

(SSE-21/12/256/3)- DESIGN AND ANALYSIS OF CIRCULAR PATCH ANTENNA GAIN PATTERN AT 2.4 GHz and COMPARE WITH and WITHOUT SLOT

PICO:

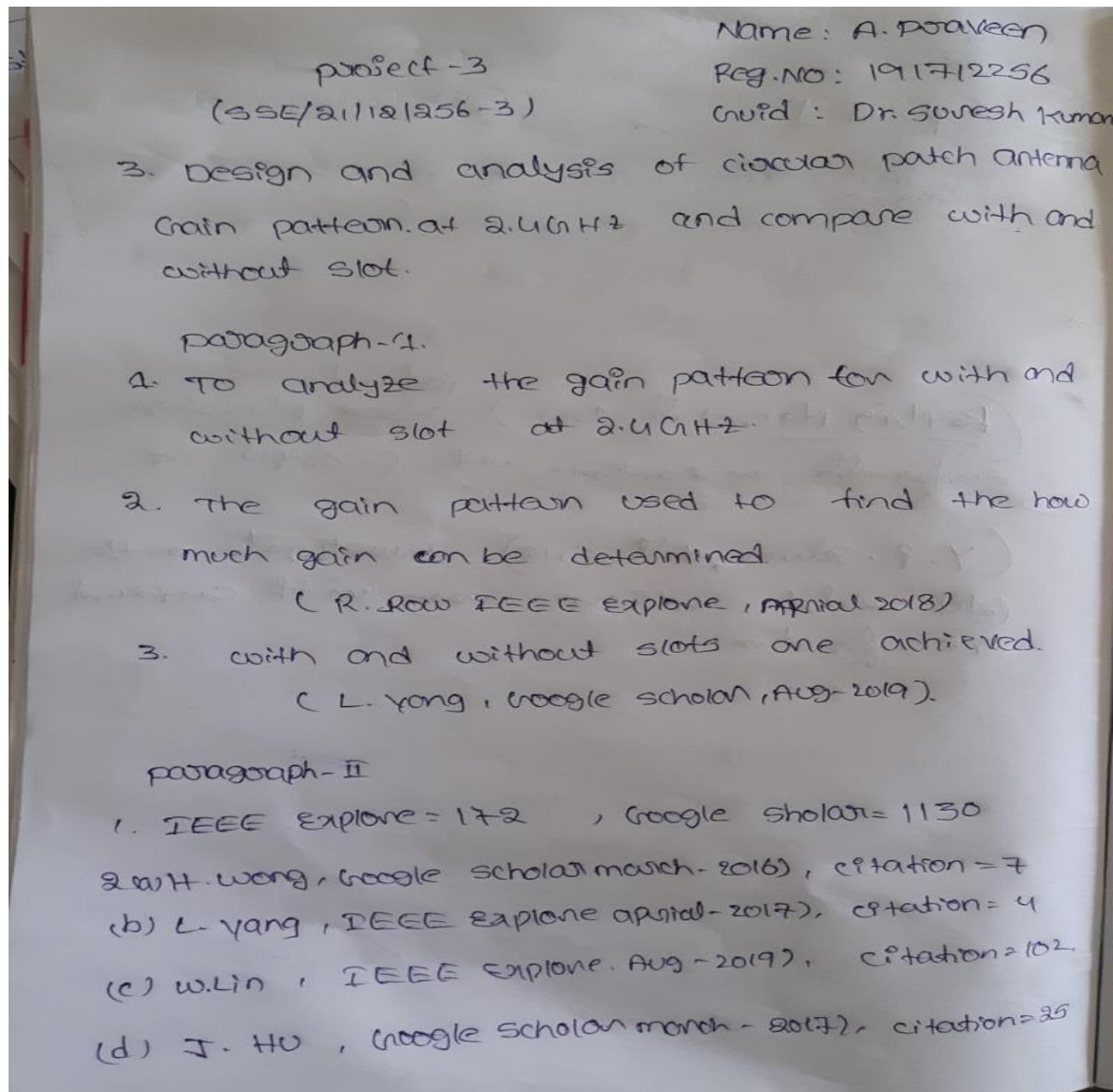
Problem: Minimum polarization gain

Intervention: Improved using substrate material and slot creation in the antenna

Comparison: Gain pattern of with and without slot

Outcome: Frequency vs Gain pattern (with and without slot)

INTRODUCTION:



3. W-Lin, IEEE Explore, Aug-2019, Citation: 102

paragraph-III

1. The gain pattern in polarization reconfigurable antenna inspired me to do this research.
2. Author: D Rodrigo, B. A. et al.
Title: A frequency and radiation pattern reconfigurable of multisize pixel antenna.
Year: 2017.
3. To achieve the gain pattern for with and without slots at 2.4 GHz.

MATERIALS AND METHODS

materials and methods

(SSE/21/12/256-3)

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Guide: Dr. Suresh Kumar M

Title 3: Design and analysis of circular patch antenna gain pattern at 2.4GHz and compare with and without slot.

para-1

Study Setting: Saveetha School of Engineering

No. of groups: 2

sample size: 16

Total sample size: 32

pre-test power: 80%

para-2

sample preparation group-1

Designing a circular patch with slot antenna using at 2.4GHz.

procedure:

1. Design a circular patch with slot antenna by calculating the gain pattern
2. Give the feed between two patches.
3. Give the radiation and boundary
4. analysis and frequency sweep
5. save and validate id.

page-3

sample preparation group-2

Designing a circular patch without slot antenna using HFSS at 2.4GHz.

procedure:

1. Design a circular patch without slot antenna by calculating the gain pattern.
2. Give the ground (perfect ϵ)
3. Give the source to antenna.
4. Give frequency sweep and validated the design.

page-4

* Ansoft HFSS is a 3D electromagnetic simulation software for designing high frequency electronic product such as antenna, arrays, RF and high-speed filters and connector set.

* circular patch antenna, length, width, radius and ^{RT dupix 5320} ~~dielectric~~ substrate were set.

Testing procedure:

- * Assign RT duroid material and frequency
- * calculating the length and width of patch using microstrip test line calculator.
- * Assign boundary conditions
- * Assign excitation
- * assign analysis setup
- * validating design
- * Result analysis

para-5

Data collection: data entered in excel sheet.

para-6

Statistical software used:

- * HFSS software used for simulation and verification
- * ORIGIN v8.0 software.
- * SPSS.

Independent variable:

- * frequency (GHz)
- * RT duroid ^{5820mm} constant
- * RT-duroid ^{5820mm} height

dependent variable:

* Radiation pattern.

analysis done:

comparing the gain pattern of circular patch antenna with slot and circular patch antenna without slot at 2.4GHz.

Data collection: with slot

S.NO	GROUP1	GAINPHI,PHI=0	GAINPHI,PHI=90	GAINPHI,THETA=0	GAINPHI,THETA=90
1	1	-45.6154	-28.4796	-1.58775	-15.486
2	1	-39.5956	-22.458	-1.56883	-15.5071
3	1	-36.0752	-18.9345	-1.53749	-15.5424
4	1	-33.5785	-16.4336	-1.49401	-15.5918
5	1	-31.6431	-14.4927	-1.43879	-15.6556
6	1	-30.0631	-12.9061	-1.37231	-15.7337
7	1	-28.7288	-11.5639	-1.29515	-15.8262
8	1	-27.5748	-10.4007	-1.20797	-15.9333
9	1	-26.5588	-9.37446	-1.11149	-16.0551
10	1	-25.6523	-8.45636	-1.00652	-16.1916
11	1	-24.8348	-7.62607	-0.89386	-16.343
12	1	-24.0913	-6.8686	-0.77439	-16.5091
13	1	-23.4105	-6.17263	-0.64899	-16.6899
14	1	-22.7837	-5.52946	-0.51855	-16.8852
15	1	-22.2041	-4.93224	-0.38397	-17.0945
16	1	-21.6661	-4.37551	-0.24614	-17.3172

Data collection: without slot

S.NO	GROUP2	GAINPHI,PHI=0	GAINPHI,PHI=90	GAINPHI,THETA=0	GAINPHI,THETA=90
1	2	-37.77	-23.50	2.63	-22.95
2	2	-31.75	-17.48	2.65	-22.89
3	2	-28.23	-13.96	2.69	-22.79
4	2	-25.73	-11.46	2.75	-22.65
5	2	-23.79	-9.51	2.81	-22.46
6	2	-22.21	-7.93	2.90	-22.22
7	2	-20.87	-6.58	2.99	-21.93
8	2	-19.71	-5.42	3.10	-21.57

9	2	-18.69	-4.39	3.22	-21.17
10	2	-17.78	-3.48	3.35	-20.72
11	2	-16.96	-2.65	3.49	-20.22
12	2	-16.21	-1.89	3.64	-19.70
13	2	-15.52	-1.19	3.79	-19.15
14	2	-14.89	-.55	3.95	-18.58
15	2	-14.31	.05	4.11	-18.01
16	2	-13.76	.60	4.28	-17.43

TABLES AND GRAPHS(SPSS)

Group Statistics:

	group	N	Mean	Std. Deviation	Std. Error Mean
gainphi0	withoutslot	16	-21.1357	6.83738	1.70934
	withslot	16	-29.0047	6.82175	1.70544
gainphi90	withoutslot	16	-6.8336	6.86547	1.71637
	withslot	16	-11.8128	6.86409	1.71602
gaintheta0	withoutslot	16	3.2720	.54841	.13710
	withslot	16	-1.0679	.44476	.11119
gaintheta90	withoutslot	16	-20.9029	1.85117	.46279
	withslot	16	-16.1476	.59821	.14955

Independent Samples Test:

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
gainphi0	Equal variances assumed	.000	.993	3.259	30
	Equal variances not assumed			3.259	30.000
gainphi90	Equal variances assumed	.000	.999	2.052	30
	Equal variances not assumed			2.052	30.000
gaintheta0	Equal variances assumed	1.033	.318	24.586	30
	Equal variances not assumed			24.586	28.773
gaintheta90	Equal variances assumed	20.032	.000	-9.777	30
	Equal variances not assumed			-9.777	18.099

Comparison of gain pattern of with and without slot by varying the frequency ranging from 1GHz to 3GHz. there is statistically significant difference in gain pattern of with and without slot. The gain pattern of without slot is higher when compare to with slot.

BAR CHART COMPARITIVE MEANS:

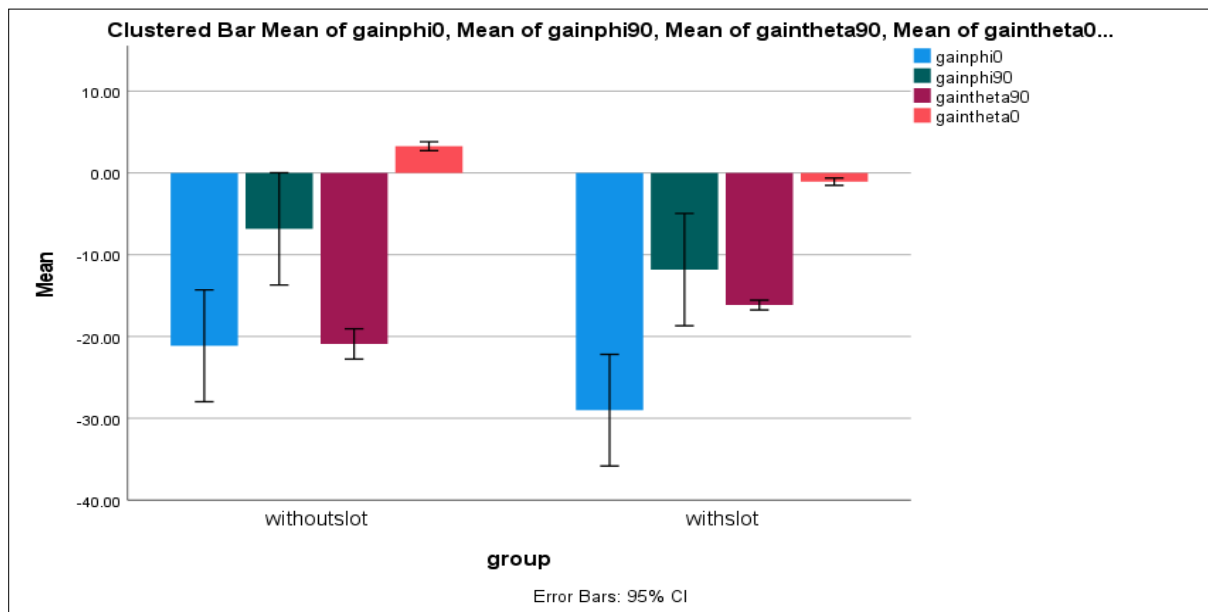
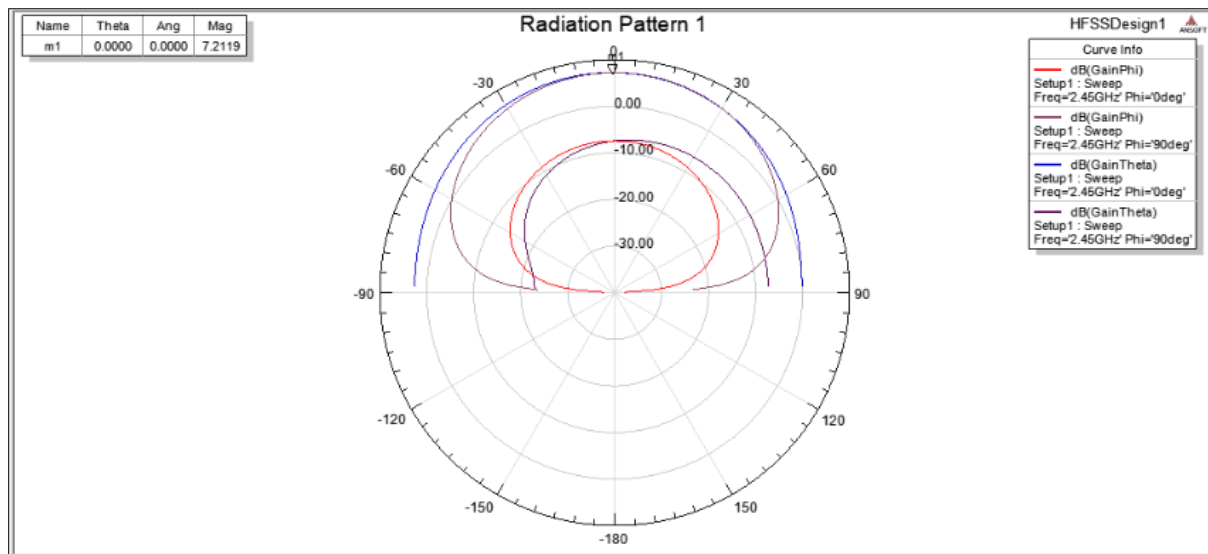


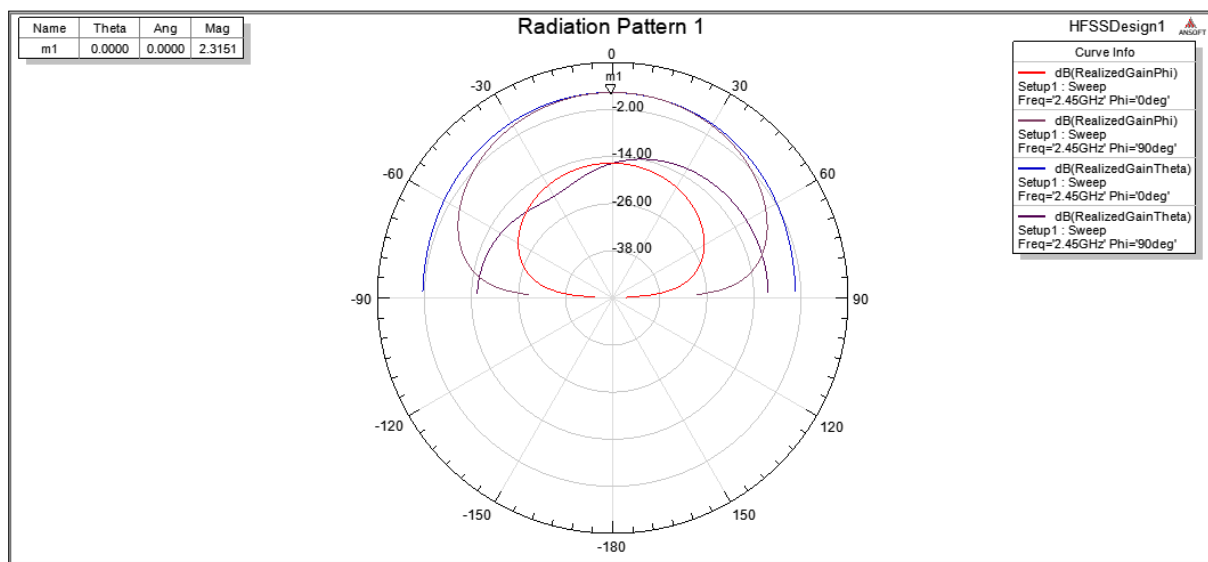
Fig. Bar chart comparing the mean gain pattern of with and without slot by varying the frequency. There is no significance difference between the two groups $p > 1.00$ (Independent sample t test).

WITHOUTSLOT GAIN PATTERN:



Frequency at 2.45GHz and gain pattern without slot = 7.2119

WITHSLOT GAINPATTERN:



Frequency at 2.45GHz and Reflection coefficient with slot= 2.3151

DISCUSSION HINTS

project 3:

Design and analysis of circular patch antenna
Gain pattern at 2.4 GHz and compare with and
without slot.

para-1

Circular patch antenna of gain pattern without
slot is more than compare to with slot.

para-2

* slot creation affects the circular patch antenna
of gain pattern.

* The slot creation in the antenna and improved
using substrate material.

para-3

IEEE xplore citation = 22, Google Scholar citation = 24.
* S. Liu, W. Wu and D. Fang. - May 2016.

wideband monopole-like Radiation pattern circular patch
antenna with high gain and low cross-polarization.

* X. Dai, T. Zhou and G. Cui - 2016.

Dual-band microstrip circular patch antenna with
monopole Radiation pattern.

modification:

slot created with length = 10cm

and width = 9cm.

future scope:

Improved polarization, gain and fabricated in future.

Limitations

- * Gain pattern should not exceeds below zero while creating slot in with and without slots.
- * antenna polarized gain pattern and frequency.

conclusion:

within the limits of this study, the gain pattern of without slot is high and ^{compare} ~~also~~ with slot.

- * The maximum gain is 7.2119 dB

Approved,
M.S.
(Guide)