Circularly Truncated Cross Slit Microstrip Patch Antenna for WLAN Application

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***Abstract*— A novel compact design of a single-feed with cross slot in the patch centre along with a pair of circularly truncated corners is proposed and investigated for parametric evaluation. Prototype of the proposed antenna is simulated and measured for return loss evaluation and gain variation as a function of frequency. Proposed structure is analyzed by Ansoft HFSS v.14 based on Finite Element Method (FEM).Antenna shows good return loss of about -31.38 dB and gain of about 4 dBi at operating band of frequency. Simulated and measured results are in good agreement.**

Keywords—Compact microstrip patch, cross slot, WLAN.

1. INRODUCTION

Microstrip patch antennas (MPA) are used in communication system due to its attractive features like low profile, light weight, conformable to any shape, simple and inexpensive to manufacture using modern printed-circuit technology, and compatible with MIC [1].

Generally, compact handheld communication devices such as personal communication systems, mobile handsets, and radio frequency identification (RFID) systems required lightweight, cost effective, small size, and circularly polarized antenna [2]. In article [3] authors demonstrated a novel, modified, circular microstrip antenna with a cross-slot of equal arm lengths for compact CP operation in which two near-degenerate modes are excited by incorporating a pair of small peripheral cuts introduced at opposite sides of the patch boundary.

In article [4], a mathematical model is proposed to analyze the radiation characteristics of a compact square microstrip antenna for circular polarization. In article [5] authors have proposed a novel dual-band asymmetric slit with defected ground structure microstrip antenna for circular polarization (CP) operation. In article [6] it is found that the resonance frequency of the proposed structure is highly depending on length and width of cross-slot and corner slit for entire band of circular polarization. In article [7] the authors have experimentally investigated a single-feed, reduced-size circularly polarized circular microstrip antenna with four slits equally spaced and inset at the boundary of the circular patch.

In this article a novel designed compact circularly truncated microstrip patch is proposed using single coaxial feed. The compactness is achieved by loading a cross-slot in the center of the single-feed microstrip antenna. Further, compactness is achieved by introducing slits at the corners of patch. The proposed structure is simulated and optimized using finite element method based simulator Ansoft HFSS v.14 [8]. This article is organized as follows: Section 2 presents antenna structures and design. Section 3 presents simulated and measured results of the proposed antenna. Finally, a conclusion is presented in Section 4 of this article followed by references.

2. ANTENNA STRUCTURE AND DESIGN

Figure 1 shows the configuration of the single-feed cross slot loaded MPA along with two circularly truncated corner of the patch. The antenna is fed using 50 ohm coaxial probe near the centre of the patch. Antenna is simulated and measured on a 1.6-mm-thick FR-4 epoxy substrate of relative permittivity 4.4 and loss tangent of 0.0012. The detailed dimensions are listed in Table 1 where the symbols represent the length, width of cross slot and circularly truncated patch structure.

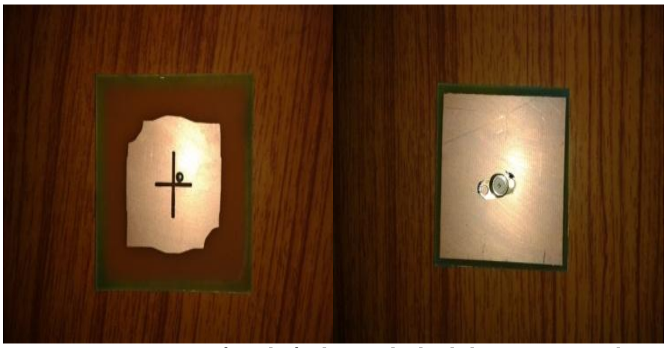


Figure 1 Geometry of single-feed cross slot loaded micro-strip patch antenna: (a) top view and (b) bottom view

The size of the ground plane for both the antennas is 46 *46 mm^2.

TABLE 1
Dimension of the Proposed Structures

Parameter	(mm)
ε_r	4.4
tan δ	0.0012
l_x	16
l_y	12
w	0.3
w_x	1
h	1.6
S	5
R_e	16.50

3. RESULTS AND DISCUSSIONS

The S11 variation with frequency of the antenna are shown in Figures 2.The proposed antenna shows resonance at 2.1 GHz which is desired band of operation for WLAN wireless application. Some harmonics are being introduced at higher band of frequency (4.5-5.0) GHz which can easily be removed by technique of defected ground structure (DGS). Figures 3 show the variation of antenna gain of 4 dBi at 2.1 GHz which clearly depicts its excellent performance for WLAN operation.

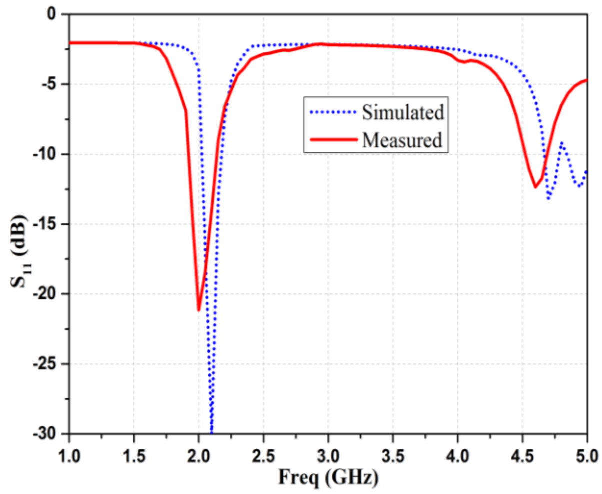


Figure 2. Simulated and measured S_{11} variations with frequency of antenna.

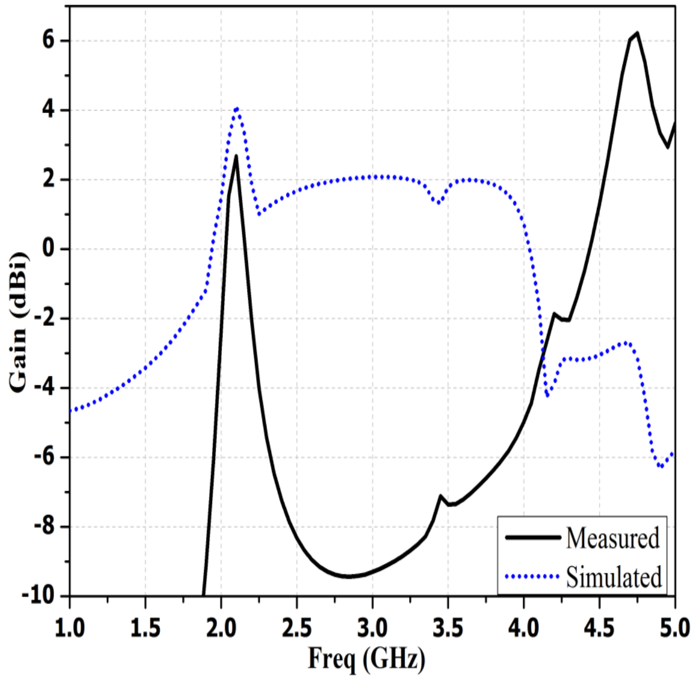
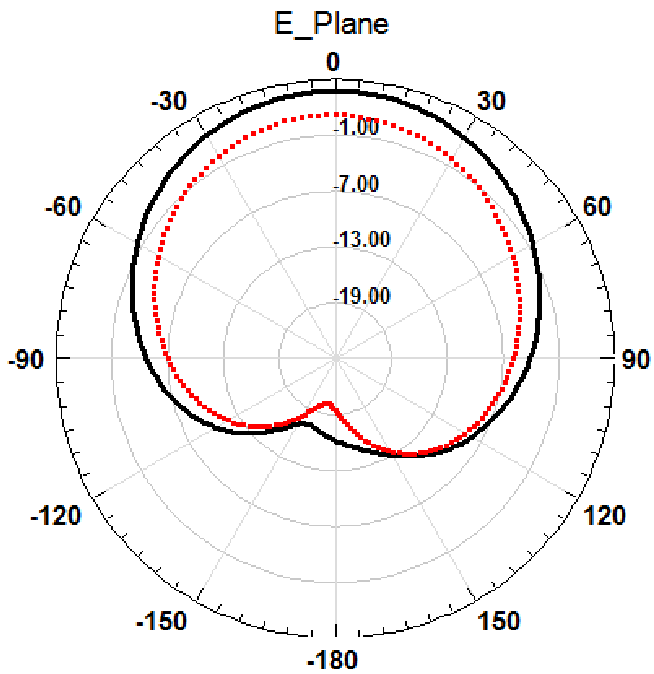


Figure 3. Simulated and measured antenna Gain variation with frequency of antenna.

Figures 4 shows Simulated and measured radiation pattern at 2.1 GHz in E and H plane for antenna. A good agreement between the simulated and measured result is observed for desired band of operating antenna.



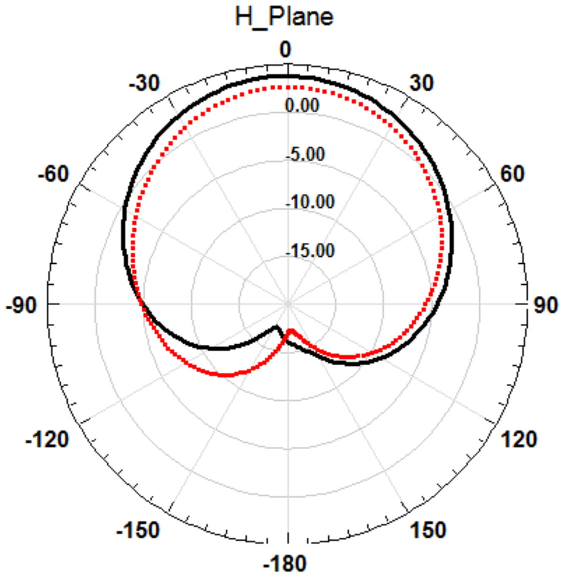


Figure 4. Simulated and measured radiation pattern at 2.1 GHz in E and H plane for antenna; (a) E-Plane, (b) H-Plane, ▬▬ Simulated, ▪▪▪▪▪▪ Measured.

4. CONCLUSION

In this article by introducing a cross slot in the patch centre and truncated corners compact novel MPA have been simulated and measured for superior performance of the device. Thus the proposed novel antenna may be a good choice for indoor WLAN and various other wireless applications which require small antenna to achieve insensitive orientation between the transmitter and receiver section of the antenna.

5. REFERENCES

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