

# Packing a Two Meter Bell



10 decibel = 1 bel

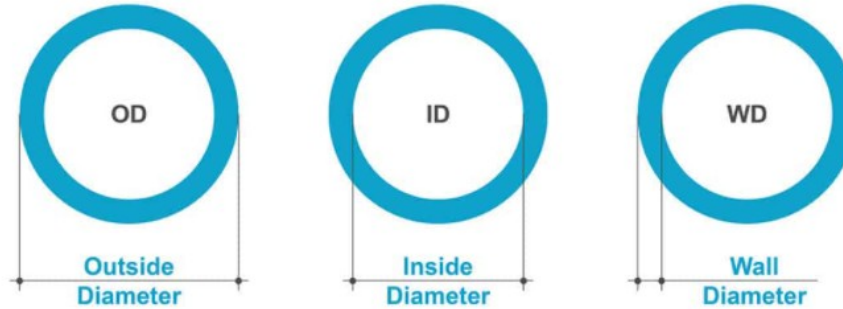
# Objectives of Antenna Effort

- A basic 6 element Yagi antenna with 10 dBi of gain
- Portable, pack-able, hike-able
- Assembly is easy, fast and no tools required
- No geometrically complex matching mechanism
- Disassembly in the dark
- Low cost, readily available materials
- 144.260 MHz, horizontal polarization
- Less concern about F/B ratio or bandwidth

# PVC Pipe Sizes

## PVC SIZE GUIDE

Outside Diameter | Inside Diameter | Wall Diameter



PVC SCHEDULE 40	Actual OD (English)	Actual OD (Metric)	Average ID (English)	Average ID (Metric)	Min. Wall Thickness	Min. Wall Thickness
1/2" PVC Pipe	13/16"	21.33 mm	5/8"	15.87 mm	1/8"	3.17 mm
3/4" PVC Pipe	1 1/16"	26.67 mm	7/8"	22.22 mm	1/8"	3.17 mm
1" PVC Pipe	1 5/16"	33.40 mm	1 1/16"	26.98 mm	1/8"	3.17 mm
1 1/4" PVC Pipe	1 5/8"	42.16 mm	1 3/8"	34.92 mm	1/8"	3.17 mm
1 1/2" PVC Pipe	1 7/8"	48.26 mm	1 5/8"	41.27 mm	1/8"	3.17 mm
2" PVC Pipe	2 3/8"	60.32 mm	2"	50.80 mm	1/8"	3.17 mm



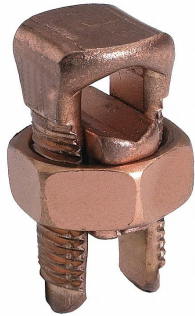
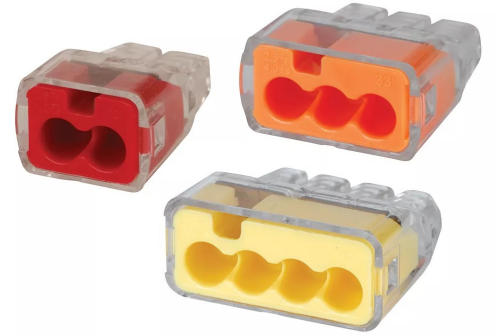
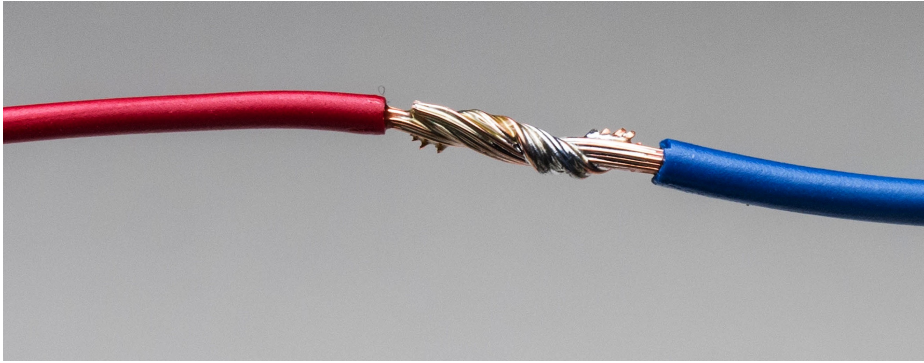
# Element Diameter (Copper wire)



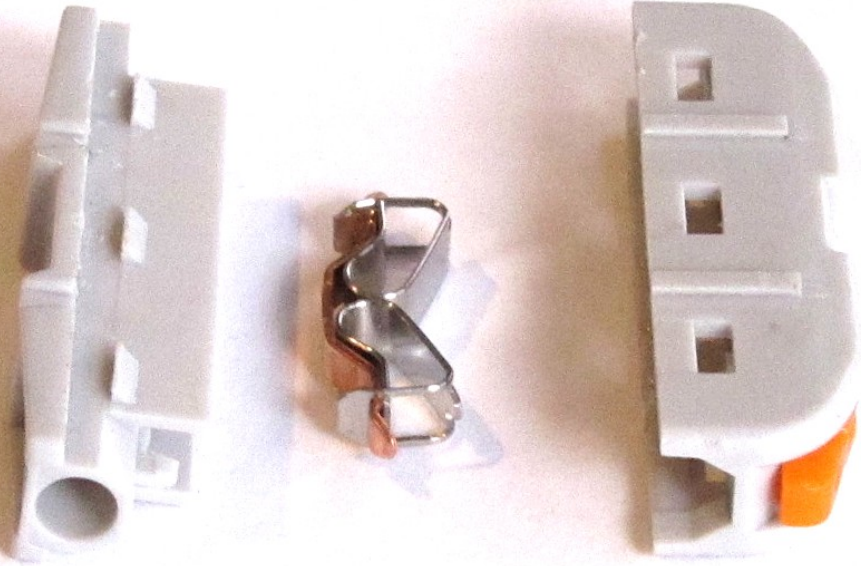
American Wire Gauge (AWG)	Diameter (inches)	Diameter (mm)	Cross Sectional Area (mm <sup>2</sup> )
0000	0.46	11.68	107.16
000	0.4096	10.40	84.97
00	0.3648	9.27	67.40
0	0.3249	8.25	53.46
1	0.2893	7.35	42.39
2	0.2576	6.54	33.61
3	0.2294	5.83	26.65
4	0.2043	5.19	21.14
5	0.1819	4.62	16.76
6	0.162	4.11	13.29
7	0.1443	3.67	10.55
8	0.1285	3.26	8.36
9	0.1144	2.91	6.63
10	0.1019	2.59	5.26
11	0.0907	2.30	4.17
12	0.0808	2.05	3.31
13	0.072	1.83	2.63
14	0.0641	1.63	2.08
15	0.0571	1.45	1.65
16	0.0508	1.29	1.31
17	0.0453	1.15	1.04
18	0.0403	1.02	0.82
19	0.0359	0.91	0.65
20	0.032	0.81	0.52
21	0.0285	0.72	0.41
22	0.0254	0.65	0.33
23	0.0226	0.57	0.26
24	0.0201	0.51	0.20
25	0.0179	0.45	0.16
26	0.0159	0.40	0.13



# Wire Connections



# Clamp Connector Mechanism



# Clamp Connector at Feed

Coax conductor



Driven element



# Mounted Clamp Connector

Open Connector




Mounted Element



Prepared Element



# On-Line Yagi Calculator



## REQUIREMENTS

Freq. [MHz]

Boomlength [m]


Gain [dBd] (approx.)

Elements

Diameter of parasitic Elements [mm]

Diameter of Boom [mm]

Is the boom isolated from parasitics?  yes  no



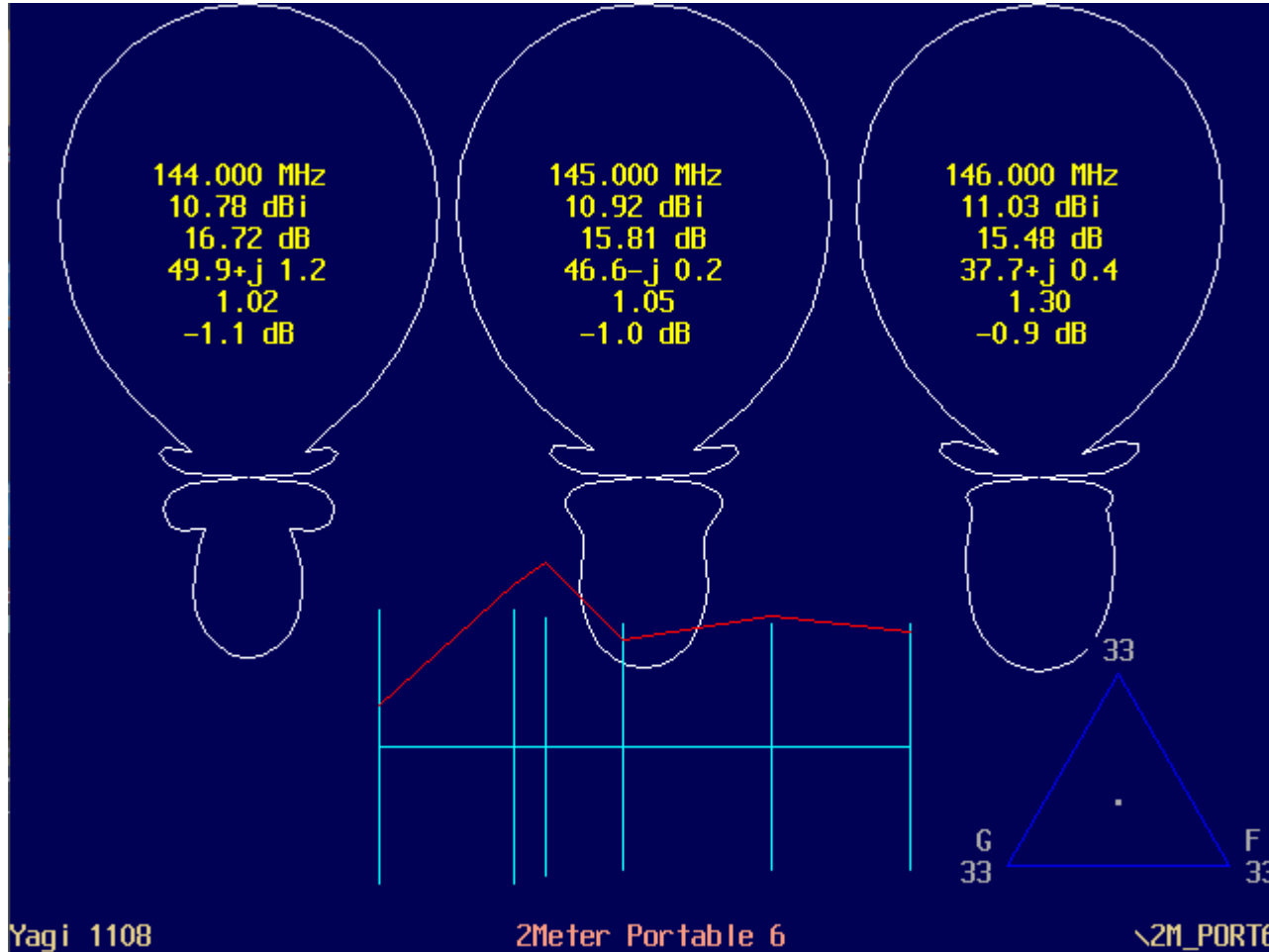
## DESIGN DATA FOR YOUR YAGI

Reflector Length : 1002 mm  
Reflector Position : 0 mm  
-----  
Dipole Position : 499 mm  
-----  
Director #1 Position : 655 mm , Length : 945 mm  
Distance Dipole - Dir. #1 : 156 mm  
-----  
Director #2 Position : 1029 mm , Length : 936 mm  
Distance Dir. #1 - Dir. #2 : 374 mm  
-----  
Director #3 Position : 1476 mm , Length : 928 mm  
Distance Dir. #2 - Dir. #3 : 447 mm  
-----  
Director #4 Position : 1996 mm , Length : 921 mm  
Distance Dir. #3 - Dir. #4 : 520 mm  
-----  
Directors / Parasitics are isolated.  
Please choose an isolater thicker than : 15 mm

[https://www.changpuak.ch/electronics/yagi\\_uda\\_antenna.php](https://www.changpuak.ch/electronics/yagi_uda_antenna.php)  
Javascript Version 12.01.2014, based on Rothammel / DL6WU

# Design Summary

Frequency  
Gain  
Front to Back  
Impedance  
VSWR  
From Optimum



**Yagi Optimizer**  
1990's Yagi Software  
K6STI Brian Beezley

# Element Spacing and Length

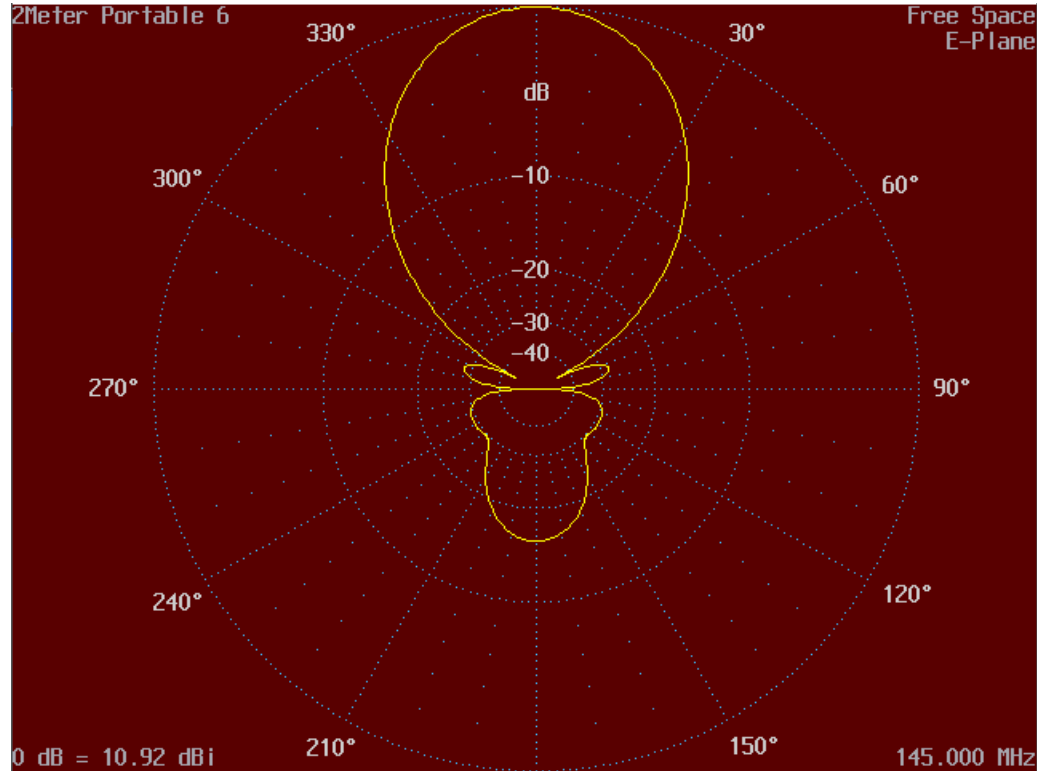
Elements		
	Position	Length
Ref	0.0	515.0mm
DE	→ 504.3	515.0
Dir 1	627.7	482.0
Dir 2	918.1	464.0
Dir 3	1476.0	464.0
Dir 4	1996.0	464.0
Boom	2.00m	0.97λ

}  
-  
}

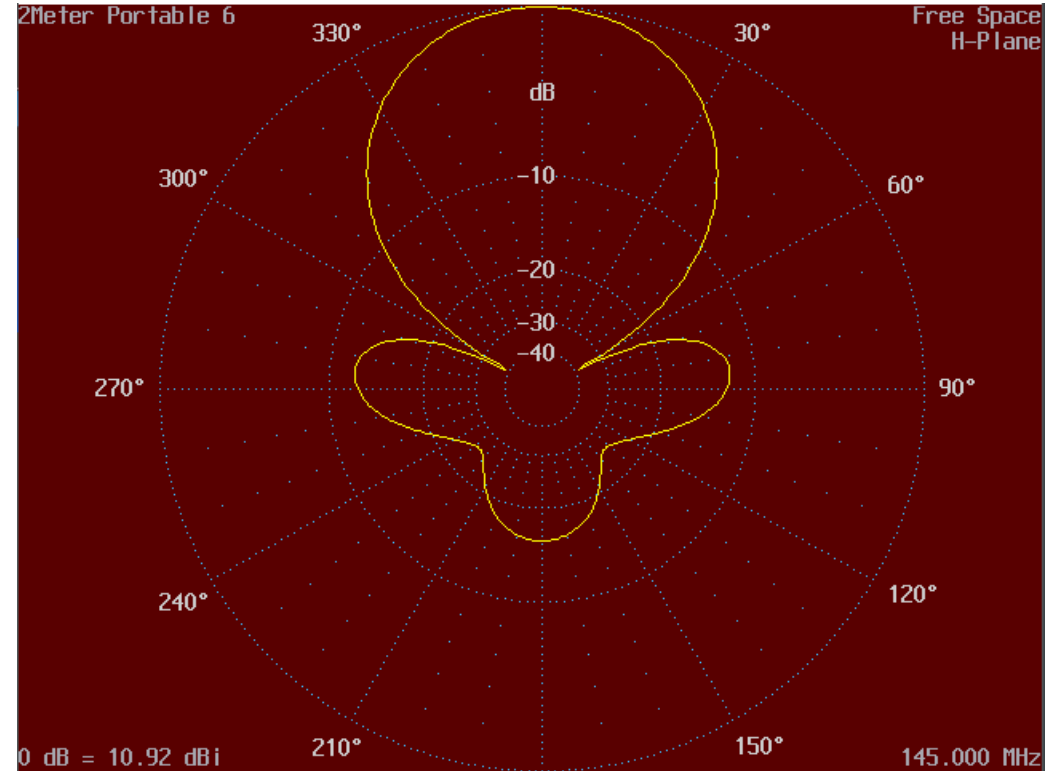
# E and H Plane Patterns

Log Scale

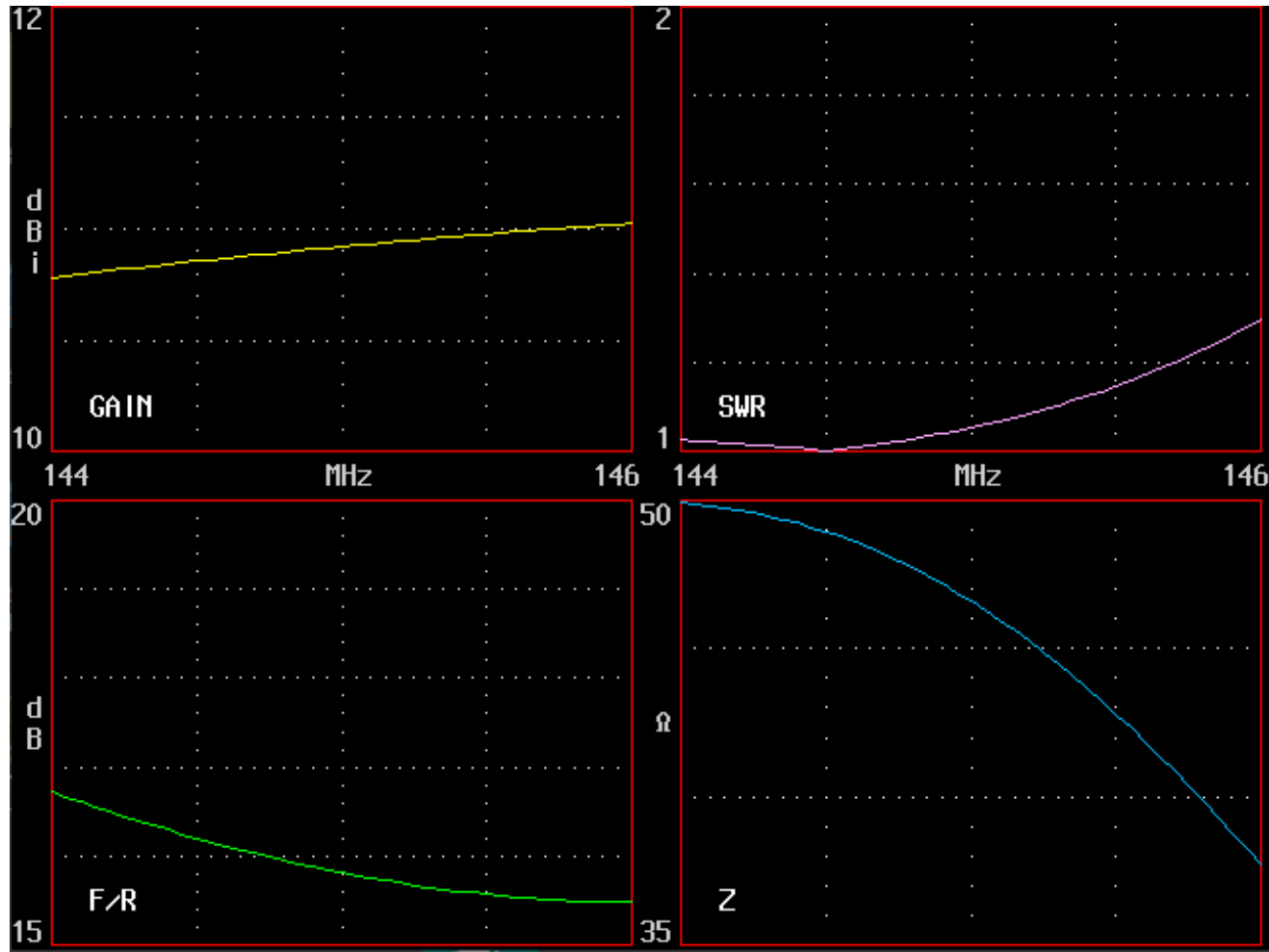
E-Plane



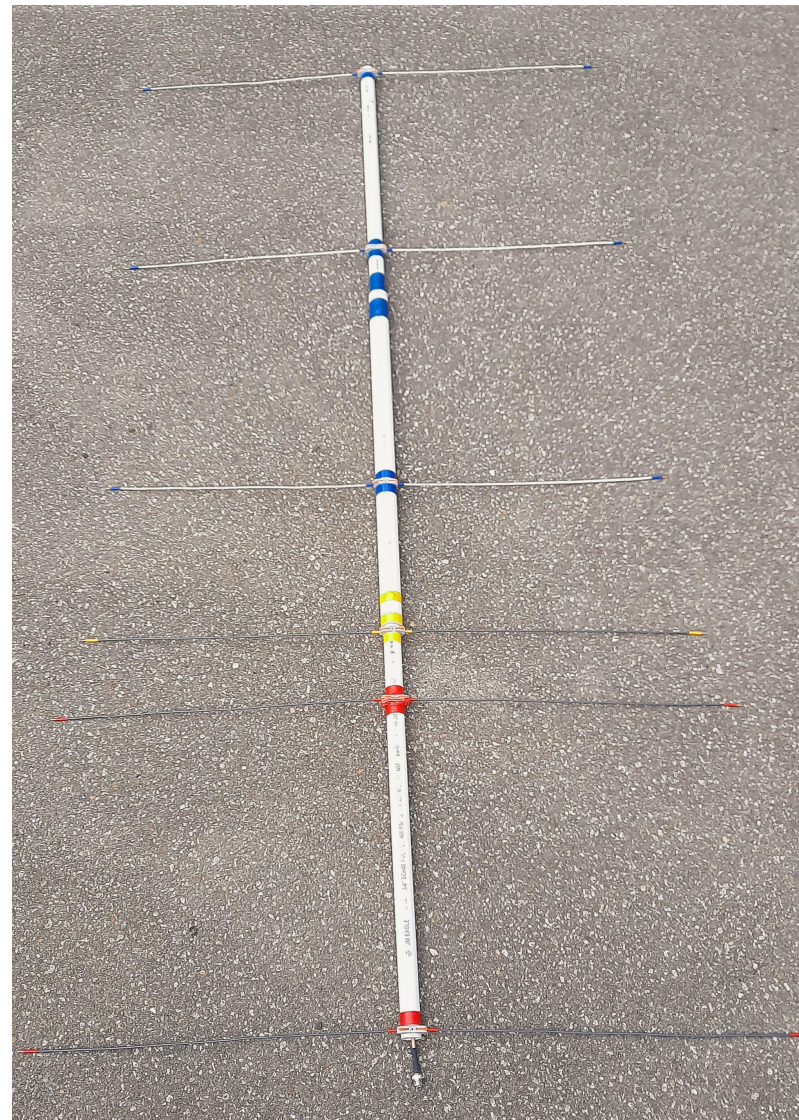
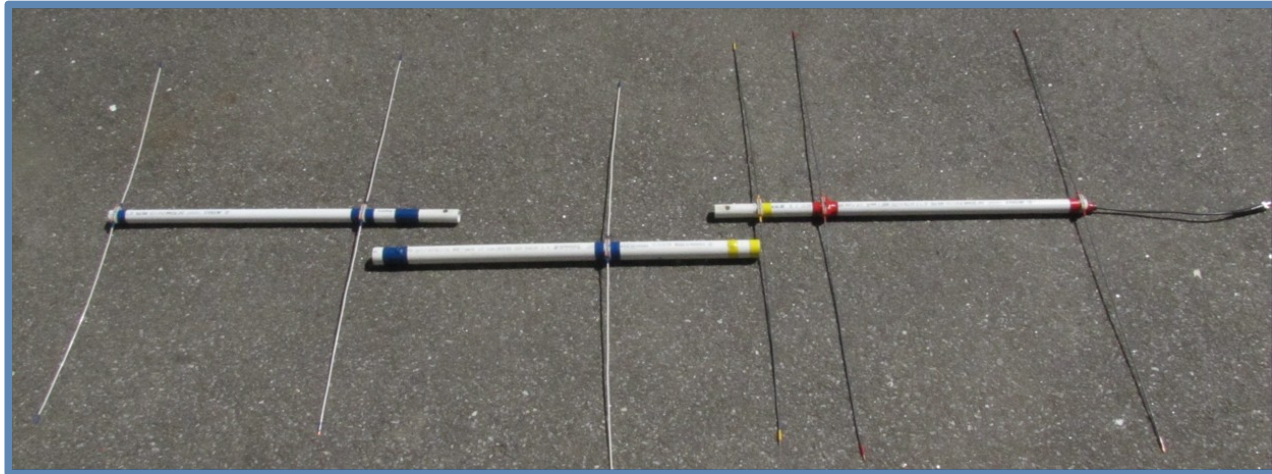
H-Plane



# Gain, SWR, Front/Rear, Impedance



# The Antenna Assembly



# On a Tripod

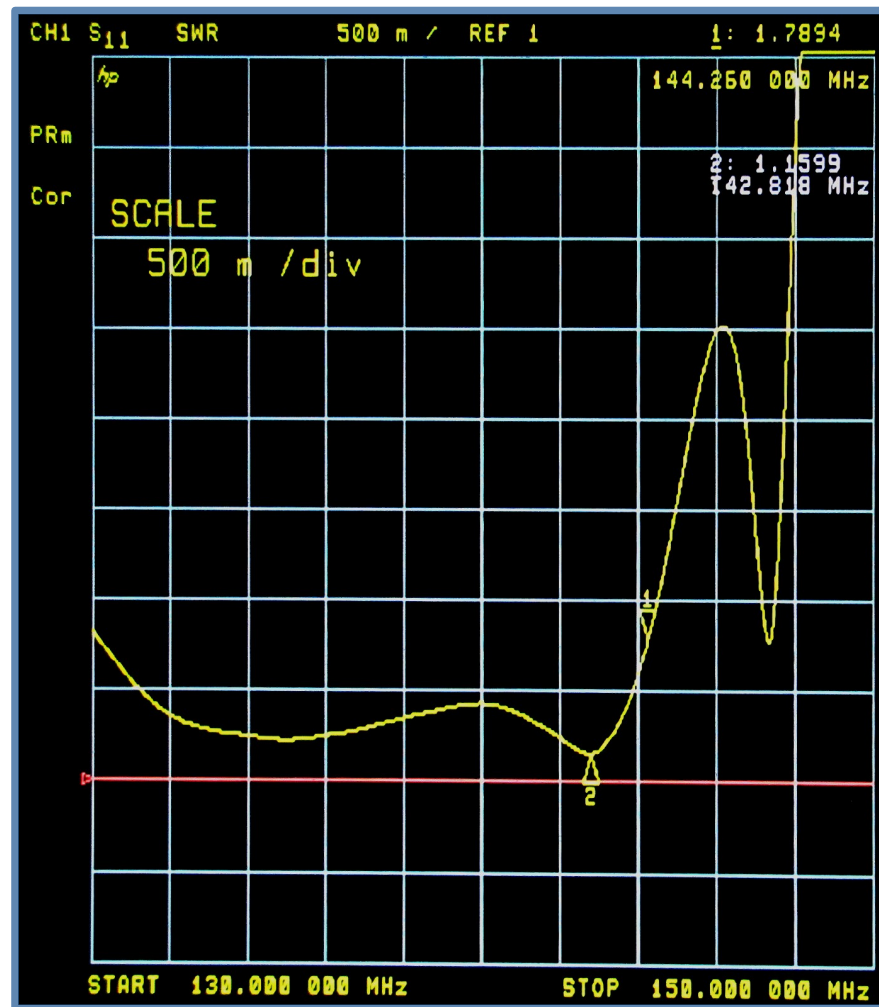
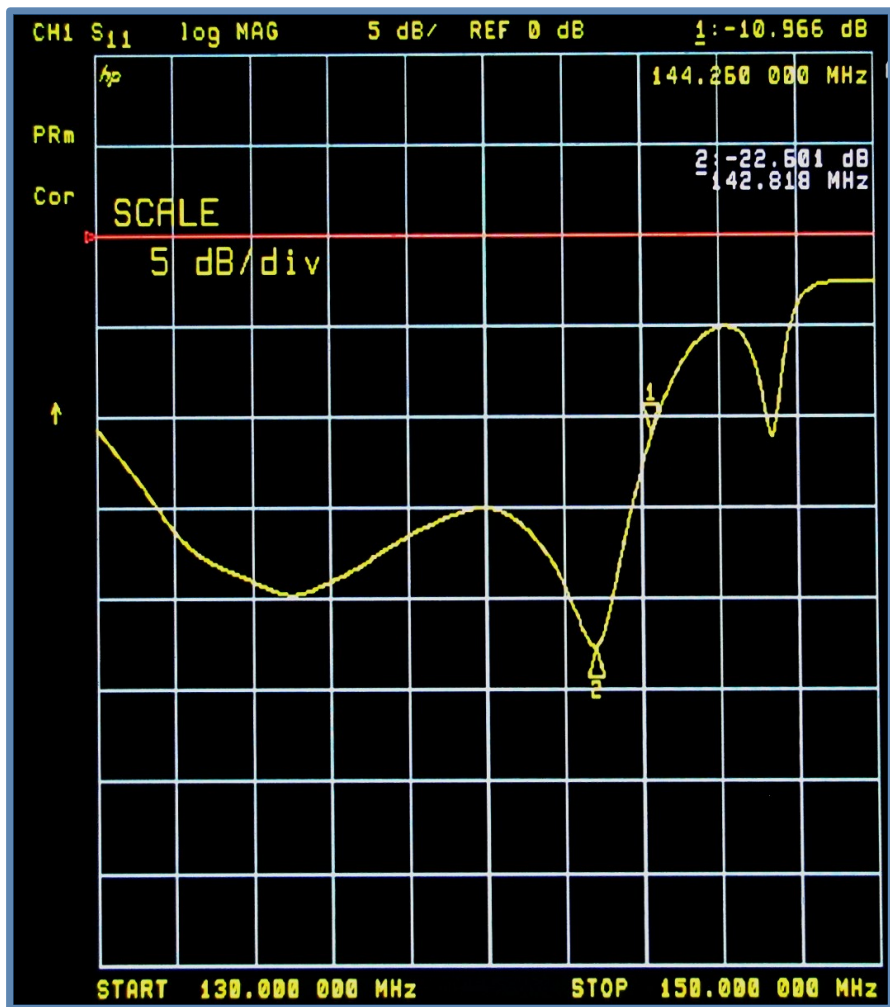




# Measurement Results

Return Loss

VSWR



# Some Discoveries and Features

- Element length and weight is at (or beyond) the design limits of the spring loaded connectors.
  - The cantilever or pry-bar effect means that contact may become inconsistent
  - This design concept is more conducive to shorter elements, higher bands
- The impedance match measurements are low in frequency
  - The wire insulation is an unaccounted dielectric loading
  - The added inductance of the connector is unknown
- The physical alignment precision of these clamps is not perfect. Adjusted for parallelism visually
- The copper elements are easily bent.
  - They are easy to bend back into shape.
  - This is a good feature as the element don't break and are easily "repaired".
- The elements are color-coded for assembly
  - 3 different lengths.
- The element connections are not waterproof
  - not an all-weather antenna.
  - The driven element connection at the feed is particularly sensitive to water.
- The BNC connector out the back of the antenna makes for easy coaxial connection to the radio.