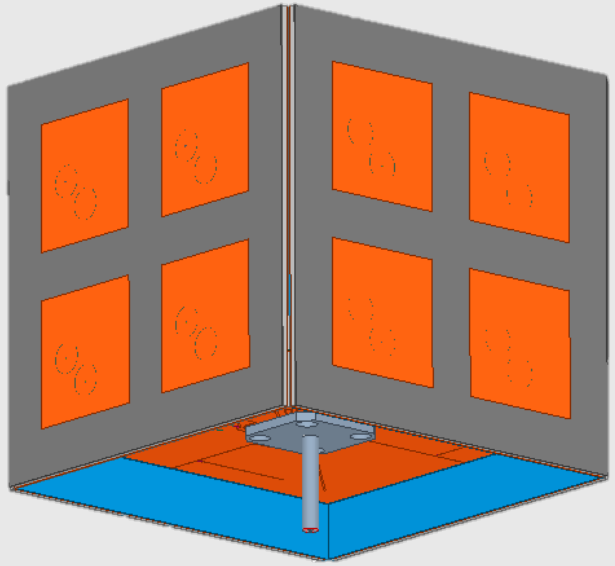


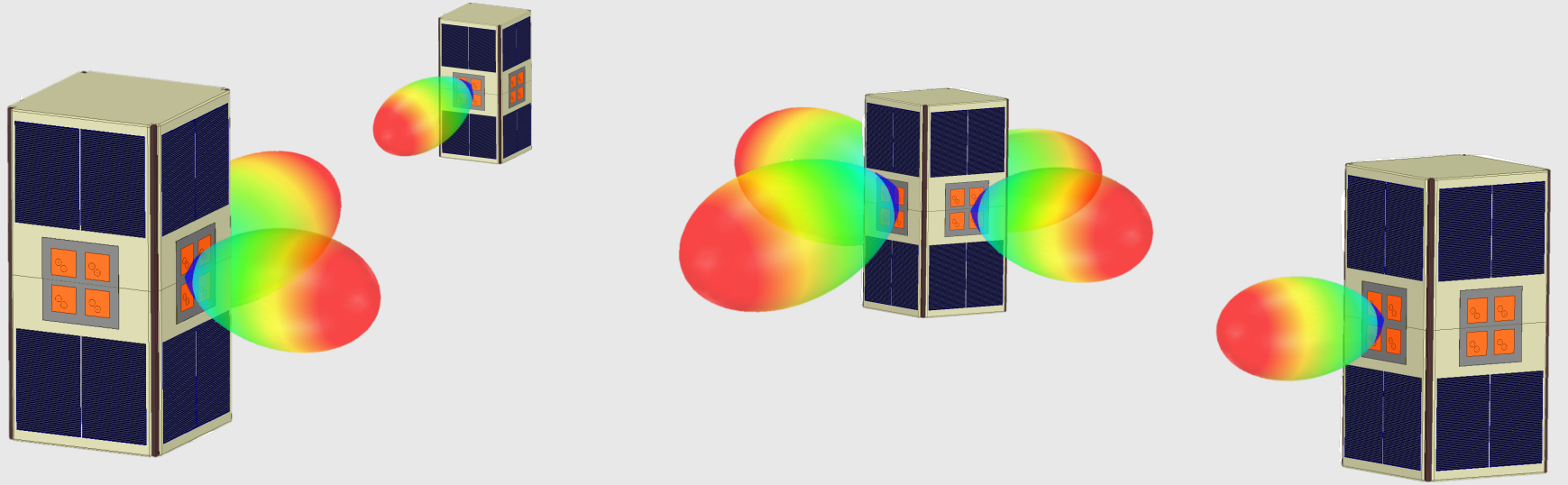
Pattern Reconfigurable Antenna for Cognitive Radio

M. Patriotis, F.N. Ayoub, C. G. Christodoulou
Electrical and Computer Engineering Department, University of New Mexico, Albuquerque, NM, USA

Application

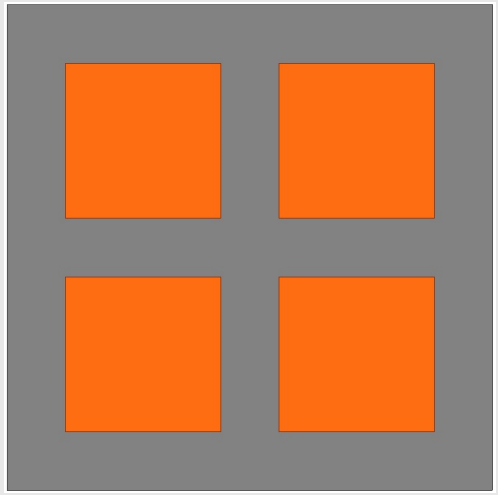
- Single RF-Port Antenna System
- Numerous reconfigurable radiation patterns
- RHCP directional beams

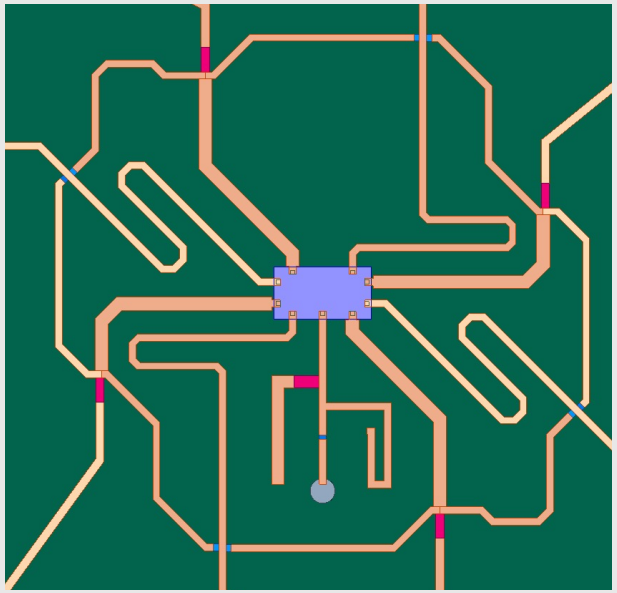
5.8 GHz (C-Band)

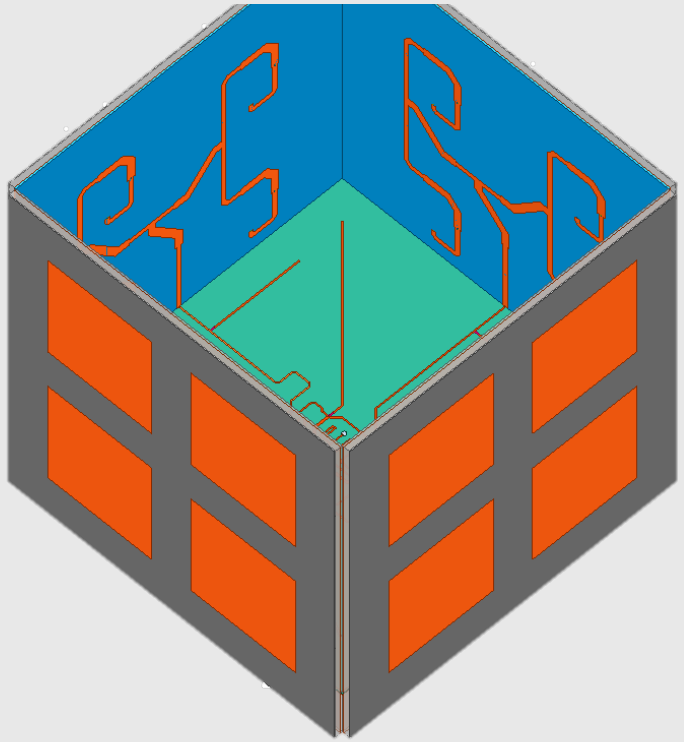


Design Steps

- Antenna Array
- Reconfigurable Feeding Network
- Antenna System – 8 Recon. Patterns

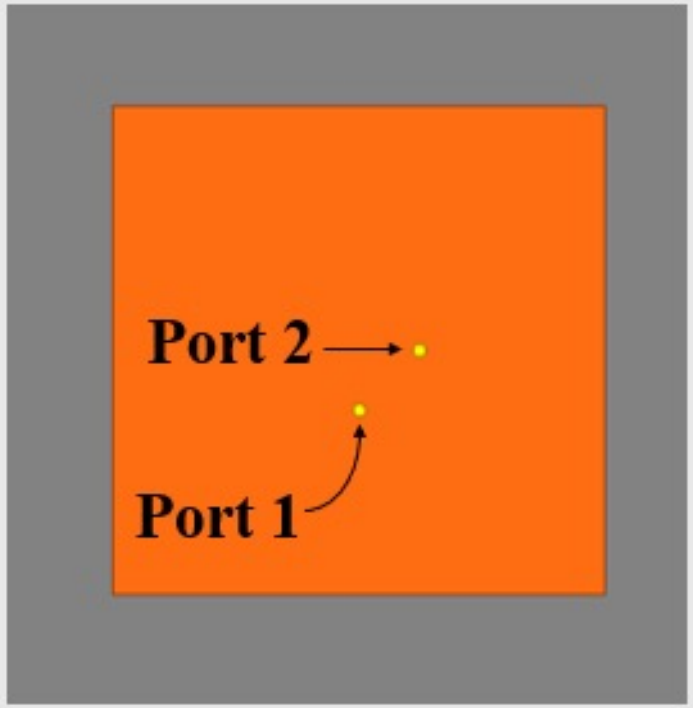


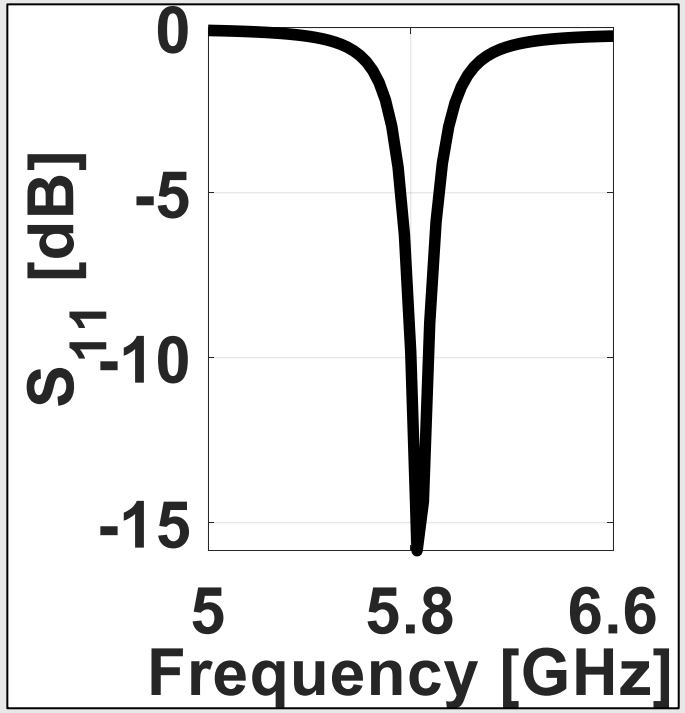




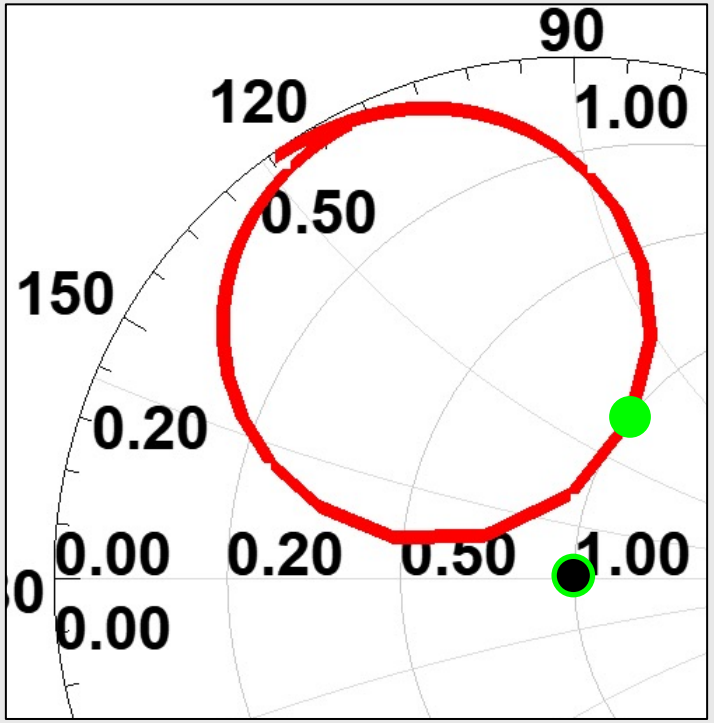
Antenna Element – Model 1

RT5870 (ε_r=2.33, tanδ=0.0012, h=0.79 mm)



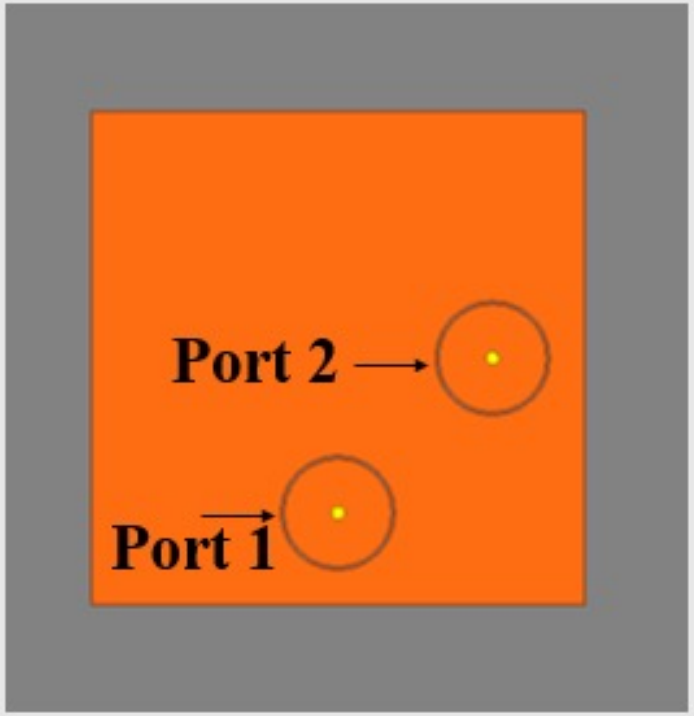


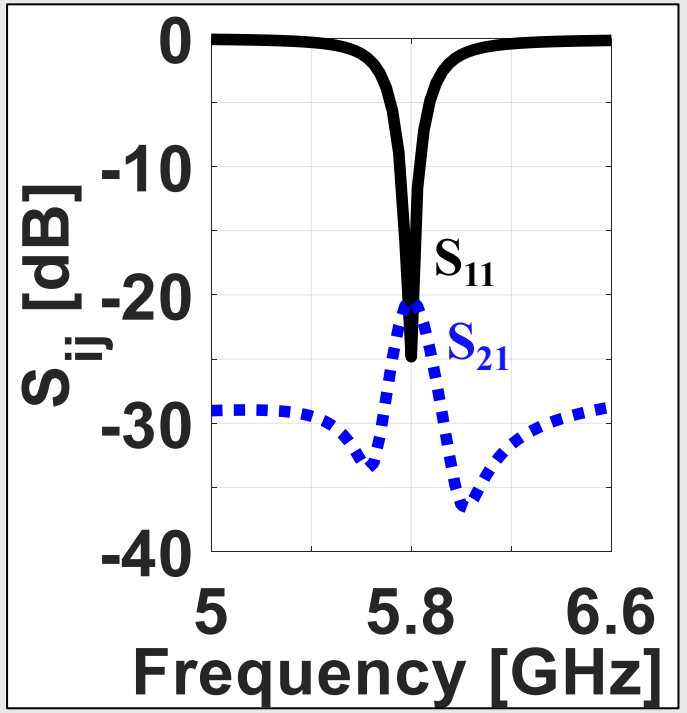
Smith Chart



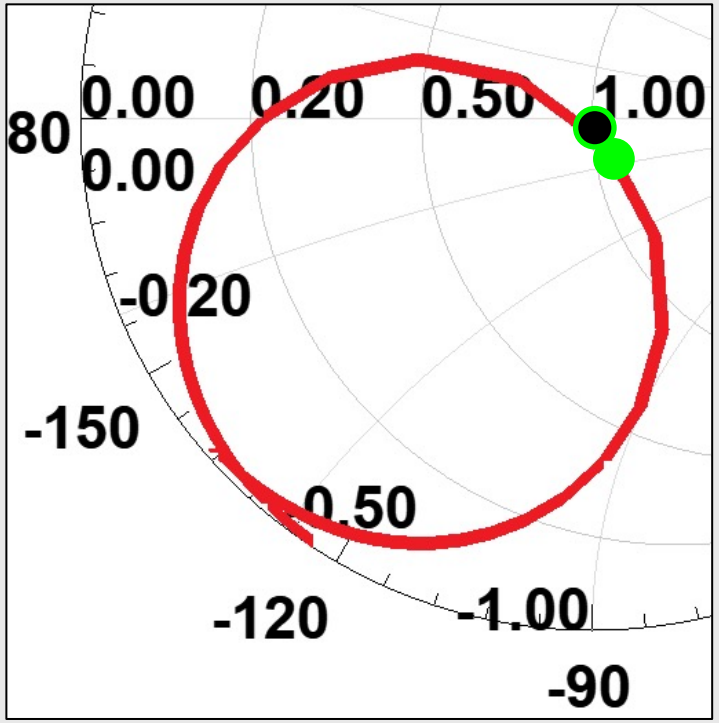
Antenna Element – Model 2

RT5870 (ε_r=2.33, tanδ=0.0012, h=0.79 mm)



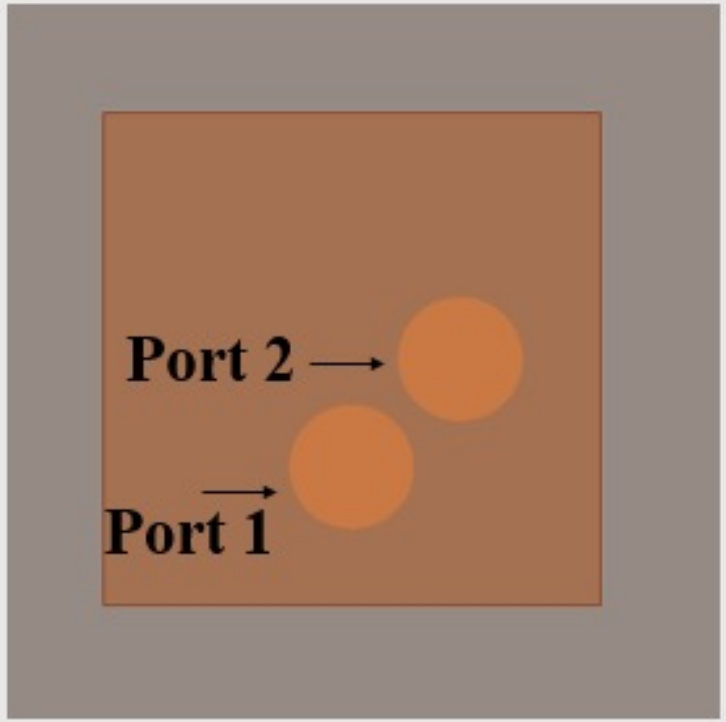


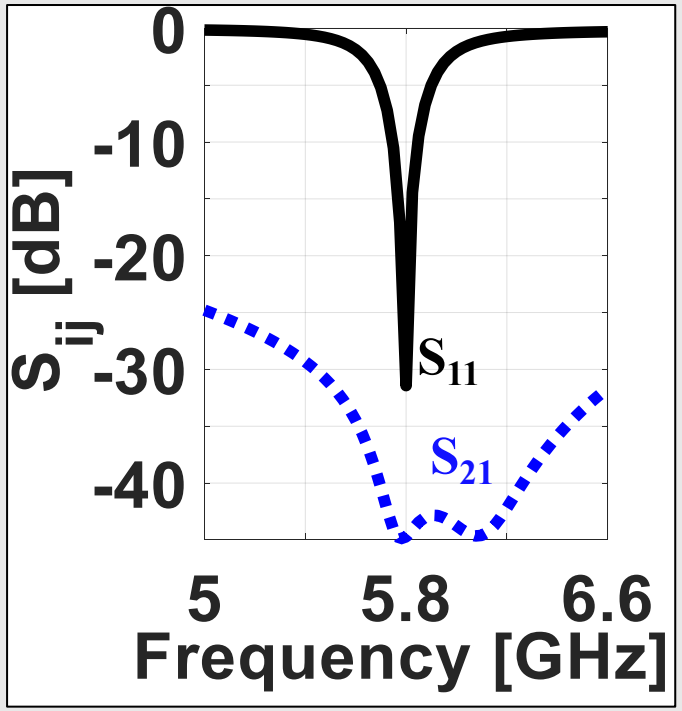
Smith Chart



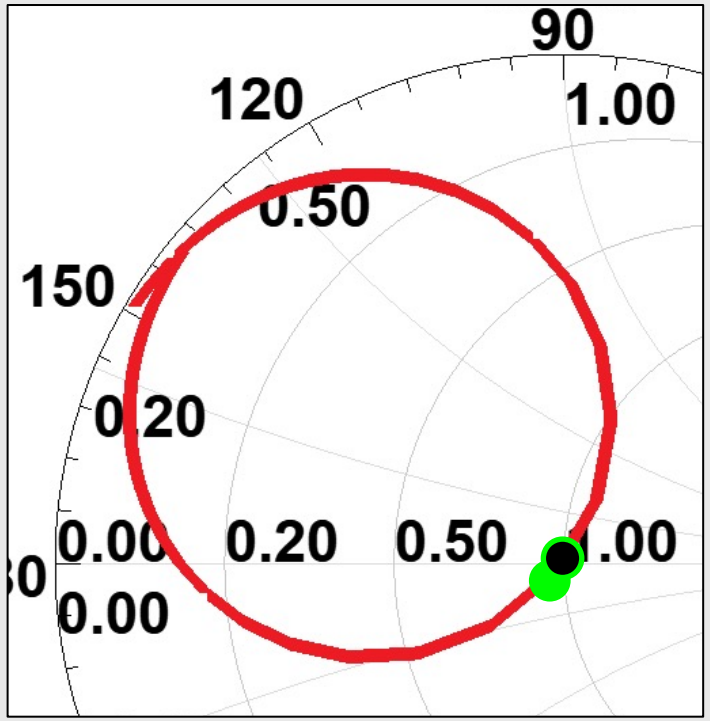
Antenna Element – Model 3

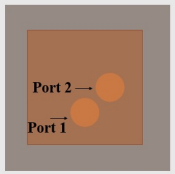
RT5870 (ε_r=2.33, tanδ=0.0012, h_1=0.13 mm, h_2=0.79 mm)





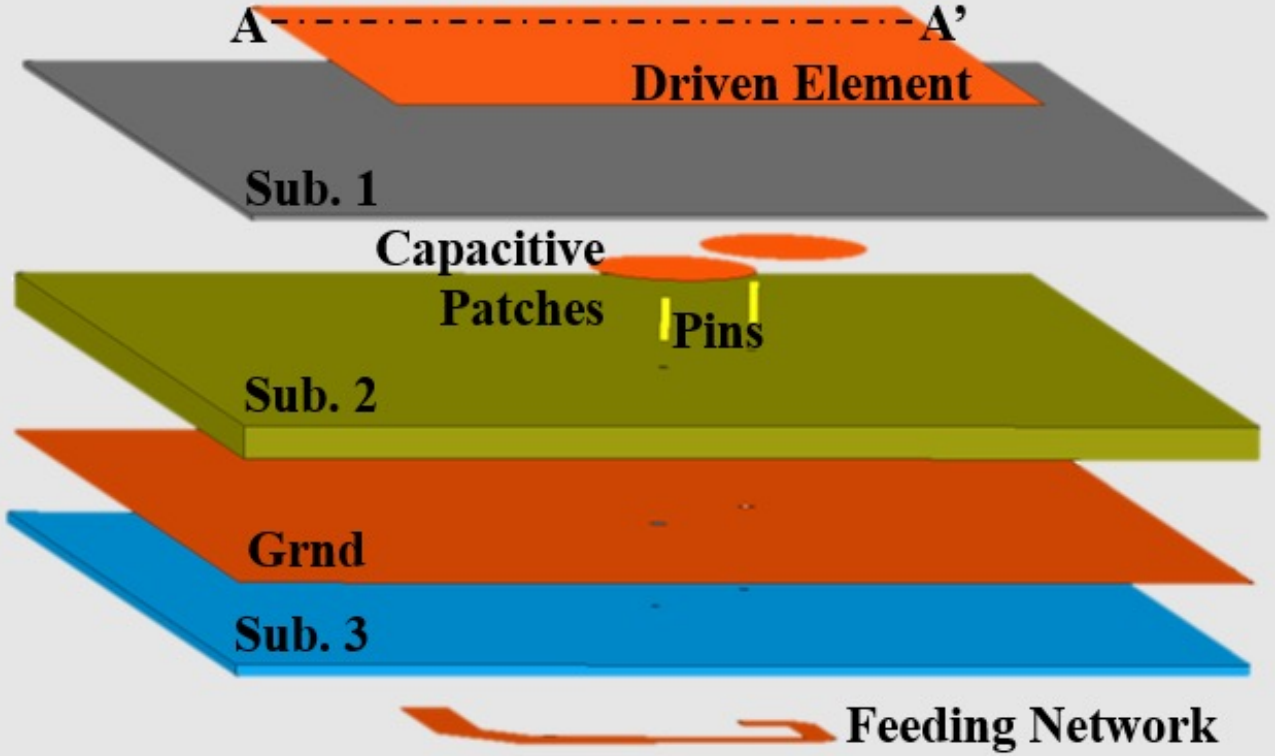
Smith Chart

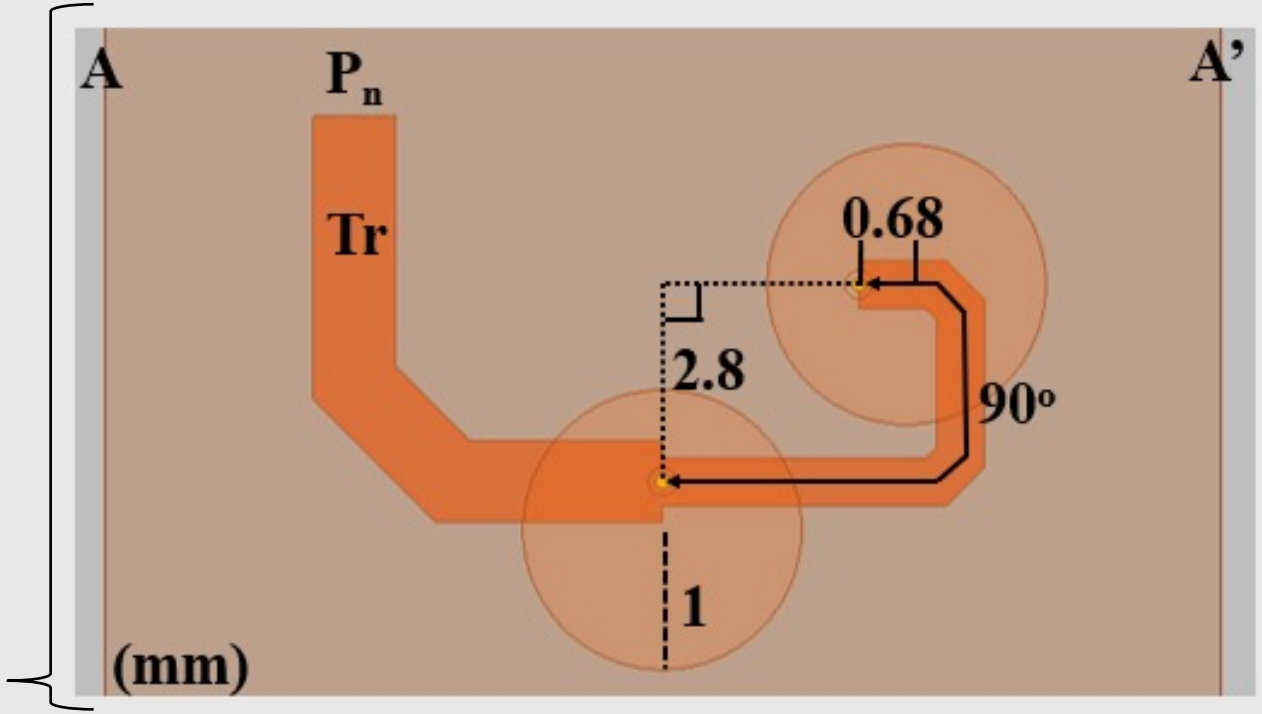




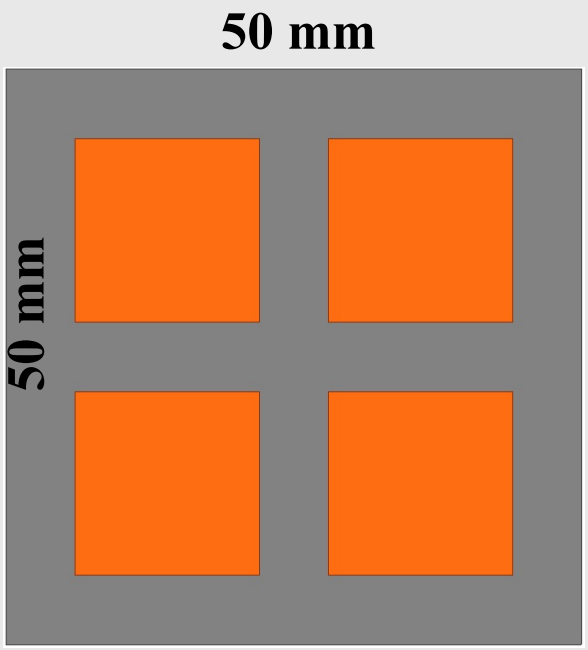
Antenna Element – Model 3

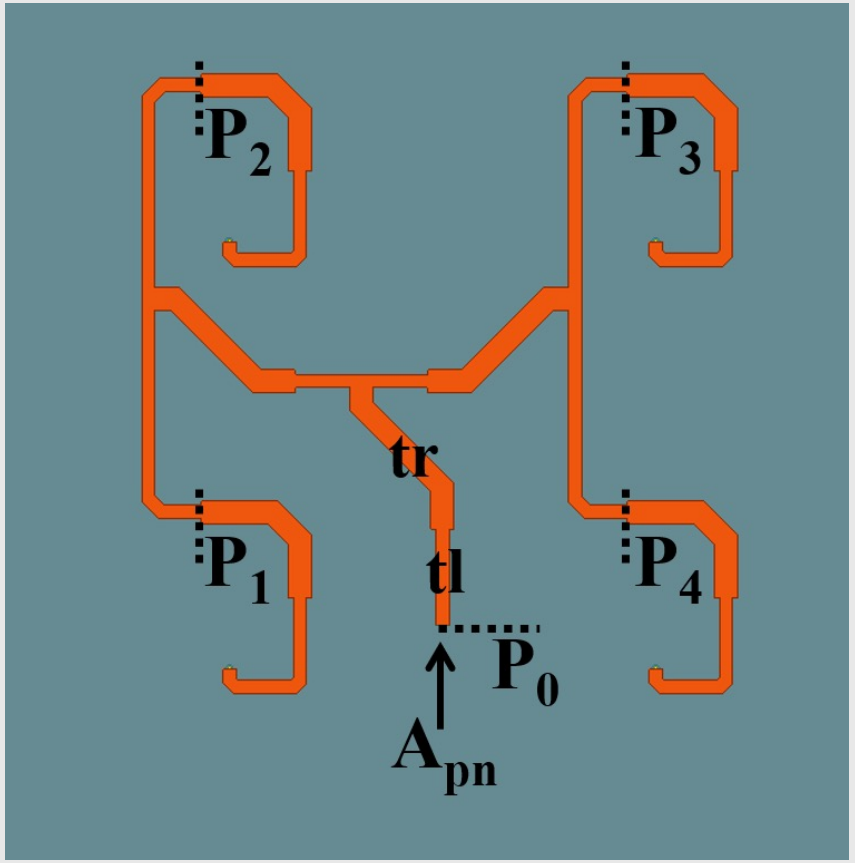
RT5870 (ε_r=2.33, tanδ=0.0012, h_1=0.13 mm, h_2=0.79 mm, h_3=0.25 mm, AA':15.98 mm)

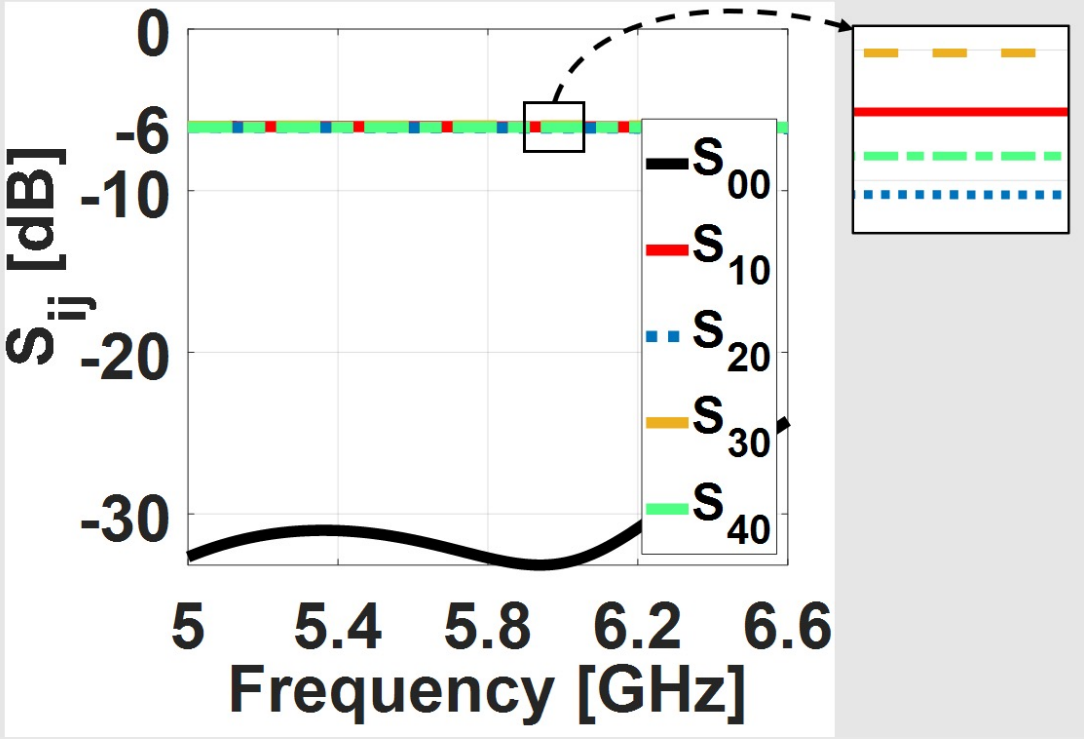




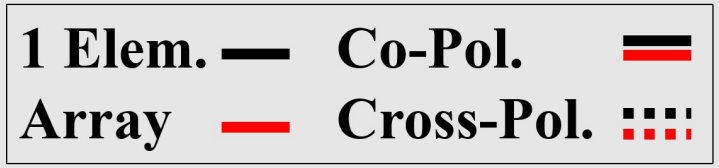
Antenna Array – Feeding Network

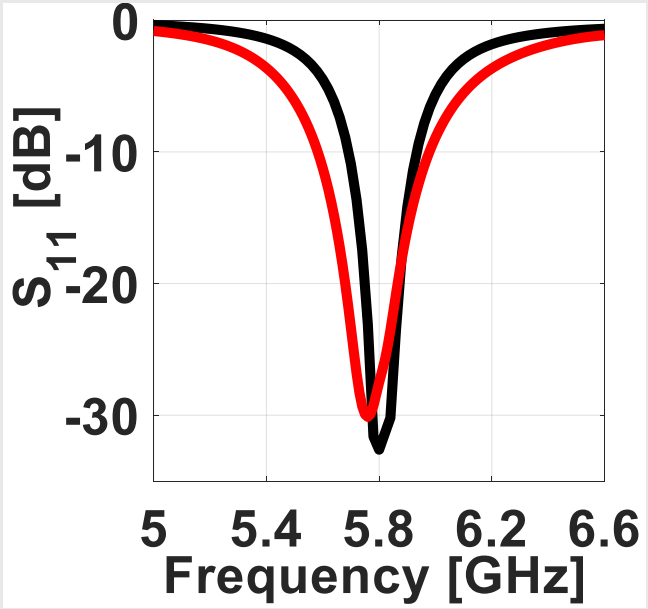


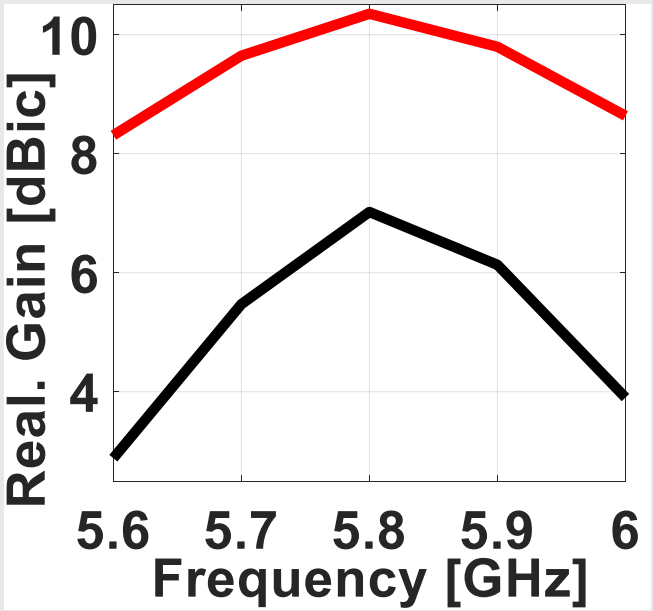


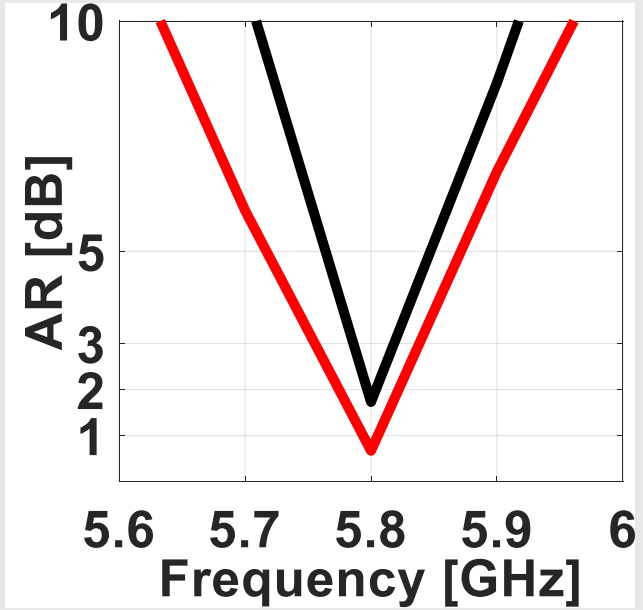


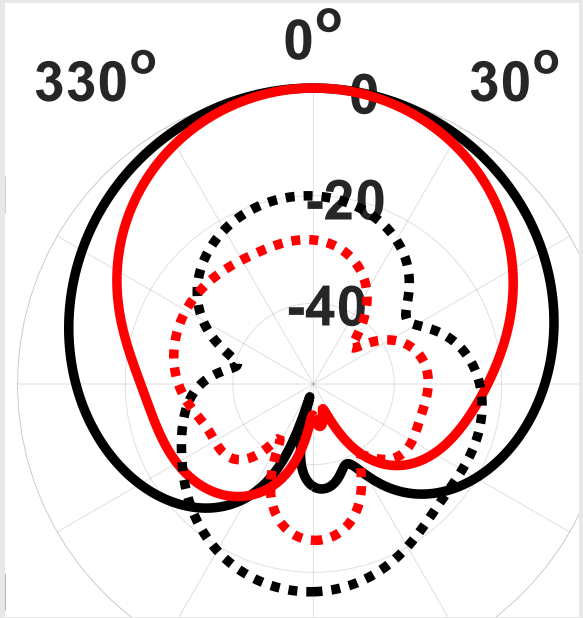
Antenna Element vs Antenna Array











Reconfigurable Feeding Network 1/3

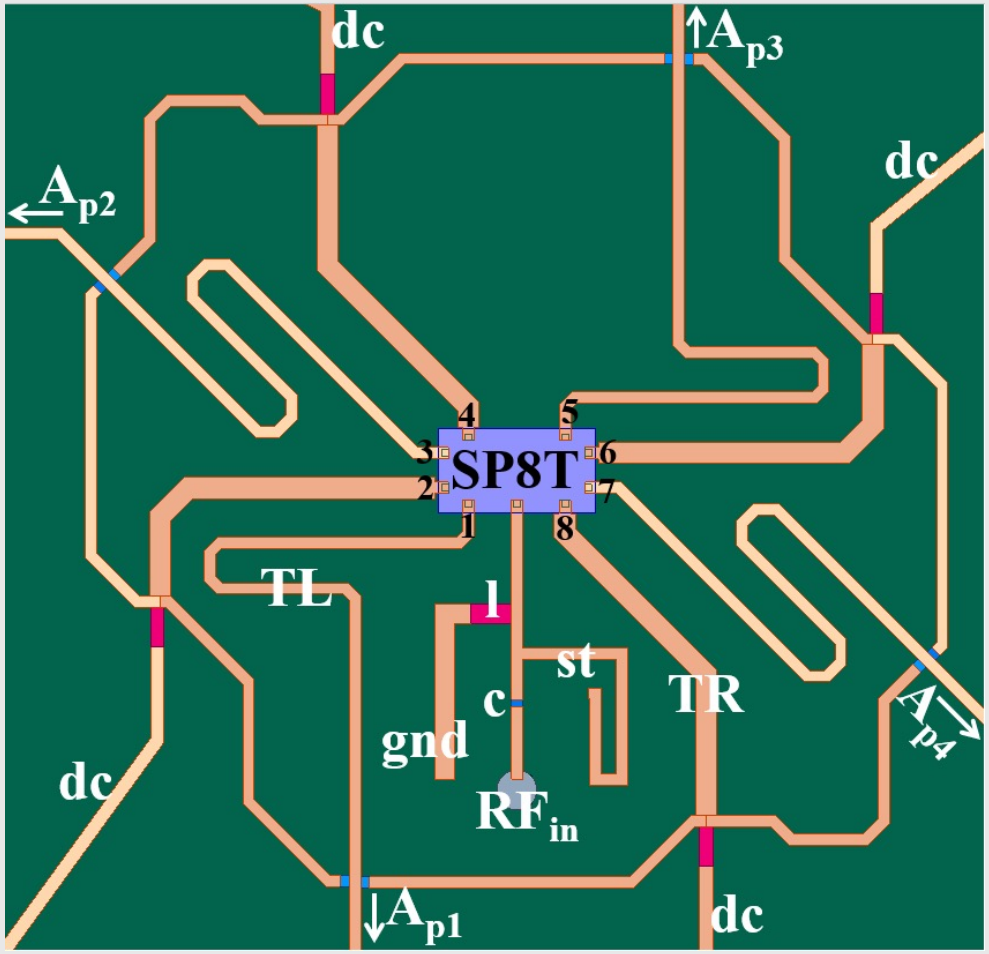
RF_{in}: RF probe

TL: microstrip line of 50 Ohm

TR: microstrip line of 35.35 Ohm

RF Switch: SP8T

C: capacitor (9.9 pF) – dc block



L: inductor (27 nH) – rf choke

A_{pn}: Antenna Ports

st: Matching stub

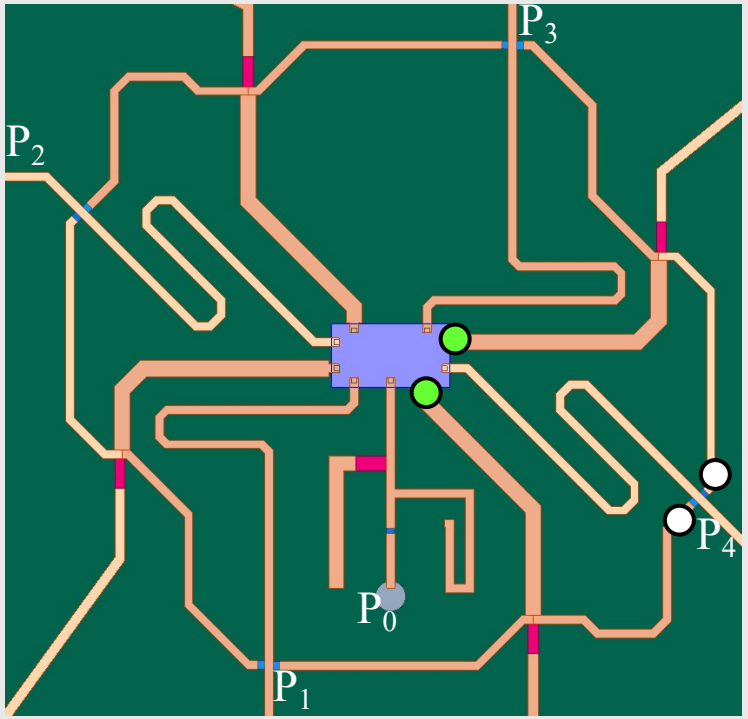
dc: DC source

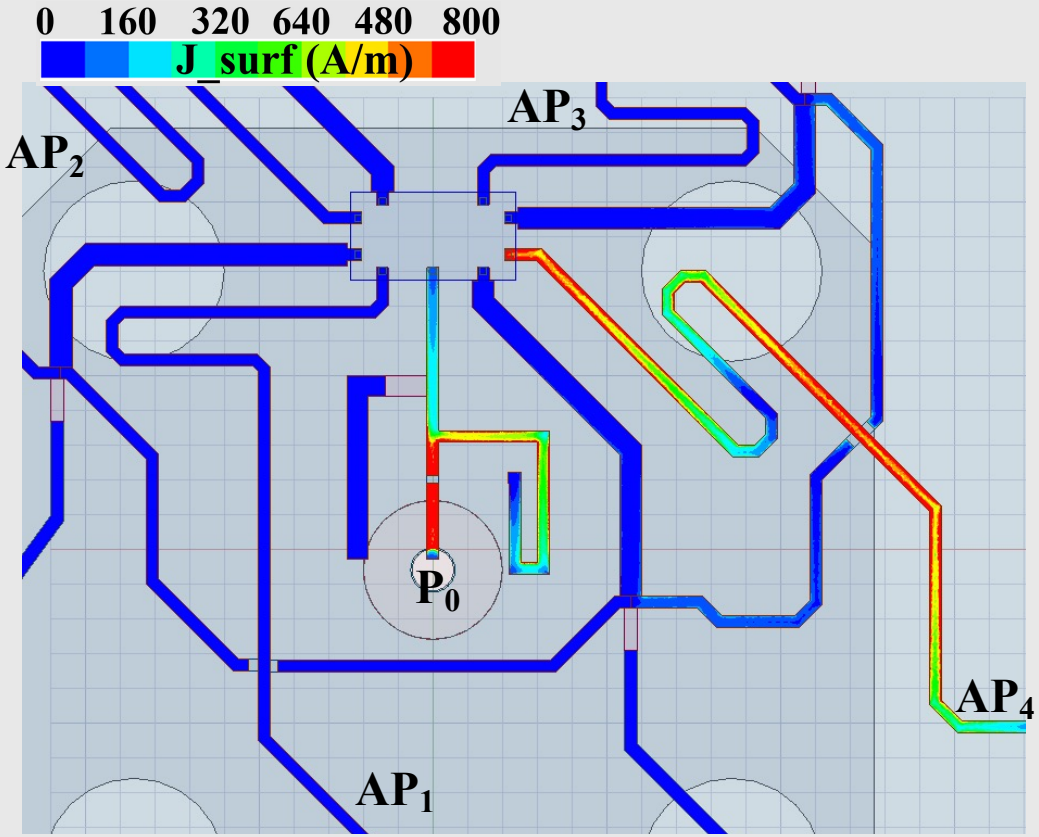
gnd: Ground

Reconfigurable Feeding Network 2/3

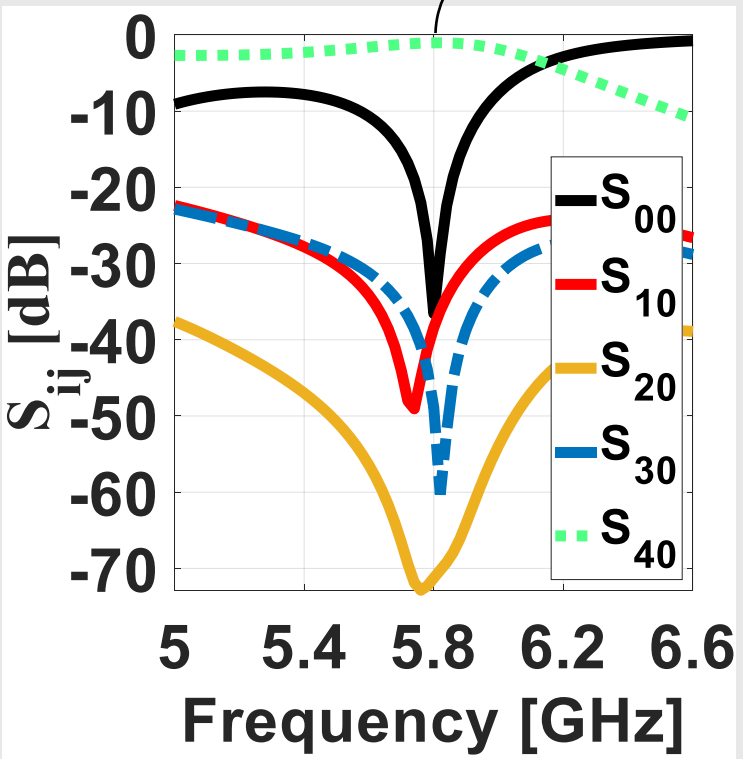
phase: n*180 degrees → $Z_{in}=Z_0*(Z_L+Z_0\tan(\beta l))/(Z_0+Z_L\tan(\beta l))$

Switch port OFF





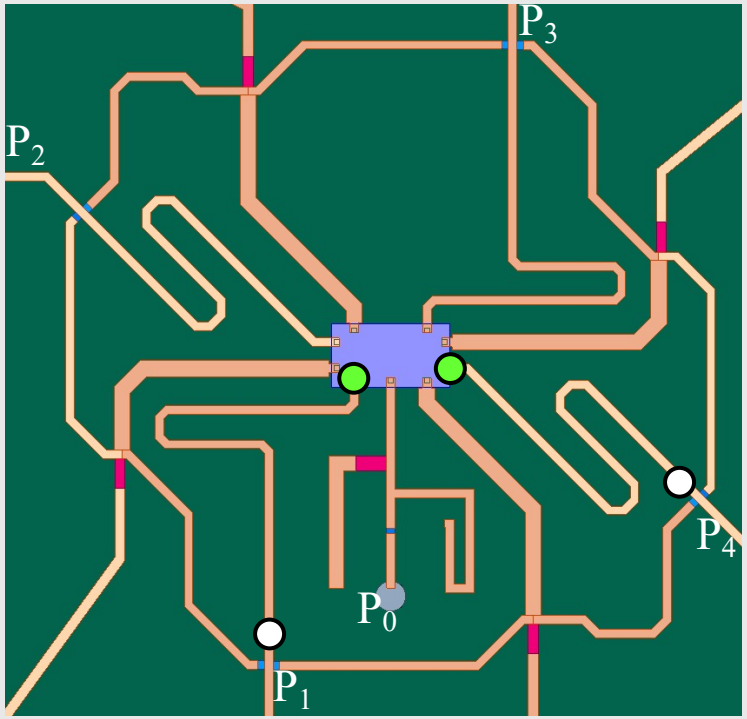
switch transmission loss: 0.96 dB

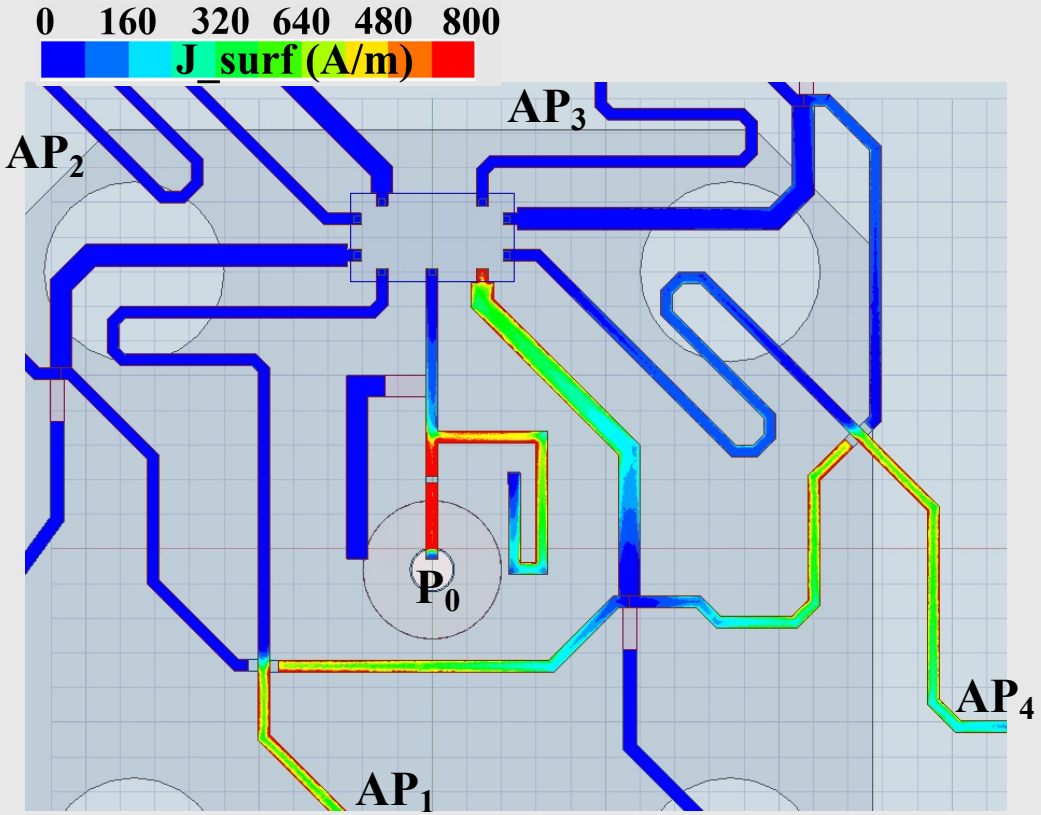


Reconfigurable Feeding Network 3/3

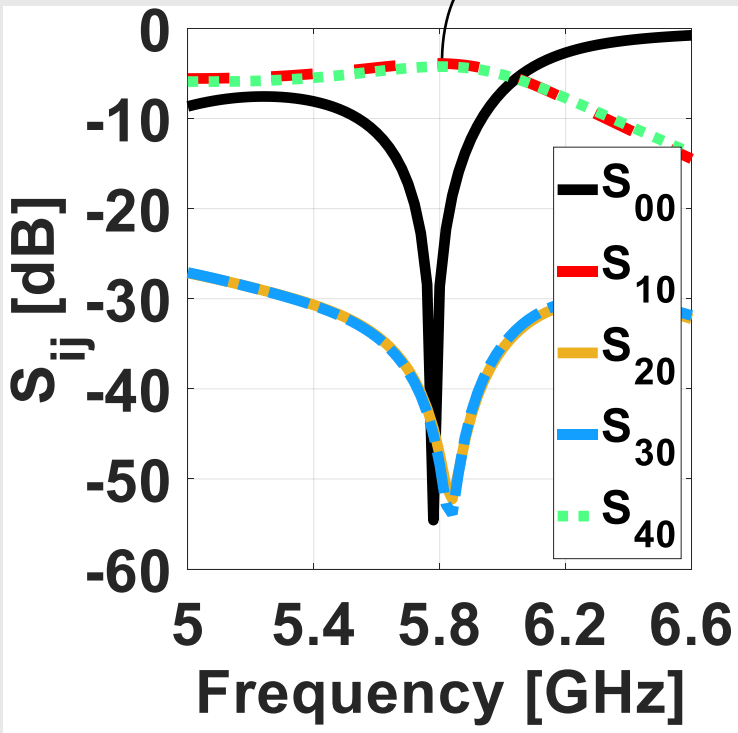
phase: n*180 degrees → $Z_{in}=Z_0*(Z_L+Z_0\tan(\beta l))/(Z_0+Z_L\tan(\beta l))$

Switch port OFF

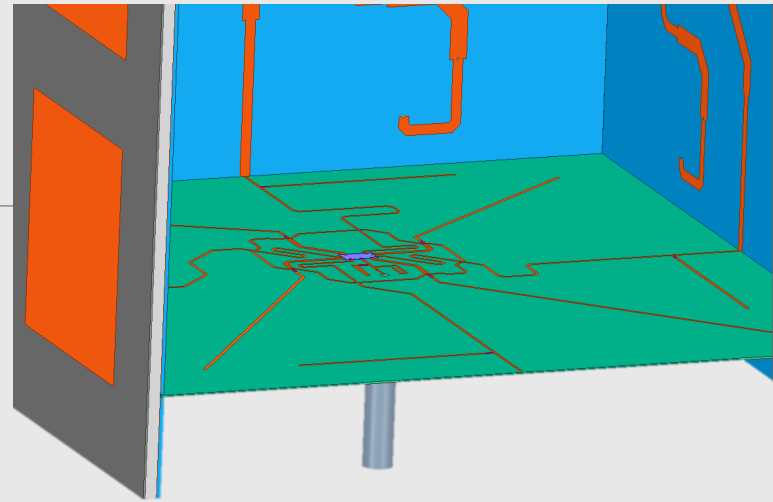




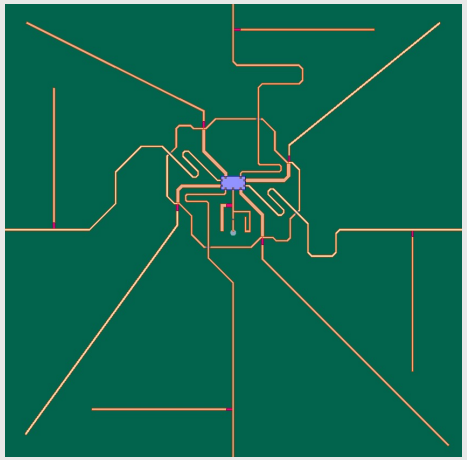
switch transmission loss: 0.96 dB



Antenna System – 8 Recon. Patterns

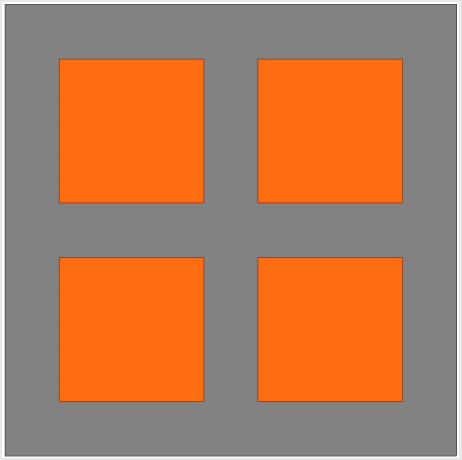


Reconfigurable Feeding Network



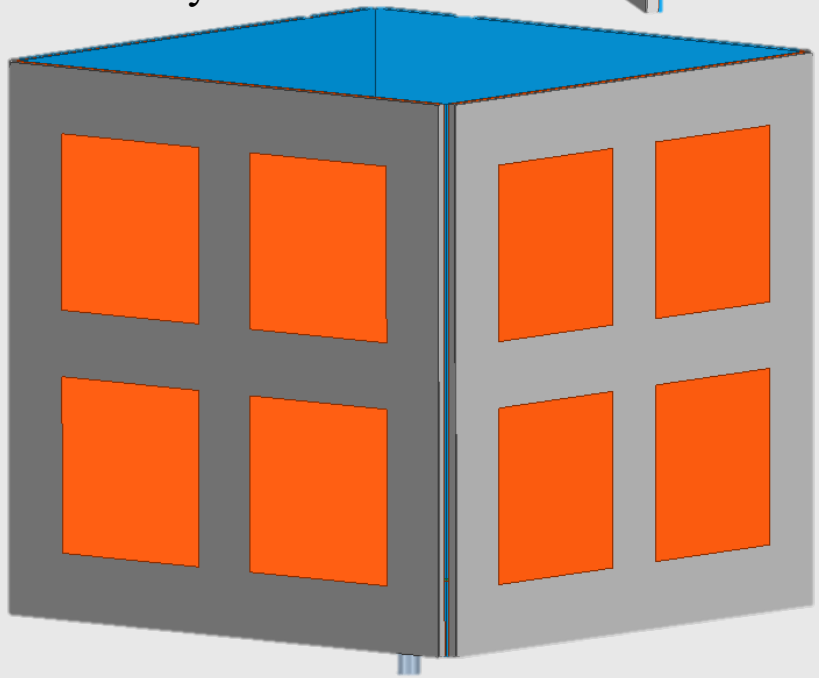
+ 4 x

Array Antenna



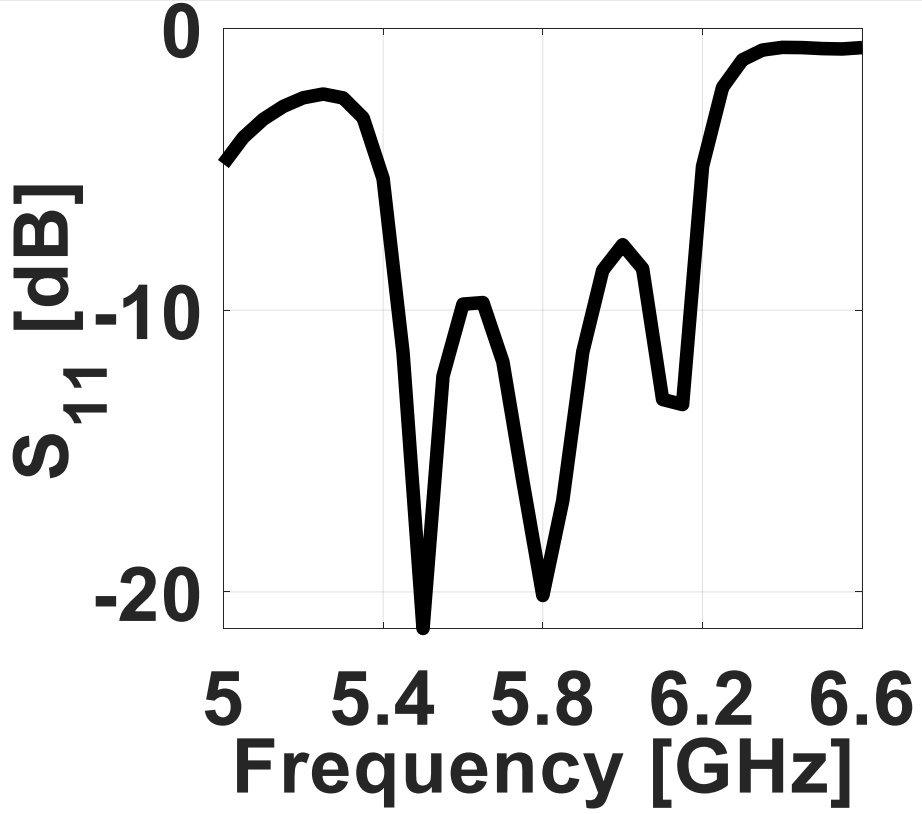
→

Antenna System

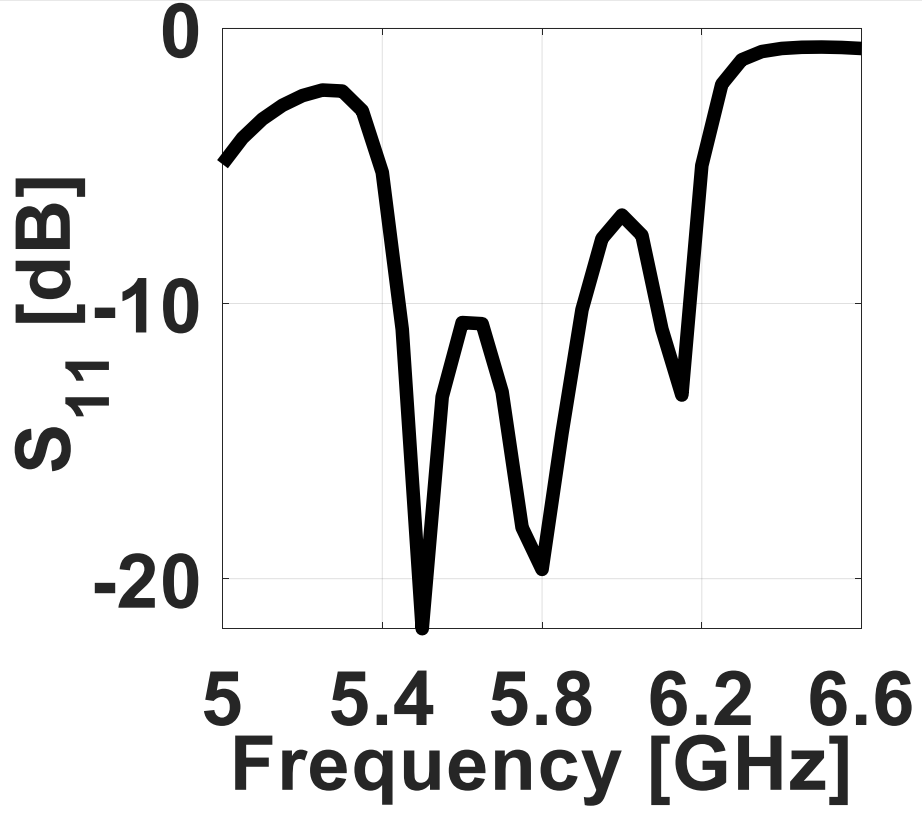


Results – S-parameters

1 Active Unit



2 Active Units

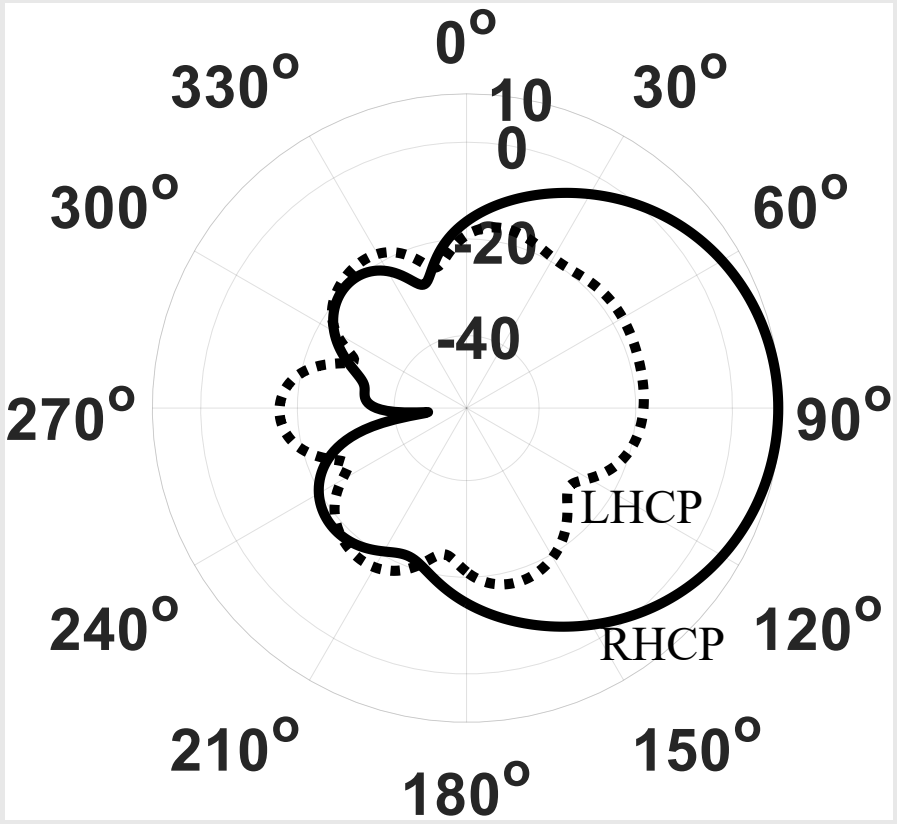


Results – Radiation Pattern

1 Active Unit

9.5 dBic

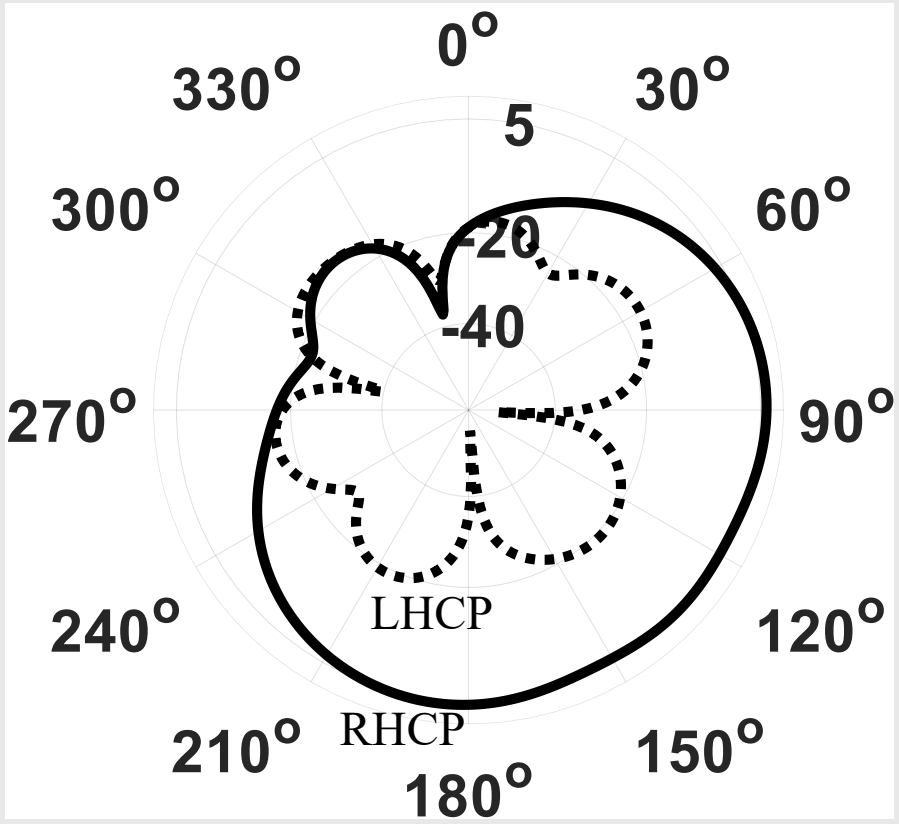
HPBW: 55°



2 Active Units

6.3 dBic

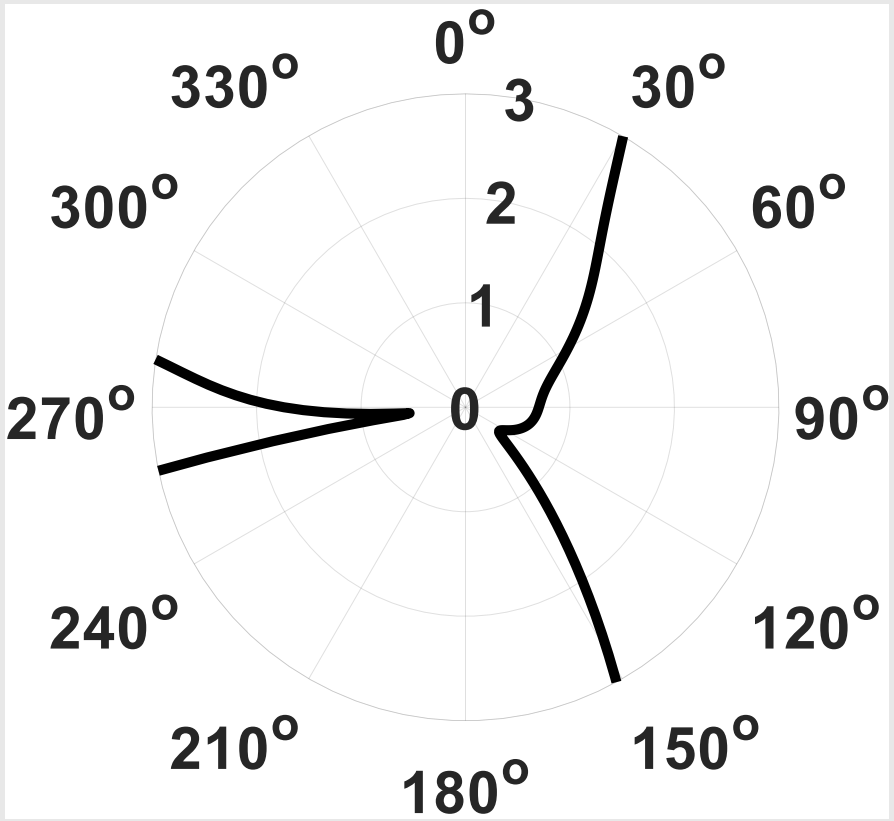
HPBW: 150°



Results – Axial Ratio

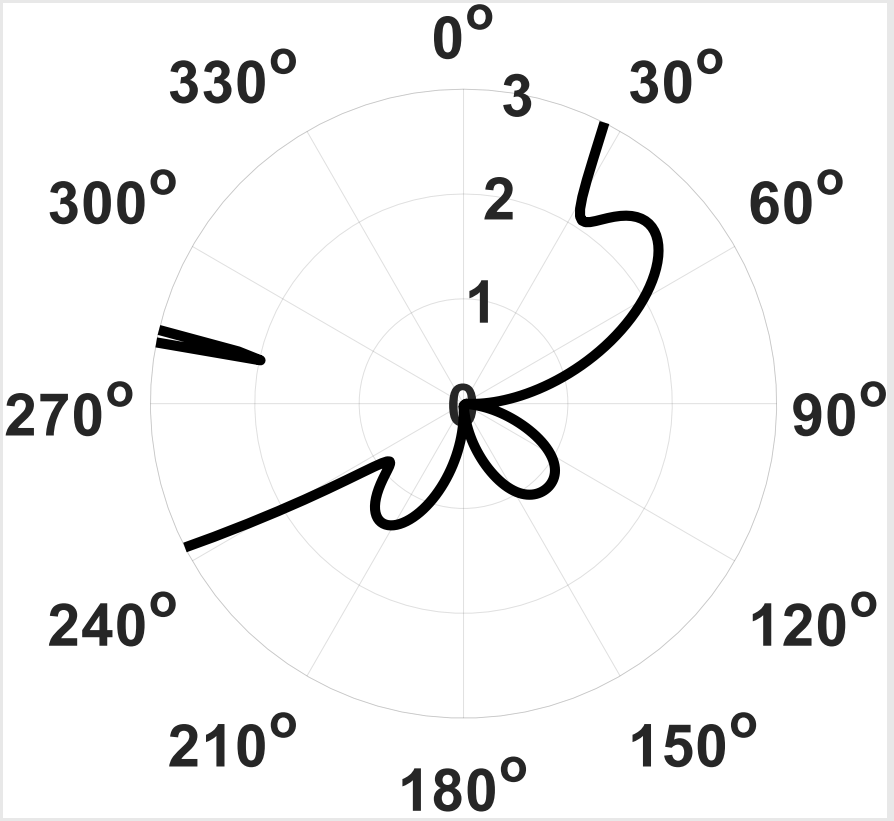
1 Active Unit

BW: 120°

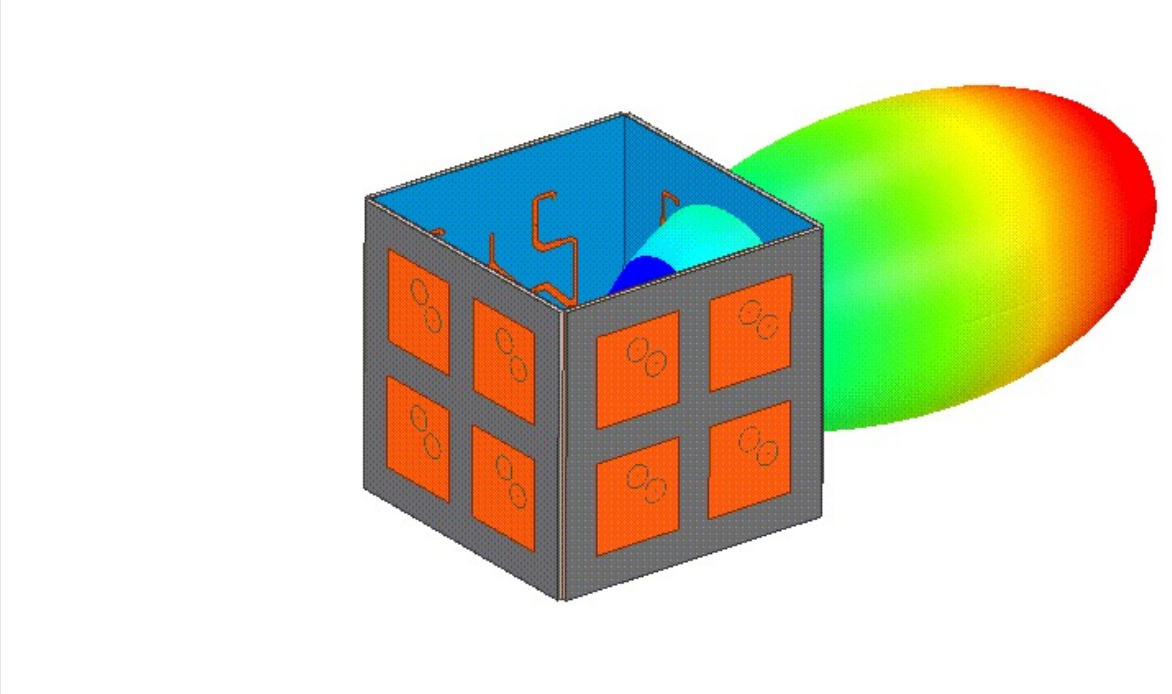


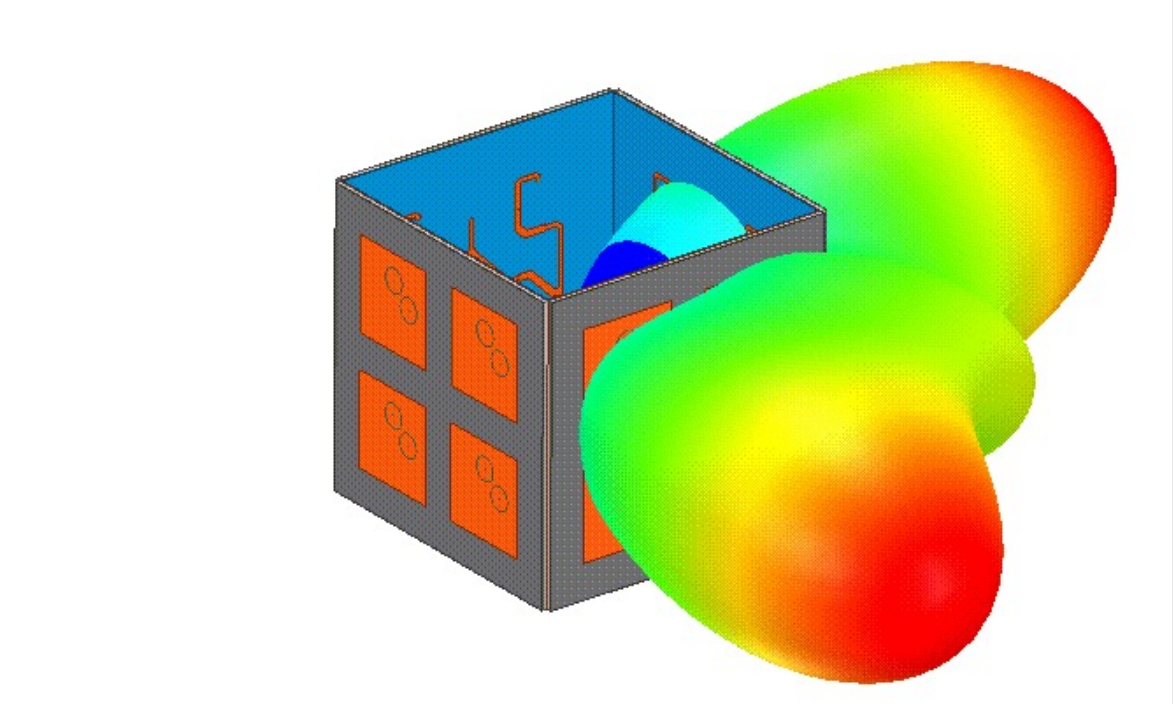
2 Active Units

BW: 210°



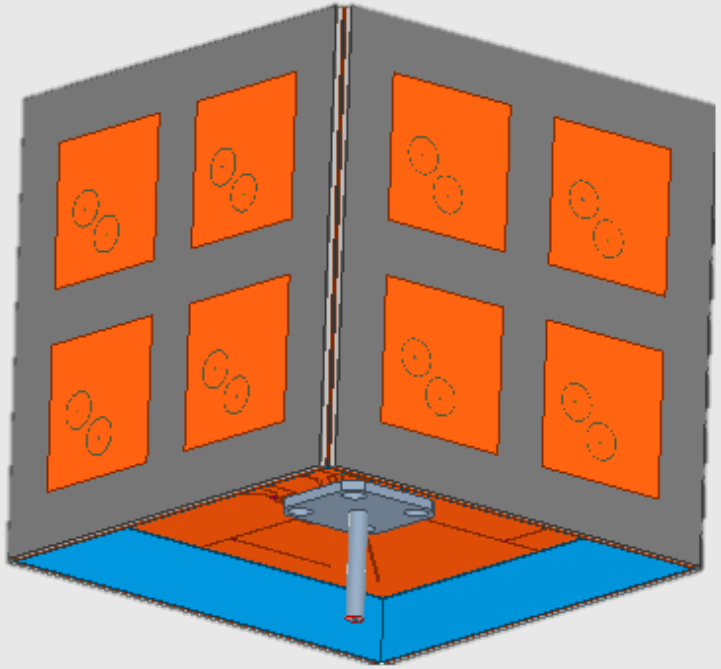
Simulated 3D patterns





Summary & future work

- Single RF port Cube Antenna Structure.
- 8 reconfigurable patterns with 1 and 2 active 90º-sectors.
- RHCP with peak Real. Gain 9.5 dBic and 6.3 dBic.



- Replace SP8T RF switch and design the respective antenna.
- Fabrication and field test for cognitive radio training.

Thank you

Questions

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patriotism@unm.edu