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Multiband Microstrip Patch Antenna for 5G Applications using DGS Technique

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Abstract: In this article, a multiband microband antenna fed by a microband feeder is proposed, with a total area of 30x24x1.6 mm ^ 3 [1]. The planned antenna is printed on the FR4 epoxy resin substrate with a relative dielectric constant of 4.4 [2]. The multiband characteristics are produced by the differently shaped grooves used in the ground plane. The antenna covers two frequency bands, 24.0 GHz to 24.53 GHz, for K-band applications, and 26.7 GHz to 27.6 GHz, for Ka-band applications [3] [4]. The prototype of the expected antenna is planned and measured in advance. Ansys HFSS software simulation results are consistent with measurement result.
Key Terms -X-band, Microstrip Antenna, K-band, Ka band, HFSS.

I. INTRODUCTION

Microstrip patch antennas have many advantages, such as light weight, small size, low cost, and ease of manufacture. However, performance and bandwidth are low. Recently, antennas in wireless communication systems with multiple frequency bands are playing an important role in the standard requirements of wireless services. Interest and research on multi-band antennas is increasing, especially to reduce the number of antennas installed in an antenna by overlapping multiple applications. Recently, researchers have made great efforts to realize that characteristic. Groove technology, DGS technology and other methods. Used to design multiband antennas. Appropriate selection of feeding techniques using different types of methods and techniques in the MSP antenna structure can help to easily achieve these characteristics [5]. Design the MMSPA 5G using various techniques and methods [6] [7]. This article uses DGS technology to project and analyze a low profile 5G wireless communication microchip patch antenna. With less than contributions, microchip patch antennas for 5G wireless communications are planned. The dimensions of the projection antenna are 30x2 x1.6mm ^ 3, which resonates at frequencies of 2 .22GHz and 27.20GHz in the K and Ka bands, respectively. Part 2 of describes the design and dimensions of the projection antenna. Section 3 generally describes the technical implications of using and not using dgs. The fourth segment contains irradiance results such as reflection attenuation plot (s11), 3D gain plot, and 2D irradiance plot. Finally, the conclusion is reached in paragraph 5.

II. ANTENNA DESIGN

The block diagram of the designed antenna is shown in the figure below. The design parameters and dimensions are shown in the following table. The antenna here is printed on FR epoxy resin with a dielectric constant of . . [2] [9]

A. Ground Plane Design And Dimensions

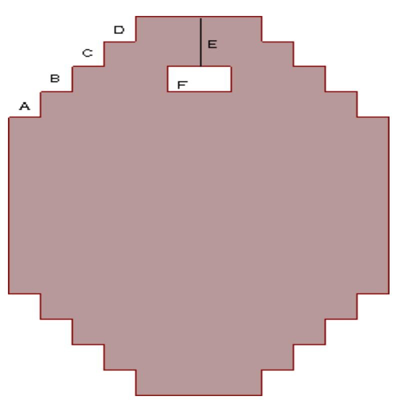

Fig. 1.Ground Design

The reference plane with grooves and defects and the dimensions listed in the table below.

NAME	LENGTH (mm)	WIDTH (mm)	HEIGHT (mm)
GROUND	30	24	0
A	8	2	0
B	6	2	0
C	4	2	0
D	2	2	0
F	4	2	0

E = 4mm

B. *Substrate Design And Dimensions*

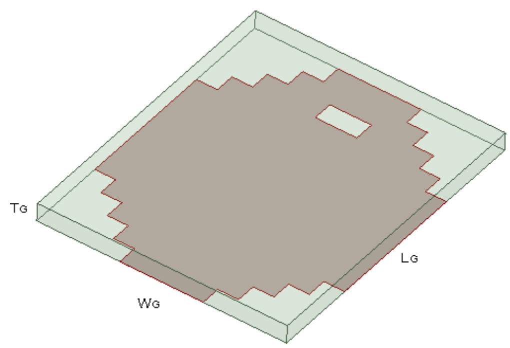

Fig. 2.Substrate Design

The substrate used is FR4 Epoxy of permittivity 4.4 and dimensions mentioned below.

NAME	Lg	Wg	Tg
SUBSTRATE	30	24	1.4

C. *Patch and Geed Line Design And Dimension*

The **size** design listed in the table below **uses** patches and feeders with **many** rectangular grooves

NAME	LENGTH	WIDTH	HEIGHT
PATCH	14	10	1.6
FEEDLINE	15	3	1.6
PATCH SLOTS	2.5	0.5	1.6
FEED SLOTS	2	0.5	1.6

P1 = P2 = 5mm P3 = P4 = 2.5mm
P5 = 2mm P6(Radius) = 1mm

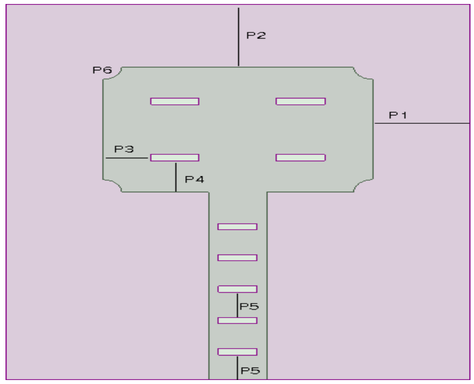

Fig.3.Patch and Feedline

D. Final Proposed Design

Top view and Dimetric view of projected antennae design are shown below:

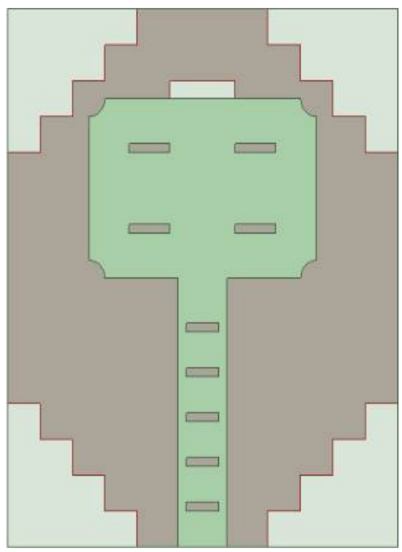

Fig.4.Top view

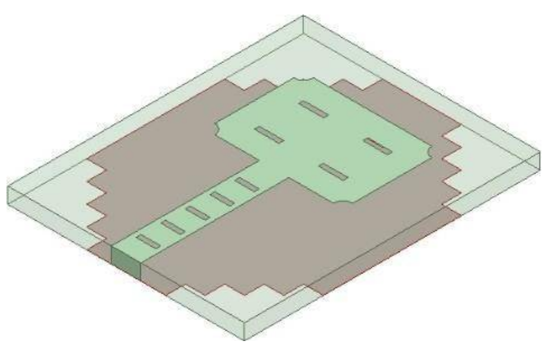

Fig.5.Diametric View

Antenna patch simulation and design must be performed using accessible simulation tools. The tool used is HFSS (Radio Frequency Structure Simulator). This antenna is specially used to visualize future 5G applications in any of the frequency bands. The next section describes the various simulation results. [10] [1]

III. EFFECT OF DEFECTED GROUND STRUCTURE ON PROPOSED DESIGN

The projection antenna gain remains unchanged before and after the dgs, but S11 and the frequency diagram have a great influence without adding a gap (dgs) to the ground. There are no dgs in the image below. [12

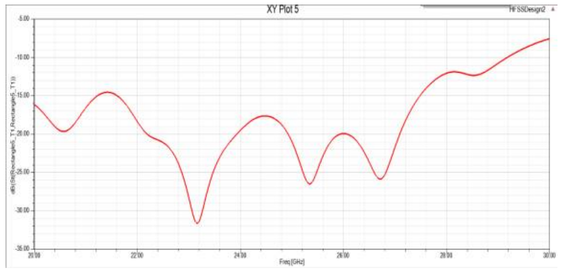

Fig.6.without dgs

IV. SIMULATED RESULTS

A. Return Loss Plot

Using port settings, we can get parameters with reserved return loss from S11. 10db is a benign value to measure mobile communication, so it is called the benchmark value [13].]. Any content below this value is considered the best use case. The antenna is operating in the expected 5G frequency band. The patch antenna return loss is 42.56 dB, the resonance frequency is 24.22 GHz, and the bandwidth is 2.13 GHz. Similarly, the resonance frequency is 27.20 GHz, the return loss is 39.34 GHz, and the bandwidth is 47 GHz

Below plot shows the return loss plot of the antennae.

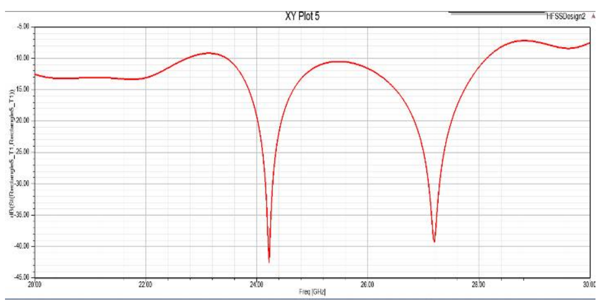

Fig.7.Return Loss plot

B. 3D polar plot

The efficiency of the antenna is determined by the 3D polar graph. The projected antenna design achieves a gain of 10.00 dB, which is considered admirable in terms of the robust antenna proposal. The 3D gain diagram of the projection antenna is shown below [14].

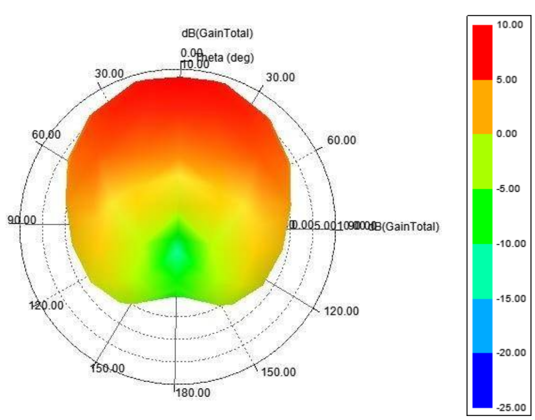

Fig.8.Polar plot

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C. Radiation Pattern

The 2D radiation pattern of the projection patch antenna is shown below. An expected omni-directional shape is required for antennas used in 5G communications

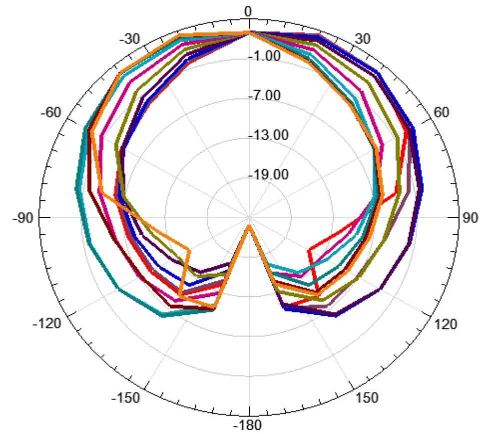
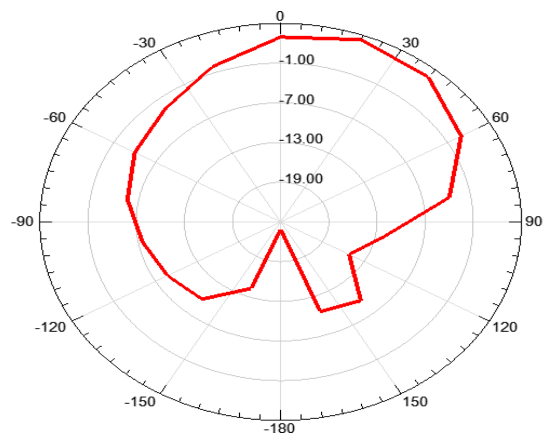


Fig.9.Radiation pattern



Radiation pattern at phi=0 degrees
Fig.9a.Radiation pattern 2

The antenna exhibits a good radiation pattern, has a good expansion value, and can be used for 5G wireless communications. 5G wireless standards are appearing more and more in today's age. It can be used for high speed transmission links. In the next 5G standard, we may see great progress. [fifteen]

D. Smith chart

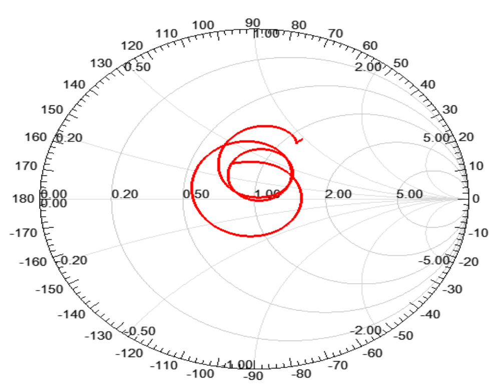


Fig.10.Smith chart

V. CONCLUSION

In this projection document, a multiband slotted microband antenna with DGS for 5G wireless applications is presented. The recommended antenna with the following parameters can be used for 5G wireless applications.

RESONATES (GHz)	RETURN LOSS(dB)	BANDWIDTH(GHz)
24.22	**-42.56**	**2.13**
27.20	**-39.33**	**2.57**

The projection antenna shows a good radiation pattern and a good gain of 10 db. The projection antenna has a simple structure, low cost and small size. The profile of the projection antenna is very low, ie 30mm x 24mm x 1.6mm, which can be integrated into the device effortlessly.

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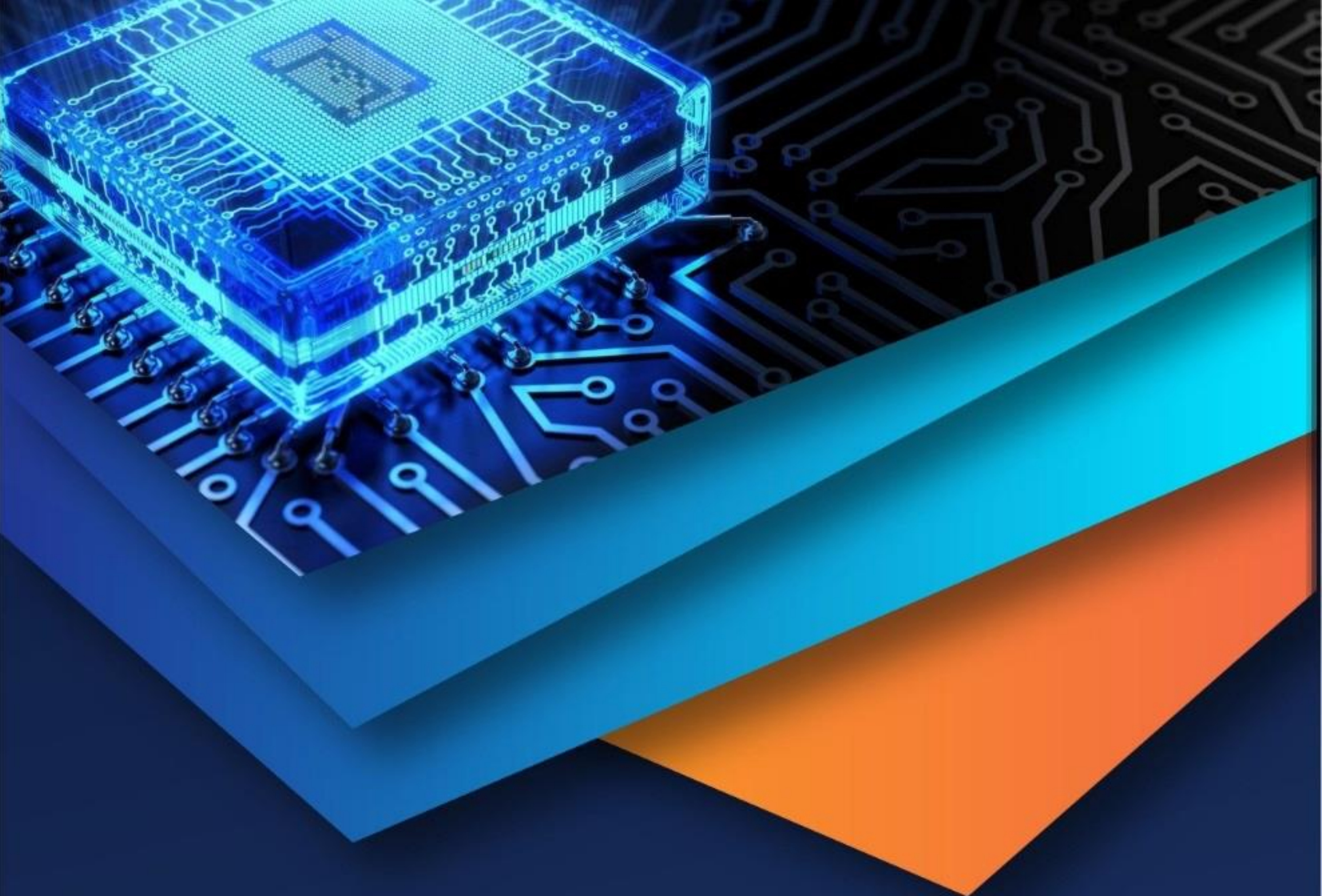

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