CERAMIC MATERIAL BASED CIRCULAR SPIKE SHAPED CPW FED ANTENNA FOR HEALTHCARE MULTIBAND APPLICATIONS

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ABSTRACT

This work states the design and analysis of compact circular spike shaped antenna. The proposed antenna having the dimensions of 30x30x1.3mm3 which having the coplanar waveguide feed. The circular shaped patch is modelled to spike shape for the upper half and a minimum gap of 0.5 mm is maintained between ground plane and the feed line. The designed antenna model is resonating at multiband and covering the health bands of ISM, WBAN, commercial communication bands of Wi-Fi, wireless local area network and radar applications. Antenna simulated parameters are analyzed and the prototyped design measurements also provided in this work for validation.

Keywords: Ceramic Material, Circular Spike, CPW Fed, Healthcare

I. INTRODUCTION

In the field of medical communication there is a rapid grow of wireless technology with the applications like WBAN, communication implantable devices and IOT devices in bio-medical field etc. While in WBAN [1-2] application the proposed antenna is situated on the body and the observing equipment situated on the outside in which the variables can be extract. The utilizations of the wearable body area network [3-4] innovation incorporate situation of body observing sensors and other fitness monitoring sensor with biomedical hardware. In the clinical field, wireless telemetric joins send the demonstrative, treatment and essential data to outside the body [5-12].

The dis-advantages like compactness of antenna, bio-compatibility, radiation propagation losses inside the body, communication link, safety issue are taking a lead while we are implementing the antenna on the human body [10]. Body repeater is required to enhance the transmission link in the wearable devices [13-15]. Phantoms will be used in the simulation to understand the characteristics of human body while we are placing the implantable devices [16-20]. Double band implantable antennas and spiral type antenna are developed in recent technologies to use in MICS band and ISM bands respectively [21-26]. In telemetry applications uniplanar type antenna are proposed [29-30]. To reduce the effect of specific absorption rate various techniques like EBG, AMC and ferrite loading are used [31].

Antenna Design

This section deals with desing of novel compact ultra wide band printed monopole antenna with the integration of arc-shaped circular serrated. The characteristics like relevant impedance and the omnidirectional radiation patterns are the important deatures of the proposed antenna. The optimized dimensions of the proposed antenna are placed in the table 1 and the prototype model of the proposed antenna are place in fig 1. The proposed antenna having the dimensions of 30*30*1.6mm3 having Fr-4 as substrate layer which provides the wide bandwidth of 8500MHz in between 2.5GHz to 11GHz and having voltage standing wave ratio of <2.
Fig 1. Proposed Circular Spike Antenna, (a) Antenna Model, (b) Prototype

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II. RESULTS AND ANALYSIS

The fig 2 states the return loss and voltage standing wave ratio of the proposed antenna. The proposed antenna having reflection co-efficient value of < -30dB with an operating frequency range of 2.5 to 11GHz having a bandwidth of 8500MHz. Similarly, the proposed antenna having the VSWR value < 2 having an operating frequency range of 2.5 to 11GHz.

Fig 2. Reflection Coefficient/VSWR Vs Frequency
Fig 3. 3D Gain plot of proposed antenna at 3.3 and 5GHz

Fig 3. states the peak gain value of proposed antenna at an operating frequency of 3.3 and 5.5 GHz. At an operating frequency of 3.3 GHz the antenna having the gain of 3.3 dB and similarly at a frequency of 5 GHz the antenna having the gain of 5.75 dB.

Fig 4. H-plane and E-plane values at (a) 3.3 GHz, (b) 5GHz, (c) 6.8 GHz

Fig 4 states the radiation patterns of proposed antenna at various operating frequency like 3.3, 5 and 6.8 GHz. At a frequency of 3.3, 5 and 6.8 GHz the antenna showing omnidirectional and dumbbell shape with respective H and E plane. Similarly, the antenna having difference between co and cross polarization is around 10dB at 30 deg and 6dB at 120 deg at various operating frequency of 3.3, 5 and 6.8 GHz.
Fig 5 state the radiation value of 14.8 and 6.7 at respective E and H plane at an operating frequency of 3.3 GHz.

Fig 6 states the surface current distribution value of 10 A/m at an operating frequency of 3.3 GHz. Its having the maximum intensity across the feed line and the outer edge of the patch having maximum intensity.

III. CONCLUSION

This work deals with compact ceramic material based circular spike shaped antenna. The proposed antenna having the dimensions of 30x30x1.3mm³ which having the coplanar waveguide feed. The circular shaped patch is modelled to spike shape for the upper half and a minimum gap of 0.5 mm is maintained between ground plane and the feed line. The designed antenna model is resonating at multiband and covering the health bands of ISM, WBAN, commercial communication bands of Wi-Fi, wireless local area network and radar applications having the efficiency more than 85% with the gain value of above 5dB. Antenna simulated parameters are analysed and the prototyped design measurements also provided which are in good agreement.

REFERENCE


