Stacking the Deck in Your Favor

A Practical (and Slightly Entertaining) Guide to VHF/UHF Antenna Stacking

By Greg, N5XO

Introduction — When One Antenna Just Isn't Enough

There comes a moment in every VHF/UHF ham's life when you realize:

"The other guy is hearing things I'm not…"

And the natural conclusion is:

"I need MORE antenna."

Welcome to **antenna stacking**—where things get better… or weird… depending on how you do it.

This guide will walk you through:

- What stacking actually does
- How to do it correctly
- Why feed systems matter (a LOT)
- How to space and tune your antennas
- And how to avoid turning your station into a science experiment

PART 1 — WHAT IS ANTENNA STACKING?

The Simple Version

Stacking = combining **two or more identical antennas** so they behave like one higher-performance system.

Usually:

- **Vertically stacked** (most common)
- Same direction (same azimuth)

What It Does

✔ Adds Gain (~2.5–3 dB for two antennas)

✔ Lowers takeoff angle

✔ Improves signal-to-noise

✔ Focuses RF where you actually want it

Visual Example — Stacked Yagis

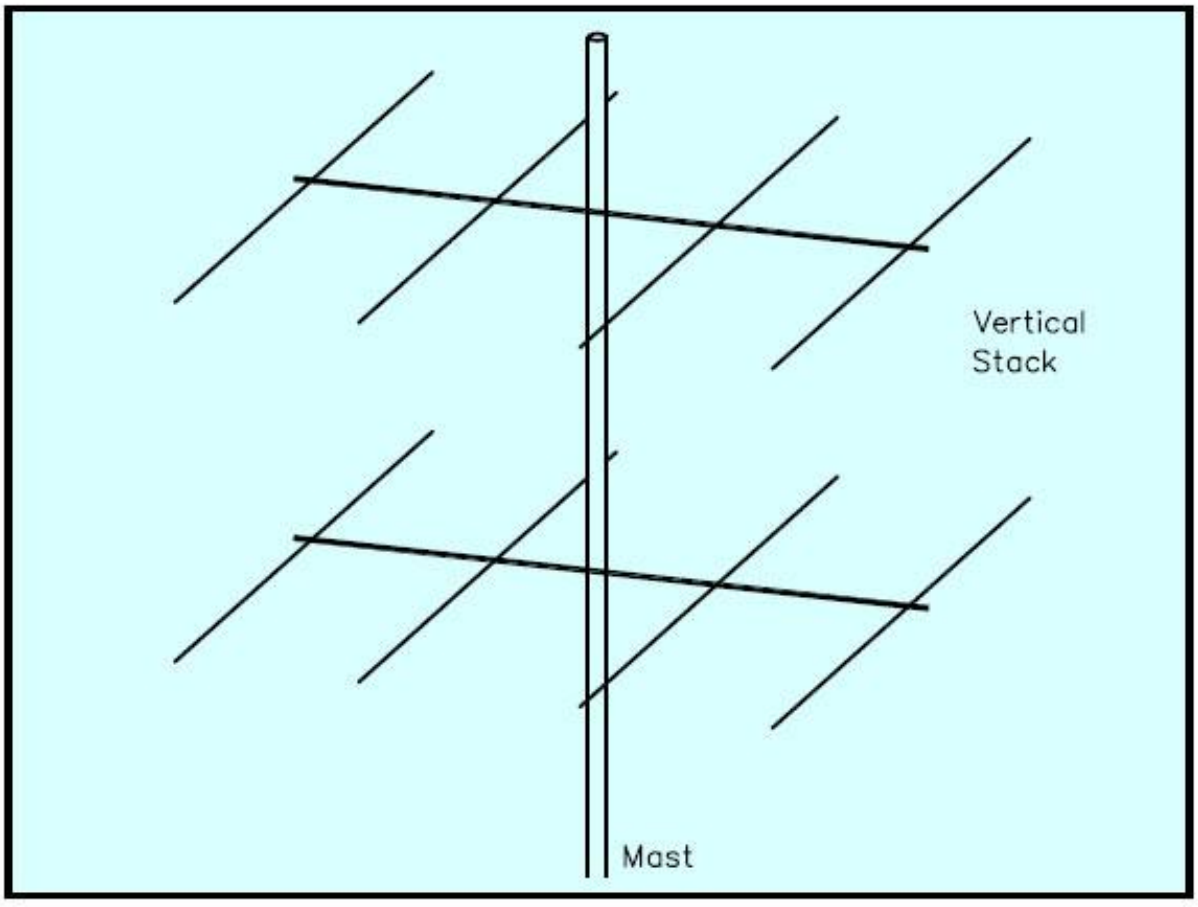
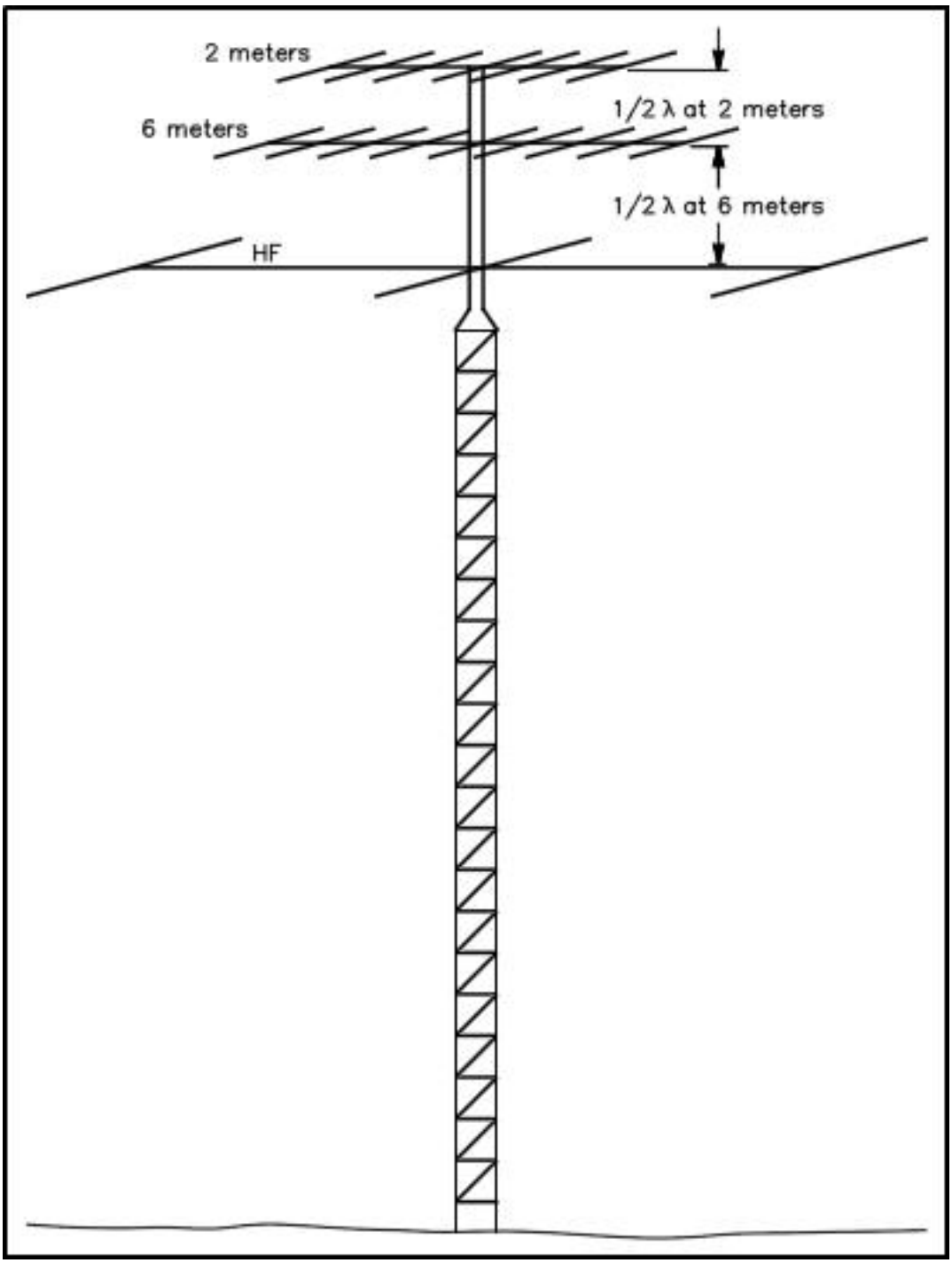


Figure 1—An example of vertical antenna stacking.


2 meters
6 meters
1/2 λ at 2 meters
1/2 λ at 6 meters
HF

👉 Notice:

- Identical antennas
- Vertical spacing
- Same direction

PART 2 — WHY STACKING WORKS

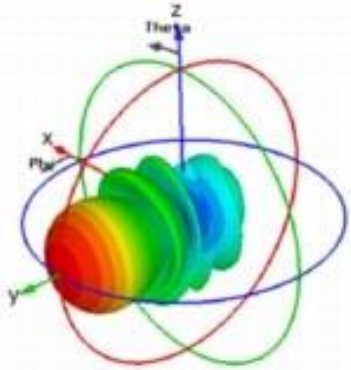
Stacking changes your **radiation pattern**.

Instead of spraying RF everywhere, you get:

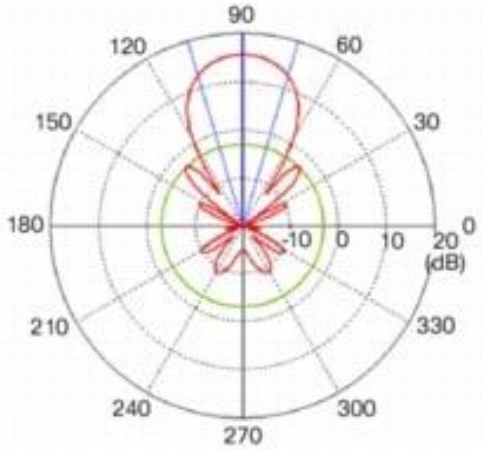
- More energy toward the horizon
- Less wasted upward
- Better long-distance performance

Pattern Concept (Simplified)

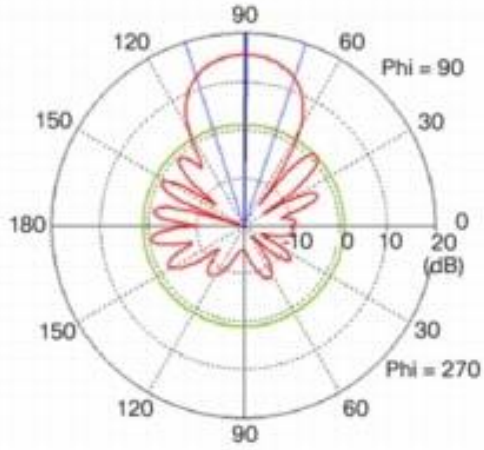
(a) Yagi Antenna Model



(b) Yagi Antenna 3D Radiation Pattern



(c) Yagi Antenna Azimuth Plane Pattern



(d) Yagi Antenna Elevation Plane Pattern

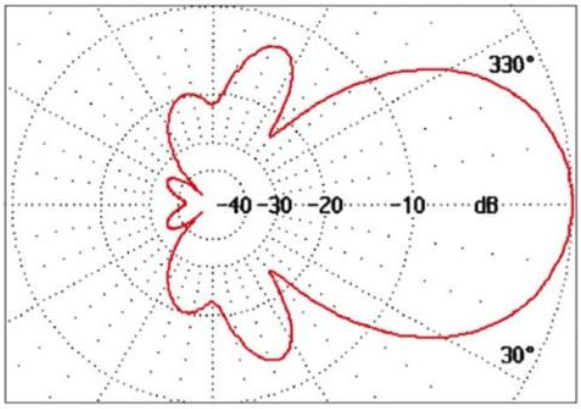


Figure 1: Directional diagram in the vertical plane (H-plane) of a 7-Ele.-28-Ω yagi according to DK7ZB (gain 10.5 dBd).

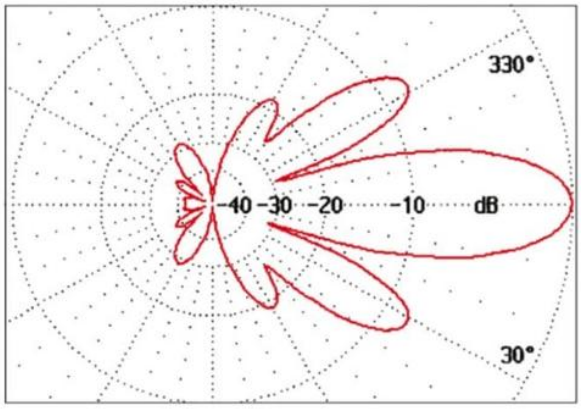


Figure 2: Directional diagram in the vertical plane (H-plane) for two 7-element yagis stacked at 3.12 m (gain 13.9 dBd)

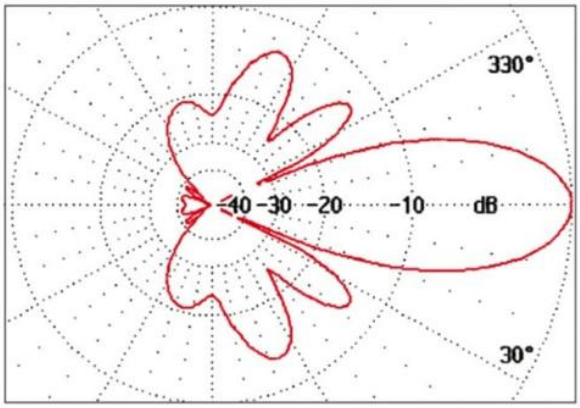


Figure 3: Directional diagram in the vertical plane (H-plane) for two 7-element yagis stacked at 2.46 m (gain 13.5 dBd)

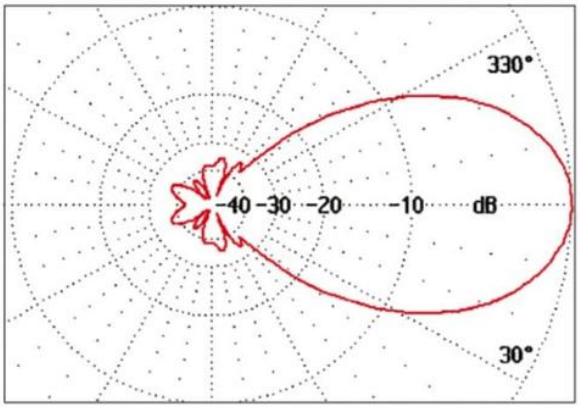


Figure 4: Directional diagram in the vertical plane (H-plane) for two 7-element yagis stacked at 1.14 m (gain 12 dBd)

Image source: Magazine “Funkamateur FA 5/97”

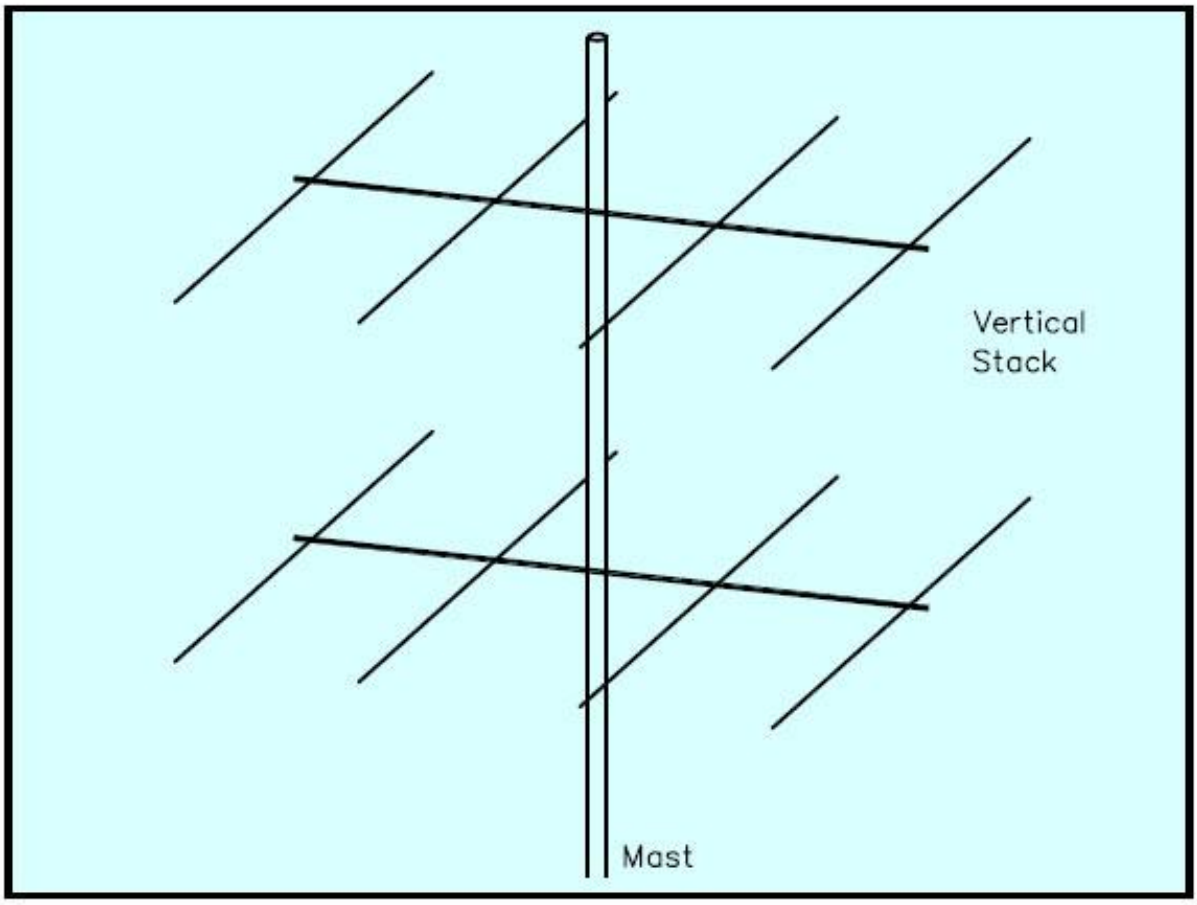


Figure 1—An example of vertical antenna stacking.

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👉 Stacked antennas:

- Narrow the vertical beam
- Push energy outward instead of upward

PART 3 — PROS AND CONS

Pros

✔ More gain
✔ Better weak signal performance
✔ Lower takeoff angle
✔ Improved receive

Cons

✖ More complexity
✖ Requires precise phasing
✖ Feedline losses matter more
✖ Mechanical stress (wind, weight)

PART 4 — THE MOST IMPORTANT RULE

USE IDENTICAL ANTENNAS

Same:

- Model
- Length
- Design

Mixing antennas is not stacking…

👉 It's chaos engineering.

PART 5 — FEED SYSTEMS (WHERE MOST PEOPLE MESS UP)

The Temptation: The "T Connector"

"I'll just split it here…"

No.

Just… no.

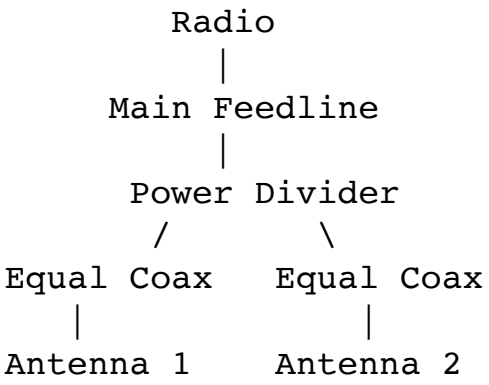
Why T-Splits Fail

- No impedance matching
- No phase control
- Creates reflections

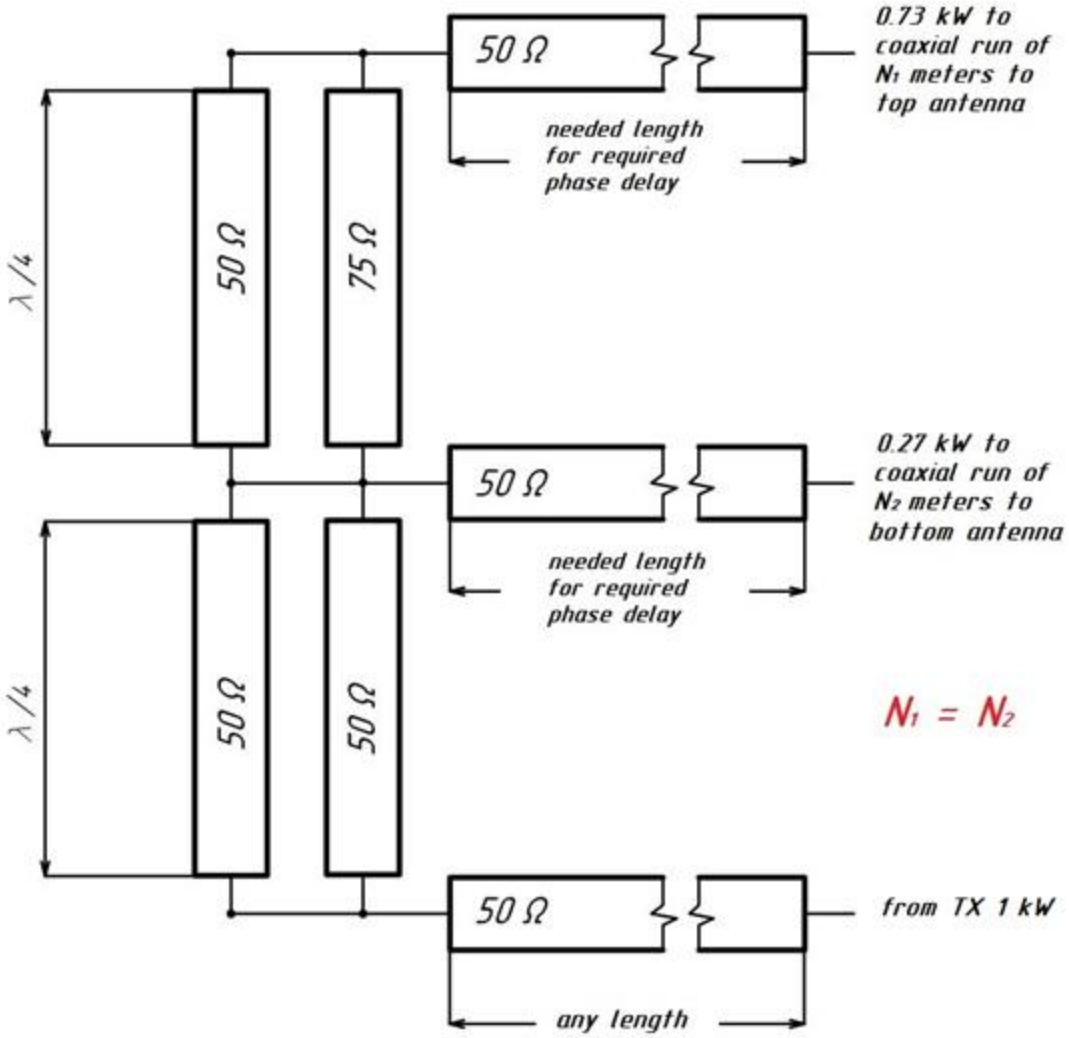
- Uneven power distribution

What You NEED — Proper Power Divider / Phasing Harness

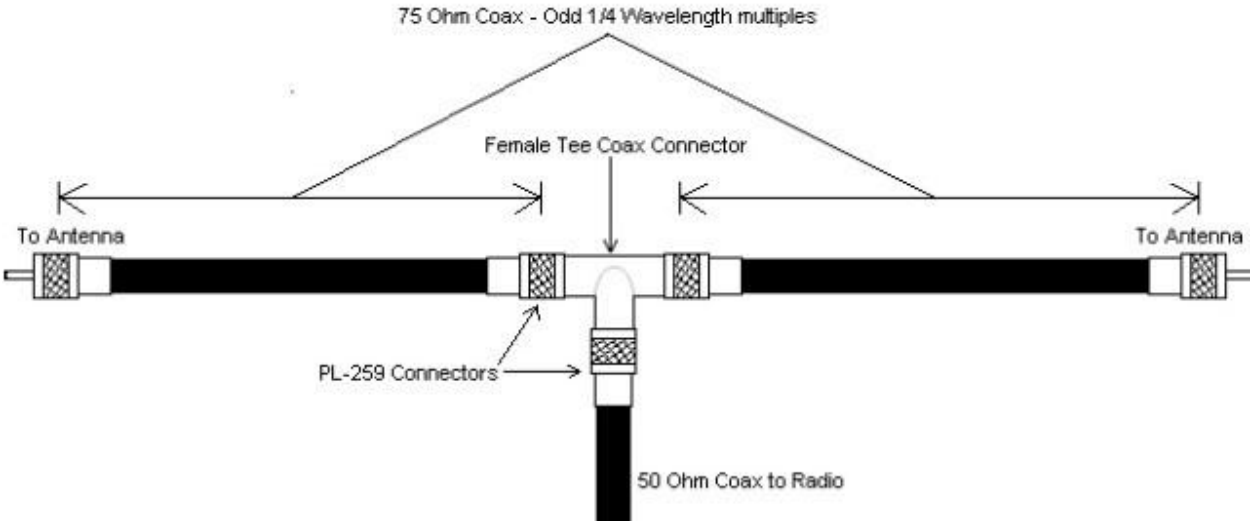
Correct Setup

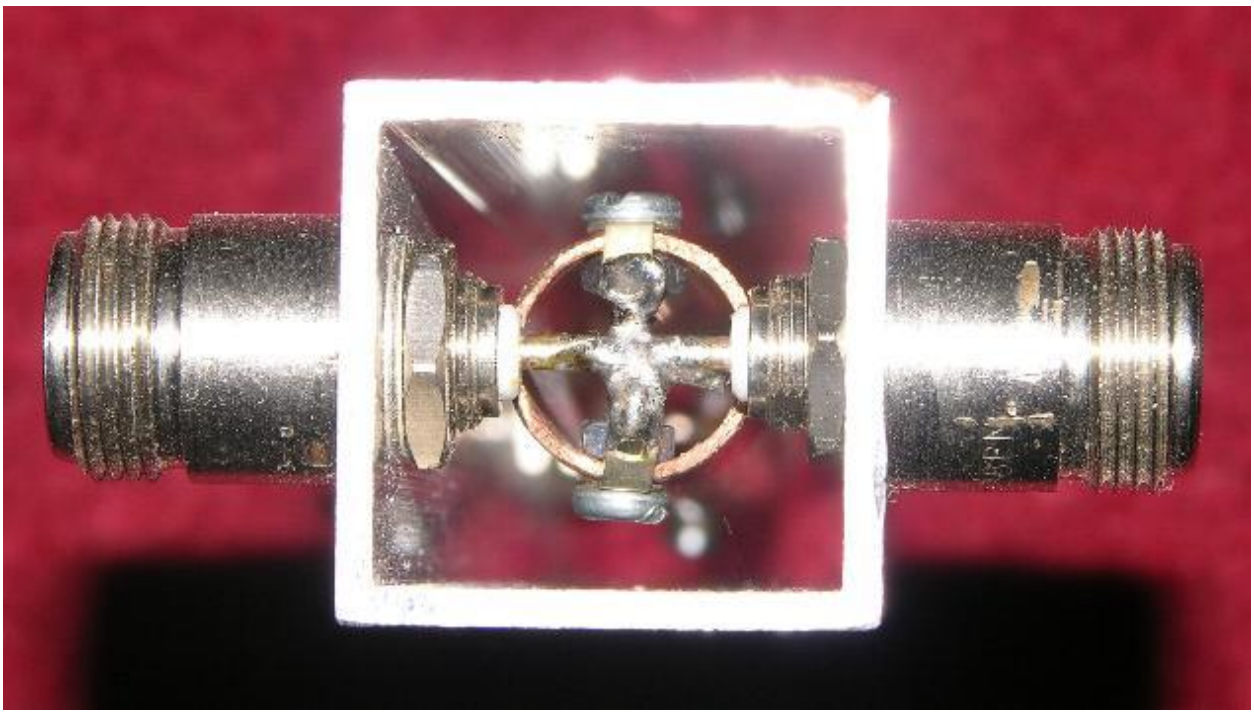


Visual Example — Proper Feed System


50 Ω
0.73 kW to coaxial run of N1 meters to top antenna
needed length for required phase delay
50 Ω
75 Ω
λ/4
50 Ω
0.27 kW to coaxial run of N2 meters to bottom antenna
needed length for required phase delay
λ/4
50 Ω
50 Ω
N1 = N2
50 Ω
from TX 1 kW
any length

Method for Co-Phasing 50 Ohm Antennas





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👉 Key rules:

- Equal coax lengths
- Same type coax
- Clean connections

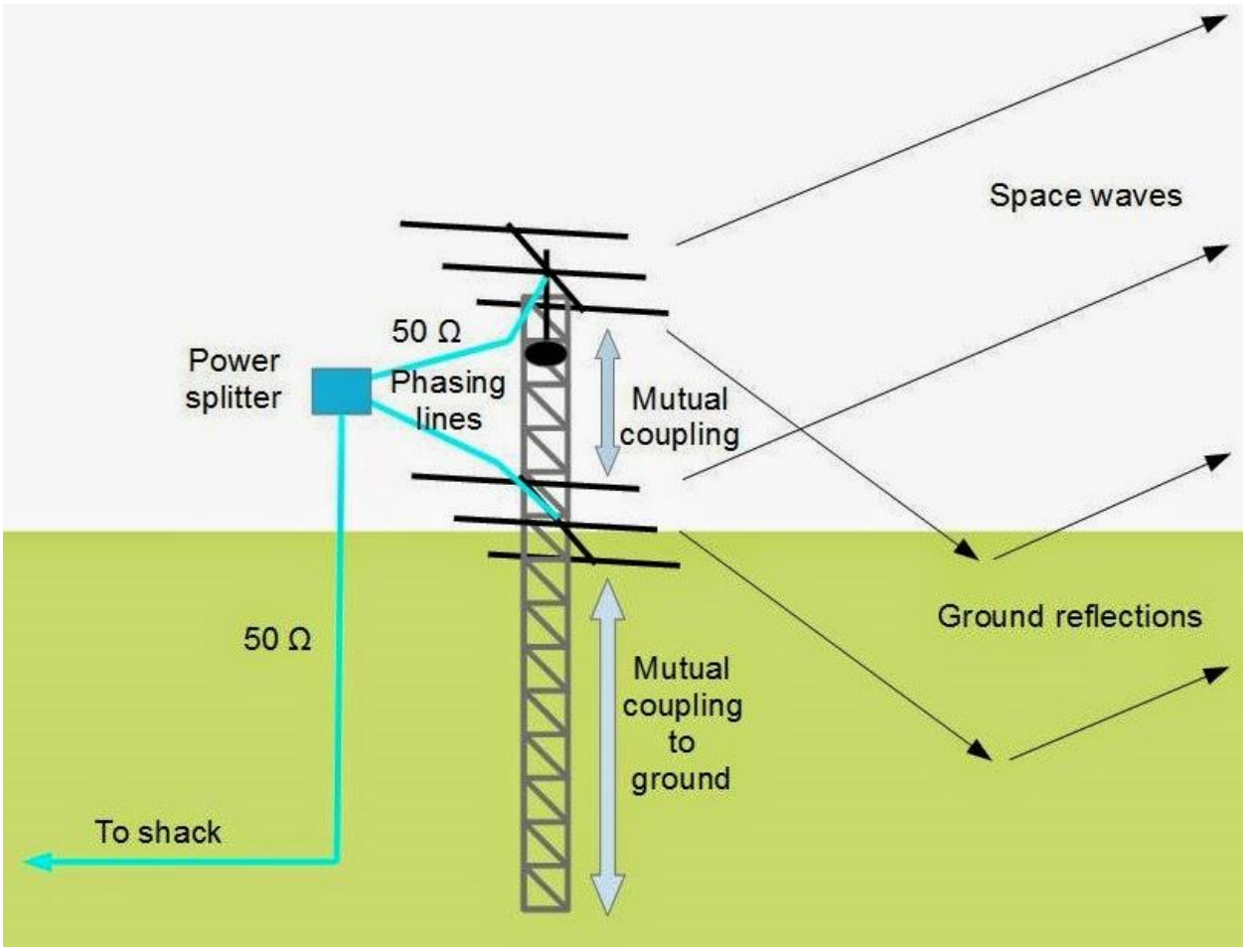
PART 6 — QUARTER-WAVE PHASING (THE CLASSIC METHOD)

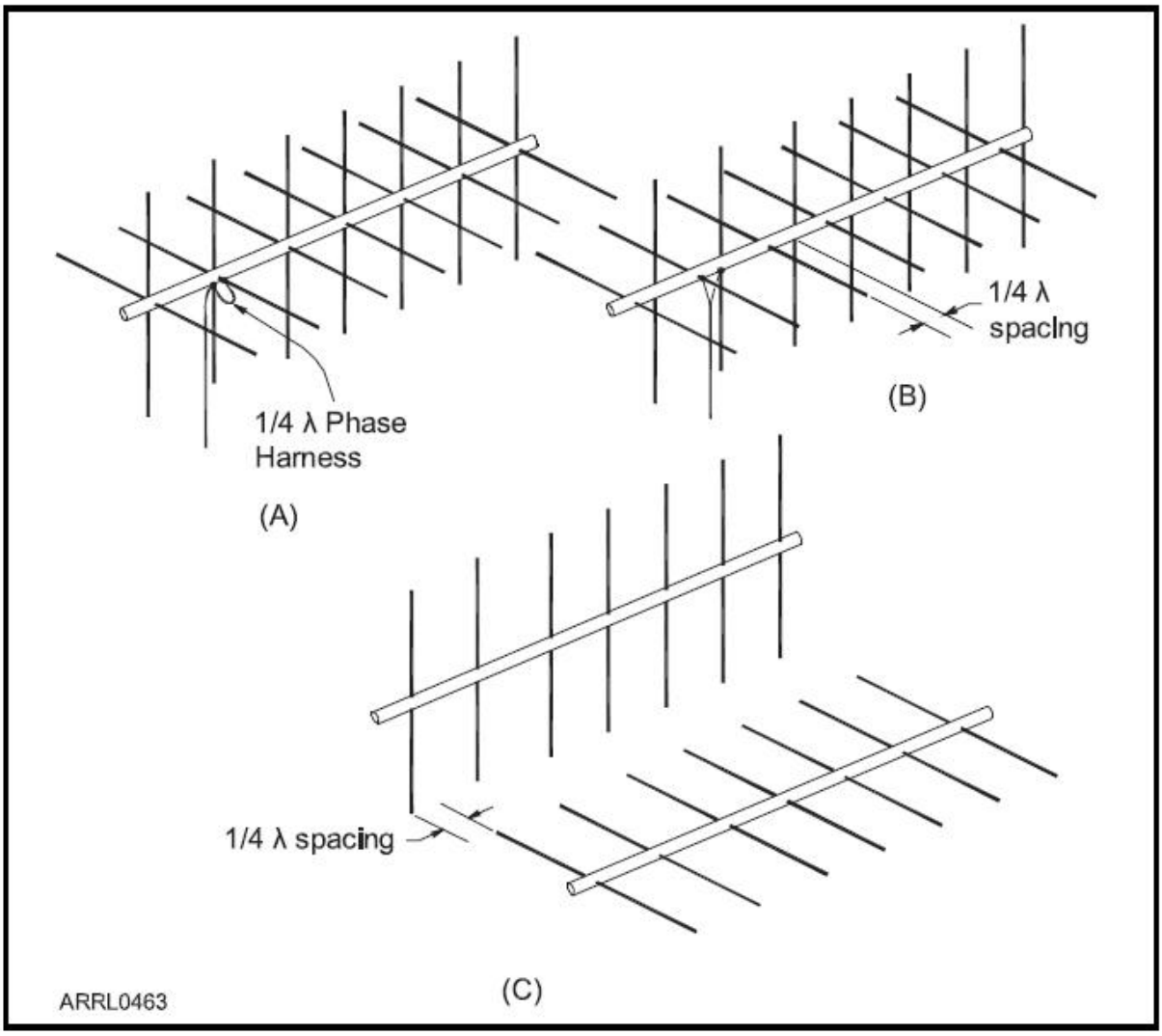
Why It's Used

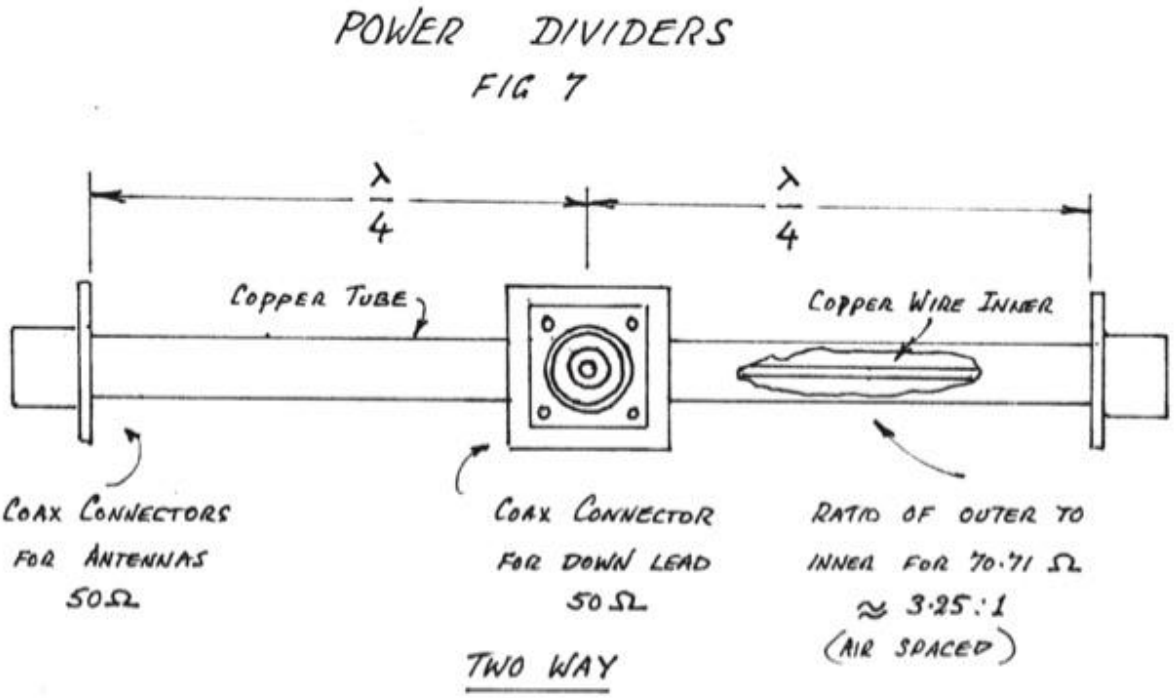
Quarter-wave sections help:

- Match impedance
- Maintain phase
- Deliver equal power

Basic Concept




1/4 λ Phase
Harness
(A)
1/4 λ
spacing
(B)
1/4 λ spacing
(C)
ARRL0463



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Reality Check

You must account for:

- Velocity factor
- Connector length
- Real-world trimming

👉 Close counts in horseshoes… not in phasing lines.

PART 7 — ANTENNA SPACING (CRITICAL)

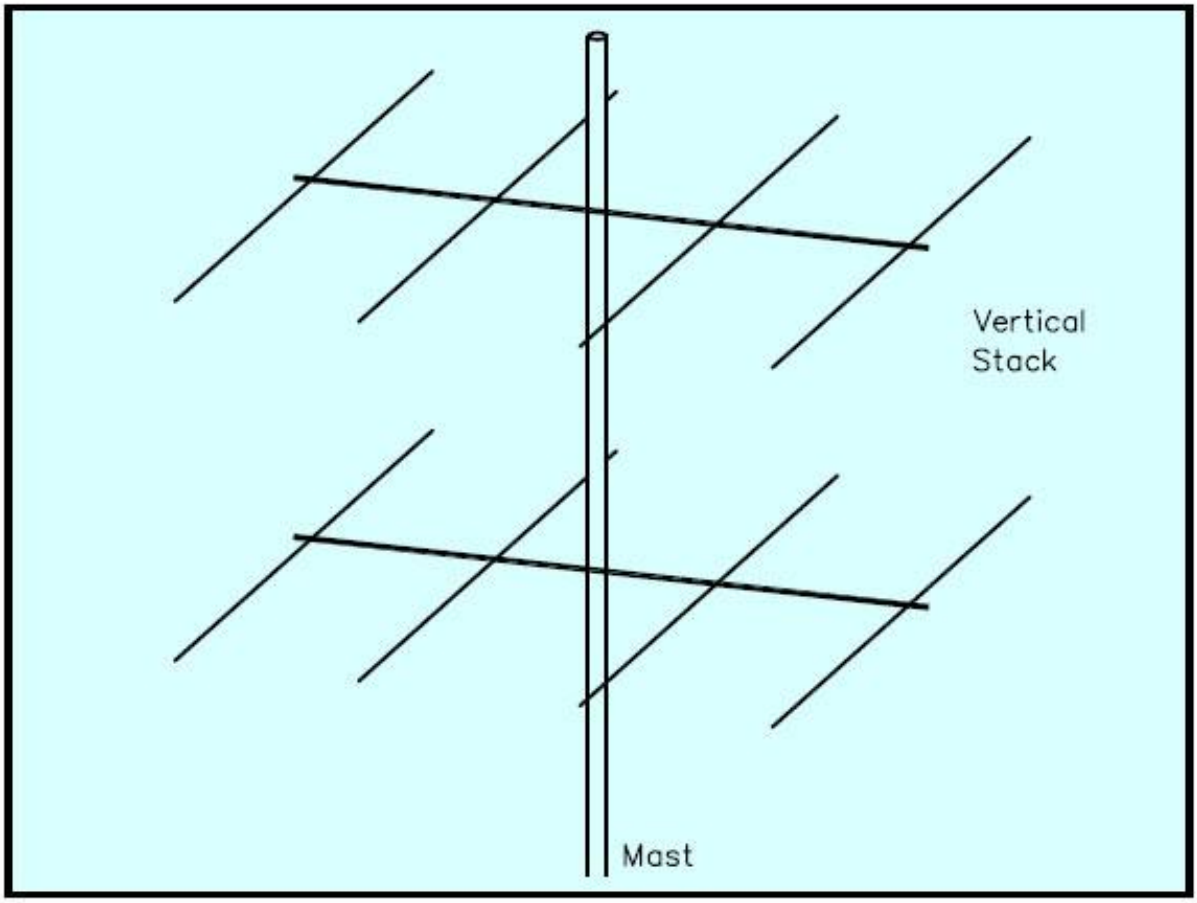
General Rule

Spacing ≈ **0.7 to 1 wavelength**

Typical Spacing

Band	Spacing
2 meters	8–12 ft
70 cm	3–6 ft
23 cm	1–3 ft

Visual Example — Spacing



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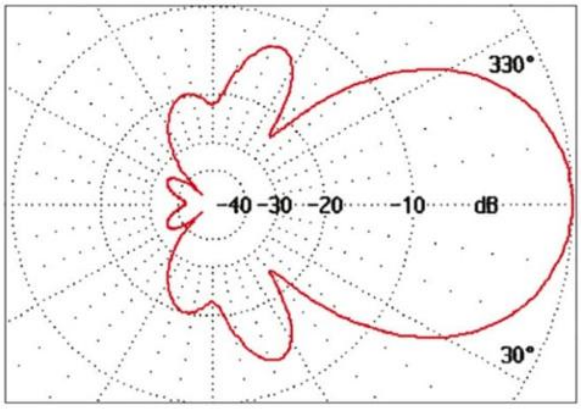

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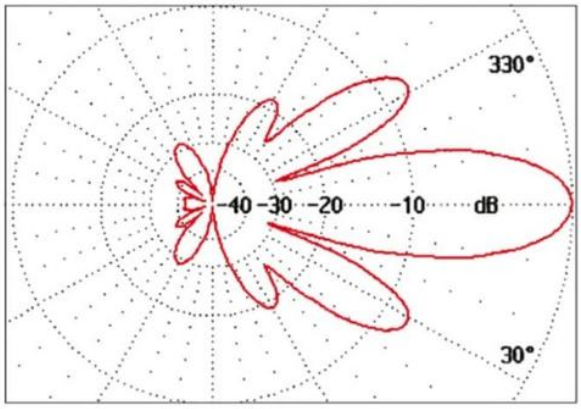

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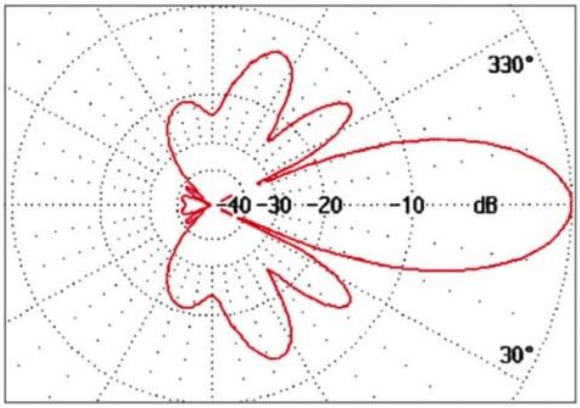

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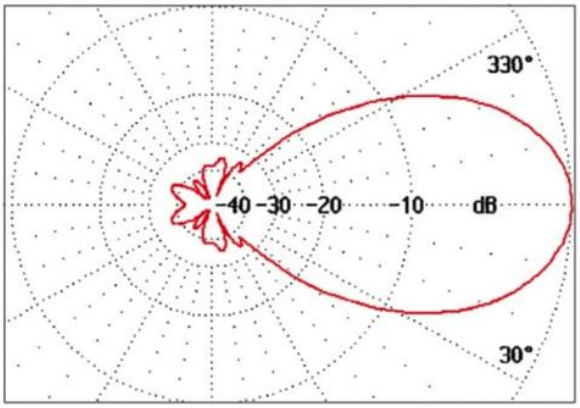

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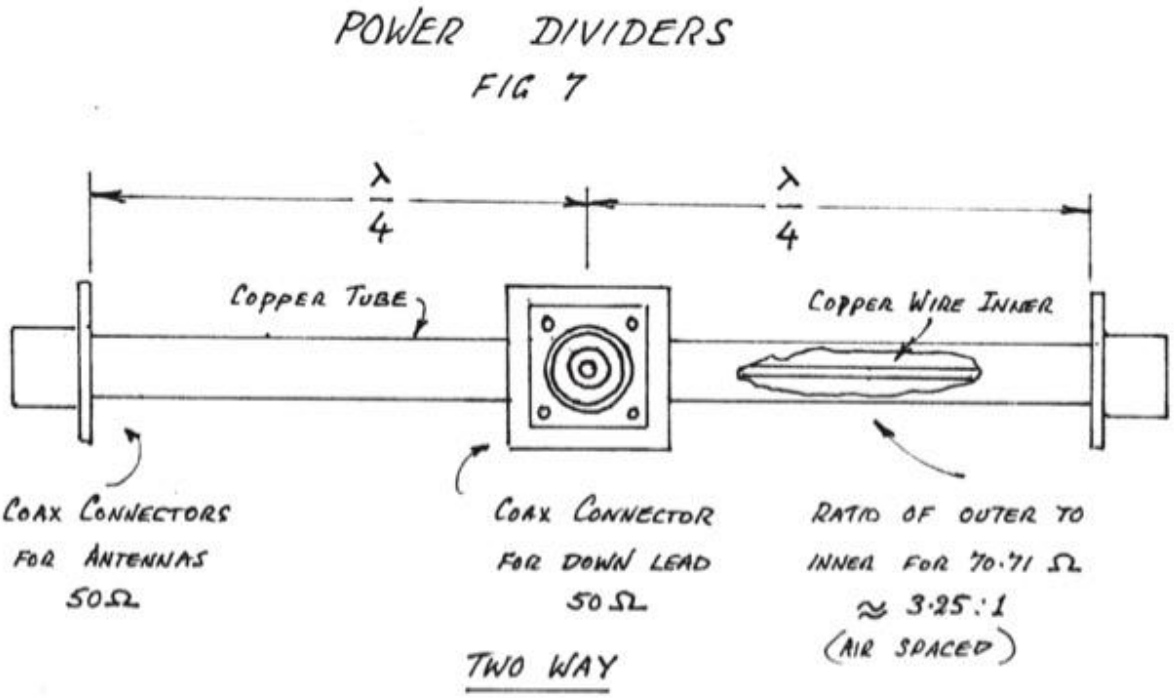


If You Get It Wrong

Too Close:

- Coupling
- Reduced gain
- Distortion

Too Far:

- Multiple lobes
- Split signal

👉 You want ONE strong lobe… not RF confetti.

PART 8 — TUNING A STACKED SYSTEM

Step 1 — Tune Each Antenna First

Each antenna must:

- Have good SWR

- Be working properly

👉 Never stack broken antennas.

Step 2 — Build Phasing Harness

- Equal lengths
- Correct impedance
- Good connectors

Step 3 — Test Combined System

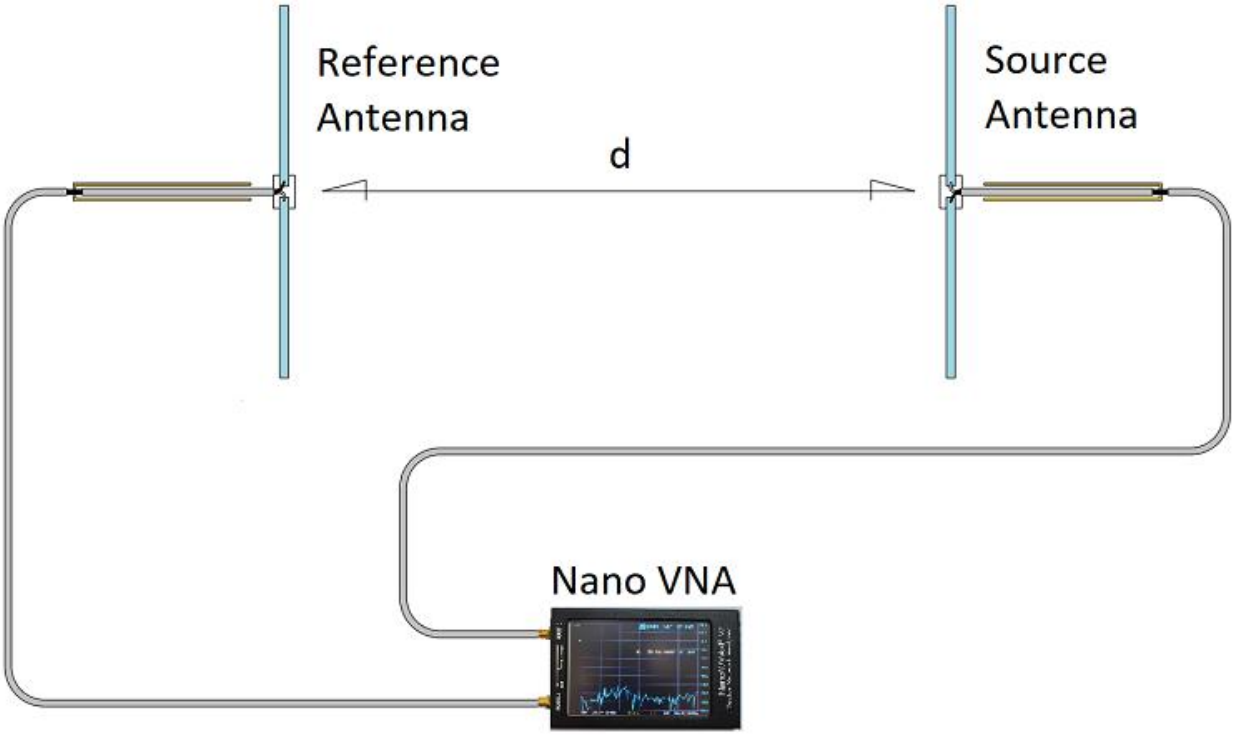
Check:

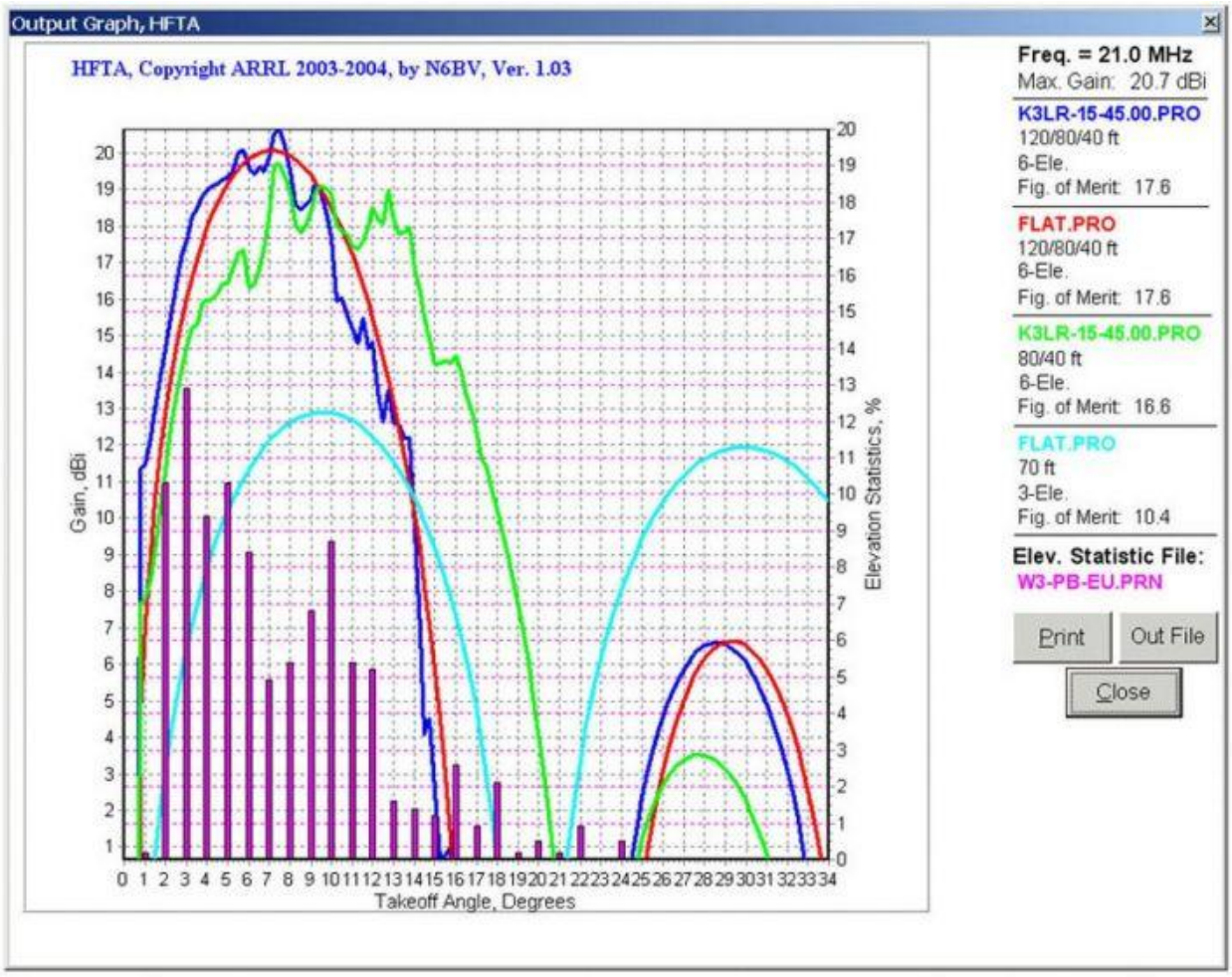
- SWR
- Performance
- Signal reports

Step 4 — Fine Tune

- Adjust spacing
- Adjust phasing length slightly
- Verify connections

Visual Example — Testing Setup


Reference
Antenna
d
Source
Antenna
Nano VNA



15 Meter Stack Response Profile from K3LR

PART 9 — REAL WORLD RESULTS

2 Meter Weak Signal Stack

Typical setup:

- Two yagis
- 10 ft spacing
- Proper phasing harness

Results:

- ~3 dB gain
- Better horizon coverage
- Improved weak signal reception

👉 That's often the difference between:

- "Maybe I heard him…"
- "You're 59 in EM12!"

PART 10 — COMMON MISTAKES

❌ **Using a T-Connector**

❌ **Unequal coax lengths**

❌ **Mixing antennas**

❌ **Ignoring spacing**

❌ **Skipping individual tuning**

FINAL THOUGHTS

Stacking antennas is one of the most effective upgrades you can make on VHF/UHF.

It's also one of the easiest ways to:

👉 Improve performance dramatically

👉 Or completely confuse yourself

Bottom Line

Do it right and you get:

- More gain
- Better pattern
- Better receive
- Better transmit

Do it wrong and you get:

- Weird SWR
- Lost power
- Confusion
- Mild regret

Final Truth

Once you experience a properly stacked system…

You won't go back.

And yes…

After all this effort…

You'll still call CQ on **144.200** and wonder where everyone is.

(It's not your stack. It's them.)

— Greg, N5XO