

# Good and Bad Plastics in an RF Environment for Home-Brew Antenna Projects

*John Portune / W6NBC*



September 9-10, 2023







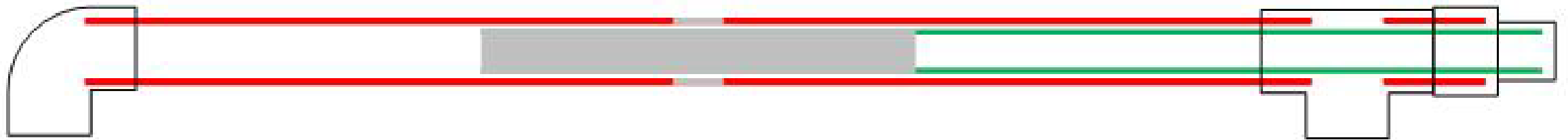
**Optimized  
PVC &  
foil tape  
loop 10-20m**

**One of my  
Projects  
A 1½ in. PVC  
4-foot  
Mag Loop with  
a low-cost  
tuning capacitor**



# Dual Linear Capacitors

## BAND Tuning Capacitor



## FINE Tuning Capacitor



*This loop and two buddies  
taught me a major lesson about  
**GOOD** and **BAD** plastics  
in antenna building*

*Rob Jahnke K0XL Loop Design*

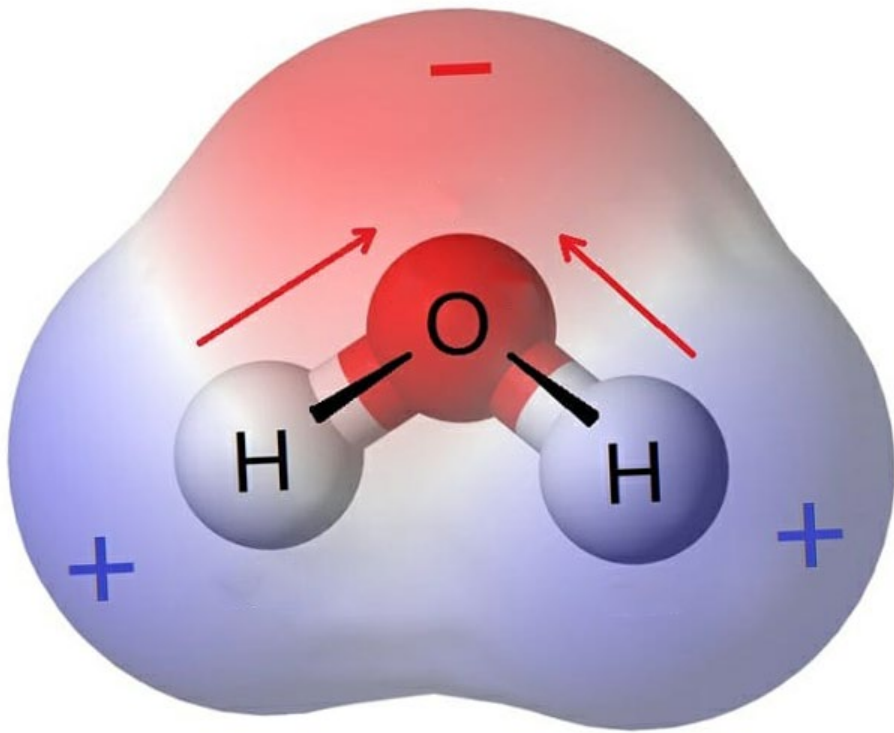
*K5DCC Denny Johnson Loop Builder/User*





- Polar and Non-Polar Plastics
- Dissipation Factor **DF**  
Loss Tangent  **$\delta$**   
(delta)





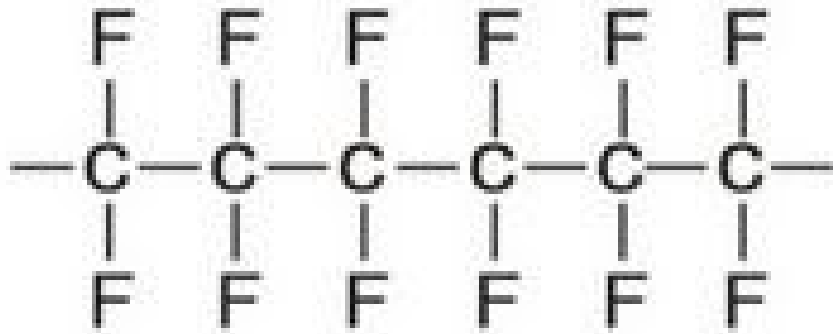
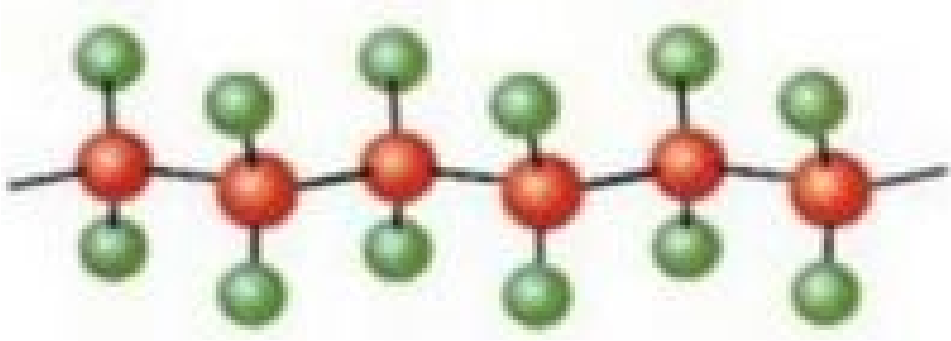
# **A Water Molecule**

## **POLAR MOLECULE**

### **(Non-Symmetric)**

- **Electrons share orbits**
- **Spend more time around Oxygen Atom**





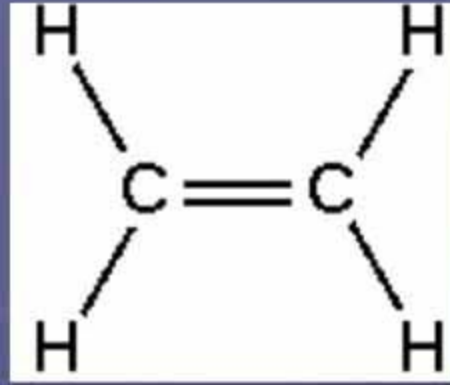
Polytetrafluoroethylene  
(PTFE)

# A Teflon Molecule (PTFE)

**NON-POLAR  
MOLECULE  
(Symmetric)**

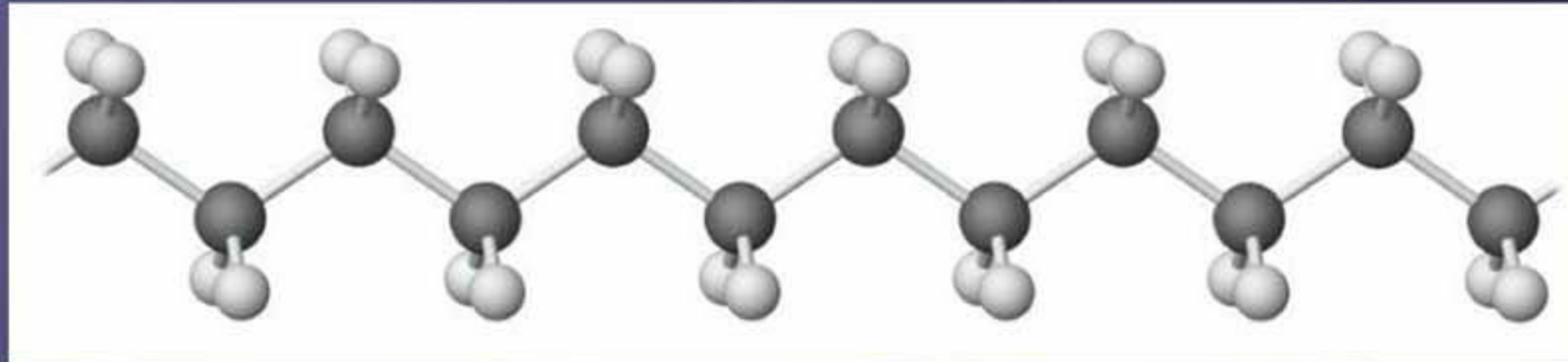






# POLYETHYLENE

*Monomers to Polymers*





**PEX A**



**PEX B**

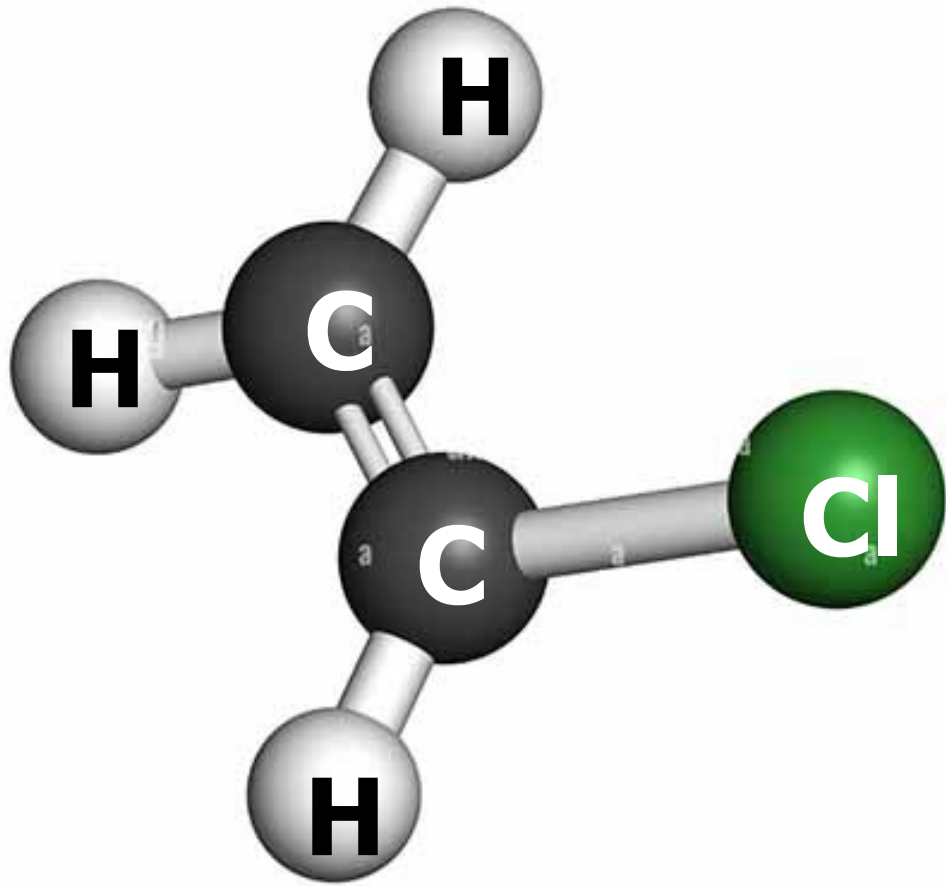




PEX-B



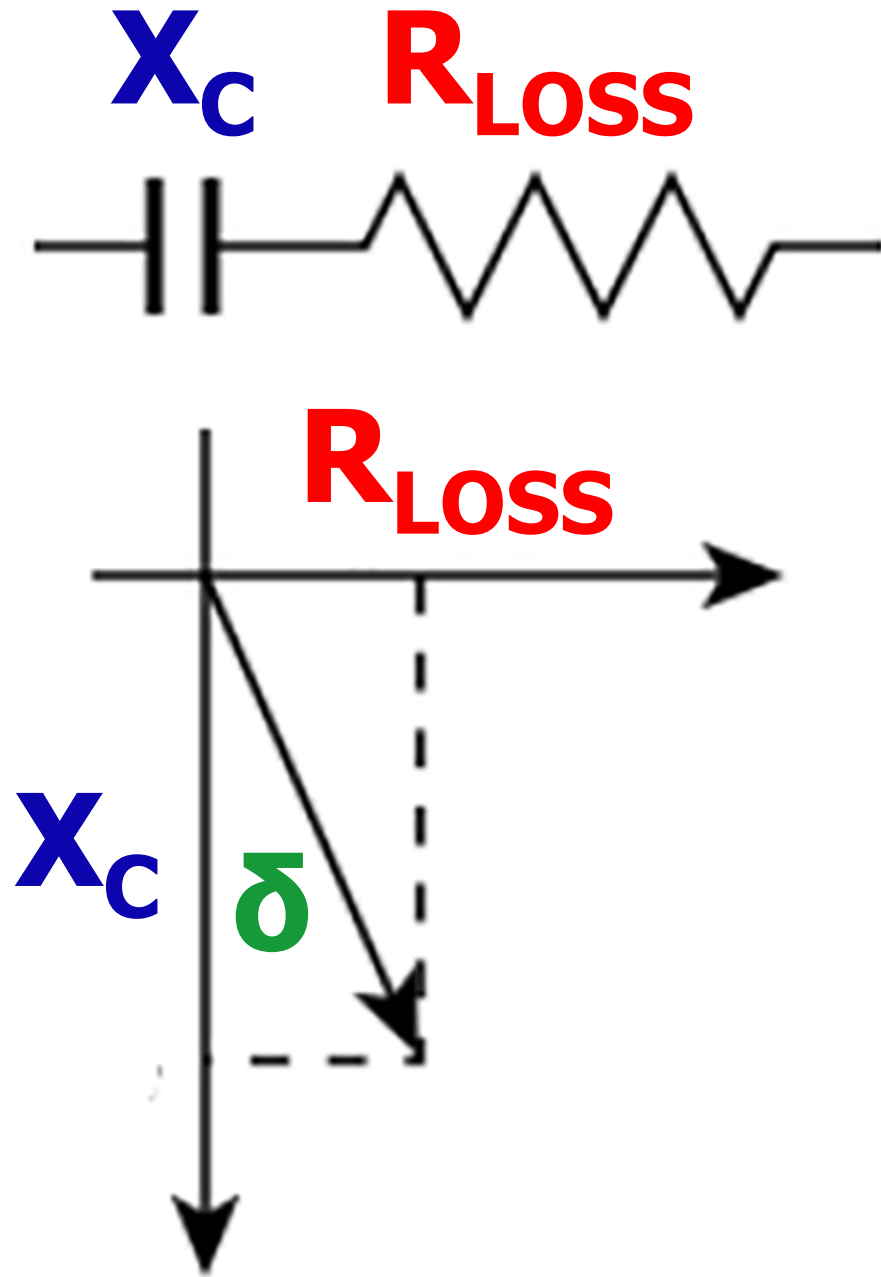




**POLAR  
MOLECULE  
(Non-Symmetric)**

**PVC Monomer**





# Dissipation Factor Loss Tangent $\delta$

Energy lost (to **heat**)  
When it's a dielectric

- If  $\delta$  is  $0^\circ$ , loss is zero
- If  $\delta$  is  $90^\circ$ , loss is 100 %





Non-polar Plastics			
PTFE	Teflon	Dissipation Factor	0.0001
PDMS	<b>Silicone Sealant (clear)</b>		0.0002
PE	<b>Low density polyethylene</b>		0.0003
PP	<b>Polypropylene</b>		0.0003
PE	<b>High density polyethylene (PEX)</b>		0.0005
PS	Polystyrene		0.0005
POM	Delrin		0.0005
BPA	Nalgene		0.0007
Polar Plastics			
PC	<b>Lexan, Polycarbonate</b>		0.0100
EVA	<b>Hot Glue</b>		0.0150
PLA	<b>Poly Lactic Acid</b>		0/0150
PET	<b>Mylar</b>		0.0160
PET	<b>PC board</b>		0/0170
PVC	<b>PVC, vinyl, electrical tape</b>		0.0170
ABS	<b>ABS</b>		0.0200
	<b>Epoxy</b>		0.0200
PMMA	<b>Acrylic, Plexiglas</b>		0.0300
PA	<b>Nylon</b>		0.0360





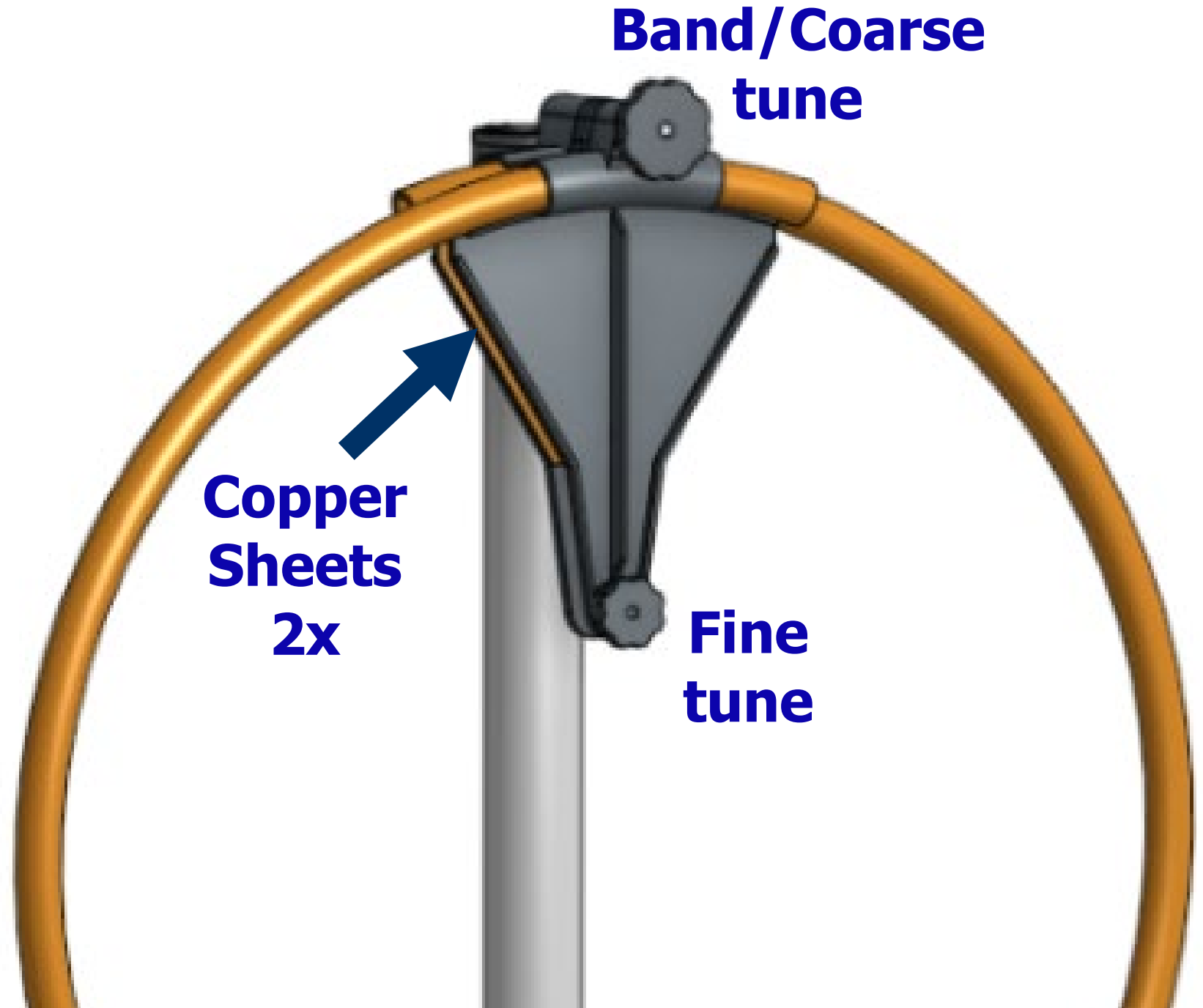
# Eye-Opening Ham Example






# KOXL

**2 ft. 5/8 in.  
OD Soft  
Copper  
with Coarse  
& Fine  
Tuning for  
6 & 10  
meters**







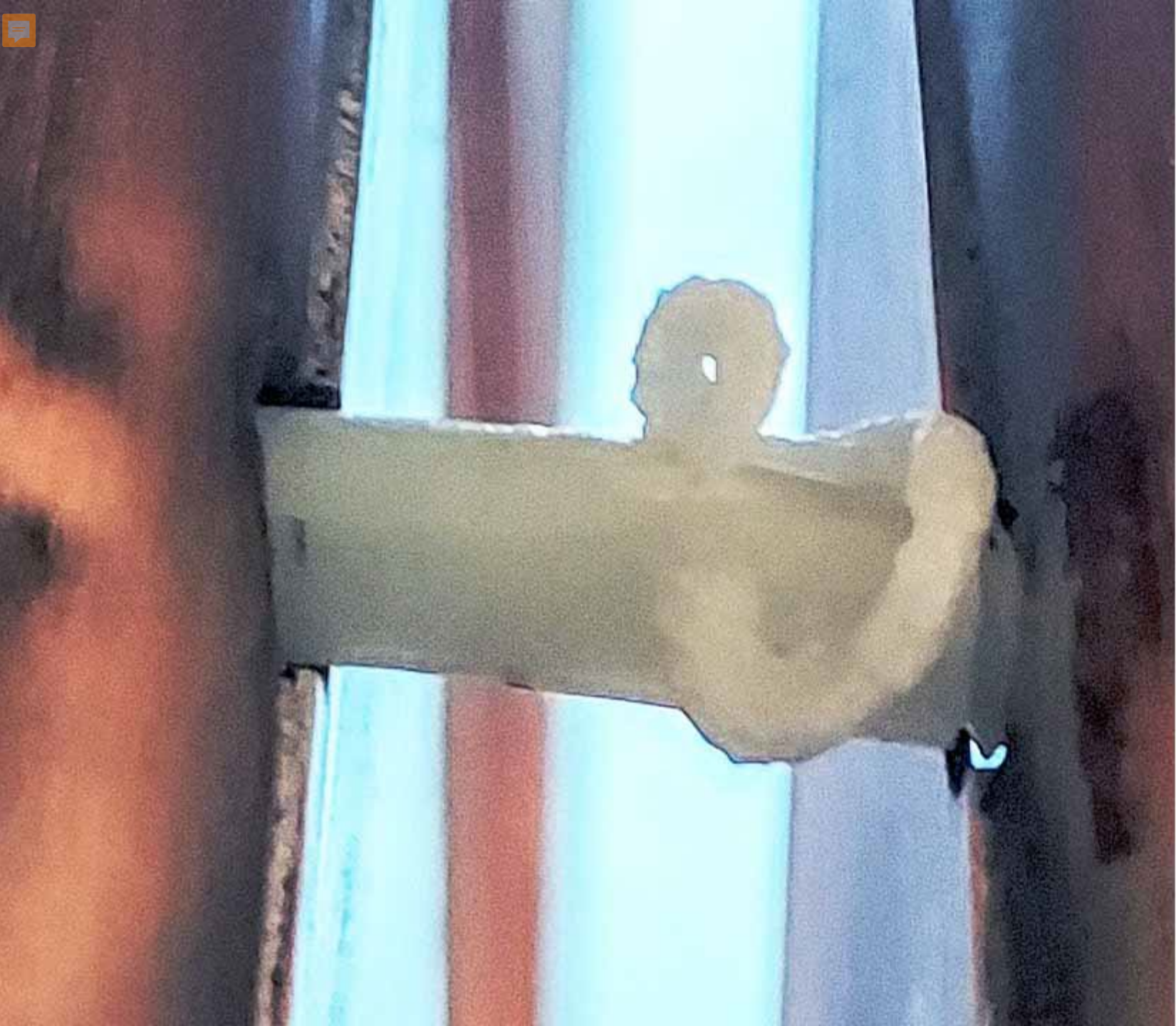
**Nylon  
Screw**

**The first version**









**50  
Watts**

**Nylon  
Jet**



# Hybrid 2 ft. Mag Loop

**1 in.  
PEX**

**Inside  
Capacitor**

**1 in.  
PVC**





# LDPE Bottles from Amazon



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

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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



Roll over image to zoom in





**OKAY**

**PVC**



**NO!**

**ABS**

**DWV**





# Take Away

Avoid just where the field is intense

Example, inside a mag loop's pipes covered with foil, there is no field.





# Take Away

- **PLA, ABS, PET, Nylon**
- **PVC, Plexiglass (acrylic), PCB**
- **Polypropylene**
  
- **Hot glue, Epoxy**
- **Silicon Sealant .**



# Take Away

If you wouldn't use  
**Nichrome** wire for an  
antenna, **don't think all  
plastics and glues are the  
same either!**



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