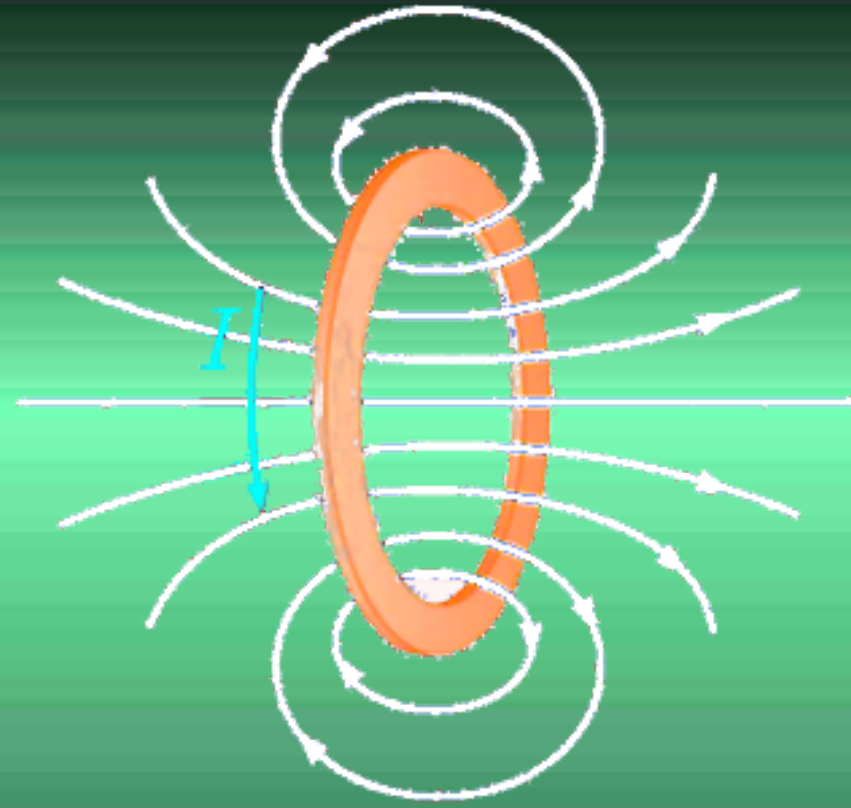


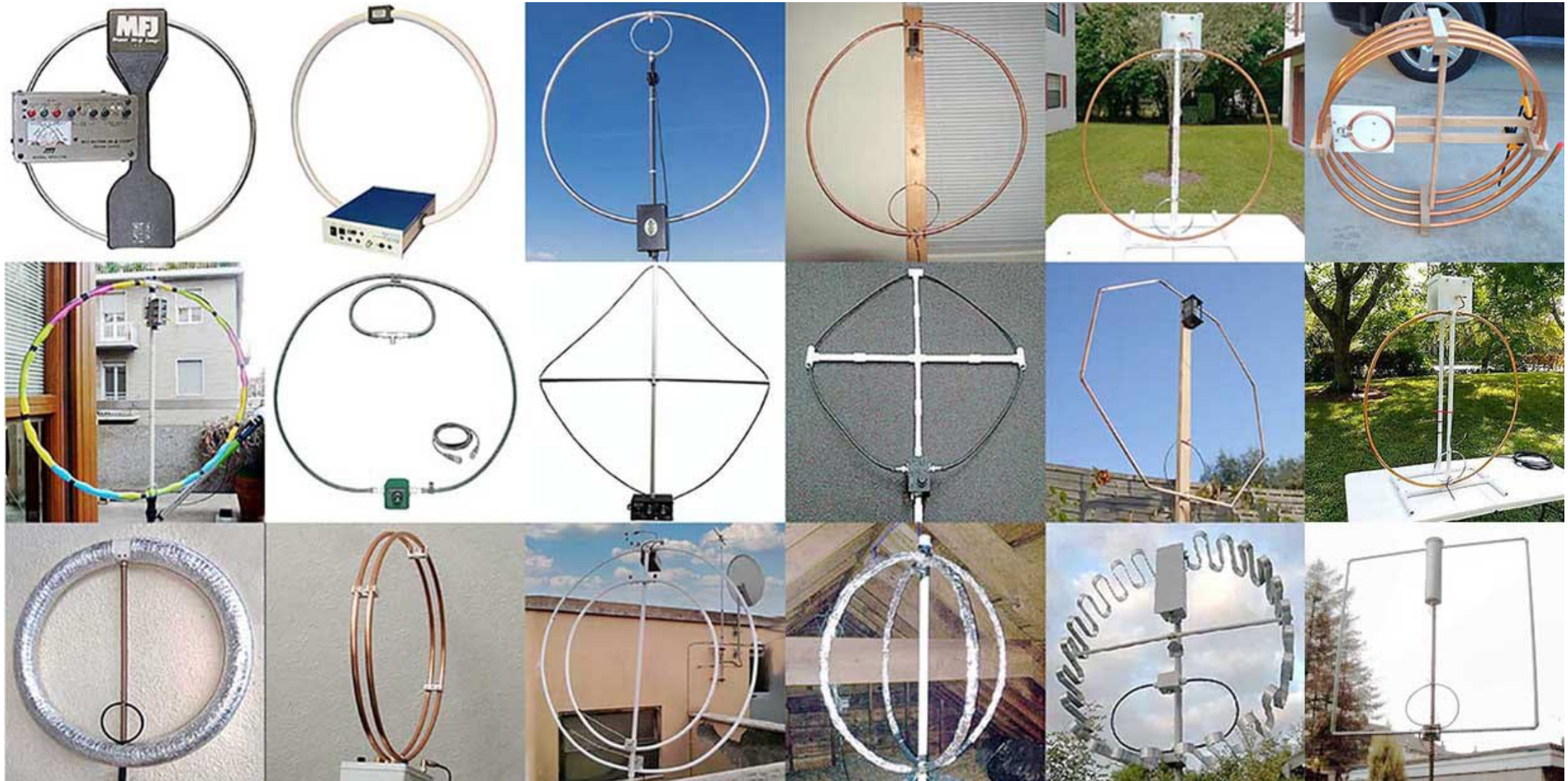
In Search of the

“Optimized”

Magnetic Loop



Magnetic Loop Antennas



**Few Optimized
Web Designs**

Many Misleading Ads

**Little Sound Principle
How to Optimize**



S
W
R

Simple Dipole

One-Step
Optimize:
 $L = f / 468$



MORE for Magnetic Loops

1. Relative conductor diameter
2. Construction material
3. Loop shape
4. Self-resonance
5. Matching method
6. Tuning method
7. Receive only

This Presentation

NOT – How they work

NOT – Their Pros/cons

NOT – How to build them

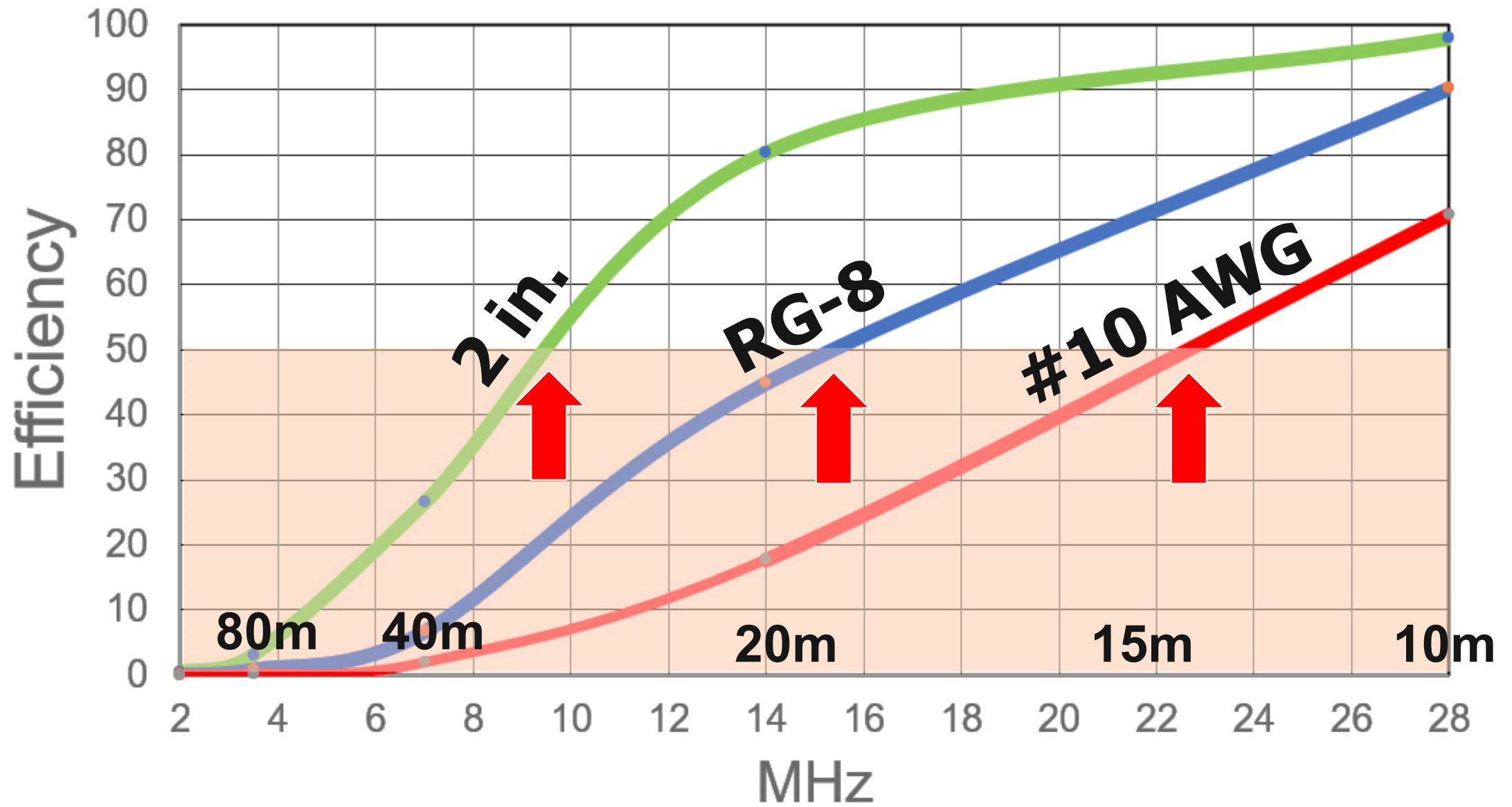
BUT – **How to Optimize them**
Factors → Max Performance

Factor 1

Relative Size of the Conductor

Efficiency / Lowest Frequency

4 ft. Square Loop by Conductor Diameter



TAKE AWAY:

EMBED

**The next image
deep in your mind**



**No smaller
than $1/24$**

**Relative
Loop to
Conductor
Diameter
Ratio**

Ciro Mazzoni
MIDI "Magnetic"
Loop Antenna

Efficient down
to 40-meters



6 1/2 ft. x 3 in.

Factor 2

Material

\$ \$ \$

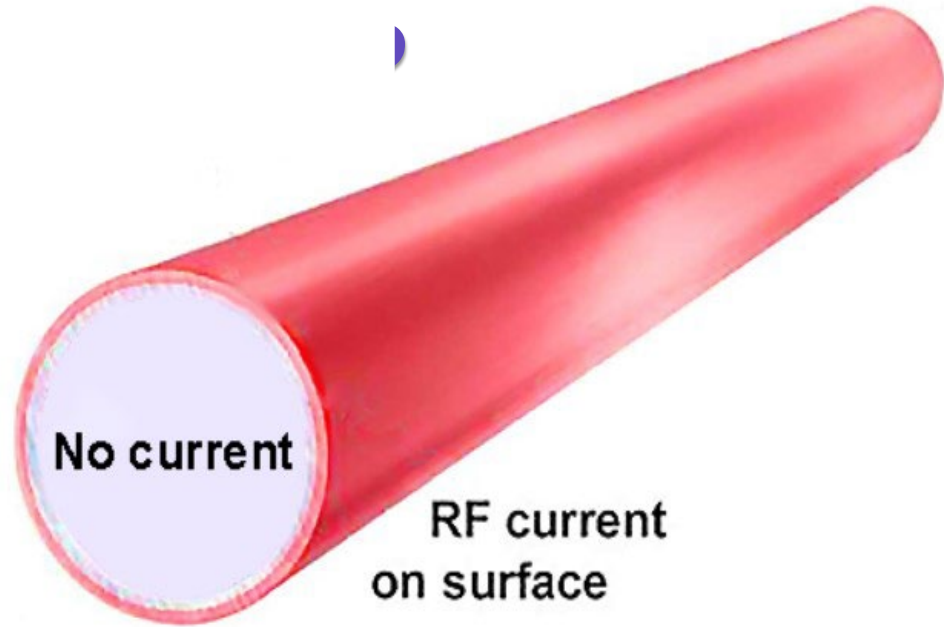
£ £ £

¥ ¥ ¥

€ € €

Skin Effect

AC/RF flows on the surface



Aluminum Wire

*Center of the
conductor is
not needed*

3X Skin Depth

Band	Aluminum mils	Copper mils
80-m	5.1	4.2
40-m	3.6	3
20-m	2.7	2.1
10-m	1.8	1.5
2-m	0.9	0.6
440 MHz	0.6	0.3

mils = 1/1000 in.

**Solid
metal not
required**

**Foil on PVC
just as good**

Buy tape of sufficient thickness

Optimized Materials



Aluminum AC Duct Tape



**Aluminum is 40% less
conductive than
Copper**

**BUT, 2x thicker skin
Equal Loop Materials**



You're shopping
Santa Maria
● OPEN until 10 pm

Delivering to
93455

1 1/2 copper pipe



My Account



Lists



Cart | 0 items

All Departments

Home Decor, Furniture & Kitchenware

DIY Projects & Ideas

Project Calculators

Installation & Services

Specials & Offers

Local Ad & Catalog

Home / Plumbing / Pipe & Fittings / Pipe / Copper Pipe

Internet #100354223 Model #1-1/2 L 10 Store SKU #741810

Cerro

1-1/2 in. x 10 ft. Copper Type L Hard Temper Straight Pipe

★★★★★ (3) Questions & Answers (3)



\$128



56

Late 2022

JM EAGLE

1-1/2 in. x 10 ft. 330-PSI Schedule 40 PVC DWV Plain End Pipe

★★★★★ (266) Questions & Answers (23)



\$16.78



3.8k

2 length for 4 ft. loop

Optimize the Cost

Factor 3

Loop Shape

Choice, Neighbors, HOA

Lew

McCoy

The

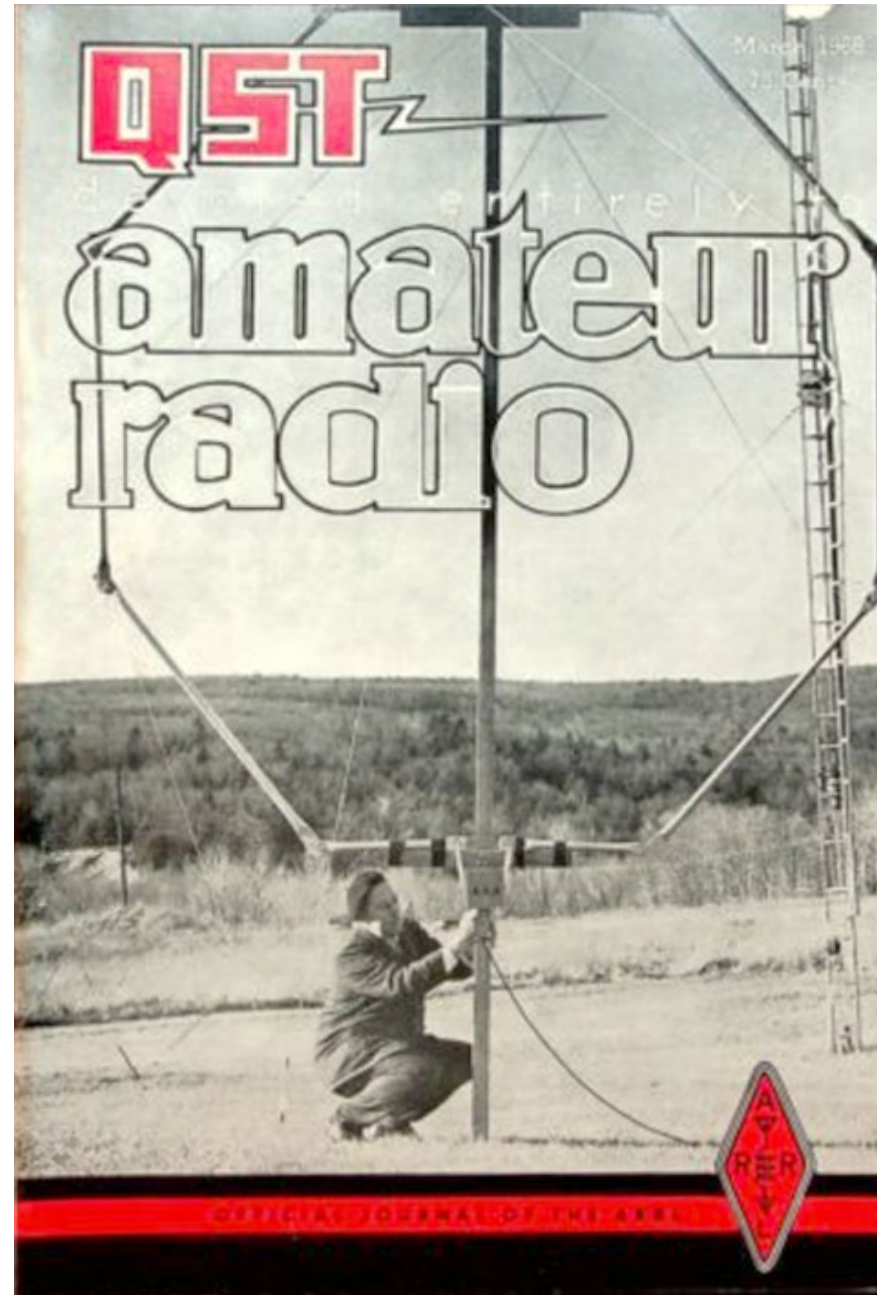
In our model, 1/2-inch-diameter stainless steel tubing, the same as the milk canner tubing, was used for the loop connections at the joints, the tubing was threaded, and stud

YULETIS G. McCOY,* NICH

The interest aroused by a loop antenna described in Electronics a few months ago sparked a letter by ARRL HQ of a home-built version. The point of comparison was the theoretical maximum induced voltage. Several designs were compared, and the loop did win A.B. tests. The report

The interest aroused by a loop antenna described in Electronics a few months ago sparked a letter by ARRL HQ of a home-built version. The point of a loop antenna in the amateur community is to produce several times the gain of a 10-m antenna. These are compared to the loop designs in A.E. tests, and the report

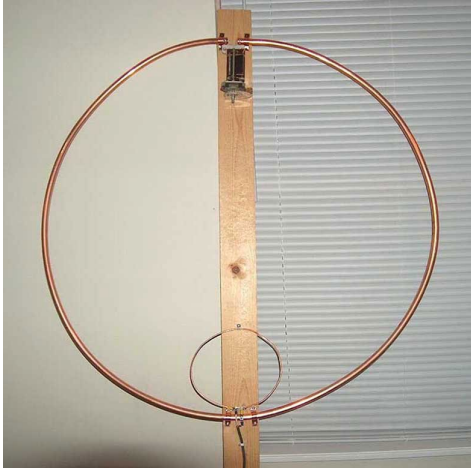
March 1968



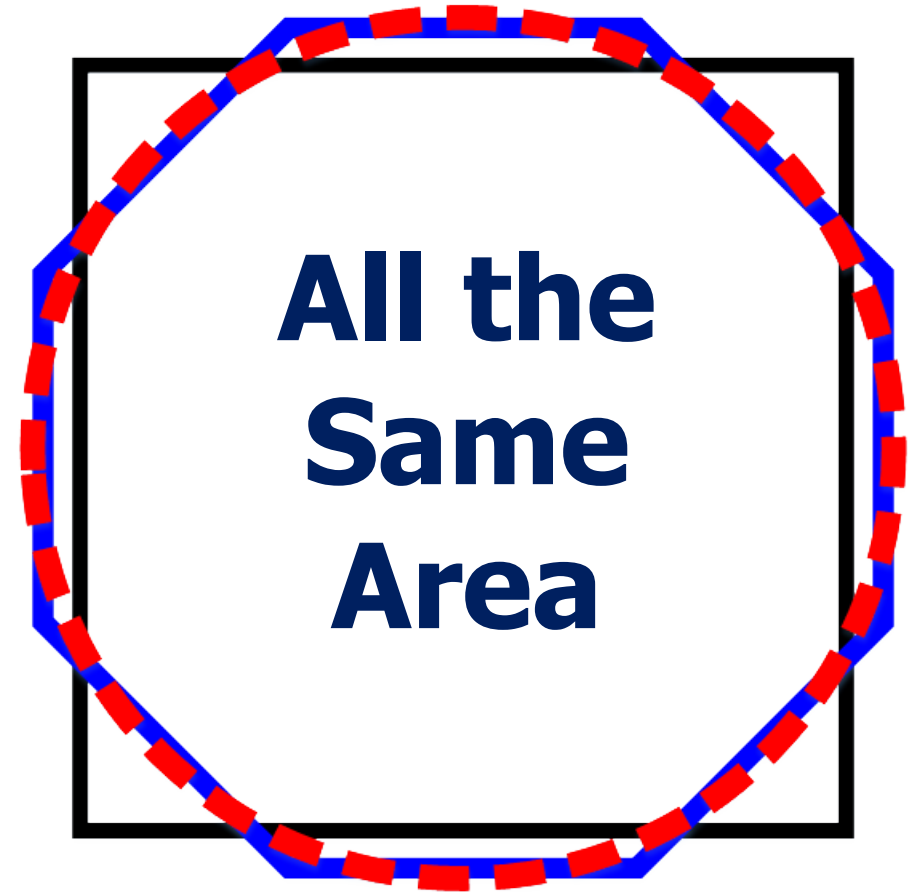
The Army Loop

Kenneth H.
Patterson, U.S.
Army Limited
War
Laboratory,
Maryland
Viet Nam

Michael Faraday – works by area not shape



**Square
Easiest
Optimized
Shape**



Least Noticeable Shape



Homeowners Association

SQUARE – Rose Trellis



***Is it a Garden
Decoration
or a “Magnetic”
Loop?
(Old trampoline
frame)***

Cute

**Ineffecient
Conductor Size**

**Good Tuning
Capacitor**



Factor 4

Self-Resonance

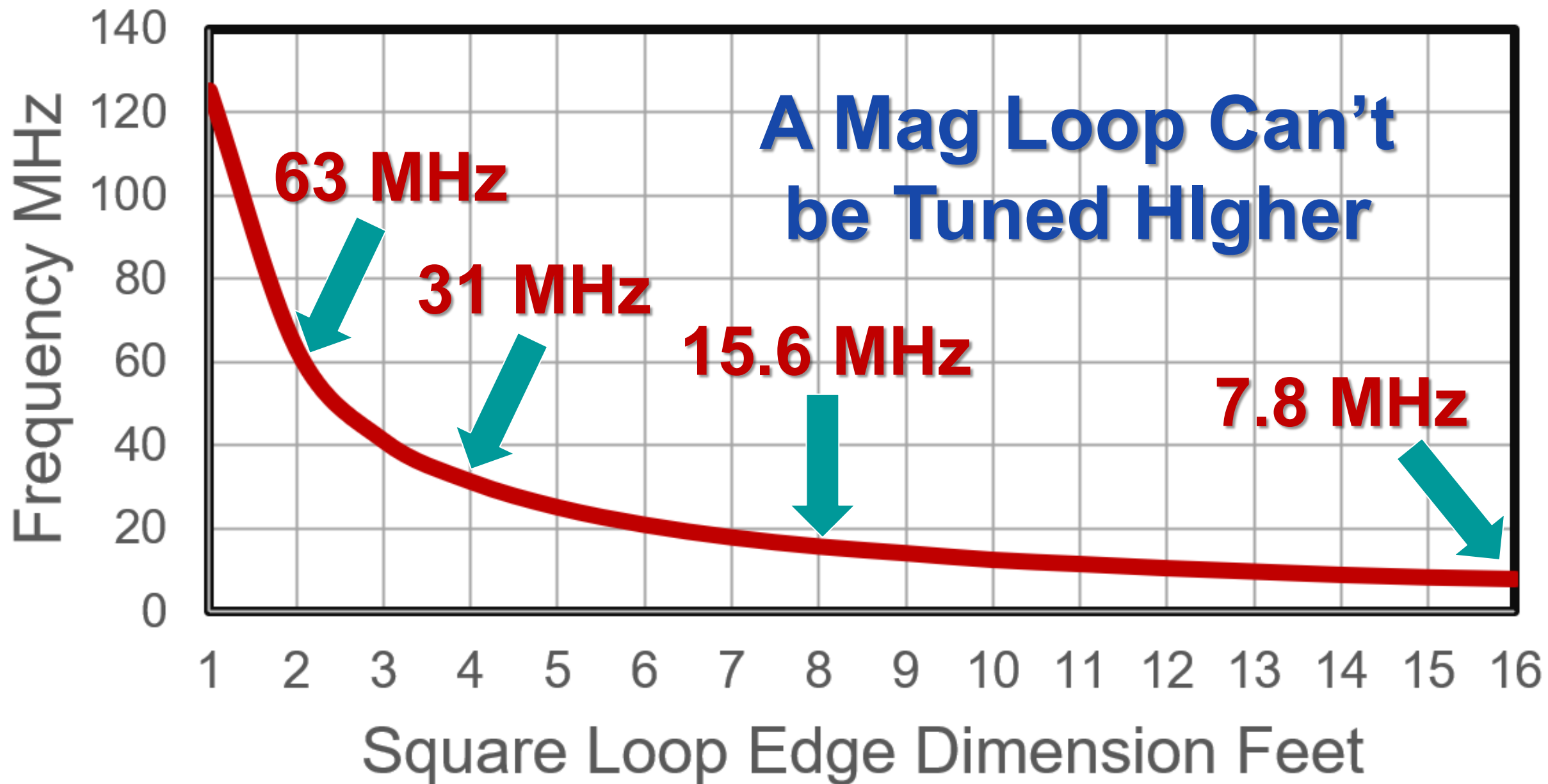
Sets the Maximum Frequency

Inductance

**Self-
Resonance**

Capacitance

Self-Resonant Frequency



Design TIP

Mono-band Loop

Make size just above
band for min. tuning C,
max. efficiency

6-meters, 2 ft. SRF 63 MHZ

Rob Jahnke K0XL





Ciro Mazzoni MIDI Magnetic Loop Antenna

**Can't work
above 25 MHz**

Ciro Mazzoni
MIDI "Magnetic"
Loop Antenna

Can't work
10-meters



6 1/2 ft. x 3 in.

TAKE AWAY:

No **one** mag loop
can work

ALL HF bands

More than one

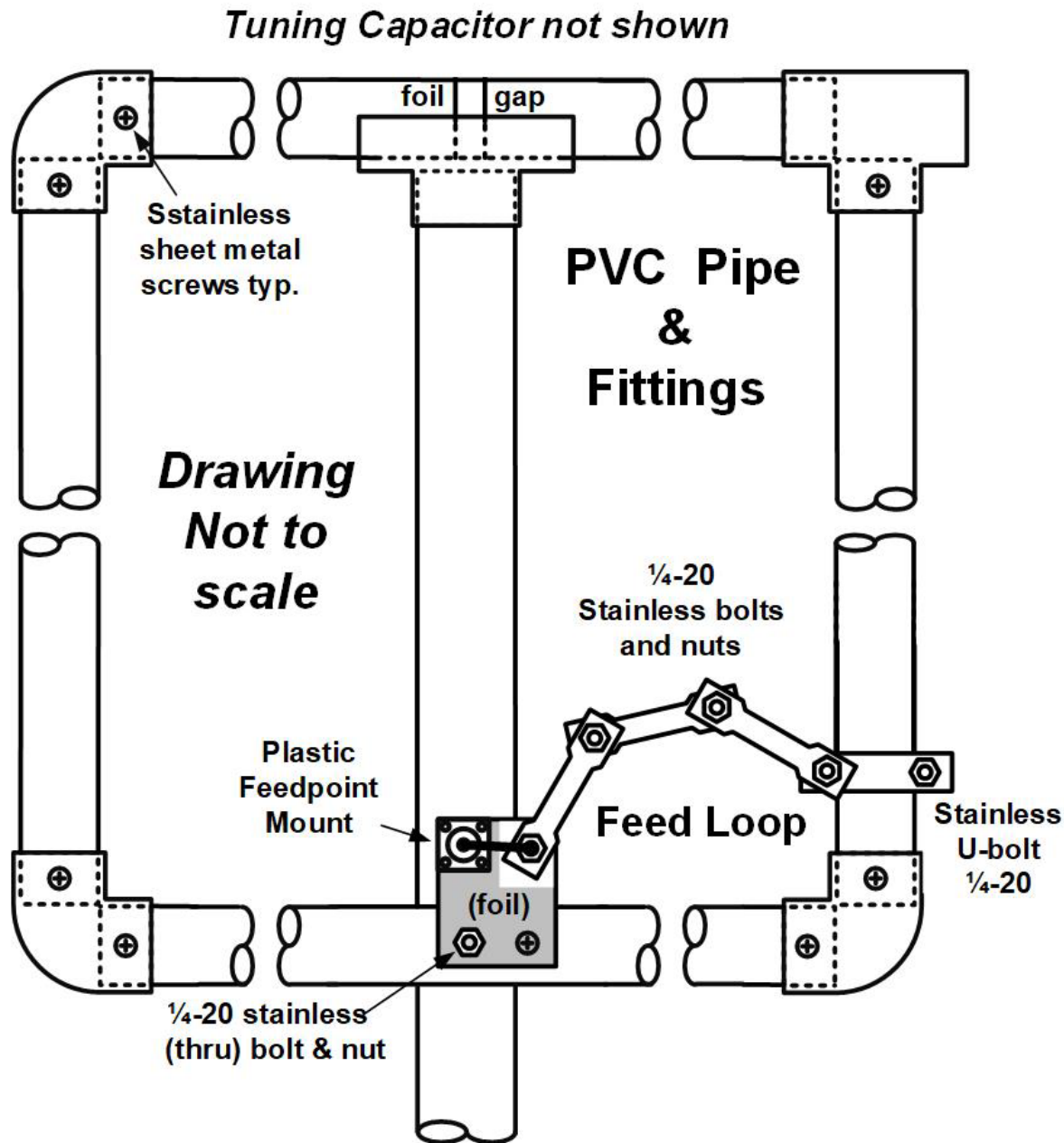
An Optimized Example



**Optimized
10-20m
okay
on 40m**

**1½ PVC
(1.9 OD)**

**4-foot
square**

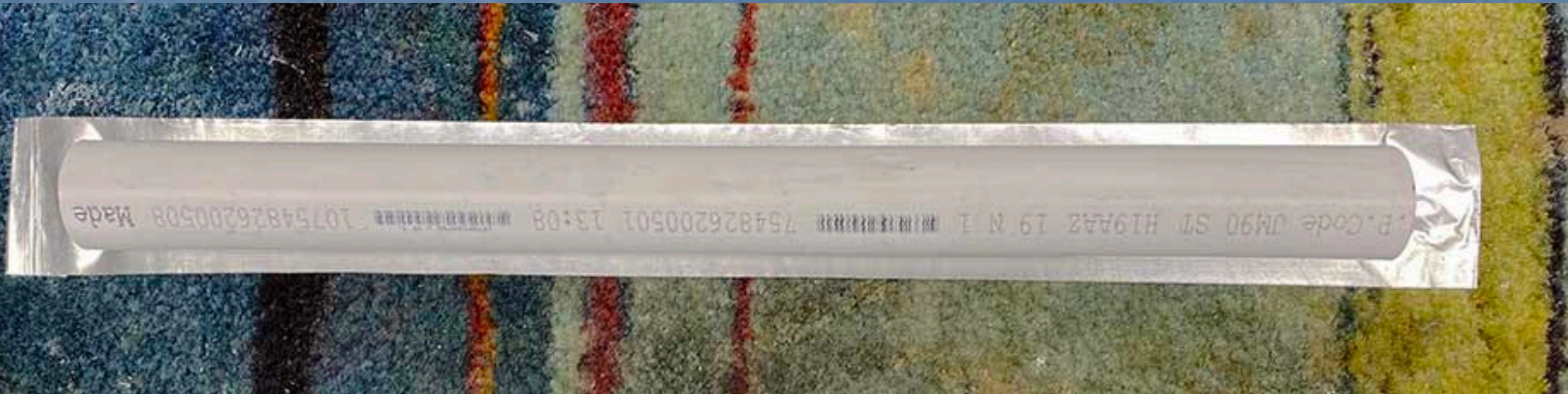


**Vertically cut
elbows/Tee,
foil inside**

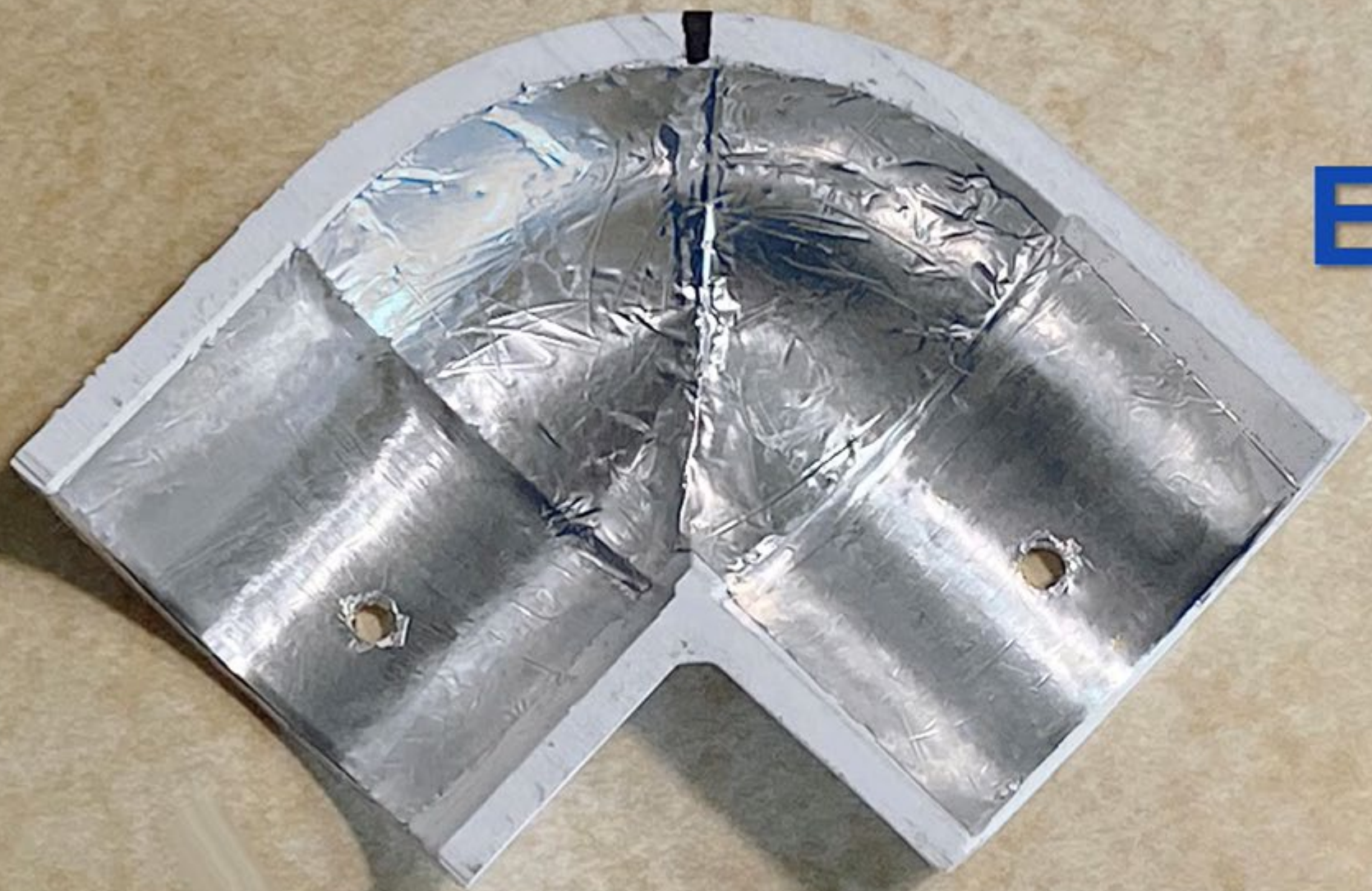
**2 in. mast and
half Tee
Saddle**

w6nbc.com/slides

Applying Foil to PVC pipes



Foil in ELBOWS



MG Chemicals Shielding Paints

Copper/Silver

Nickel





Soft Conductive Copper Nickel Plated Electricity Magnetic RF Shielding Fabric for Smart Meters 39"x43"

[Visit the Amradiel Store](#)



38 ratings | 17 answered questions

\$13⁹⁹

✓prime

FREE Returns

Size: **Width 43" inch / Length 39" inch**

Width 43" inch / Length 39" inch

\$13.99

✓prime

Width 43" inch / Length 78" inch

\$24.99

✓prime

Width 43" inch / Length 197" inch

\$62.99

50 meters long

\$600.00

100 meters long

\$1,100.00

Material

Nickel+copper+polyester

Color

Silver

Fabric Type

Polyester



**HF Mountain Toppers,
RV'ers, Portable**

Radios

Portable Power

Computers

Antennas – A problem

→ Small Whip? Wire over bush ?



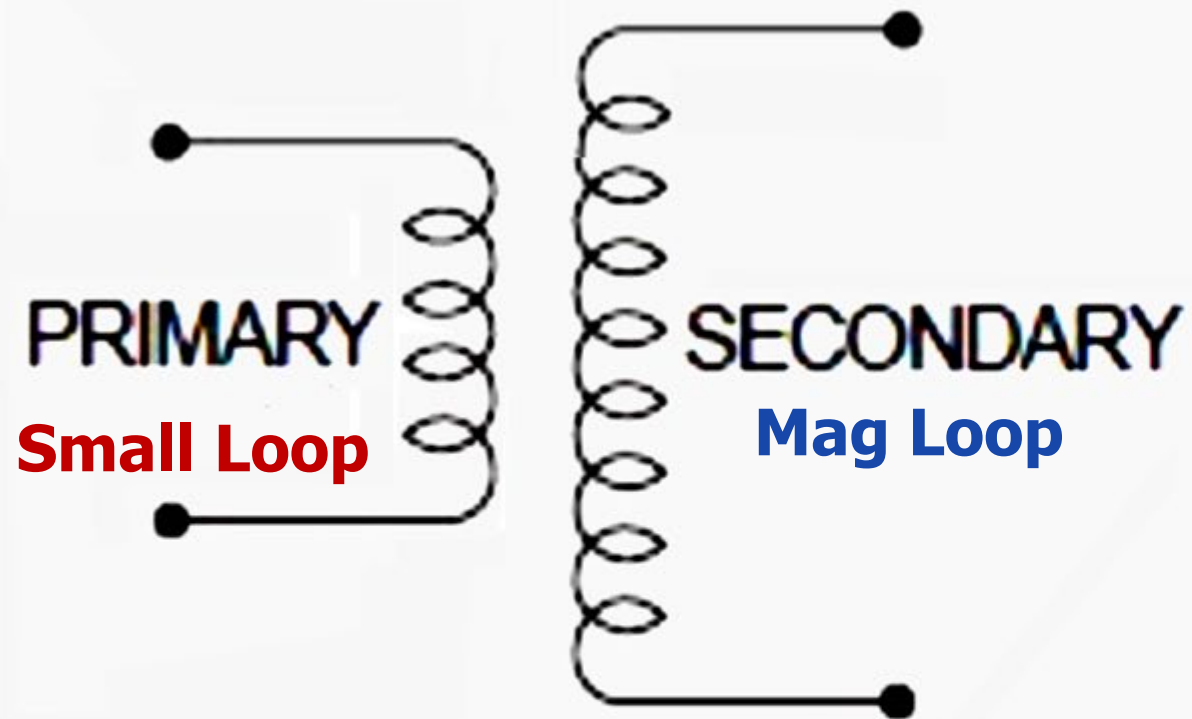


Inflated Portable Loop on Portable PVC Stand

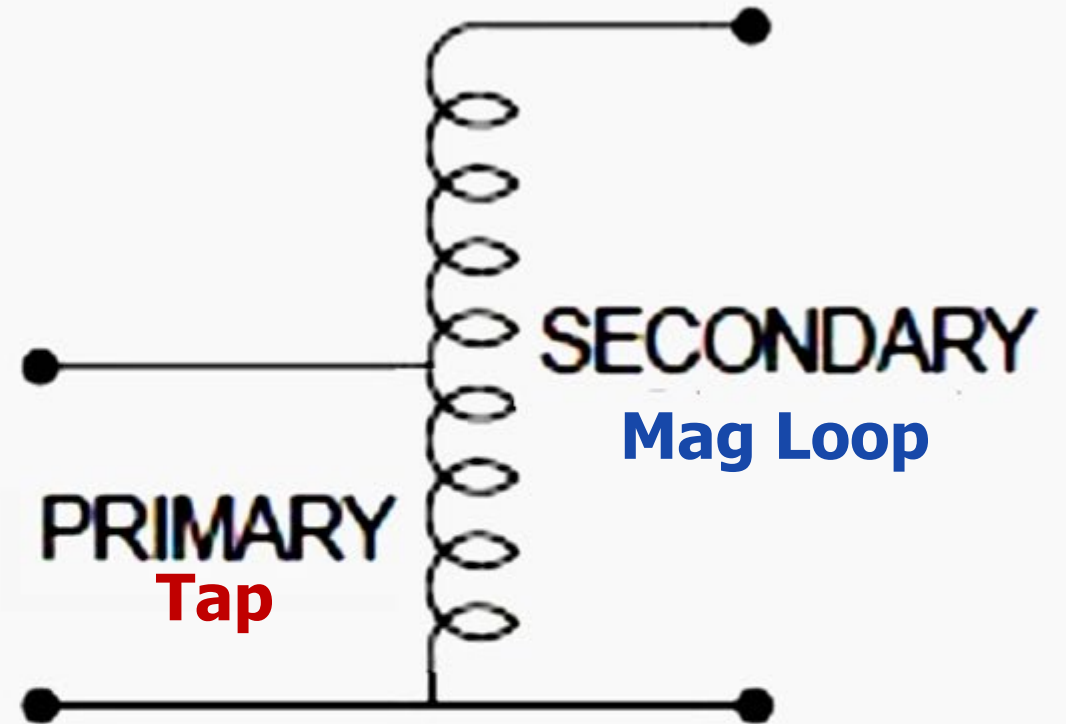
Factor 5

Matching

Ruggedness, Simplicity



TRANSFORMER

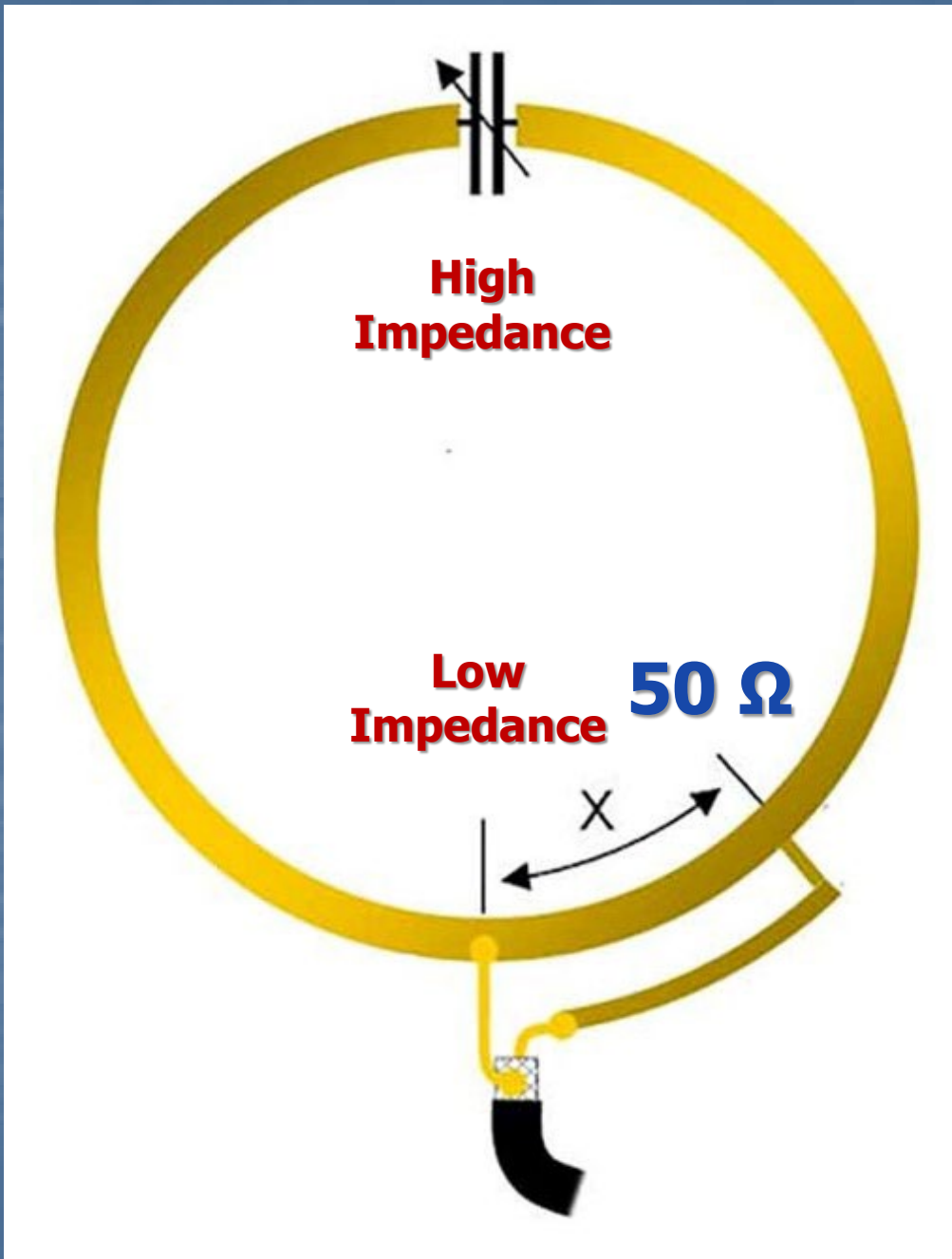


AUTOTRANSFORMER



**Small
Separate
Loop**

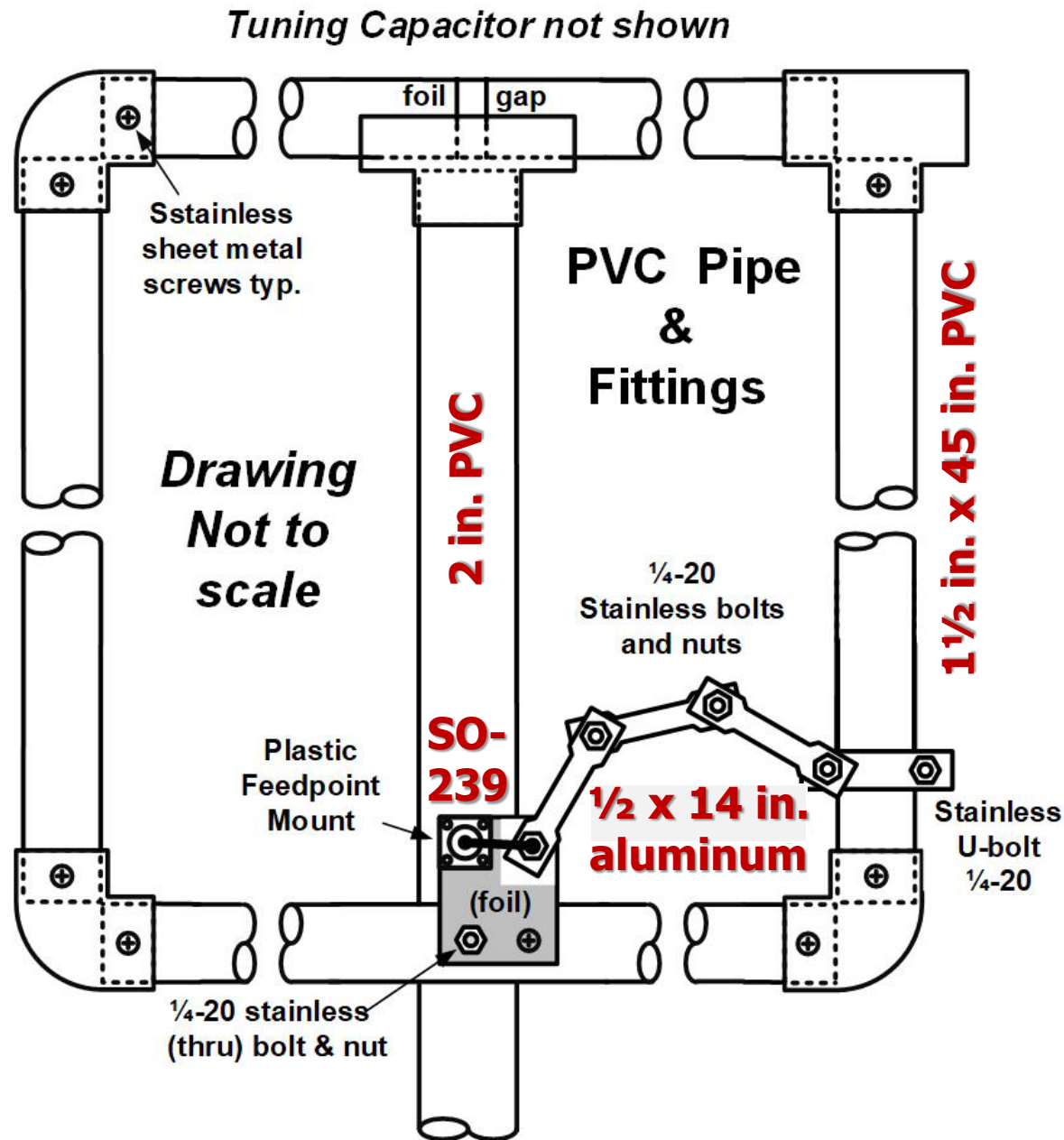
Transformer



Tap Match

Auto
Transformer





**Aluminum tubing
flattened and
drilled
1/4-20 & U-bolt**

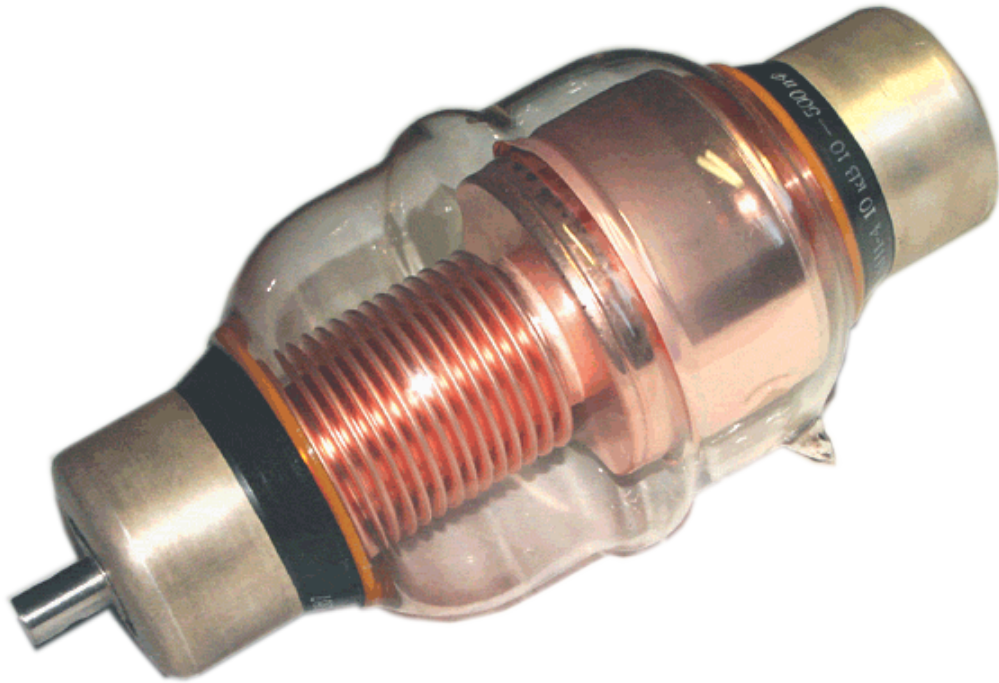
**RF Auto-
Transformer**

Factor 6

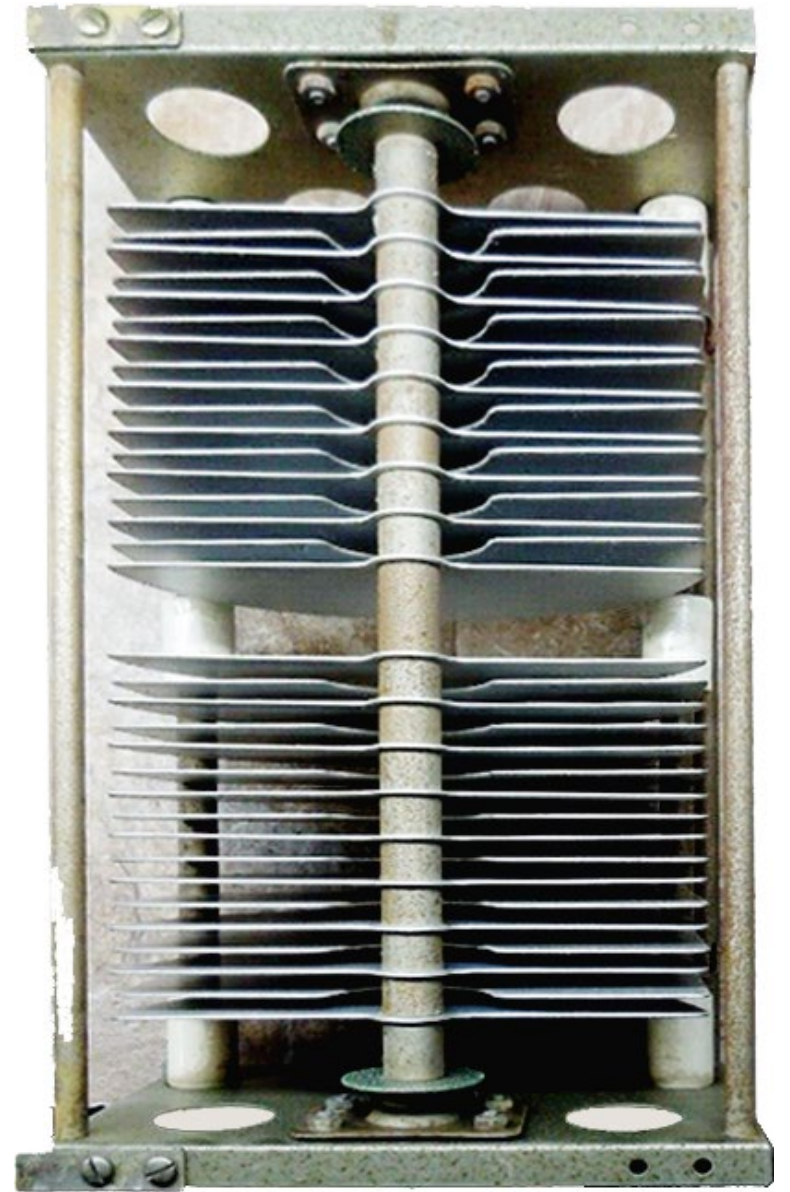
Tuning

Still Developing

Vacuum Variable



Rotary Variable



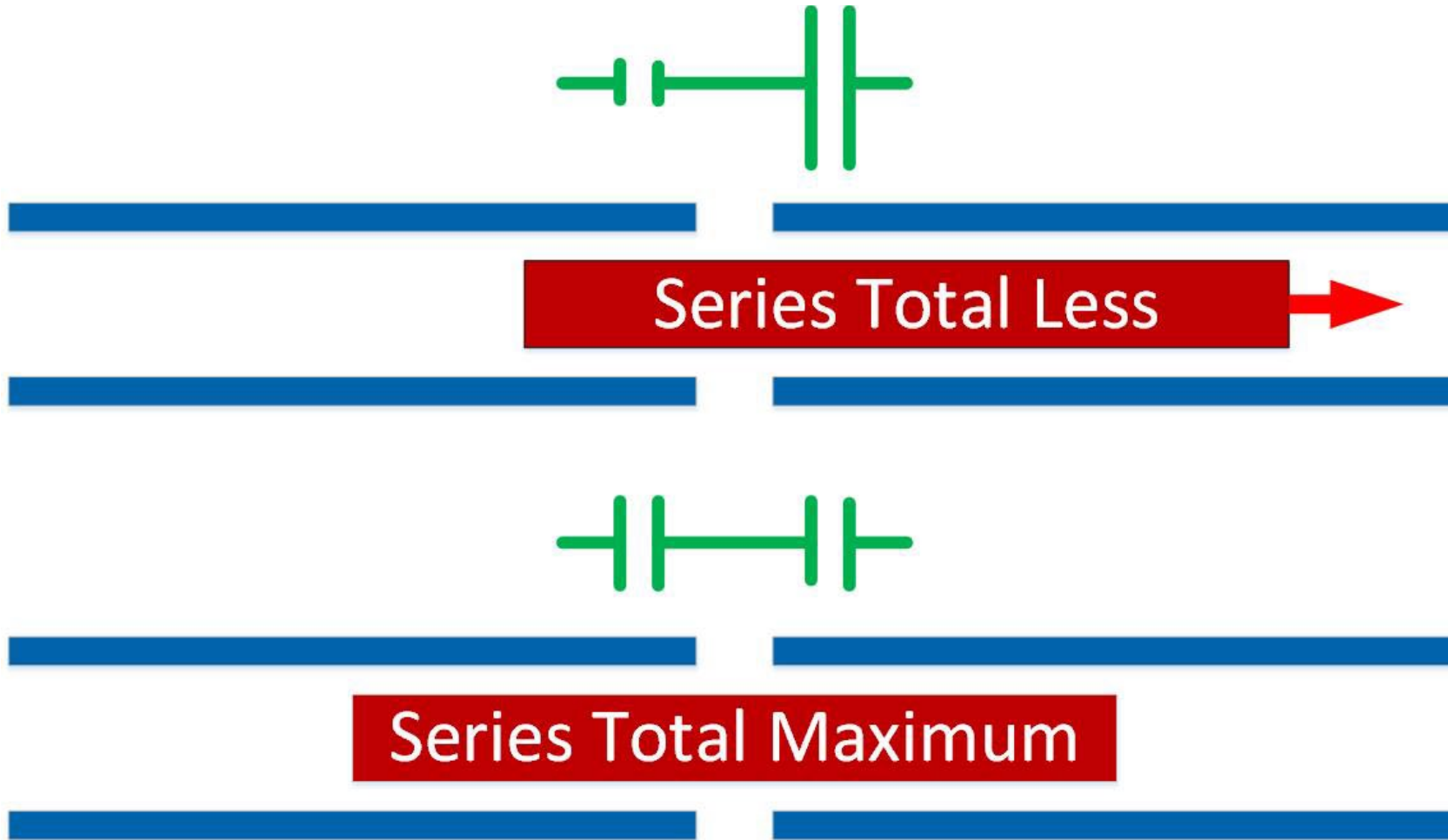




ORIGINAL COST OPTIMIZATION

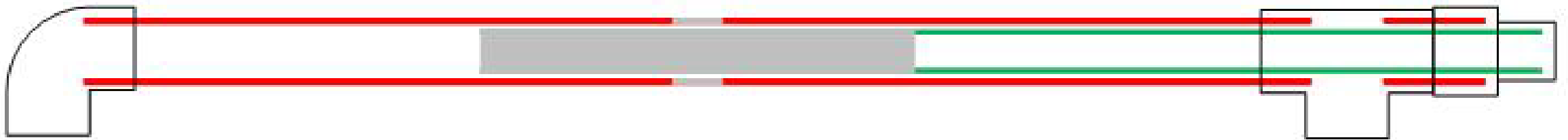
Internal
Linear
Capacitor

Internal Linear Capacitor



Dual Linear Capacitors

Band Tuning



Fine Tuning

14 in. **Band Tuning** 2 in. PVC



12 in. **Fine Tuning** 1 in. PVC



61

255 25528 14586 6



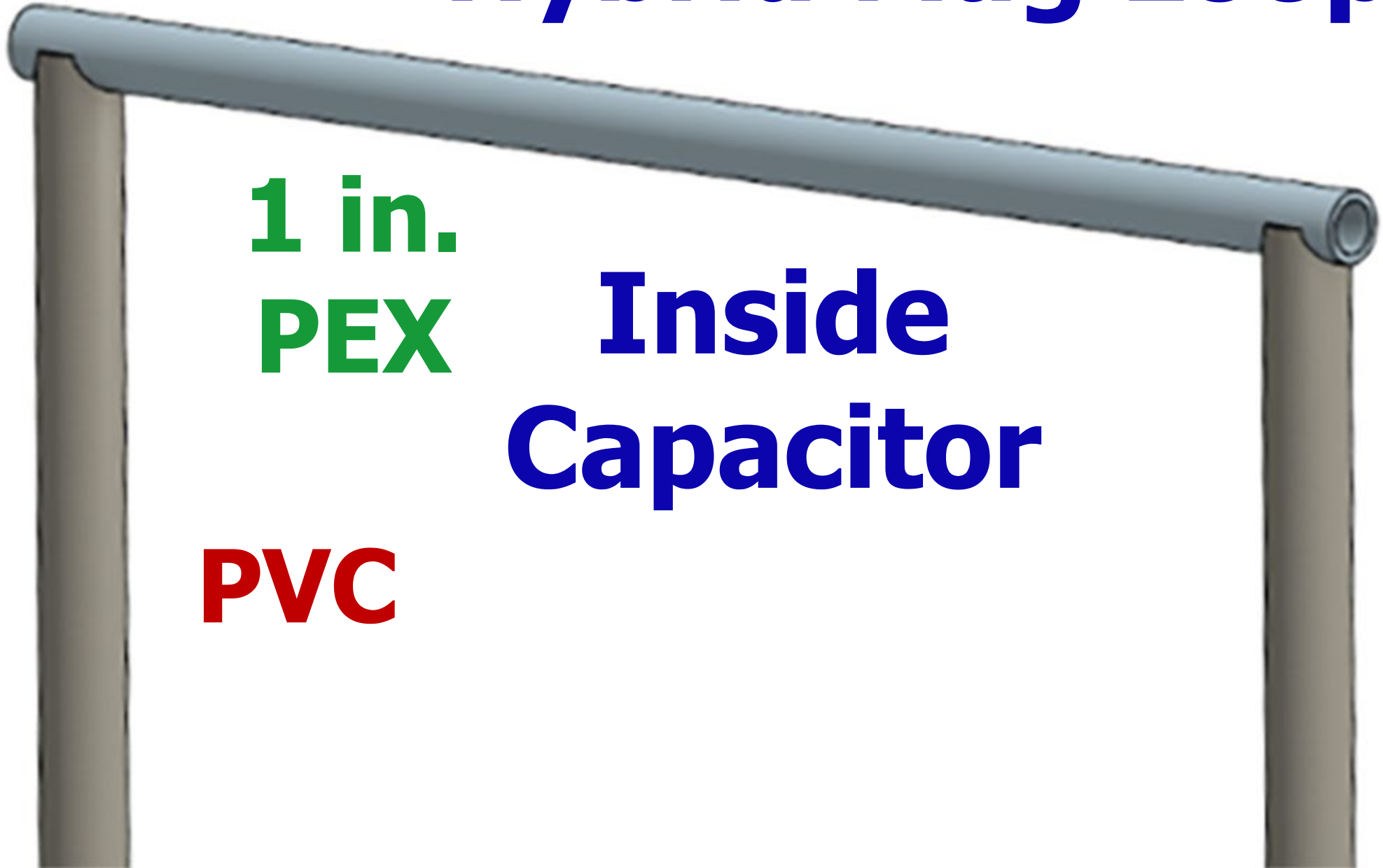
**Viewer loop
with
stepper
motor**

Hybrid Mag Loop

**1 in.
PEX**

**Inside
Capacitor**

PVC



LDPE Bottles from Amazon



Roll over image to zoom in



IMPRESA 3 Pack 16oz Plastic Bottle with 6 Caps in 2 Styles - BPA Free Latex-Free, Food-Grade, Great for Shampoo, Body Wash, Sauce and More

Visit the IMPRESA Store
4.5 ★★★★★ 2,149 ratings

Amazon's Choice in Condiment Squeeze Bottles by IMPRESA

100+ bought in past week

\$14⁹⁹

✓prime
FREE Returns

Pay \$14.99 \$0.00 for this order. Get a \$100 Amazon Gift Card upon approval for the Amazon Business Card. Terms apply.

Brand	IMPRESA
Material	Plastic
Color	Natural
Capacity	16 Ounces
Special Feature	Bpa Free

Outside Capacitor



Factor 7

Receive-Only Loops

Best: not to Match to 50Ω

- **Direct to high impedance RX**
- **Greater bandwidth**
- **Better signal to noise**
- **From an I.E.E.E. study**

**Some
Take Aways**



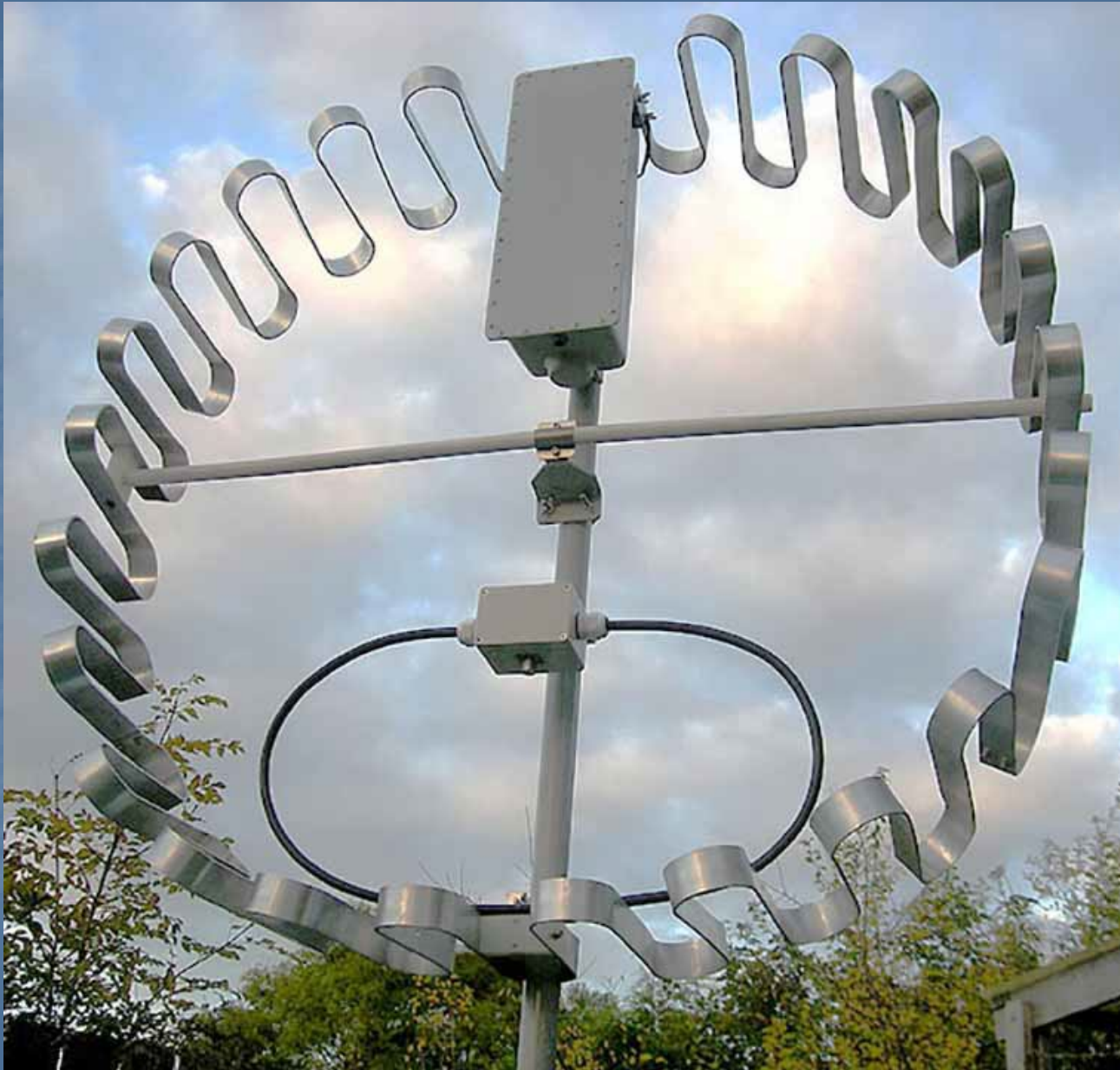
**Multi-Turn
Good Idea**

**Improves
with size
squared**



Flat Conductor Bad Idea

Edge skin effect
All the current
at edge



Convoluted Bad Idea

Small surface
high conductor
resistance

Edge skin Effect



Helical

**Small surface
area – high
conductor
resistance**

Edge skin Effect



**Horizontal
Bad Idea**

**Poor
Radiation
Pattern**

CLOSING THOUGHT

There's no such thing as a "MAG LOOP".

YES, The near field of a **small loop** is **mainly magnetic** and the near field of a **small dipole** is **mainly electric**, but both antennas respond to and make BOTH components of the E/M wave.

CLOSING THOUGHT

Both small loops and small dipoles are sensitive to both electric and magnetic fields.

CLOSING THOUGHT

There is little benefit to elevating a “magnetic” loop.

They work nearly as well ground mounted.

Magnetic Loops

1. Relative conductor diameter
2. Construction material
3. Loop shape
4. Self-resonance
5. Matching method
6. Tuning method
7. Receive only

If you build one

**Send photos &
ideas**



DØGGY

w6nbcmail@gmail.
com

w6nbc.com

w6nbc.com/slides.html



"That's all Folks!"