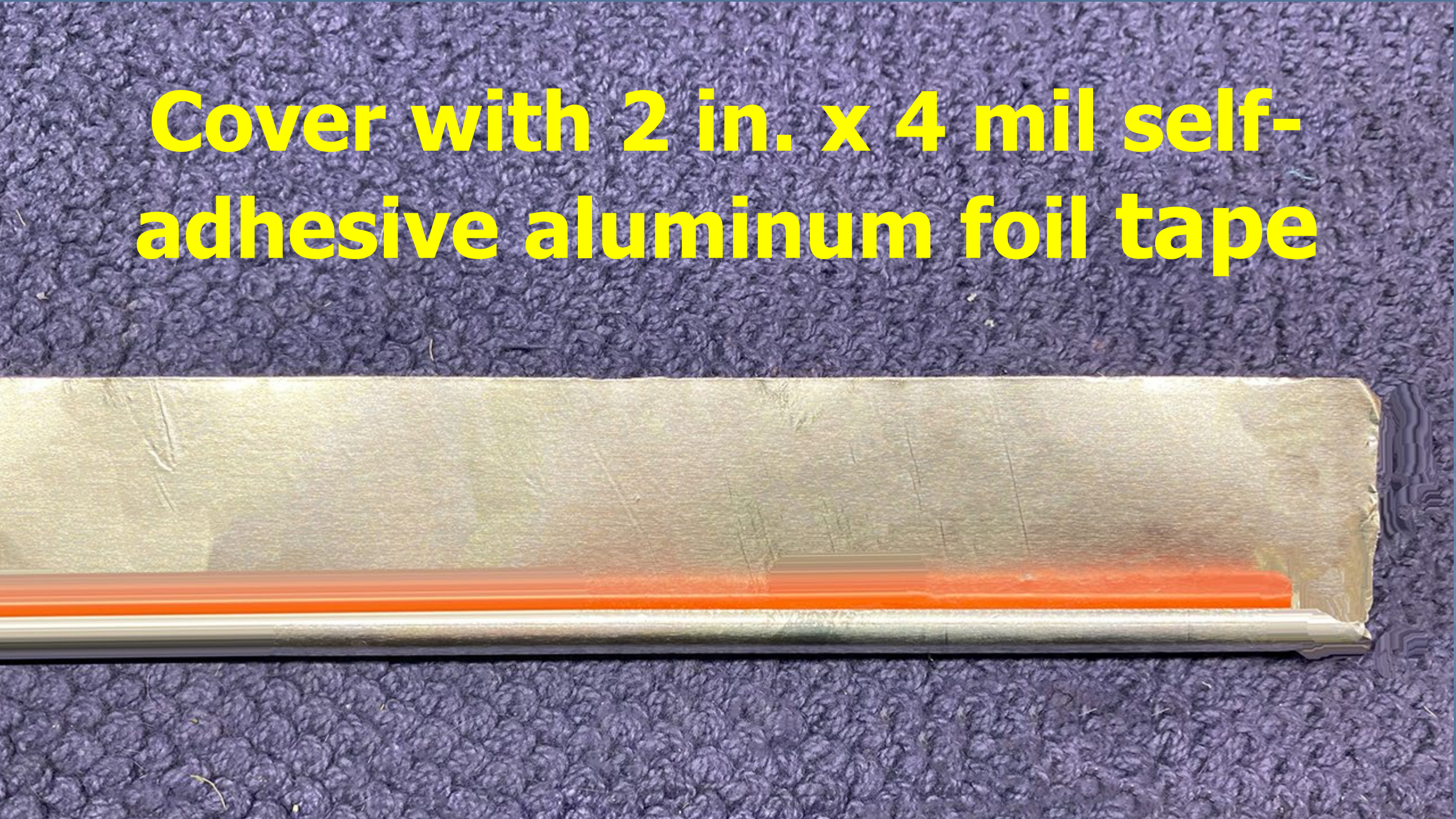
Very Durable 5/16 in. fiberglass driveway snow markers

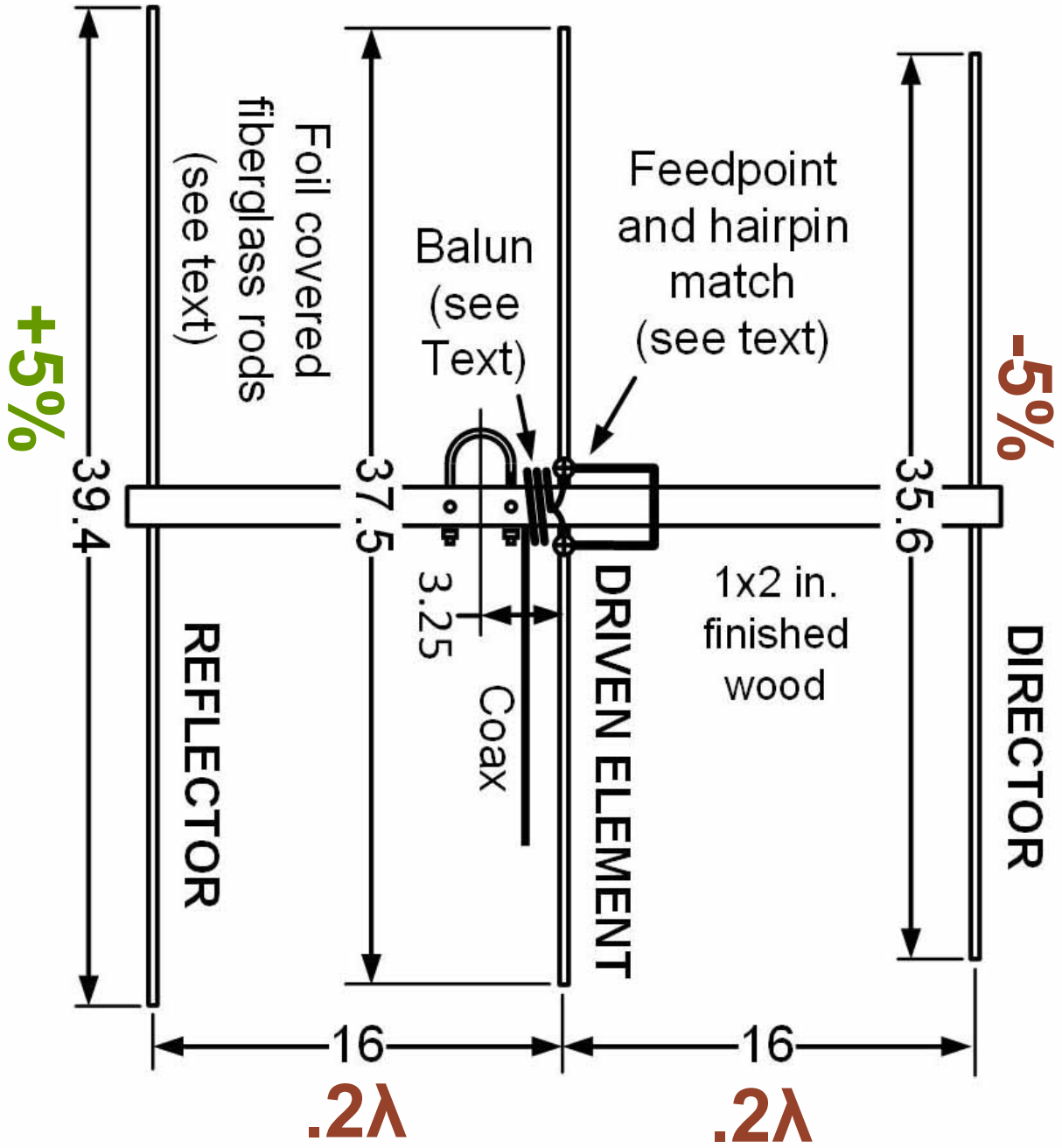
Work by Skin Effect?



Bike Flag

1/4 in. fiberglass


Cover with 2 in. x 4 mil self-adhesive aluminum foil tape



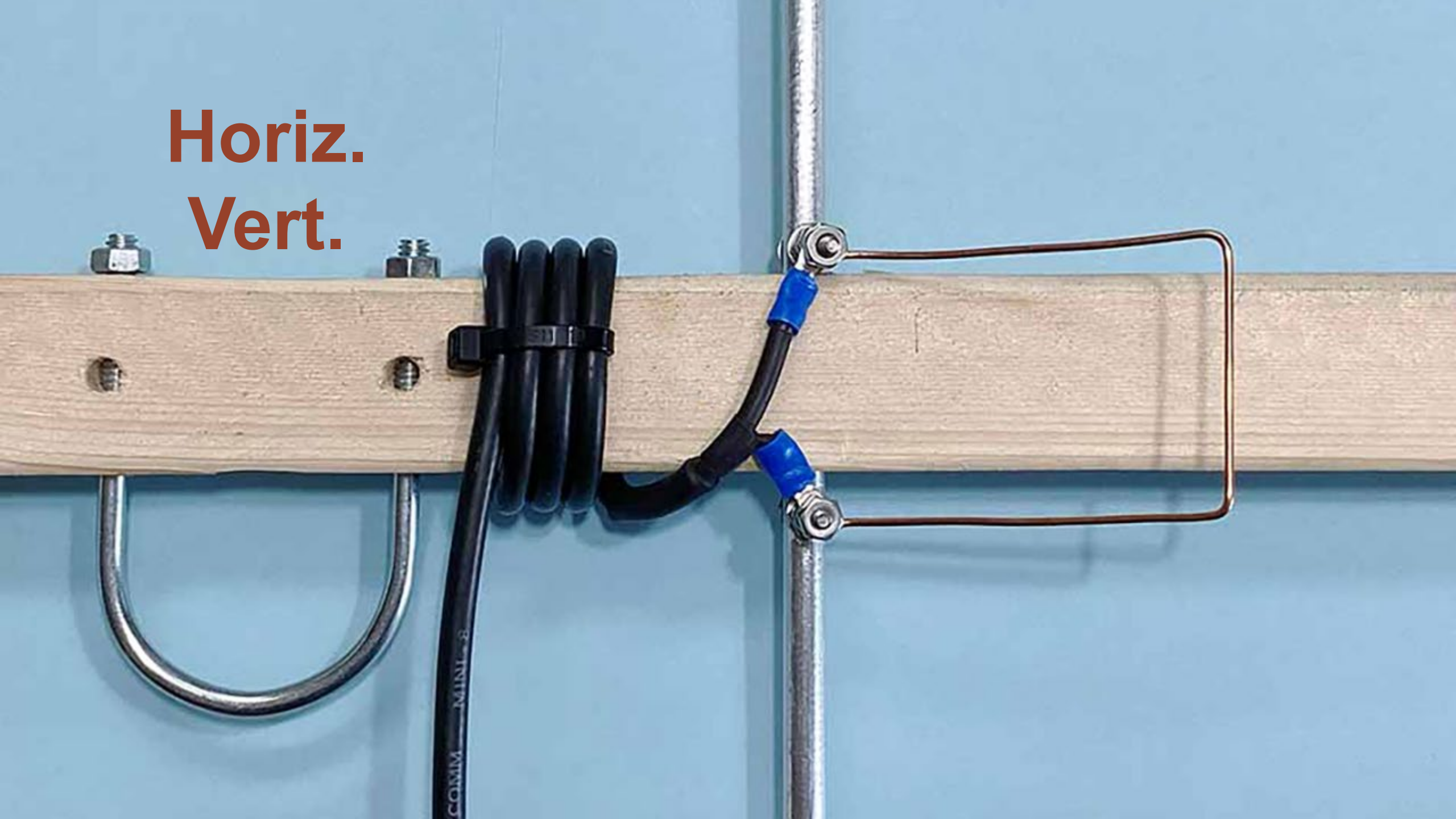
Simple, Easy 2-meter Yagi

Coming: *On the Air*


3
14 AWG Solid Copper Wire
Hairpin-Match
2
Loops for 6-32 screws

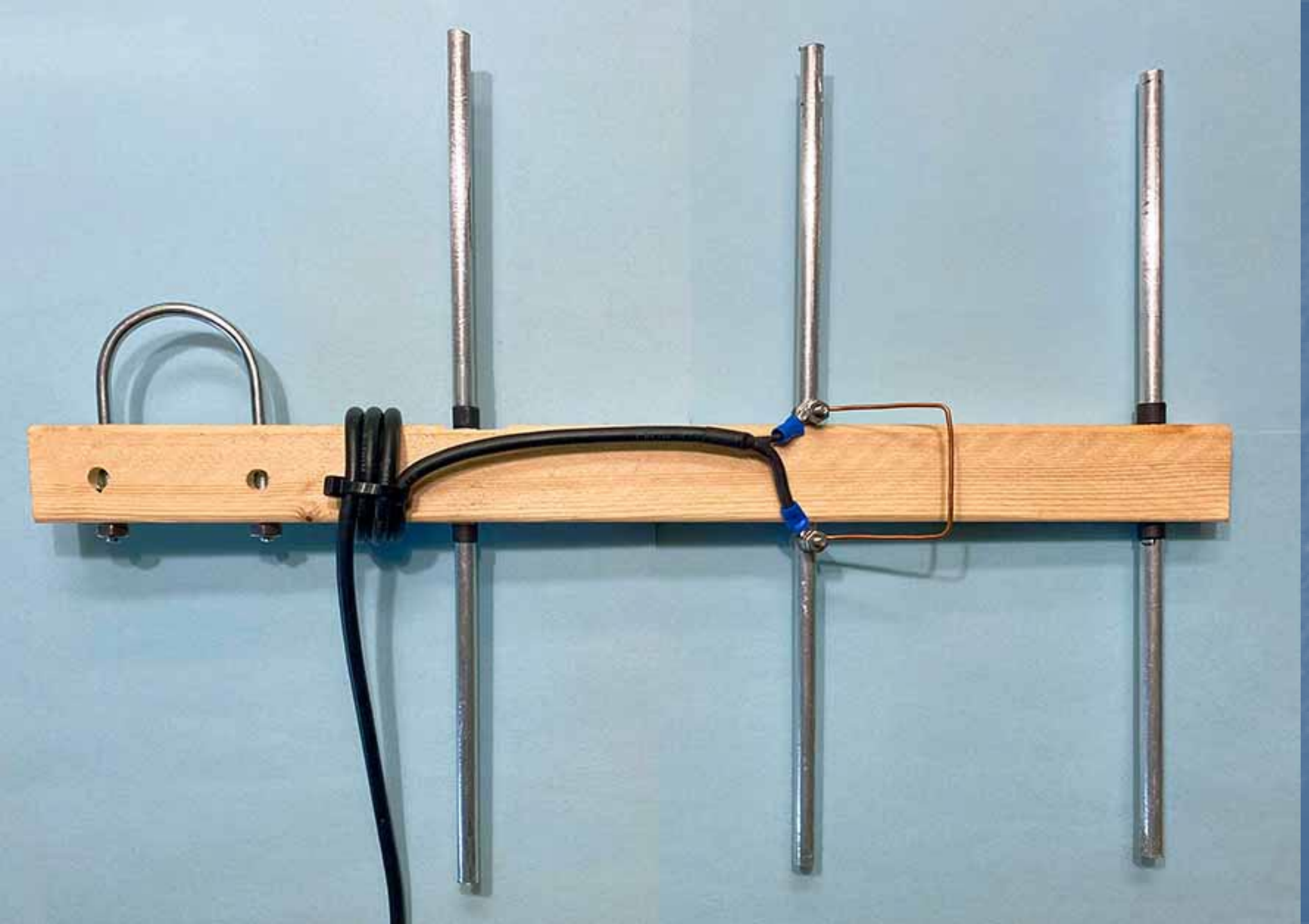
How Hairpin Match Works

- Dipole in free space – 72 Ω Ohm
- Director(s) reflector → 35 - j Ω
- Hairpin, shorted TX line – inductive

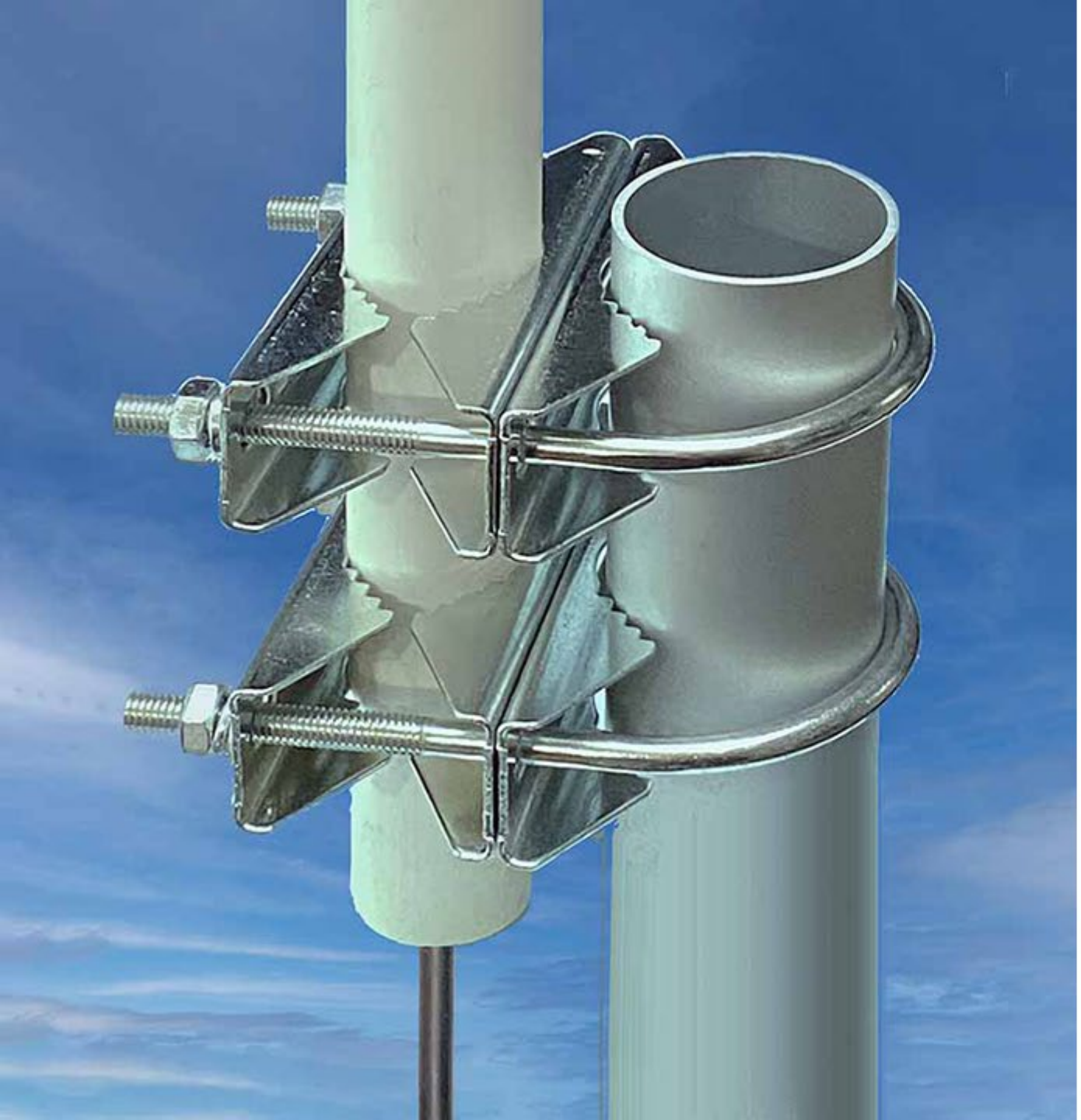

Horiz.
Vert.

Other Bands

220 MHz, 70-cm



70-cm



Double TV mast clamp

Take Away

Only 3 Sweet-Spot Rules

- All Elements 0.2 wavelengths apart.
- All Directors and the Reflector
  5% +/- than the Driven Element
- Extra Directors: Equal length/spacing

Design Steps

1. Mount/tune a drivrn element
2. Make Reflector and Director(s)

   +/- 5%, 2/10 λ spacing
3. Match the feedpoint (SWR)
4. Trim ALL element equally (Freq.)

No Longer Afraid of Yagis

There is a SIMPLE method

"Not just high-powered
engineers can design Yagis"

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