Inverted-V Log Periodic Antenna

Evaluation and Expected Performance

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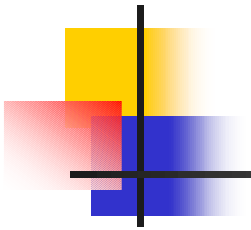
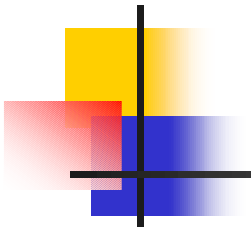


Talk Overview

- Review our objective from last year
- Improved design approach
  - Sub-bandwidth concept
- 1/100 scale prototype
  - simulation results
  - experimental results
- Conclusions



Objective

Modification of the Log Periodic Dipole Array (LPDA) antenna to achieve a more compact and robust structure that requires minimal maintenance, and provides good performance.

A Different Approach to LDPA Design

$$\frac{s_{1,2}}{L} = \frac{1-\tau}{1-\tau^{N-1}}$$

$s_{1,2}$ = Largest spacing distance

N = Elements

L = Boom length

τ = Scale Factor

Improved Structure Design

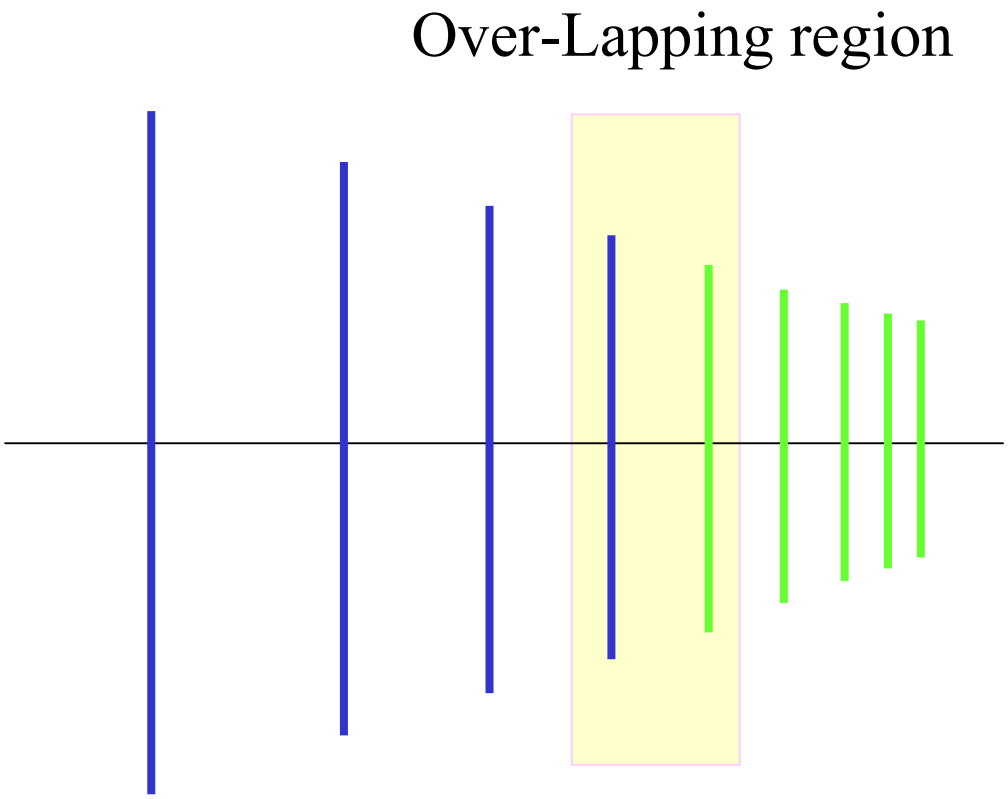
Sub-Bandwidth Concept

"*Breaking the design bandwidth into a number of sub-bandwidths*"

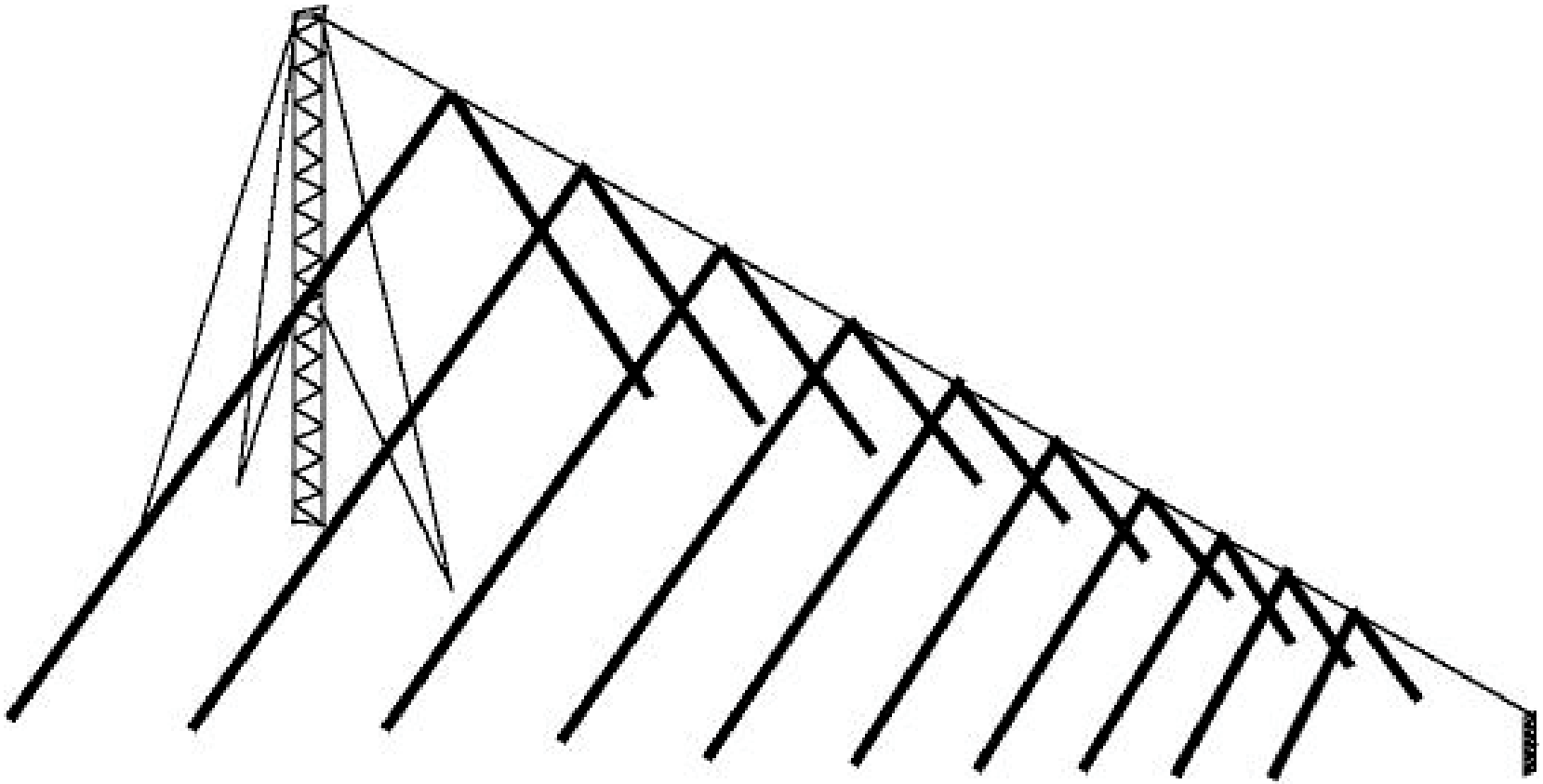
Mathematically,

$$BW = \frac{f_{\max_1}}{f_{\min}} \cdot \frac{f_{\max}}{f_{\max_1}} = \frac{f_{\max}}{f_{\min}}$$

Sub-Bandwidth Design



Inverted-V LPDA Structure

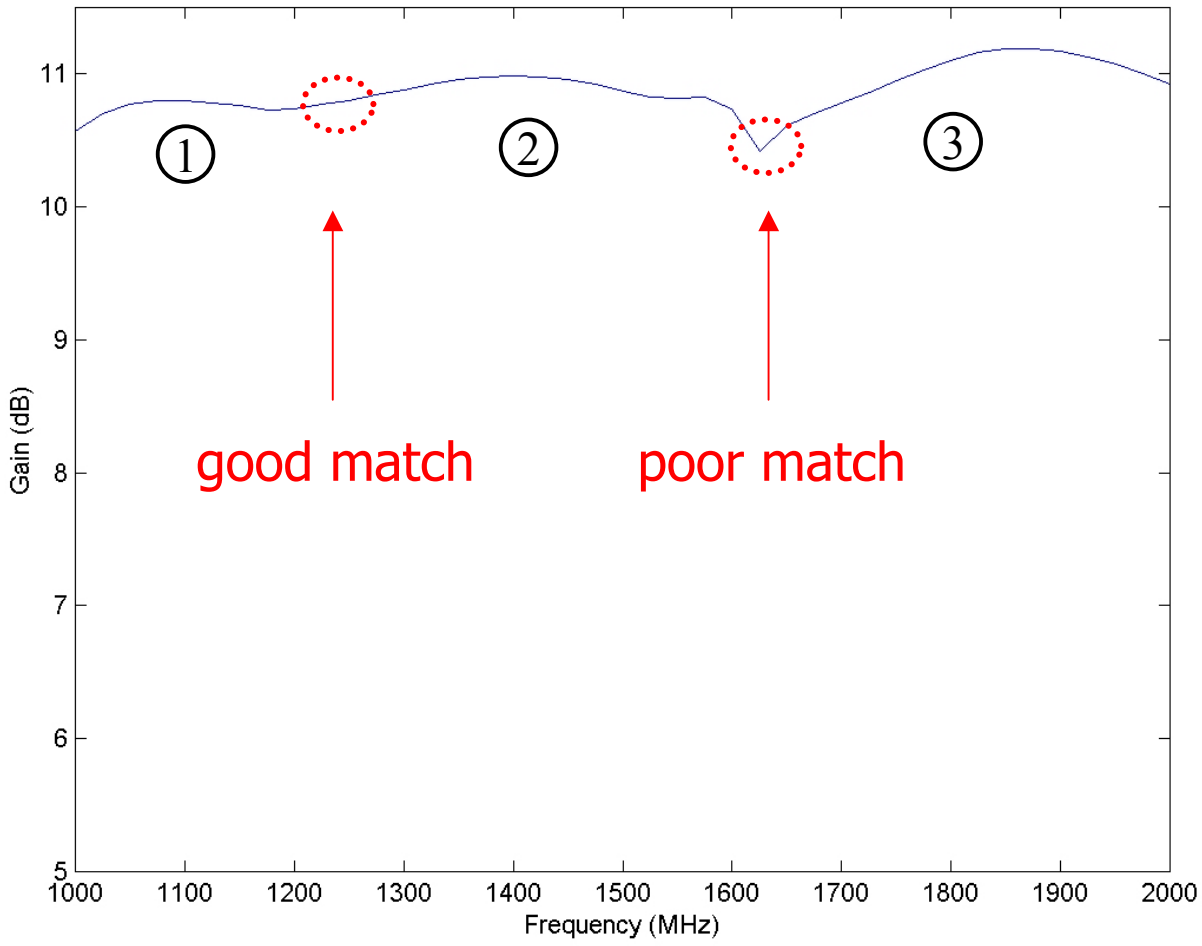


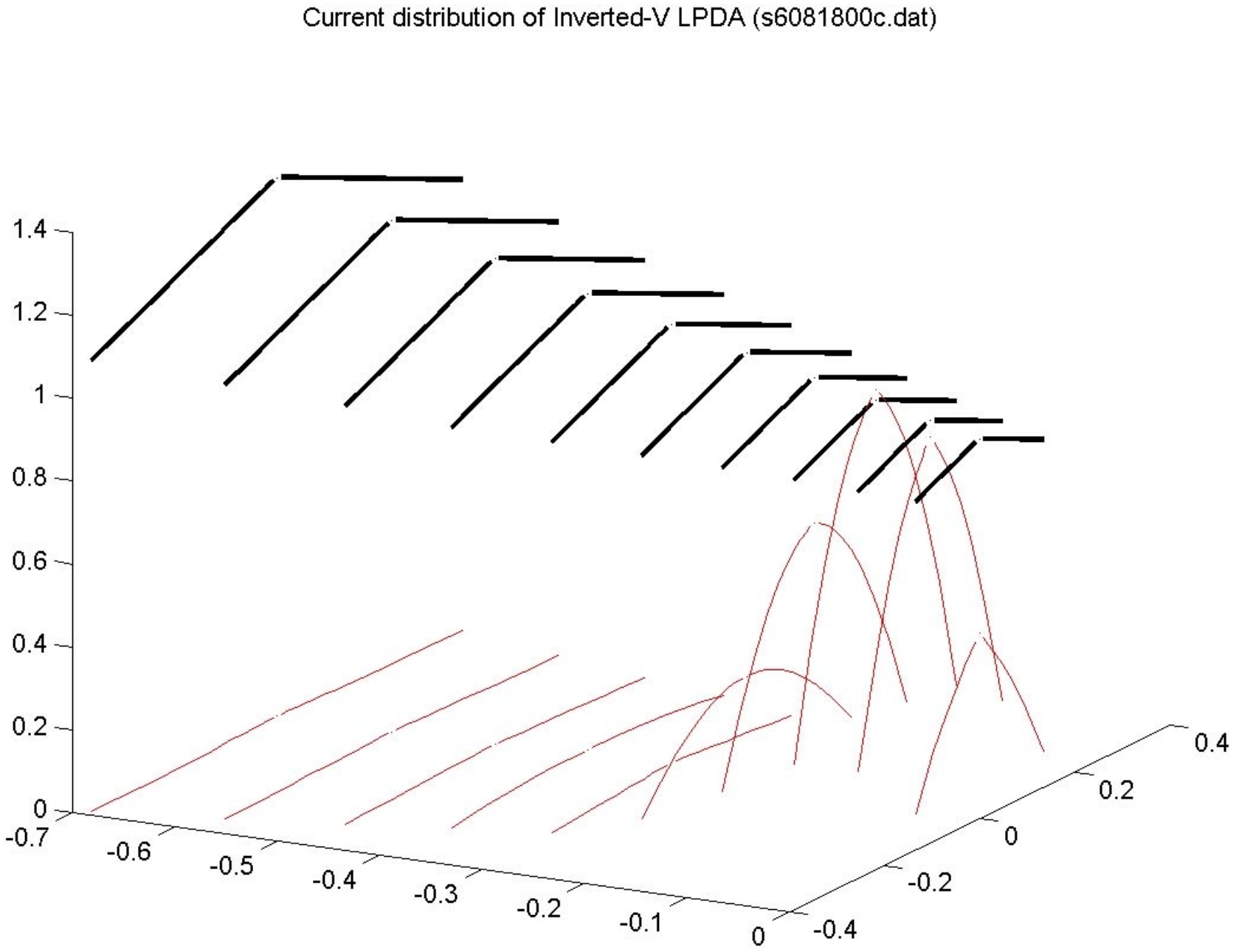
Prototype – 1/100 Scale Model Design

- For frequency band 1.2 – 1.8GHz

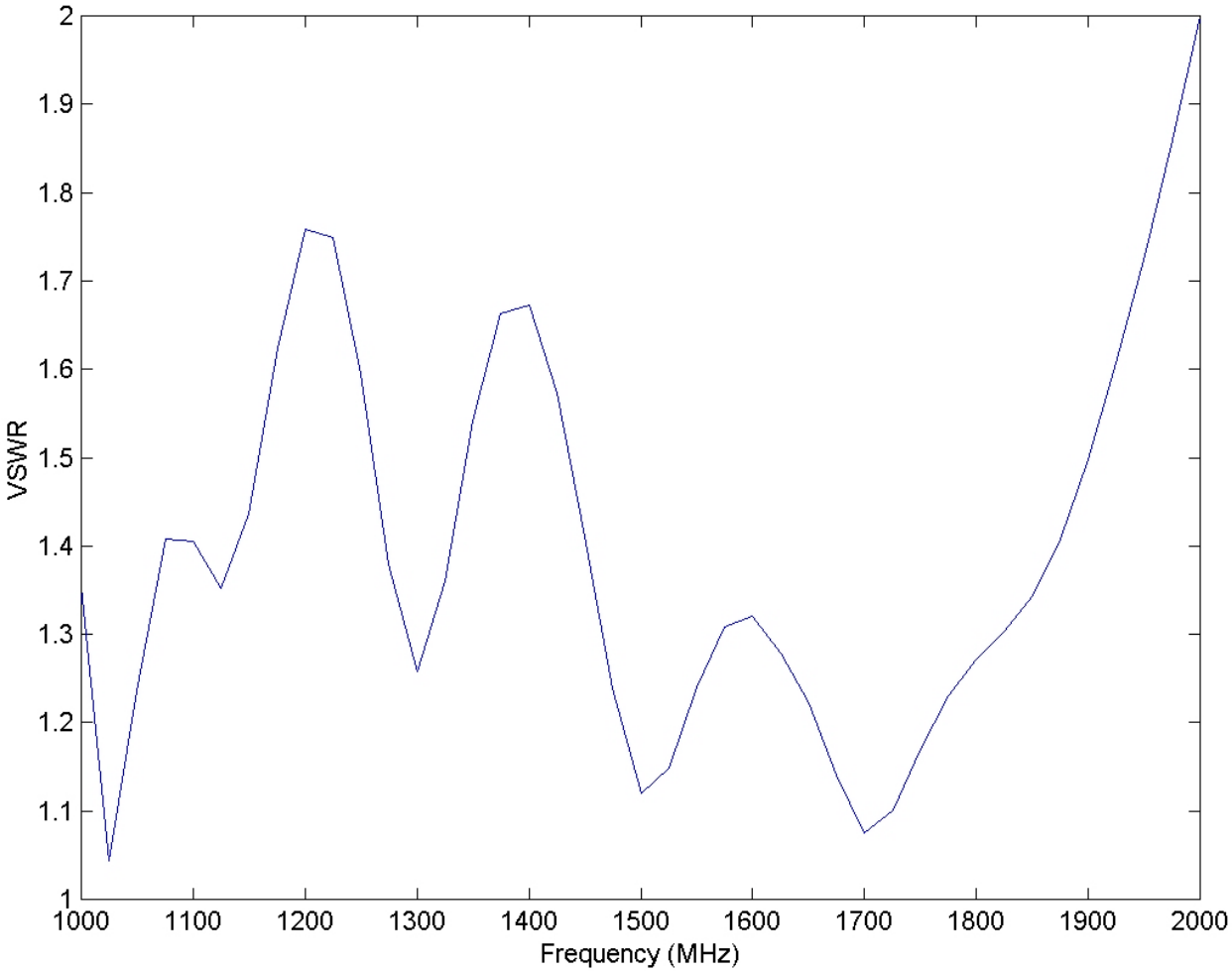
  N = 10
  L = 13.2cm
  $S_{1,2}$ = 2.4cm
  Sub-Bandwidth_1: $\tau = 0.9$
  Sub-Bandwidth_2: $\tau = 0.87$
  Sub-Bandwidth_3: $\tau = 0.9$

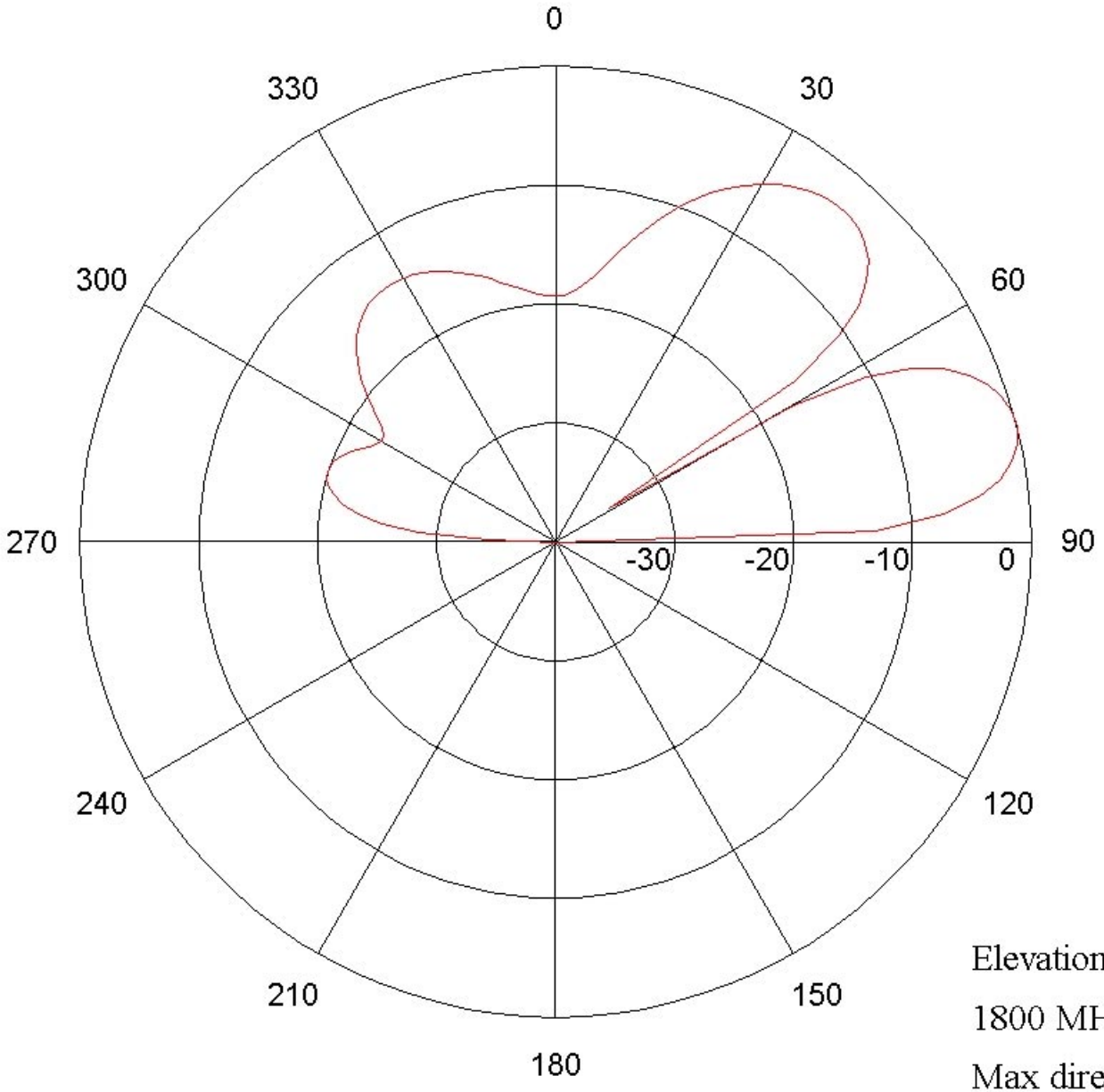
Gain over 1 - 2 GHz band




Current distribution of Inverted-V LPDA (s6081800c.dat)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.7
-0.6
-0.5
-0.4
-0.3
-0.2
-0.1
0
-0.4
-0.2
0
0.2
0.4

Smith Chart and VSWR



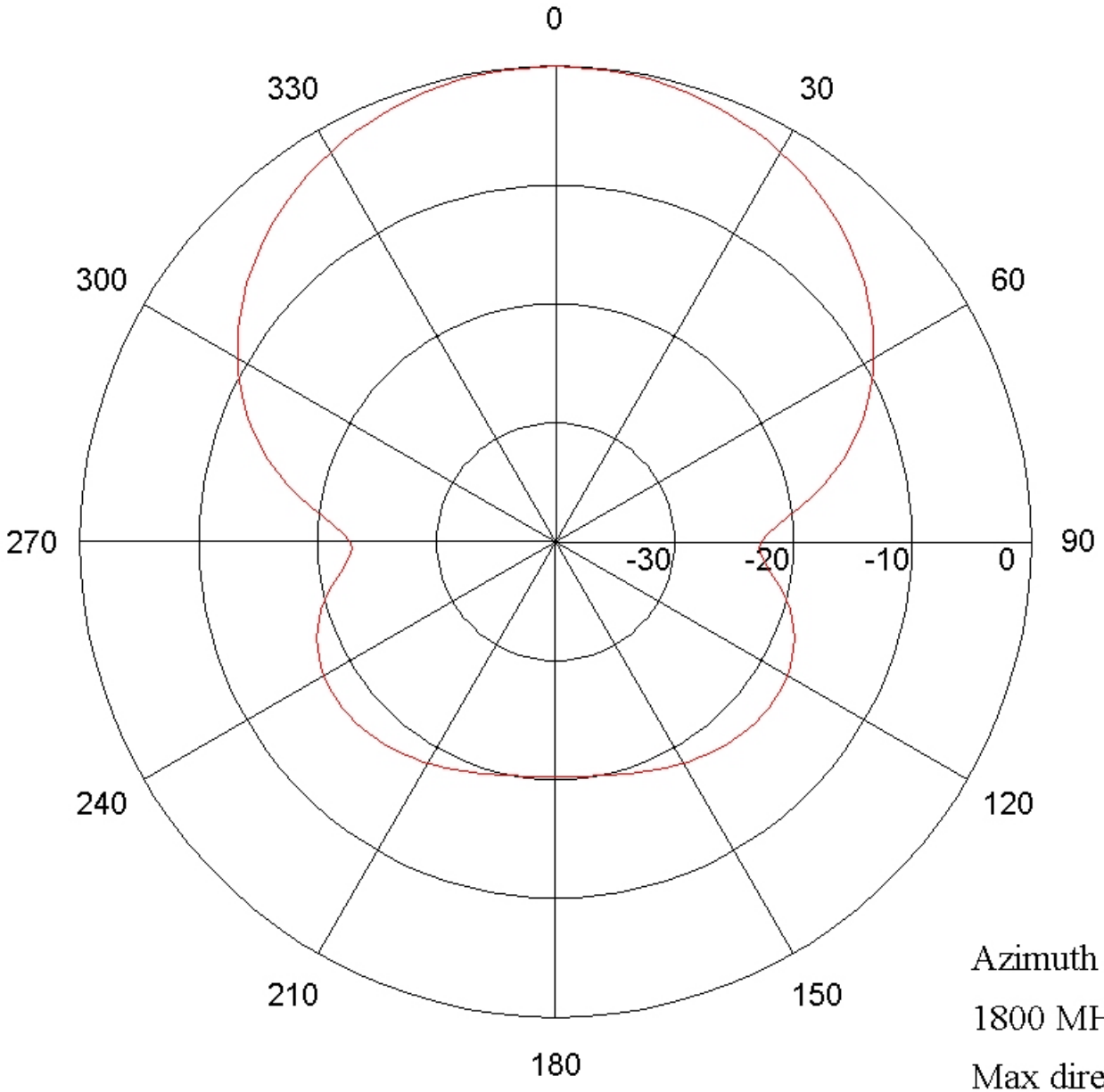


Elevation radiation pattern

1800 MHz

Max directivity 11.1 dB

s6081800p.dat

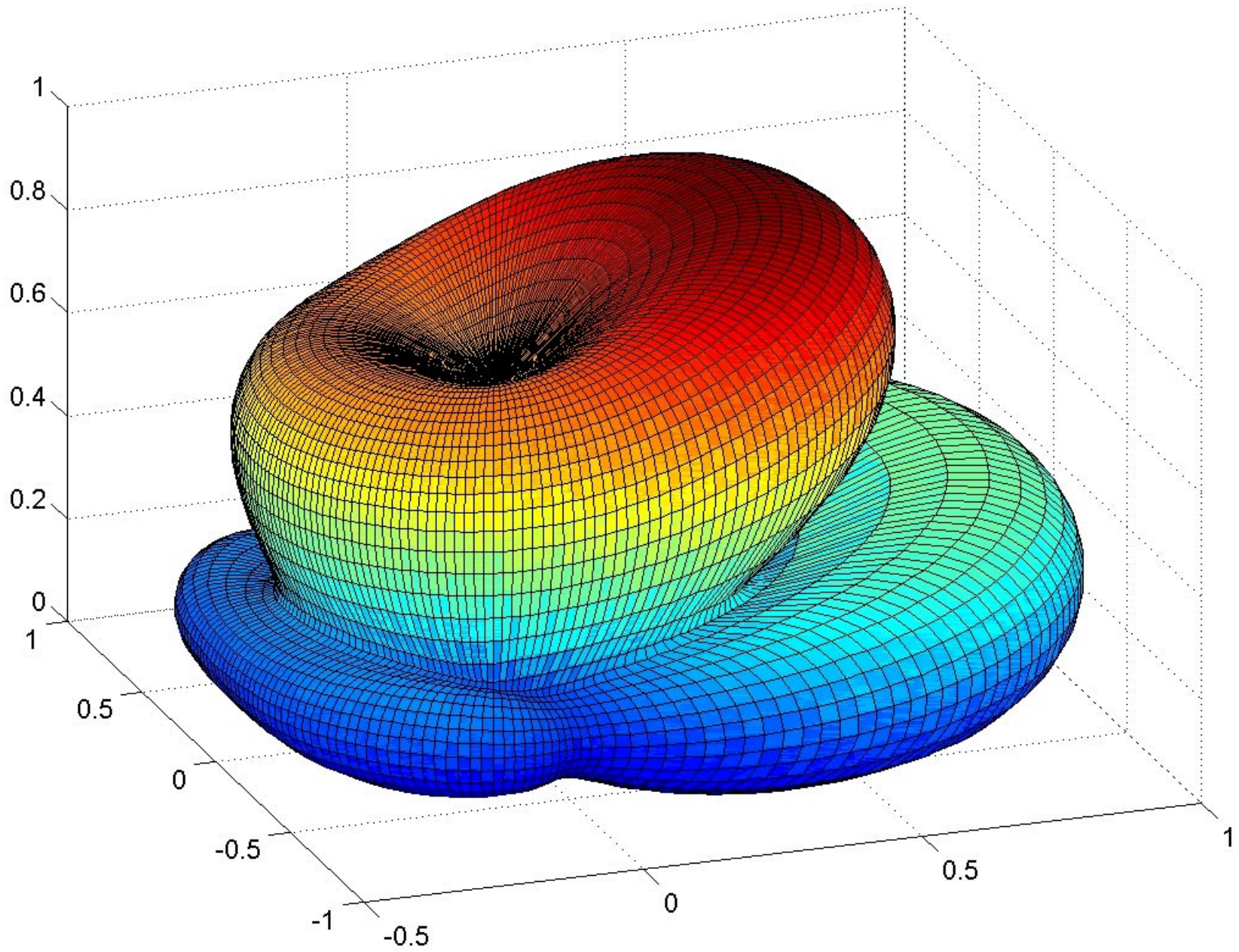


Azimuth radiation pattern

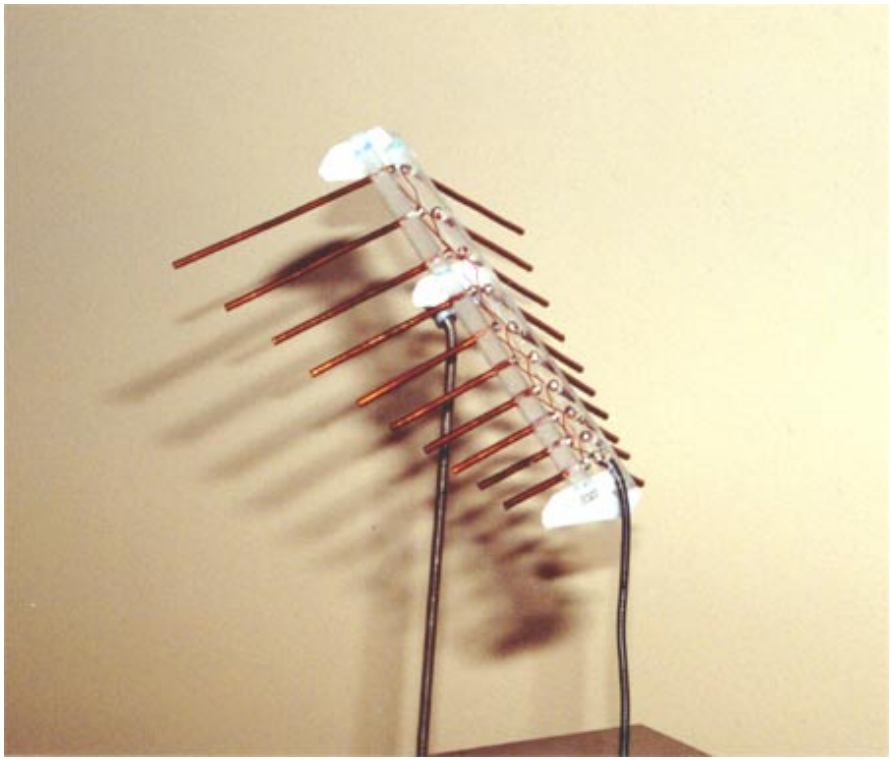
1800 MHz

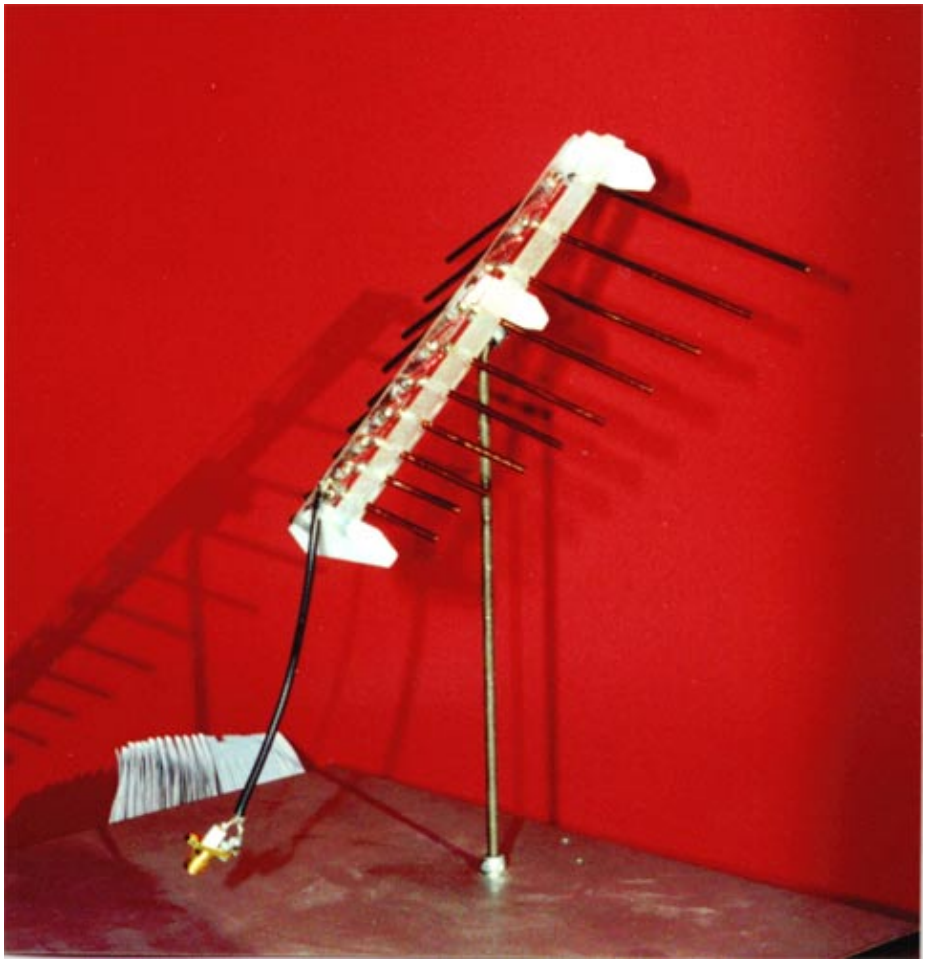
Max directivity 11.1 dB

s6081800p.dat


3D Antenna pattern of s6081800p.dat (Maximum directivity = 11.1 dB, Take-off angle = 14 degrees)
1
0.8
0.6
0.4
0.2
0
1
0.5
0
-0.5
-1
-0.5
0
0.5
1

1/100 Scale Prototype





1/100 Scale Prototype Construction

- Practical difficulties
  - Precision of dimensions
  - Conductivity of wire in scale model
  - Feeding technique

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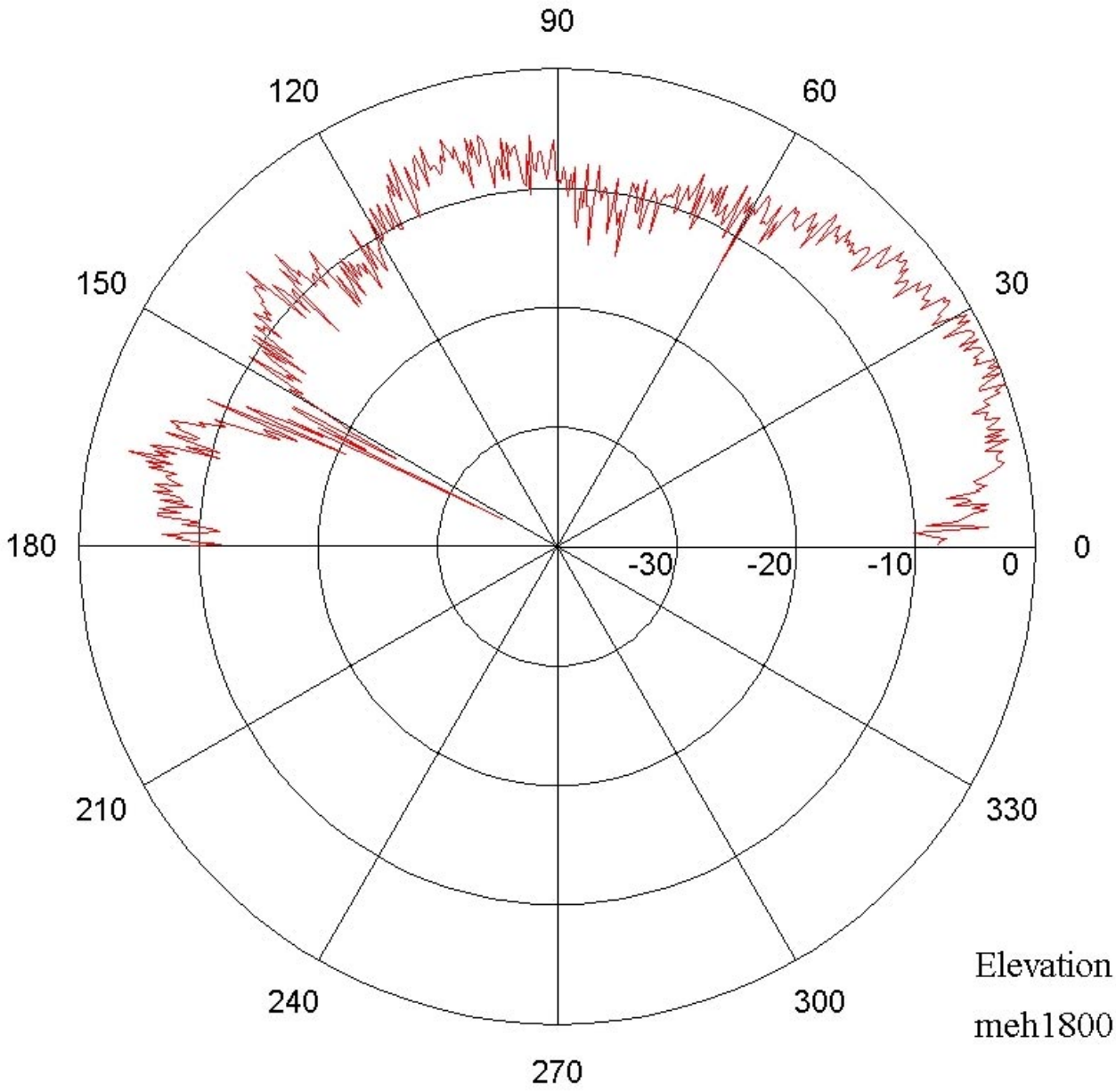
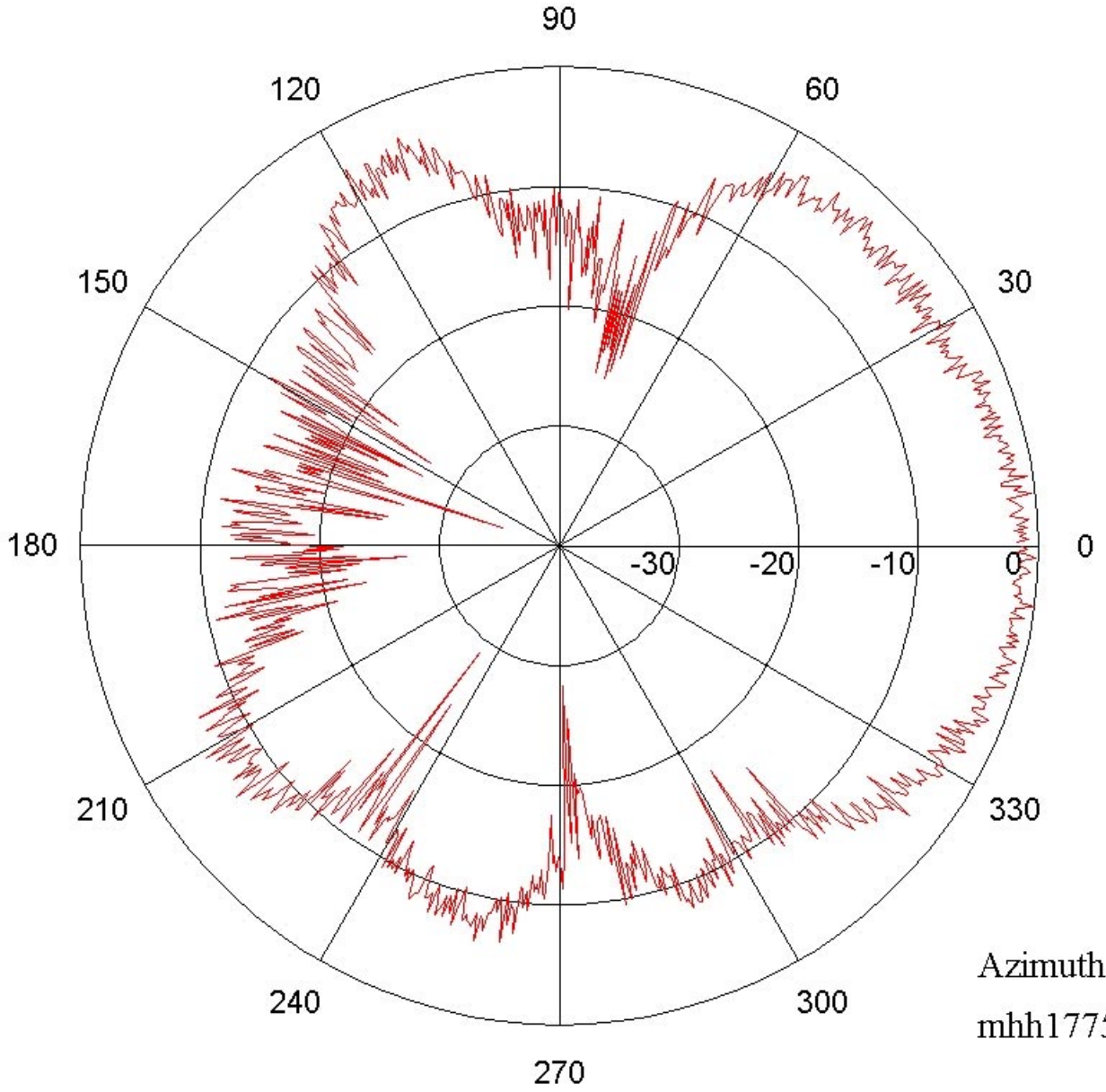


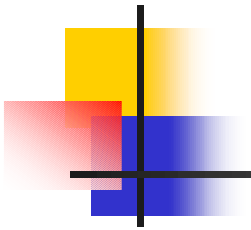
Elevation radiation pattern

meh1800.dat



Azimuth radiation pattern

mhh1775.dat



Conclusions

- Designed Inverted-V LPDA Antenna
- 1/100 scale prototype built and tested
- Fairly good results
- Design shows potential
- Future work