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Research Article

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Multiband ultra wideband cylindrical dielectric resonator antenna

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Abstract

Multiband ultra wideband dielectric resonator antenna is proposed in this paper. Here two identical cylindrical dielectric resonators with Zig-Zag slot microstrip feed is simulated. Moreover, the impedance bandwidth is 100% and frequency range 6-18 GHZ with multiple band resonating frequency 6.2 GHZ, 9.6 GHZ, 12.4 GHZ, 14 GHZ is obtained.

Keyword:

cylindrical DRA; microstrip feed; bandwidth; resonating frequency; multiple band

Introduction

In MPA bandwidth is almost achieved to 47% [1] but in the X-band, conductor losses become significant for microstrip antennas, and DRAs [2-5] are a good possible alternative. The bandwidth range is from 10-120 %. The bandwidth enhancement in DRA can be achieved by different geometry, coupling mechanism, coupling slot , conformal feeding [6-14]. As for wireless communication multiple band is suitable requirement. So literature [15-28] relate to multiple/dual band applicable for wireless communication. In the earlier literature it was observed that dual band/multiband is due to multiple DRA , DRA with slot , coplanar waveguide feeding (CPW) where upper band frequency is due to DRA and lower band frequency is due to the radiator or because of slot or because of CPW. The designed dual band antenna is mainly suitable for WLAN or WIMAX. The proposed antenna has wide bandwidth band covering a wide range of frequency from 6-18 GHZ covering C to Ku band. In this paper two cylindrical DRA with optimized orientation of slot simulated with HFSS (High Frequency Structure Simulator) software.

ANTENNA DESIGN

The proposed antenna is designed with cylindrical DRA and excited in HEM11δ mode.

The cylindrical DRA is having dielectric constant 9.4 , height= 9mm , radius 3mm. FR4 substrate of 30*25 mm sqr with thickness 1.6 is used. The microstrip feed line dimension is length 21 mm and width 1.5 mm. The proposed antenna is designed by different positionion of aperture coupled slot and divided into 5 design with results. The bandwidth is enhanced from design 1 to design 5 by changing the slot shapes.

Design 1:

As shown in figure1 , the slot length=6.6 mm and width= 1.2mm. shows good Impedance bandwidth with resonating frequency 10.3 GHZ (9.32-12.5 GHZ) and 14.1 GHZ (12.5-14.5) is shown in figure 2

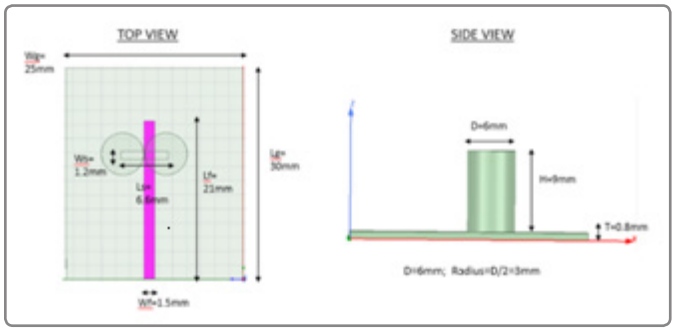

Figure 1

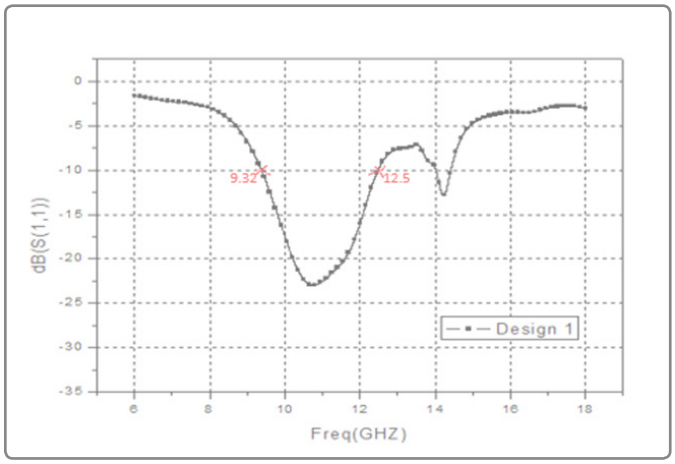

Figure 2

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Design 2: In design 2, the length of slot is same width is increased here nearly about 3 times as shown in figure 3, shows good impedance bandwidth with reonant frequency 12.2 and 16.2 as shown in figure 4

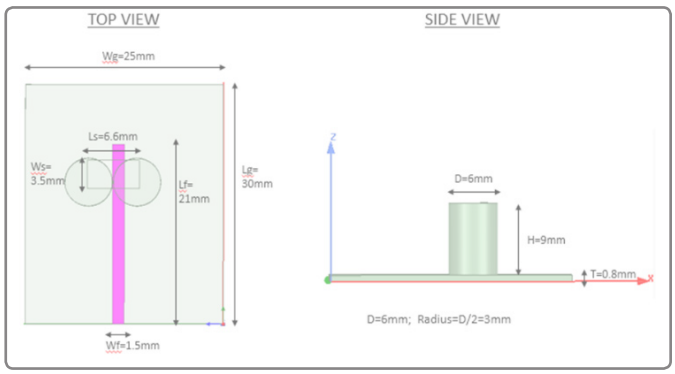

Figure 3

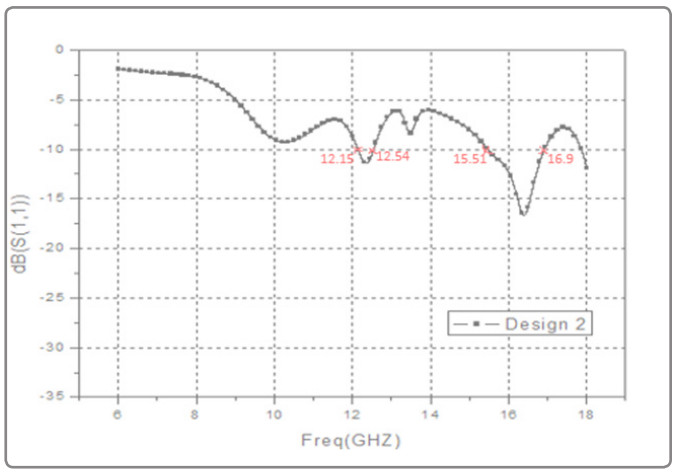

Figure 4

Design 3: In design 3, as shown in figure 5 L shaped slot is used dimension is shown in figure 5. The result is shown in figure 6 with resonating frequency 10 GHZ,12.2 GHZ and 15.8 GHZ

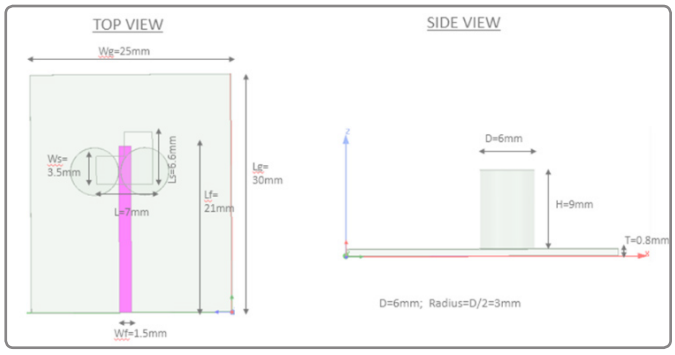

Figure 5

Result:

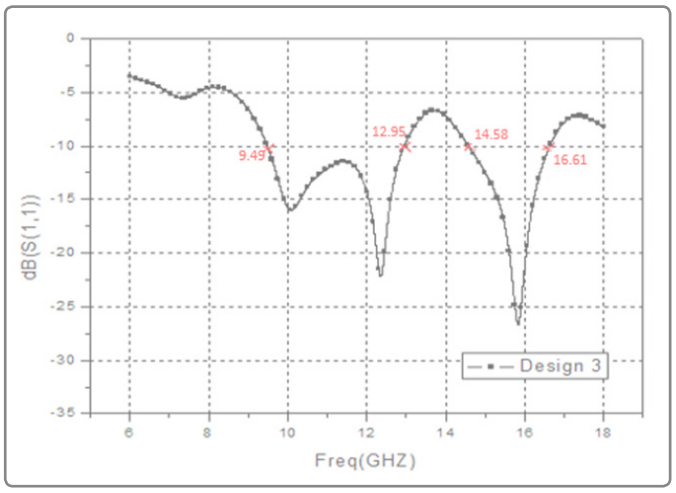

Figure 6

Design 4: in design 4 design 3 slot is inverted as shown in figure 7 . the impedance bandwidth for resonating frequency 12.3 GHZ (10.1-14.31 GHZ) and 16 GHZ (15.5-16.71 GHZ) from 15.5 to 16.71GHZ is obtained. Shown in figure 8

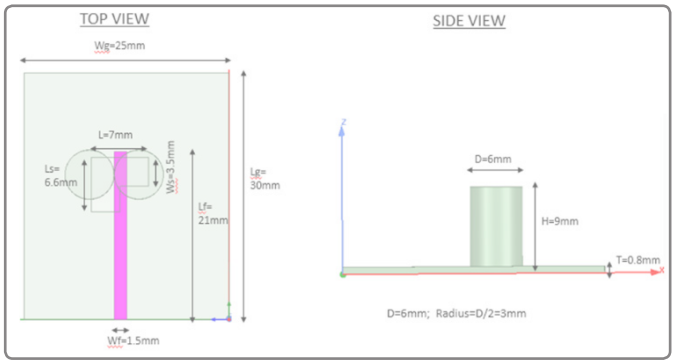

Figure 7

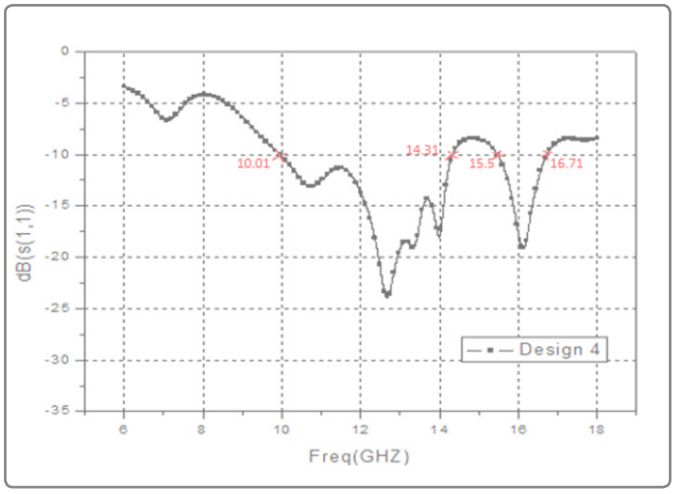

Figure 8

Design 5: In design 5, the Z shaped slot is used by mismatching two rectangular slot with identical dimension used in design 1 shown in figure 9. The proposed antenna shows multiple band with resonating frequency 6.2 (6.2-7.4 GHZ) , 9.6 GHZ (8.72-12 GHZ) , 12.4 GHZ (12-13.8 GHZ) ,14 GHZ (13.8-16 GHZ) shown in simulation result figure 10

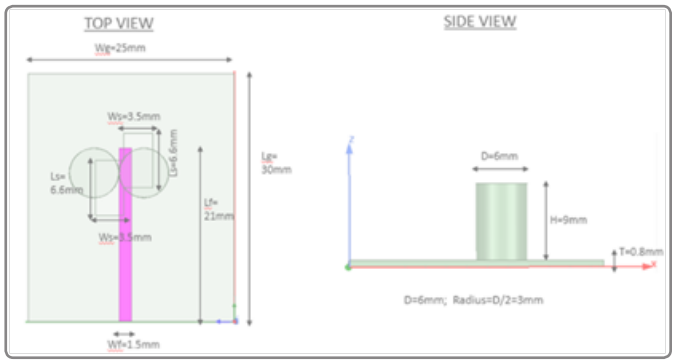

Figure 9

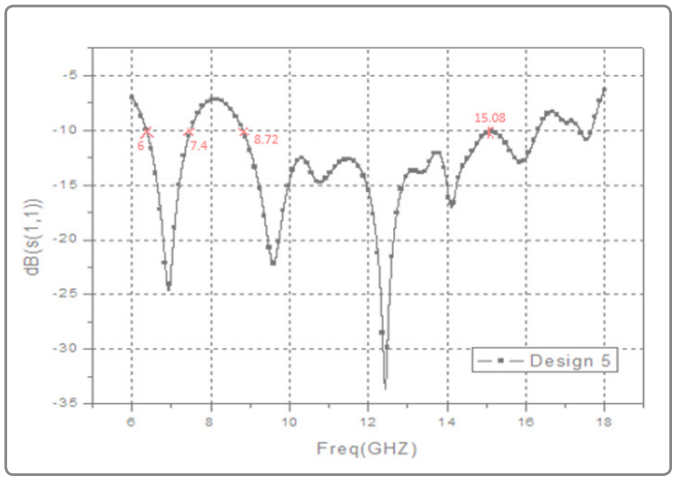

Figure 10

Results

Based on the 5 different design which is simulated in this paper. The result of the 5 design is shown in figure 11 and it is seen the proposed antenna is operating in wide frequency range from 6-18 GHZ (bandwidth % is 100) with multiple band with resonating frequency 6.2 (6.2-7.4 GHZ) , 9.6 GHZ (8.72-12 GHZ) , 12.4 GHZ (12-13.8 GHZ) ,14 GHZ (13.8-16 GHZ). The multiple band is due to two slot and two cylindrical DRA

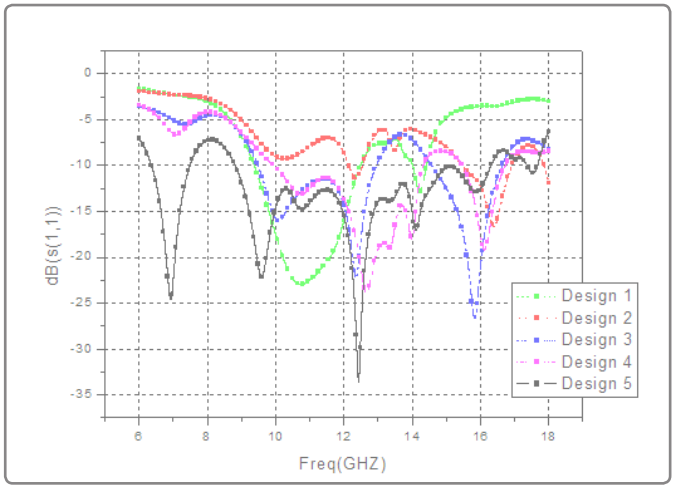

Figure 11

CONCLUSION

A compact ultra wideband antenna with impedance bandwidth 100% with frequency range 6-18 GHZ with multiple band simulated . the proposed antenna is suitable for C band as well as Ku band.

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