ISSN: 2277-9655
Impact Factor: 3.785

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

CIRCULAR SRR LOADED UWB ANTENNA WITH WiMAX BAND NOTCH

Anju A Chandran *, Shiney Thankachan
* PG Student, Department of ECE, College of Engineering Kidangoor, Kottayam, Kerala
Assistant Professor, Department of ECE, College of Engineering Kidangoor, Kottayam, Kerala

DOI: 10.5281/zenodo.51848

ABSTRACT

Now a day's UWB antenna design is one of the challenging areas. This paper proposes a simple method for filtering out 3.5GHz WiMAX band which is an already allocated band in UWB spectrum. Single circular Split Ring Resonator (SRR) is loaded on the back side of a coplanar feed printed planar monopole antenna. Coupling between the signal and SRR gives notch at frequencies.

KEYWORDS: UWB, WiMAX, SRR, Coplanar feed, Monopole antenna

INTRODUCTION

According to federal communication commission (FCC) rules, from 2002 onwards the 3.1 - 10.6 GHz band is allocated to the ultra wideband (UWB) applications [1]. UWB technology has several advantages like very wide bandwidth of about 7.5 GHZ (3.1 to 10.6 GHz) compared to many other existing wireless communication standards [4] and low cost, high data rates and less amount of average radiated power [2][3].

UWB applications can coexist with other narrowband communication standards that occupy the same radio spectrum because of the limitation of power level. But this will causes some interference between the UWB systems and narrow band systems. There are some narrow frequency bands that currently allocated various applications which cause interference to other devices. Now a day many systems operate across several frequency bands, needs a band-notched or band-rejected function. Many methods to accomplish band notch characteristics for UWB systems are available in open literature [5]-[15].Most of these techniques are complicated ones or sometimes causes spurious radiations and frequency shifts. Most of the designs mainly concentrated in making changes in the patch or ground plane. Therefore, here we proposes a simple method to design a UWB antenna with single frequency notch characteristics.

PROPOSED DESIGN OF ANTENNA

This paper suggests a simple method for designing a frequency notched UWB antenna by loading circular single ring SRR on the back plane of the antenna. Here the SRR is loaded symmetrically on the back plane of feed line and here a CPW feed is used. Printed planar monopole antenna offers a wide band width and the structure is somewhat simple. When the signal is fed through the feed line it gets interacts with the SRR and a coupling effect made on the SRR at a particular frequency which corresponds to the dimensions of SRR. As a result of this an oscillating current is flows on the SRR and the signal at this frequency gets rejected. Notched frequency depends on the SRR's geometrical dimensions [16].

Fig.1 (a) shows the schematic of the proposed antenna. The circular monopole of radius R is fed by a CPW consisting of ground planes having widthsW1, W2 and, length Ls and a feed line having width S and length Ls + t, here t=0.2mm. The slots between the ground planes and feed line have width Sg. The antenna is printed on a FR4 epoxy substrate having thickness h =1.6mm and dielectric constant εr=4.4.

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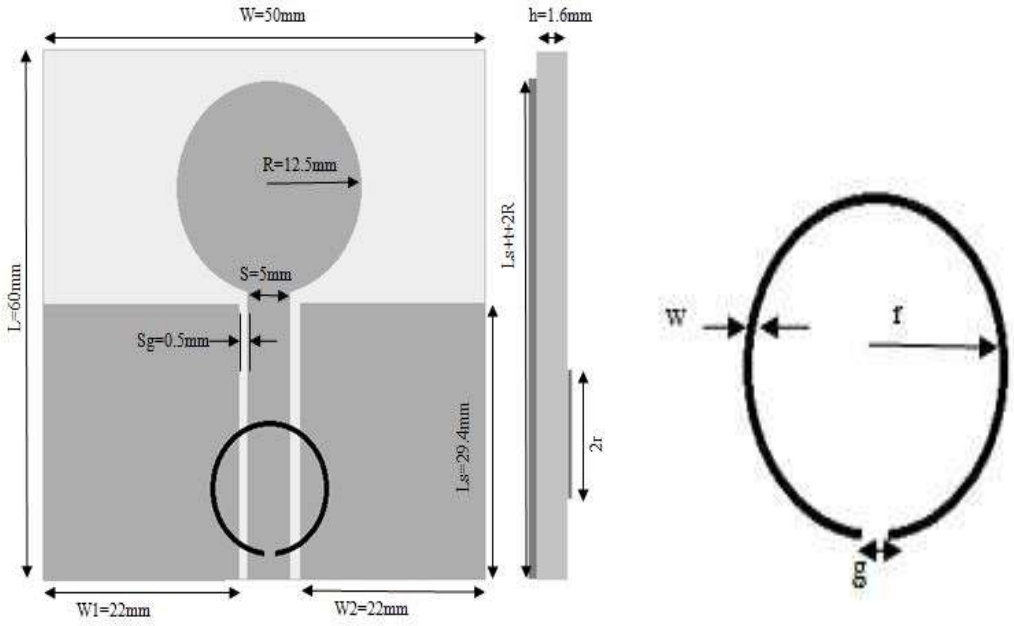

(a) (b) (c)

Fig.1 (a) Geometry of the proposed antenna with SRR loaded on the back side (b) Side View (c) Structure of single circular ring SRR

Fig 1(b) shows the side view of the structure. Circular shaped single ring split ring resonators having radius "r=8mm", conductor thickness "w=0.4mm" separation and split gaps "g=1.5mm " as shown in Fig. 1(c), are printed on the other side of the antenna. Unlike in most of the previously presented designs described earlier, where most of the inclusions and slots were arranged on the radiating patch itself or the ground planes the novelty in our design is that it can be employed on any CPW fed planar monopole UWB antenna without tampering or changing the shape of the radiator or the ground plane.

SIMULATION RESULTS

Results of a CPW fed circular single ring SRR loaded UWB monopole antenna to obtain frequency notch at 3.5GHz WiMAX band is shown in the below figures. Simulated results show a very good agreement towards the theoretical results.

a. Obtained VSWR plots

Fig 2 shows the simulated voltage standing wave ratio (VSWR) plots. VSWR also referred to as Standing Wave Ratio and it is a function of reflection coefficient which describes the power reflected from the antenna. From which it is observed that VSWR at this particular WiMAX frequency is above 2, that is perfect notching takes place at this 3.5GHz WiMAX.

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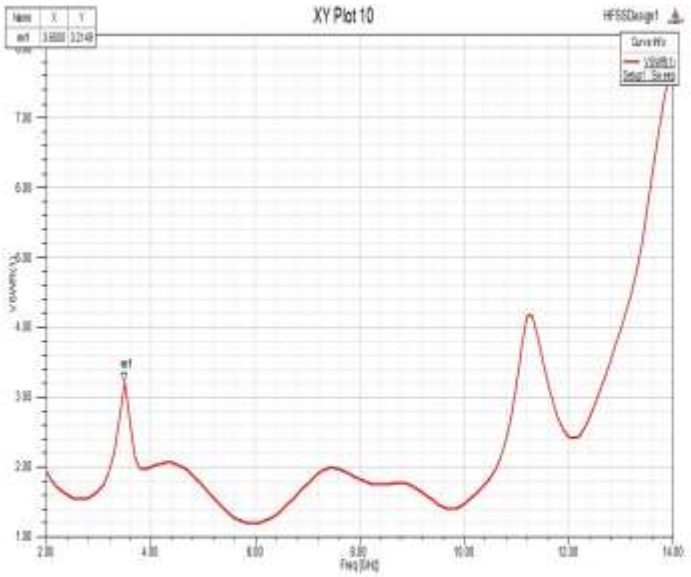

Fig.3. VSWR for single circular ring SRR loaded UWB antenna

b. Obtained return loss plots

Fig. 3 shows the simulated return loss plots. From which it is observed that return loss at this particular WiMAX frequency is above -10 dB, which means perfect notching takes place at this 3.5GHz WiMAX. For all other frequencies return loss is less than -10 dB. From graph it can be seen that the response is operated for entire UWB band width ranging from 3.1GHz to 10.6GHz.

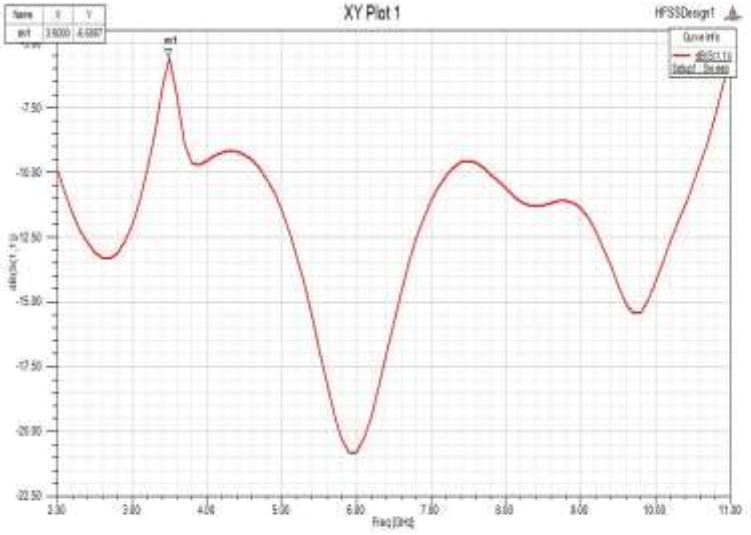

Fig. 4 Return loss for single circular ring SRR loaded UWB antenna

CONCLUSION

A CPW fed UWB circular monopole UWB antenna loaded with circular single ring SRR having single frequency notch characteristic has been proposed here. This structure is very simple and here there is no changes made on patch or ground plane unlike previous designs. The coupling between the SRR and the CPW feed line at its

resonance frequency yields the desired frequency notch. The SRR dimension only depends up on the desired notching frequency.

ACKNOWLEDGEMENT

Authors are grateful to the TEQIP, College of Engineering Kidangoor for the financial support to complete this paper work

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