uc3m
European school of Antennas
Fundamentals of Antennas: The antenna as a communication system building block
Universidad Carlos III de Madrid (Spain), 17th -21th Oct, 2022

Block Based Antenna and Microwave Component Design Methodology with Reusable Bricks

A Brief Explanation of the Concept

Umut Bulus

Contents

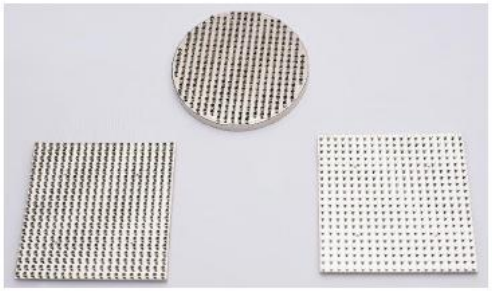
- Reusable Building Blocks
- How This Concept Works ?
- Horn Antenna Example

Reusable Building Blocks

Video


Metal Cells

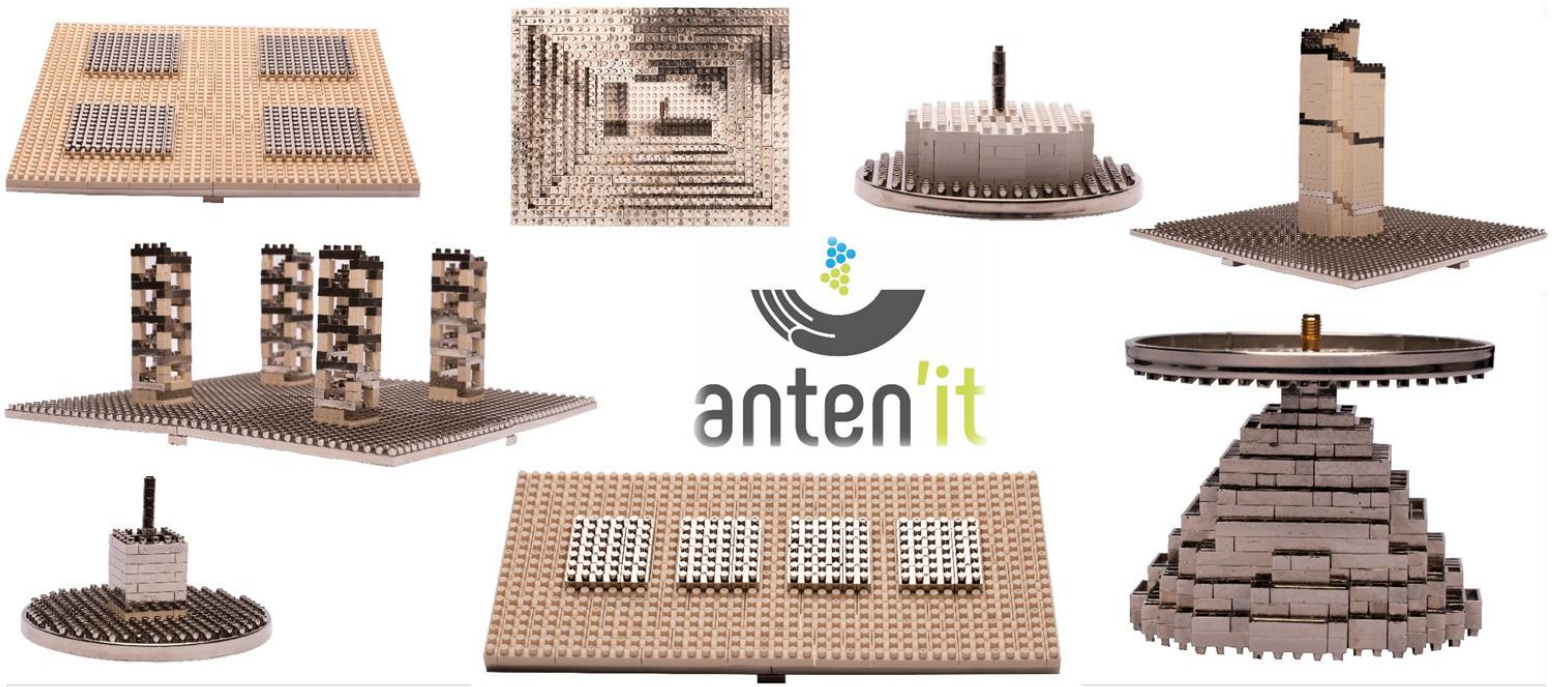

Absorber Cells

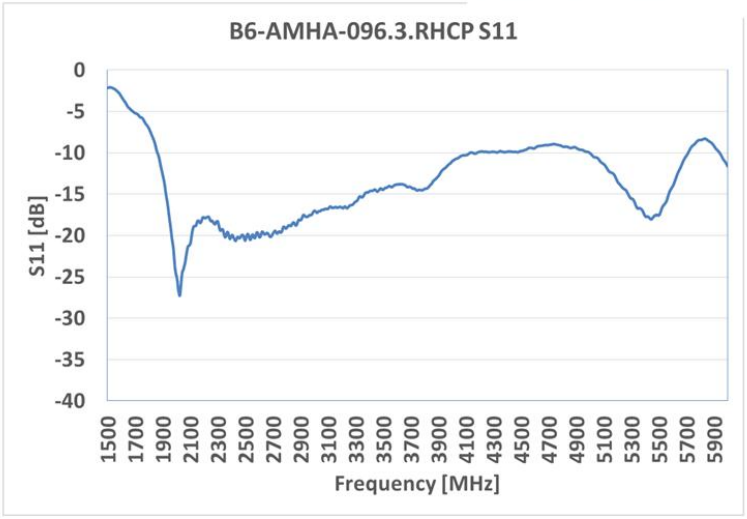

Ground Planes

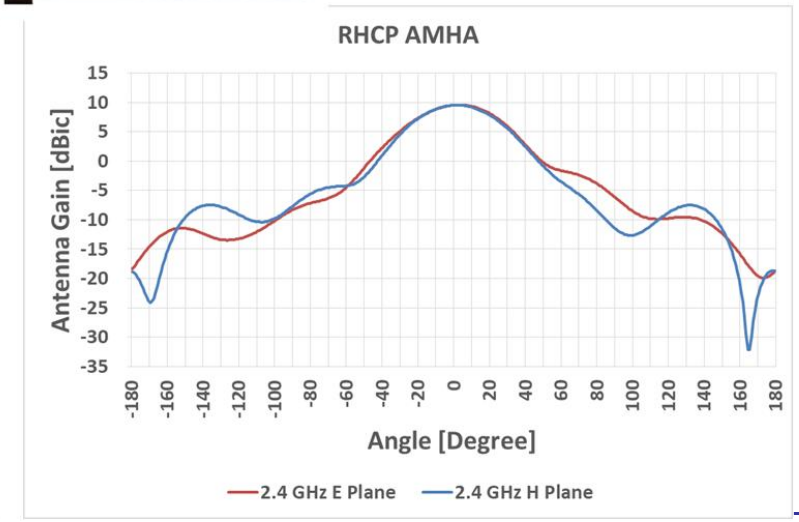

Connectors

The dielectric materials have **better than 0.002 loss tangent** up to 12 GHz

Antenna Design and Training Hardware

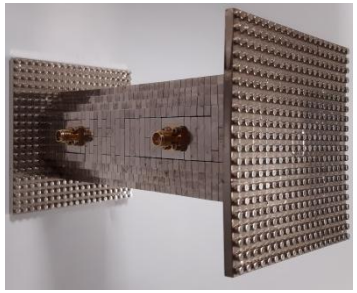




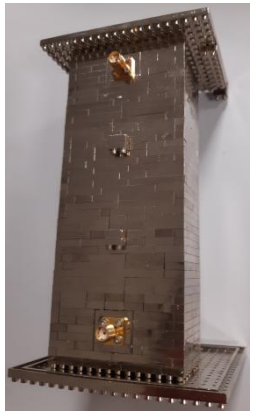


Microwave Design and Training Hardware

- Microstrip passive components
- Waveguide passive components



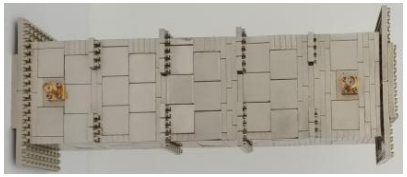
Circular Waveguide



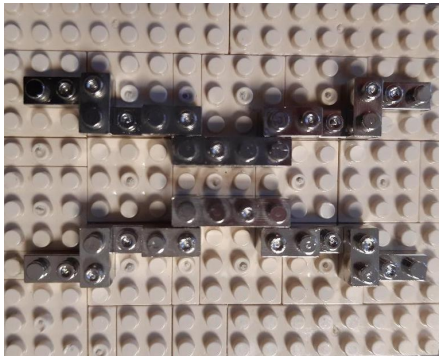
Inductive Post Filter

Waveguide Load Absorber

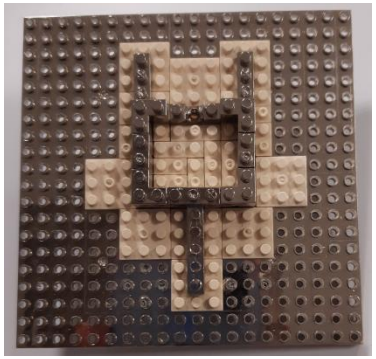
Bandpass filter



Iris Filter

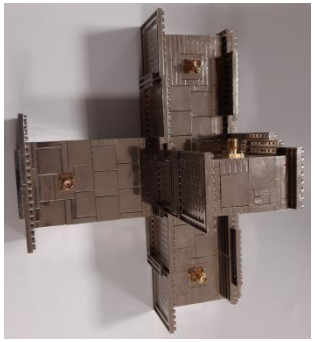


Coupled Line Directional Coupler

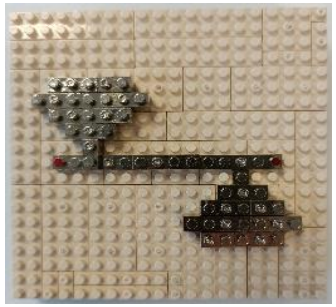


Wilkinson Power Divider

Magic Tee

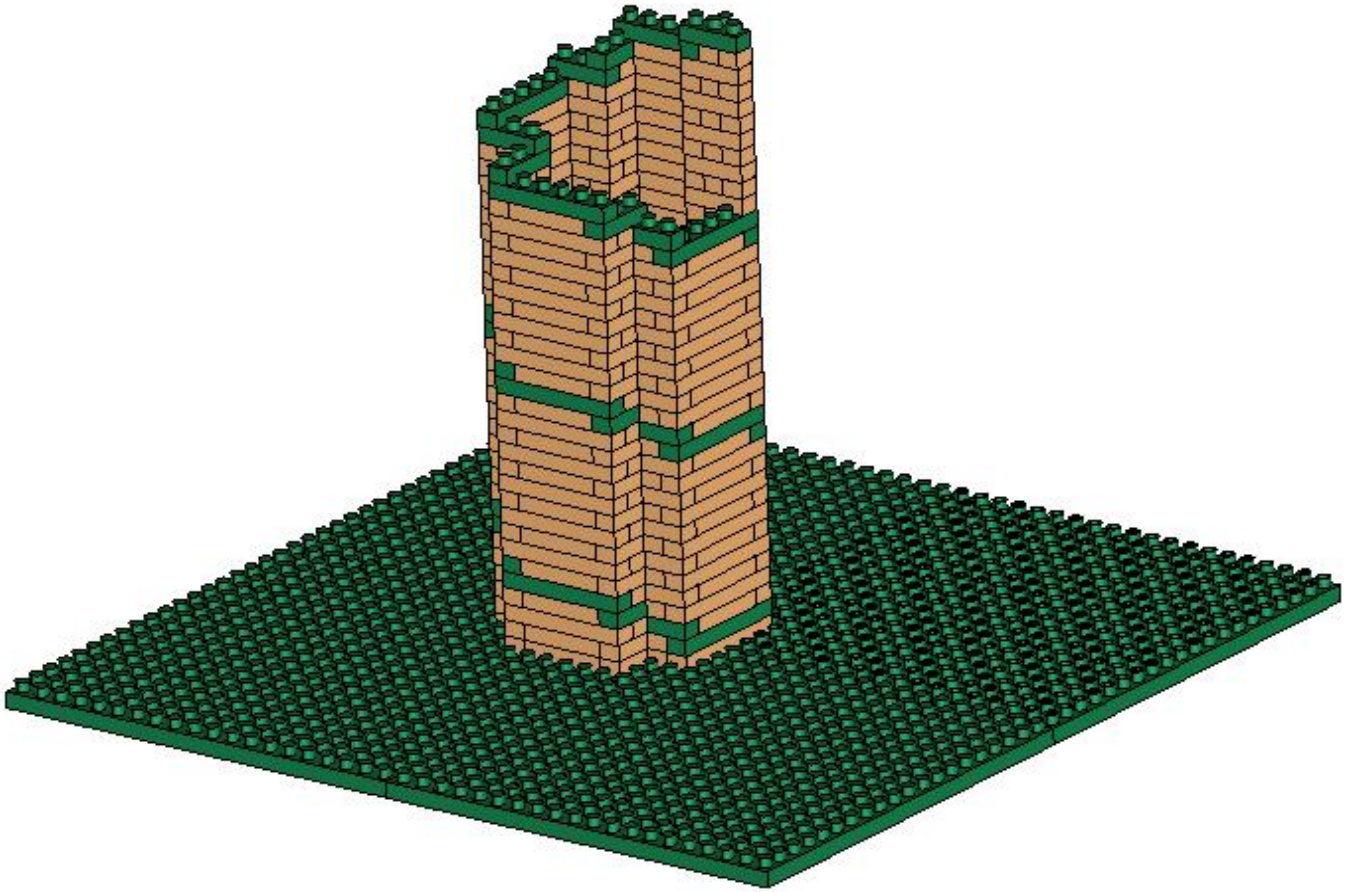


20 dB Directional Coupler



Stop Band Filter

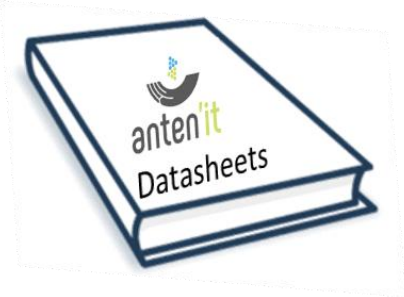
Simulation Files



Stop Band Filter

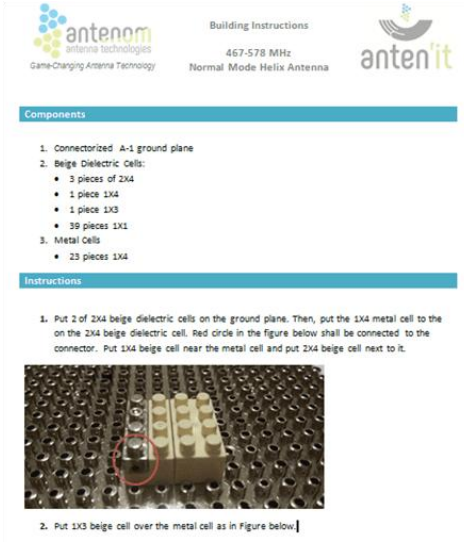
Documentation

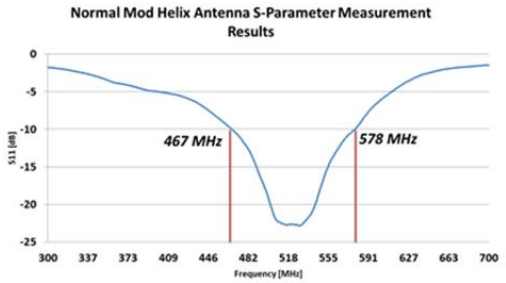
1- Look at the Datasheet Booklet which includes hundreds of datasheets



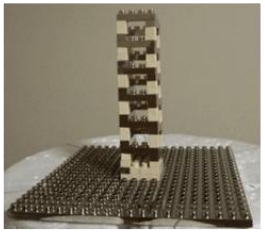
2- Find the appropriate datasheet that matches to your requirements

3- Build the antenna by the help of instructions



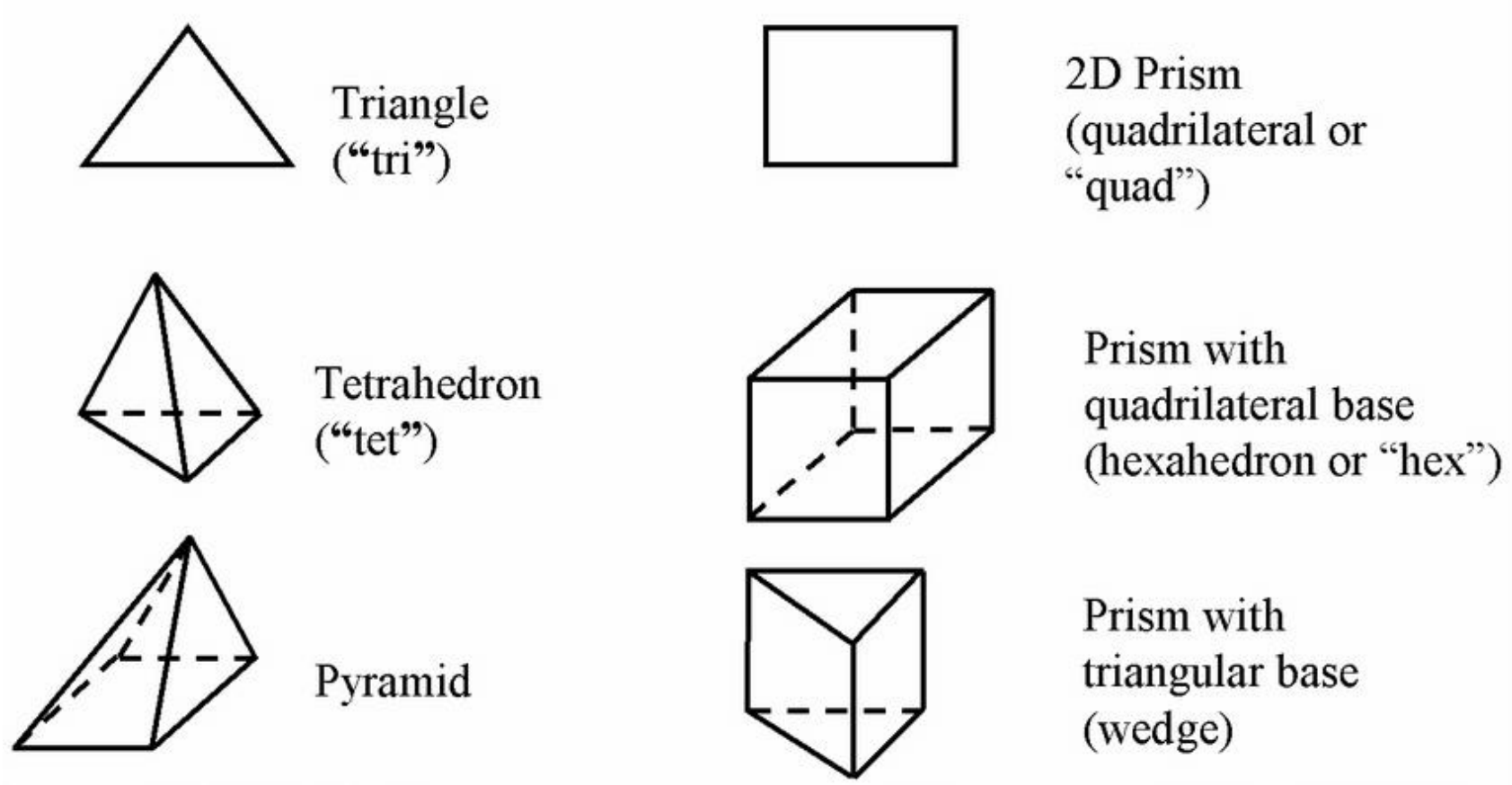


4- You have the antenna

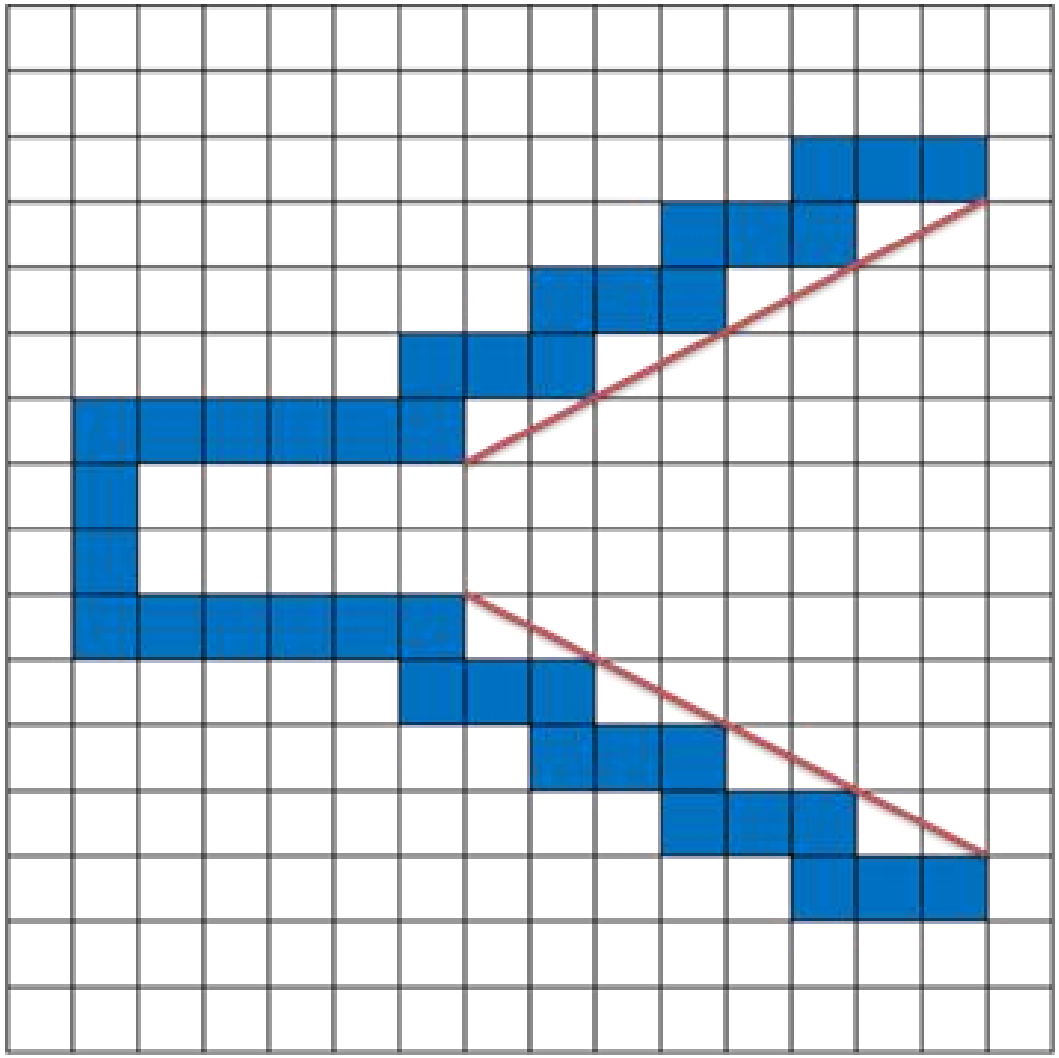


How This Concept Works ?

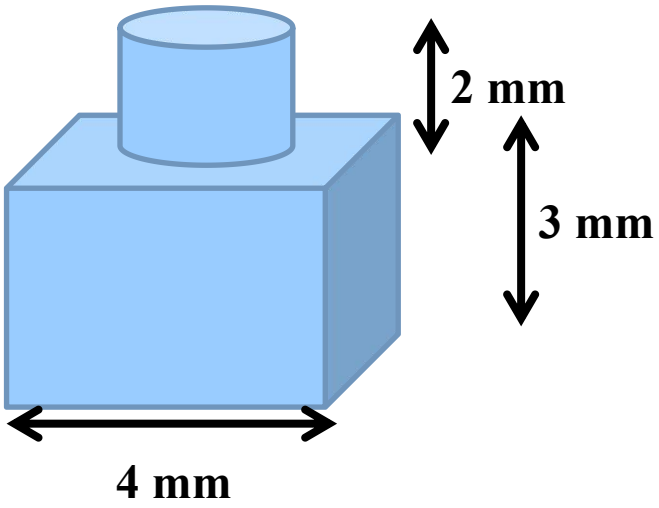
Mesh Cells in Computational Electromagnetics (CEM) Software

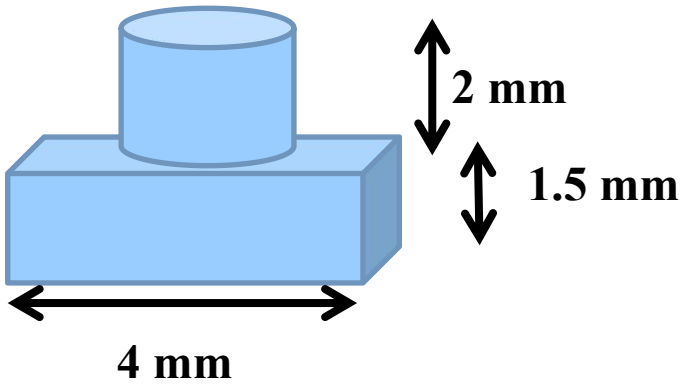


Discretized Horn Antenna



Brick Formed Mesh Cells

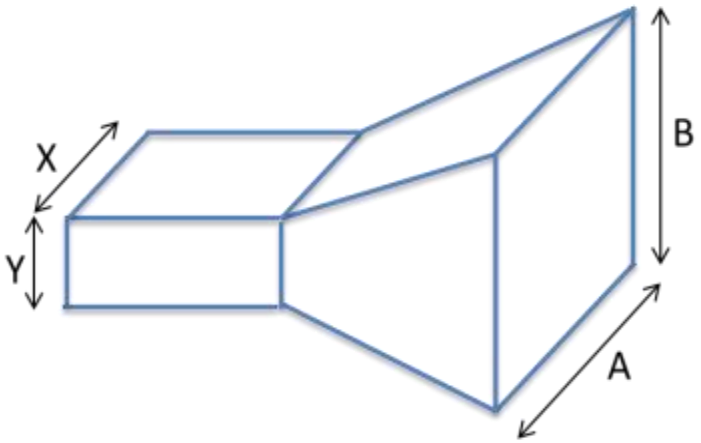




Physical Dimension	Electrical Dimension	Frequency
4 mm	λ/20	@ 3.75 GHz
4 mm	λ/12.5	@ 6 GHz
4 mm	**λ/10**	**@ 7.5 GHz**

Horn Antenna Design Example

Analytical Calculations:



Frequency = 3.9 GHz
X and Y are dimensions of WR229:

X: 58.166 mm
Y: 28.083 mm

Flare Angle: 34°

A: 80 mm
B: 52 mm

$$D = \frac{4\pi}{\lambda^2} AB$$

D= 9.53 dBi

Horn Antenna Dimensions

Calculations

@3.9 GHz

X = 58.166 mm

Y = 28.083 mm

A = 80 mm

B = 52 mm

Flare Angle = 34°

Waveguide Frequency Range:
3.3-4.9 GHz

Anten'it Resolution:

Height: 3 mm
Length and Width: 4mm

Anten'it Dimensions

@3.9 GHz

X = 56 mm

Y = 28 mm

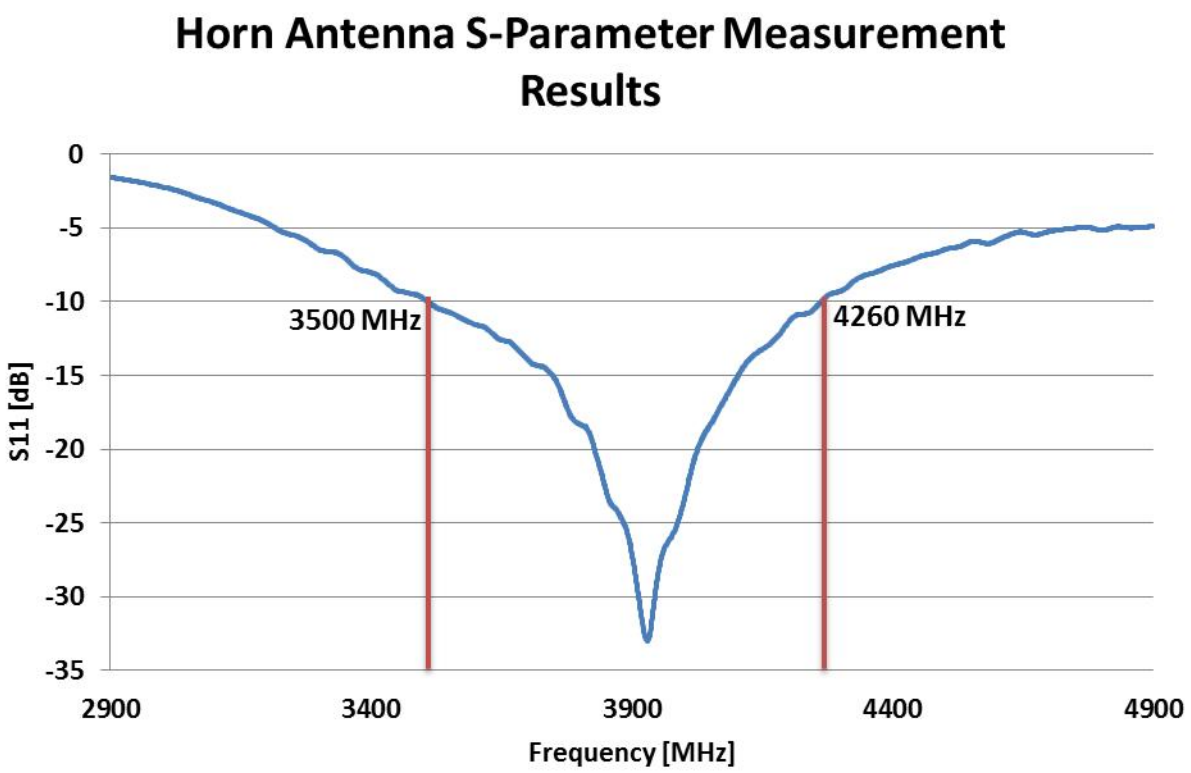
A = 80 mm

B = 52 mm

Flare Angle = 34°

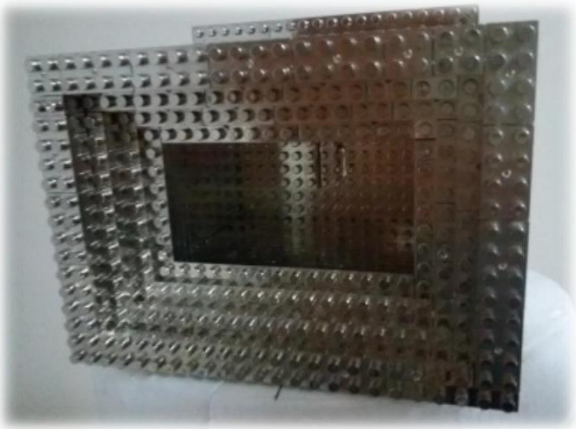
Waveguide Frequency Range:
3.3-5.1 GHz

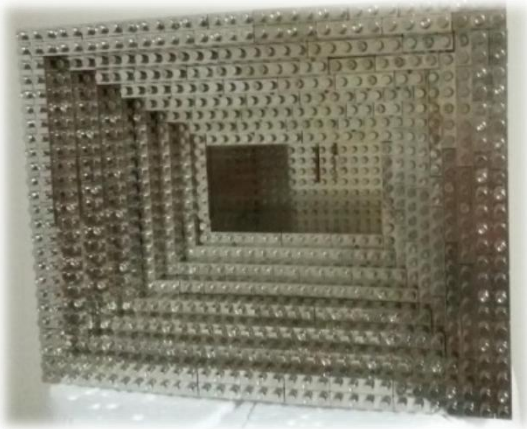
Horn-1 Antenna Reflection Coefficient Measurement



3500 - 4260 MHz frequency range

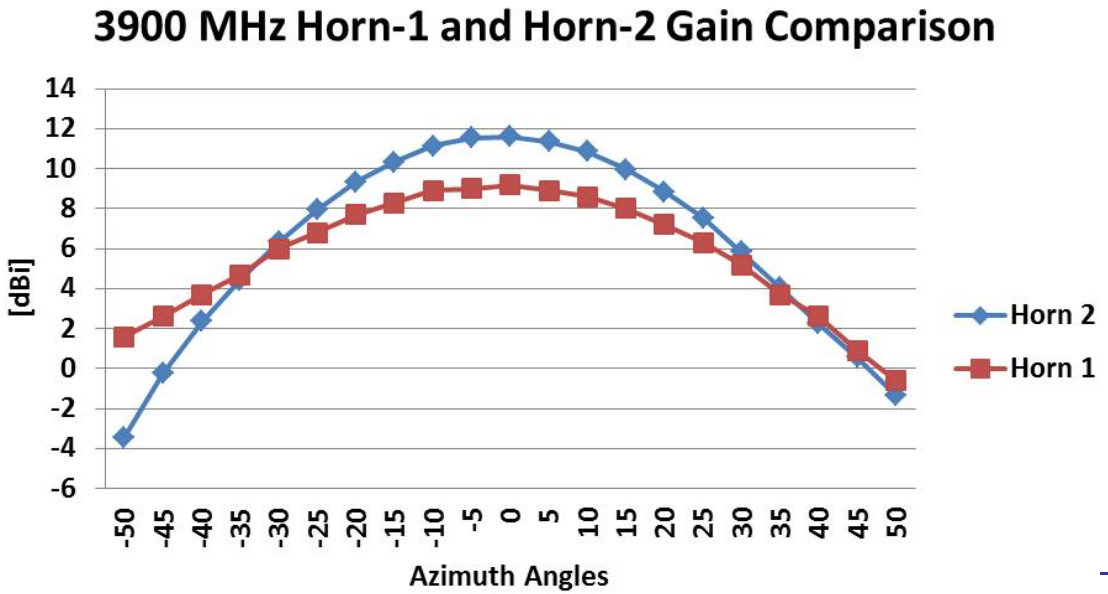
Increasing the Gain of the Horn Antenna





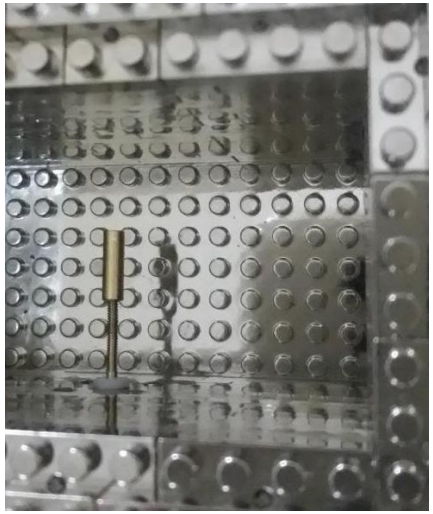
80 mm X 52 mm (A X B)
Antenna Gain: 9.2 dBi
Azimuth HPBW: 55°

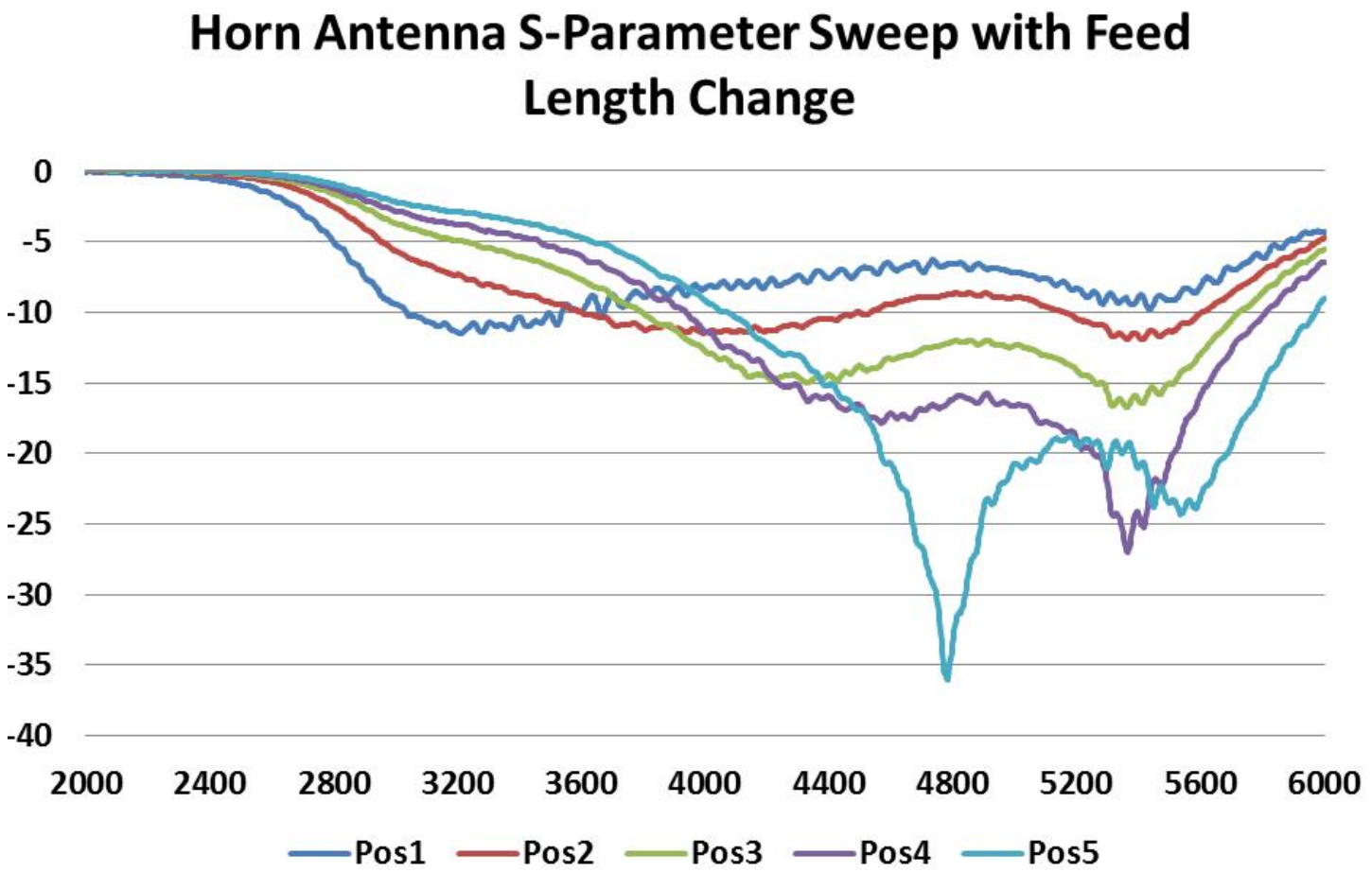
112 mm X 84 mm (A X B)
Antenna Gain: 11.6 dBi
Azimuth HPBW: 43°



Horn Antenna Feed

The position of the ring changes the center frequency





Thanks

- **Thanks for Listening!**