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A Very Small Triangular Shaped Printed Monopole Antenna For Bluetooth/WLAN and UWB Applications

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Abstract: - In this paper, a compact (12 x 20 mm^2) triangular shaped microstrip antenna with dual band characteristics is presented for Bluetooth/WLAN and ultrawideband (UWB) applications. The proposed structure consists of a simple triangular shaped radiating patch for achieving UWB characteristics and quarter wavelength inverted L shaped strip for achieving 2.45 GHz Bluetooth applications. The first operating band characteristics can be controlled by changing the electrical length of the strip along with coupling gap between the patch and strip. To enhance the impedance bandwidth of second operating band, an equilateral triangular shaped cut has been introduced in the patch. The results demonstrate that the proposed antenna exhibit dual frequency operation from 2.4 to 2.52 GHz and from 3.6 to 10.6 GHz. The antenna has omnidirectional radiation patterns in H-plane, bidirectional patterns in E-plane and acceptable peak gains and radiation efficiencies**.**

Keywords: - monopole antenna, dual-band antenna, bluetooth, UWB antenna and wireless local area network (WLAN).

References:

1. **Praveen V. Naidu** et al., "Design of asymmetric slot antenna with meandered narrow rectangular slit for dual band applications." **Progress In Electromagnetics Research B,** Vol. 60, pp. 111-123, 2014.

2. **Praveen V. Naidu** et al., "Design of CPW-Fed Dual-Band Printed Monopole Antennas for LTE/WiMAX/WLAN and UWB Applications." **Progress In Electromagnetics Research C**, Vol. 54, pp. 103-116, 2014.

Why Compact Antennas ?

Why Multi-band Antennas ?

Literature Review

S.No	Reference	Type	Antenna Size	Measured Bandwidth
1.	Ref[1]	Single-Band	120 x 100 mm^2	3.1-10.6 GHz
2.	Ref[2]	Single-Band	70 x 70 mm^2	3.1 – 10.6 GHz
3.	Ref[3]	Single-Band	30 x 35 mm^2	3.1-5.2 GHz
4.	Ref[4]	Dual-Band	45 x 32 mm^2	2.4-2.5 GHz and 3.1-10.6 GHz
5.	Ref[5]	Dual-Band	42 x 46 mm^2	2.4-2.484 GHz and 3.1-10.6 GHz
6.	Ref[6]	Single-Band	46 x 55mm^2	1.8-14.35 GHz
7.	Ref[7]	Dual-Band	18 x 32 mm^2	2.470-2.520 GHz and 3.1-10.6 GHz
8.	Ref[8]	Tri-Band	50 x 24 mm^2	2.4-2.484 GHz, 3.1-5.15 GHz and 5.825-10.6 GHz
9.	Ref[9]	Dual-Band	42 x 24 mm^2	2.4-2.484 GHz and 3.1-10.6 GHz
10.	Ref[10]	Dual-Band	40 x 32 mm^2	2.4-2.484 GHz and 3.1-10.6 GHz
11.	Ref[11]	Dual-Band	60 x 60 mm^2	2.25-2.53 GHz and 5.13-5.99 GHz
12.	Ref[12]	Dual-Band	40 x 40 mm^2	2.4-2.485 GHz and 5.15-5.825 GHz

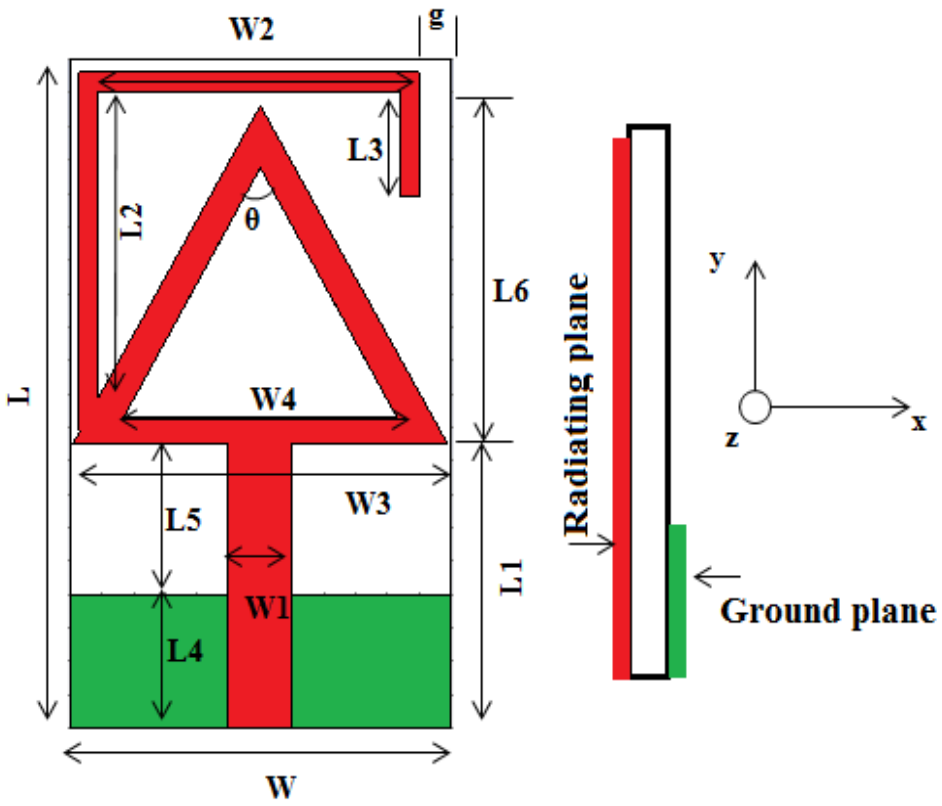
Literature Review…

S.No	Reference	Type	Antenna Size	Bandwidth
13.	Ref[13]	Dual-Band	75 x 75 mm^2	2.4–2.484 GHz and 5.150–5.950 GHz
14.	Ref[14]	Dual-Band	40 x 40 mm^2	3.15– 3.70 GHz and 5.05–5.97 GHz
15.	Ref[15]	Dual-Band	60 x 45 mm^2	2.26-2.57 GHz and 4.81-6.56 GHz
16.	Ref[16]	Dual-Band	50 x50 mm^2	1.9–2.75 GHz and 3.65–6.75 GHz
17.	Ref[17]	Dual-Band	60 x 70 mm^2	3.34–3.54 GHz and 4.90–6.26 GHz
18.	Ref[18]	Dual-Band	50 x 50 mm^2	2384–2991 MHz and 4959–6410 MHz
19.	**Proposed antenna**	**Dual-Band**	**12 x 20 mm^2**	**2.4-2.5 GHz and 3.1-10.6 GHz**

1. Reducing the antenna size

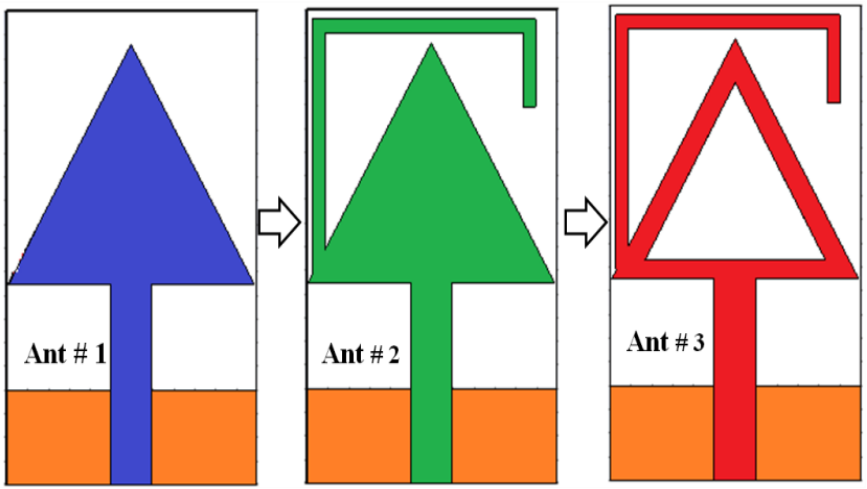
2. With good antenna characteristics

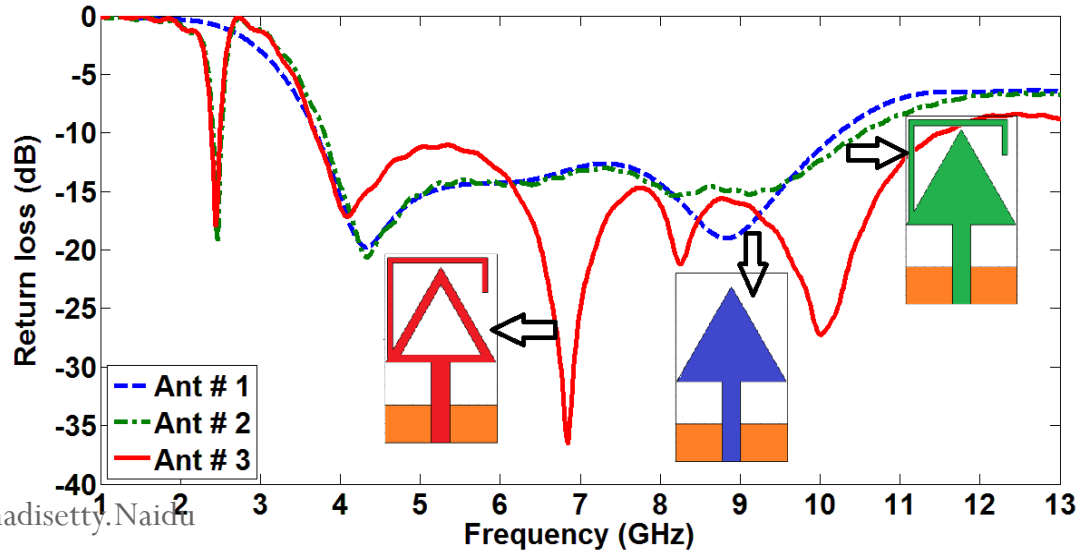
Geometry of the Proposed Antenna



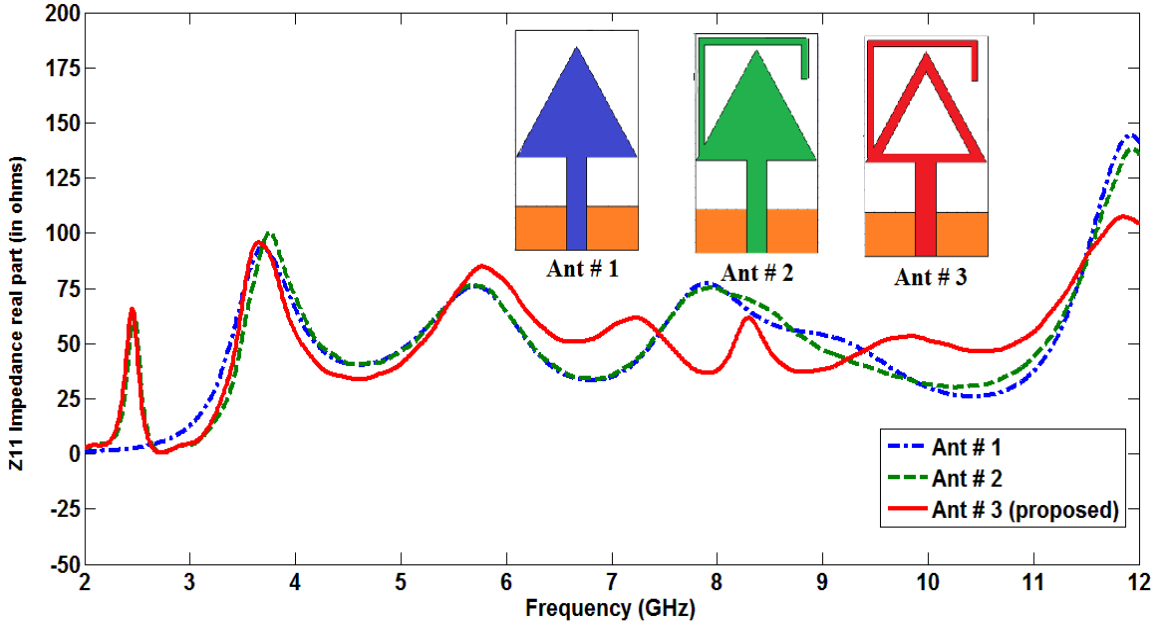
The optimized dimensions
W = 12, L = 20, L1 = 8.5, L2 = 9.1, W1= 2, W2 = 9.5, W3 = 11.8, L3 = 3.1, W4 = 8.6, L4 = 4, L5=4.5, L6 = 10.6, g = 1, θ = 60°, (all dimensions are in mm).

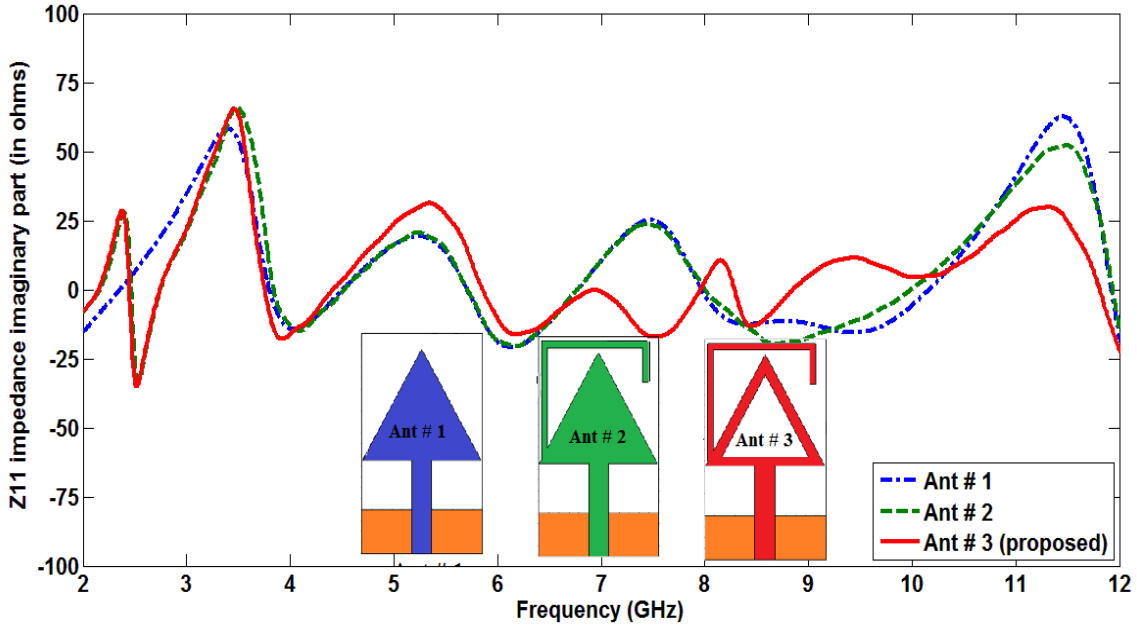
Antenna Evolution Stages



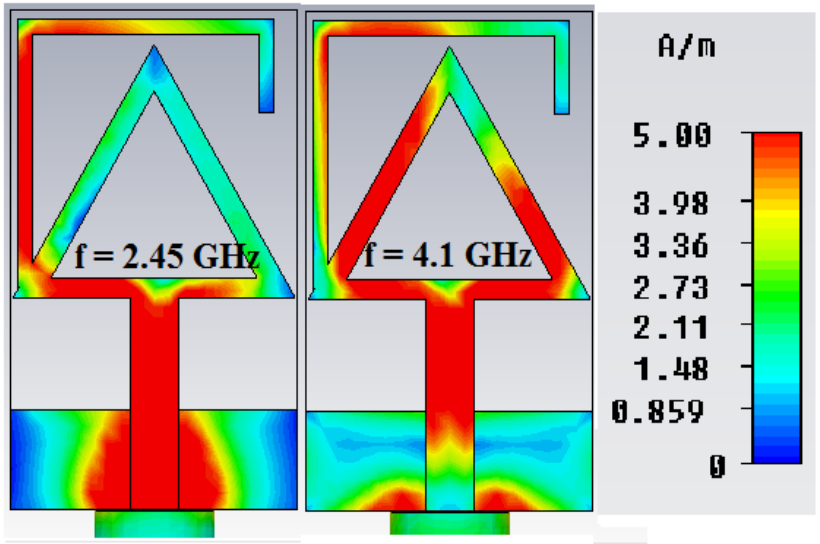


Design Analysis





Mathematical Analysis



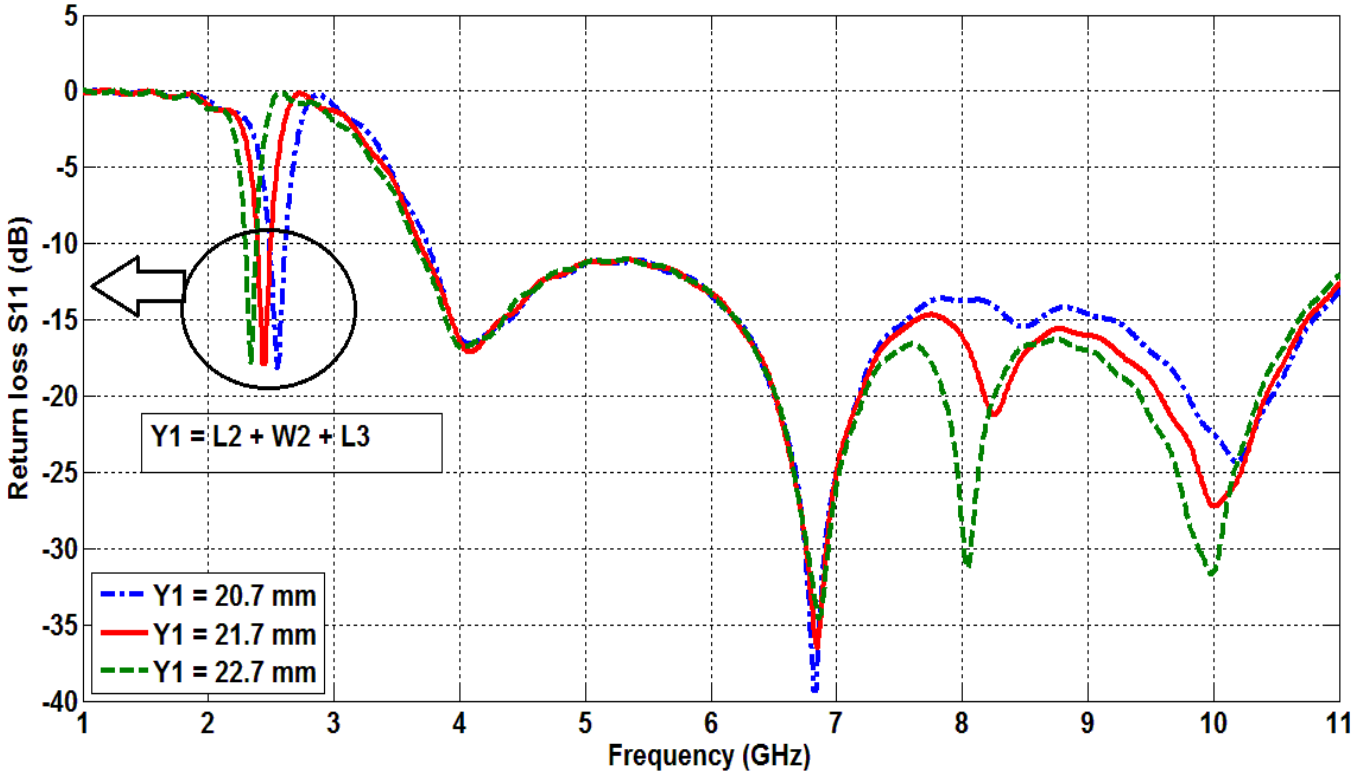
$$L6 = \frac{c}{4\, f_{2min}\sqrt{\epsilon_{r,eff}}} \qquad (1)$$

$$L5 = \frac{c}{4 f_{2max}\sqrt{\epsilon_{r,eff}}} \qquad (2)$$

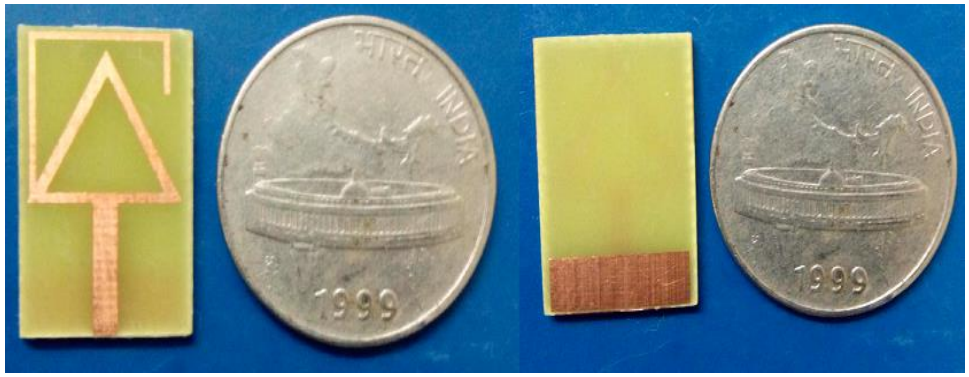
$$f_1 = \frac{c}{4Y1\sqrt{\epsilon_{r,eff}}} \qquad (3)$$

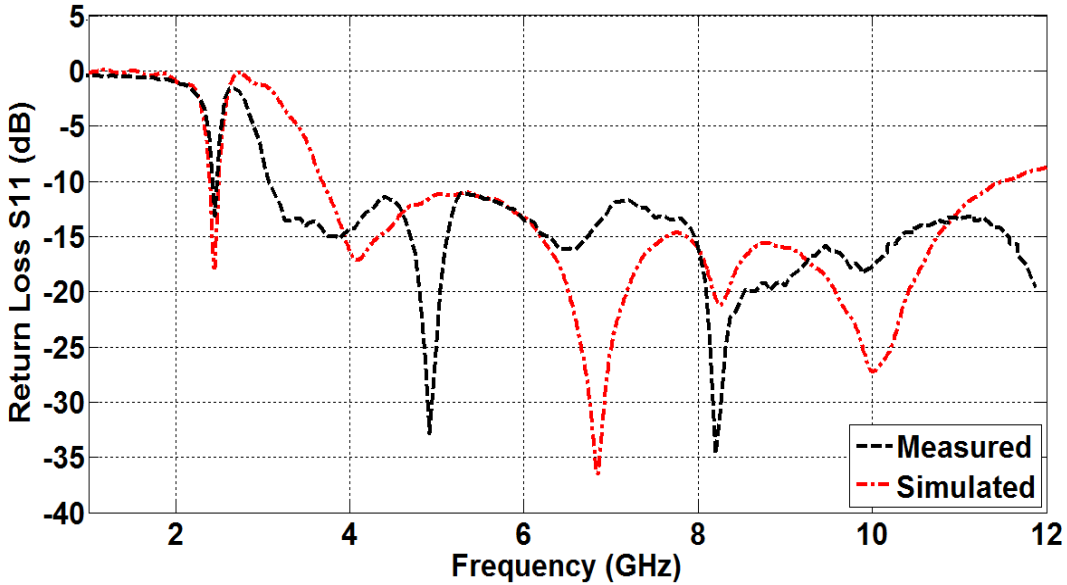
$$\epsilon_{r,eff} = \frac{\epsilon_r + 1}{2} \qquad (4)$$

Parametric Study

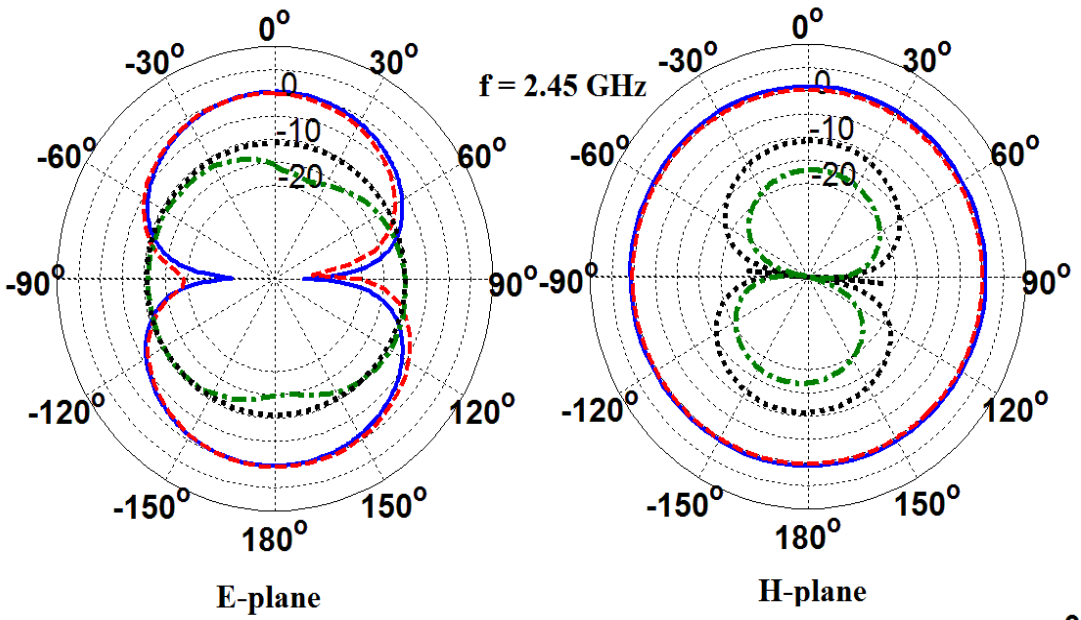


Experimental & Simulated Results

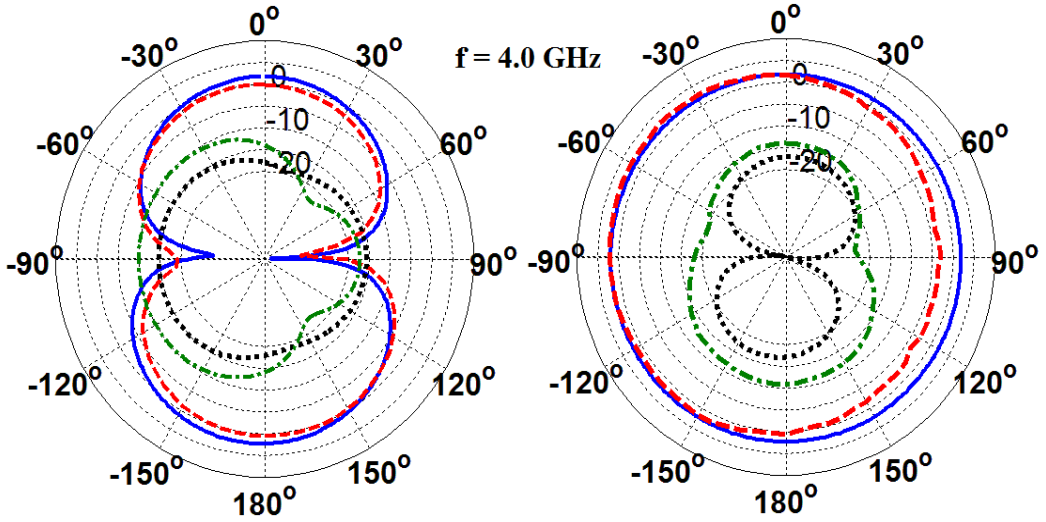




Measured Radiation Patterns

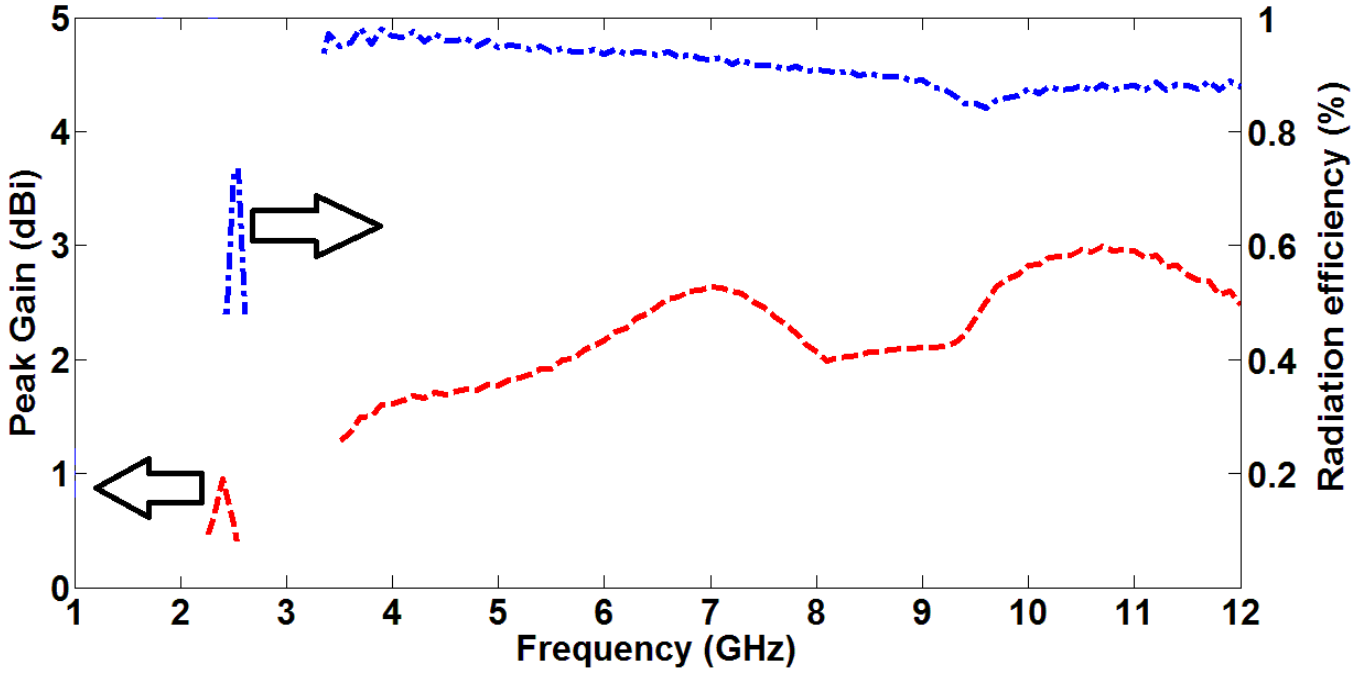


E-plane H-plane



E-plane H-plane

Peak Gains and Radiation Efficiency



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