J. Adv. Res. in Information Technology, Systems & Management
Volume 4, Issue 2 - 2020, Pg. No. 1-7
Peer Reviewed Journal

Article

A Study on Rectangular Microstrip Antenna Loaded with Open Stubs

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How to cite this article:
Pallavi B, Swamy B, Sadhana C. A Study on Rectangular Microstrip Antenna Loaded with Open Stubs. *J Adv Res Info Tech Sys Mgmt* 2020; 4(2): 1-7.

Date of Submission: 2020-08-28
Date of Acceptance: 2020-09-05

A B S T R A C T

In this paper a double band microstrip reception apparatus is acknowledged by setting open circuit stub on the edges of the fix. At the point when the stub length is taken to be almost quarter wave long, it offers capacitive and inductive impedance around the reverberation recurrence of the fix and acknowledges double recurrence reaction. In this paper, a detail examination for the impact of stub on the double band reaction of rectangular microstrip reception apparatus is introduced. The surface current conveyances and the reverberation bend plots were examined. It was seen that the stub adjusts the key and higher request symmetrical mode reverberation frequencies of the fix and acknowledges double recurrence reaction. With an expansion in stub length the bearings of surface flows are adjusted, which gives broadside radiation design at the double frequencies. The plan of thunderous length at double frequencies regarding stub measurements is proposed and they concur inside 5% with that of the mimicked results. An Open Stub Stacked Rectangular Microstrip Reception Apparatus (OSRMSA) is planned, manufactured and examined. This reception apparatus reverberates from 2.23 GHz to 9.93 GHz of frequencies and displays multiband activity with a greatest addition of about 4.81GHz. A middle took care of 50ω microstripline feed game plan is utilized to energize receiving wire. The other receiving wire boundaries like return misfortune, transfer speed and radiation design are examined and talked about. This reception apparatus might be valuable for C and S band applications.

Keywords: Microstrip Antenna, Open Stub, Multiband and Gain

Introduction

The quick advancement of the remote correspondence frameworks is at present seen in the microwave band. Since for recent many years, the microstrip recieving wires (MSA) have acquired prevalence in view of their inalienable highlights like light weight, minimal effort, straightforward plan and ability to reverberate at more than one recurrence groups[1-2], which can stay away from the utilization of various radio wires for various remote applications. Microstrip radio wires (MSAs) are finding expanding applications on account of their natural highlights, for example, planar, light weight, low profile, simple manufacture, similarity with MMICs, roughness, ease and so forth. Current correspondence frameworks, for example, WLAN, WiMax and HIPERLAN/2, frequently require reception apparatuses equipped for working at least two discrete recurrence groups with better addition which can dodge the utilization of various receiving wires. Thus it has become expected zone for the microstrip

receiving wire architect to meet these necessities. The methods accessible in the writing for the acknowledgment of multiband tasks of microstrip radio wires are by cutting openings of various calculations like necktie, rectangular, square ring, and so on the emanating patch. Additionally, the techniques proposed in the writing for the upgrade of gain of microstrip reception apparatuses are utilization of parasitic fix, utilization of cluster receiving wire. These techniques are viable at the expense of expansion in the size and thickness of the receiving wire. Yet, in this paper a straightforward method has been proposed utilizing single layer planar math containing open stubs set at the two inverse corners of the fix for multiband activities. By changing the components of open stubs, receiving wire shows a tunable property. This technique also improves the gain when contrasted to the gain of the conventional microstrip antenna intended for the same resonant frequency.

Related Work

Multi-Band Configurations of Stub-Loaded Slotted Rectangular Microstrip Antennas: Triple-band rectangular microstrip radio wires utilizing mixes of an open-circuit almost quarter-frequency stub, a resounding U-space, a couple of rectangular openings are proposed. Another arrangement for a visit band reception apparatus has been acknowledged by cutting two half U-openings inside a stub-stacked rectangular microstrip fix. The multi-port organization models for these radio wires are additionally proposed, which help in breaking down the mode circulations at different frequencies. The multi-band reaction has been tentatively checked, close arrangement was gotten among the mimicked, estimated, hypothetical outcomes.

Analysis of stub loaded rectangular microstrip antenna: In this paper, a detail investigation for the impact of stub on the double band reaction of rectangular microstrip radio wire is introduced. The surface current circulations and the reverberation bend plots were examined. It was seen that the stub changes the central and higher request symmetrical mode reverberation frequencies of the fix and acknowledges double recurrence reaction. With an increment in stub length the headings of surface flows are changed, which gives broadside radiation design at the double frequencies. The detailing of thunderous length at double frequencies regarding stub measurements is proposed and they concur inside 5% with that of the mimicked results. Formulation of Resonant Length for Triple Band Rectangular Microstrip Antenna: The triple band stub loaded U-slot or rectangular slot cut RMSAs are reviewed. The stub diminishes the reverberation recurrence of TM02 method of the fix and alongside TM10 mode yields double band reaction. Further, an examination to consider the impact of space on the triple band reaction in stub stacked rectangular miniature strip reception apparatus is introduced. The surface current dispersions and radiation design plots were considered. The U-space or rectangular opening lessens the reverberation recurrence of next higher request TM12 method of the fix and alongside the changed TM10 and TM02 modes yields triple band reaction. By examining the surface current disseminations, a definition in full length at changed TM10, TM02 and TM12 modes is proposed. The frequencies determined utilizing the proposed definitions concurs intimately with recreated results with % mistake under 5% over the total opening length range.

Slot loaded rectangular microstrip antennas for tunable dual band operation. In this paper microstrip reception apparatuses (MSA) are stacked with solid stubs, shorting pins or openings, the electrical thunderous length of the fix gets altered and consequently tunable, different recurrence receiving wires can be figured it out. As a stub projects from the outskirts of the fix, this design consumes more space. Consequently, where minimal double recurrence radio wires are required, cutting openings in the fix is more reasonable. Utilizing both CIM and IE3D, we hypothetically dissect a rectangular microstrip receiving wire (RMSA) inserted with a rectangular opening along the non-emanating edge of the fix, yielding double recurrence activity with a main side radiation design. The opening alters the resounding length of the major method of the straightforward RMSA and presents another full mode like TM/ sub 11. The impacts of space measurements and opening area on both reverberation frequencies have been explored. The proposed design is tunable for fitting decision of the space length and area of the opening. The re-enactment results have been checked tentatively and the hypothetical reverberation frequencies are inside 1.5% of the deliberate qualities.

Open Multi-Slot Wideband MIMO Antennas with Microstrip Feed Line for 4G LTE: A couple of microstrip line-took care of open multi-space radio wires are introduced for activity in 4G LTE groups. Two open spaces are utilized for shaping this open multi-space design: one roundabout opening open at one side and one rectangular space ended in the roundabout space with opposite end open. The open multi-space reception apparatus is energized by a microstrip line stacked with round tuning nails on the underside of the dielectric substrate. Two radio wires work freely for Multiple-Input Multiple-Output (MIMO) interchanges and cover a recurrence range from 800 MHz to 4.25 GHz. The receiving wire exhibits 137% fragmentary data transmission with great variety execution.

Modified C-shape microstrip antenna for dual and broadband response: Fundamental and higher order

modes of C-shape patch are discussed and their comparison against the resonant modes of equivalent rectangular patch is presented. Resonant length formulation for C-shape patch at its higher order mode is proposed. The frequency calculated using the same closely agrees with the simulated frequency. A new configuration of C-shape microstrip antenna loaded with step width open circuit stub is proposed for broadband and multi-band response with dual polarization. The addition of open circuit stub modifies the resonance frequency of second order C-shape patch mode which together with fundamental patch mode yields bandwidth of around 32 MHz (~4%) on thinner substrate. The stub modifies the surface current distribution at second order mode that gives broadside radiation pattern over the bandwidth. With respect to next higher order C-shape patch modes, stub loaded patch yields dual polarized multi-band frequency response with broadside radiation pattern at each of the frequencies. Bandwidth of nearly 2% is obtained at each of the multi-band frequencies.

Improving Isolation of Open Multi-Slot 4G Antennas with Microstrip Feed Line for MIMO Applications: A dual multi-slot microstrip line-fed antenna with circular tuning stubs is presented in this paper. The two antennas may be used independently for MIMO communications and cover a frequency range from 800 MHz to 4 GHz. The slots used include one circular slot and one rectangular slot fed by a microstrip line with circular tuning stubs on the opposite side of the dielectric substrate. A cut in the ground plane is introduced to increase the isolation between the two antennas.

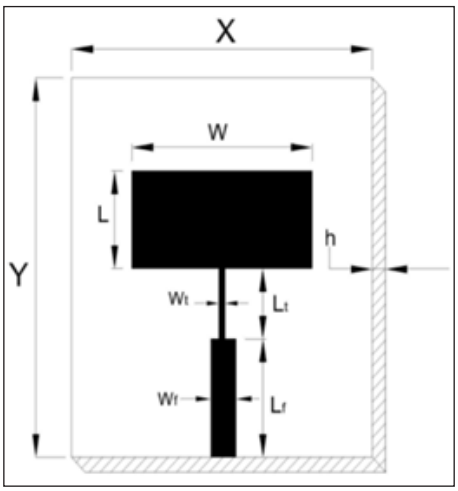

Figure 1.Top View Geometry of CRMSA

Design Consideration

The proposed antenna has been realized from conventional Rectangular Microstrip Antenna (CRMSA) designed for the frequency of 3.2 GHz. The geometry of CRMSA is as shown in above Figure 1. The radiating patch with size W x L is etched on glass epoxy substrate material of dielectric constant εr = 4.2 and tan δ = 0.02, having dimension of X x Y with thickness h = 0.16 cm. A simple 50Ω microstripline feed structure of length Lf and width Wf is used to excite the antenna at the center of the rectangular radiating patch. The quarter wavelength matching transformer of length Lt and width Wt is used to match the impedance of microstripline feed and radiating patch.

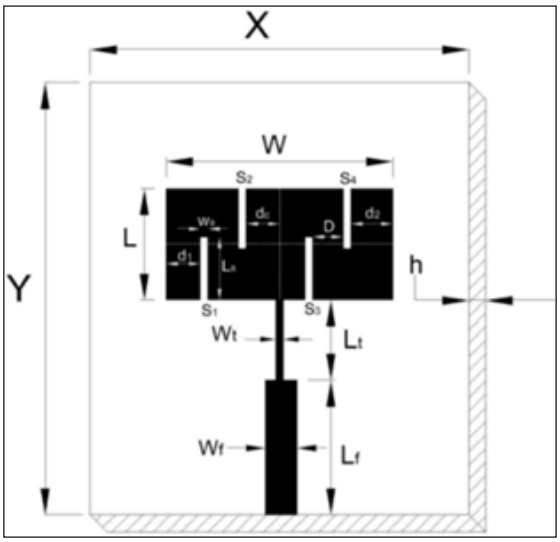

Figure 2.Top View Geometry of OSRMSA

The arrangement of OSRMSA is appeared in Figure 2. All the open stubs from S1 to S4 are of same length Ls and width Ws. The open stubs S1 and S3 are embedded vertically from the base side of the emanating edge of the fix, while the open stubs S2 and S4 are embedded vertically from the top side of the transmitting edge of the fix. All the stubs are expanded with the end goal that they are oppositely crossing the middle hub of the fix by a distance of 0.18cm. The distance D between adjoining nails S1, S2 and S3, S4 is 0.4cm. The distance of S2 and S3 from the middle hub is dC = 0.4cm. The distance between the stub and edge of the fix is taken as d1 = 0.255cm and d2 = 0.255cm. The designed parameters of CRMSA and OSRMSA are shown in Table 1 and Table 2, respectively.

Table 1.CRMSA

Parameters	Unit (mm)
X	5.3
Y	9.82
W	2.91
L	2.24
wf	0.317
Lf	2.183
Wt	0.078
Lt	1.372
h	0.16

Table 2.OSRMSA

Parameters	Unit (mm)
WS	0.2
LS	1.3
D	0.4
d1	0.255
d2	0.255
dc	0.4

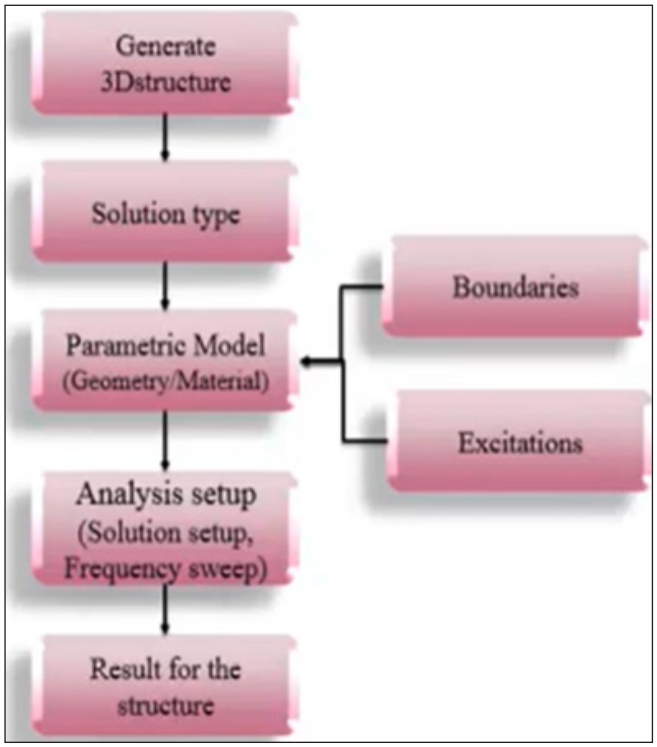

Figure 3.Flow Diagram of Proposed System

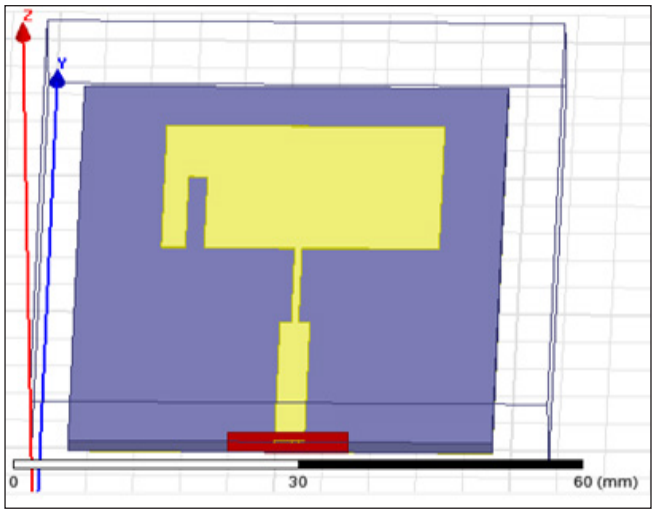

Figure 4.One Stubs Proposed Design

Result and Analysis

From Figure 4 to 24, shows different geometry views and its respective parameters like Directivty, Radiation pattern, Gain, Return loss.

Directivity

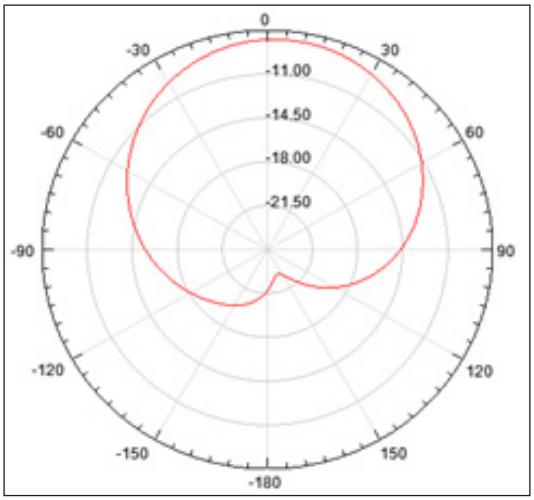

Figure 5.One Stubs Proposed Design Directivity

Radiation Pattern

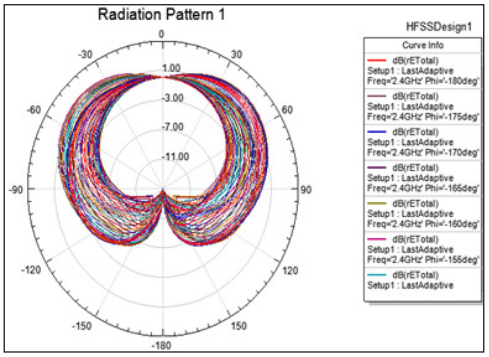

Figure 6.One Stubs Proposed Design Radiation Pattern

Polar Plot

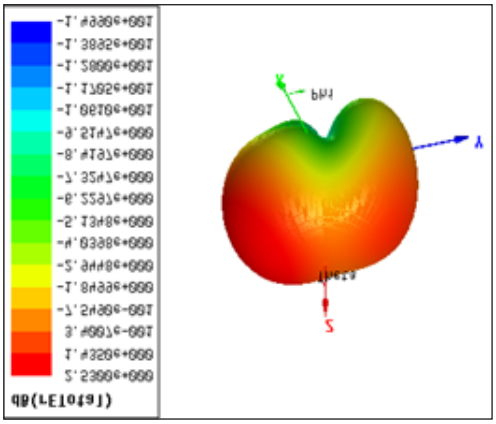

Figure 7.One Stubs Proposed Design Polar Plot

Return Loss

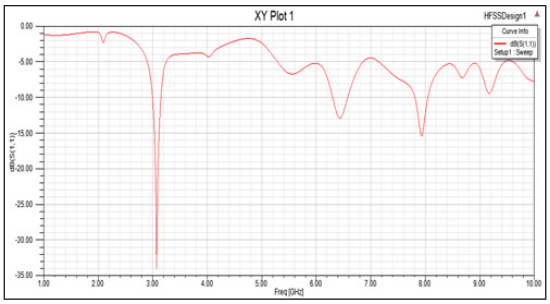

Figure 8.One Stubs Proposed Design Return Loss

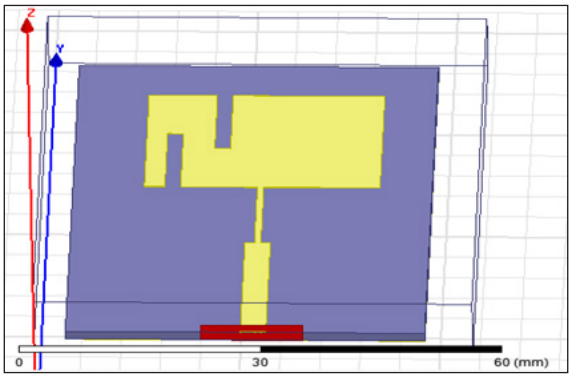

Figure 9.Two Stubs Proposed Design

Directivity

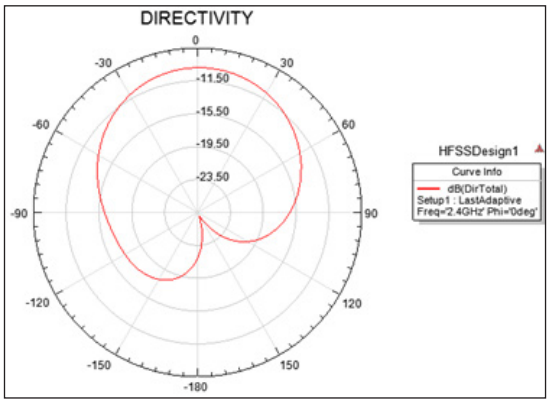

Figure 10.Two Stubs Proposed Design Directivity

Polar Plot and Gain

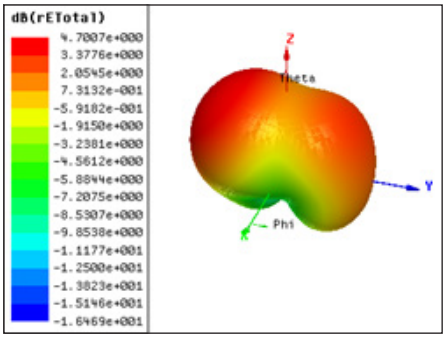

Figure 11.Two Stubs Proposed Design Polar Plot

Radiation Pattern

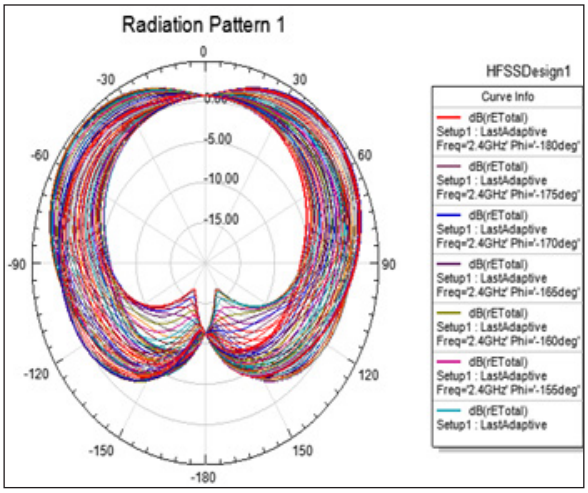

Figure 12.Two Stubs Proposed Design Radiation Pattern

Return Loss

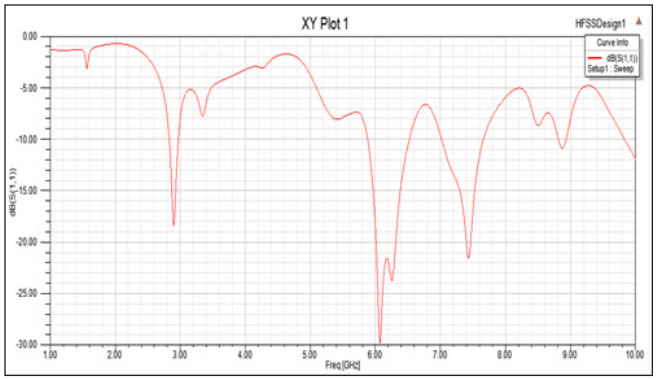

Figure 13.Two Stubs Proposed Design Return Loss

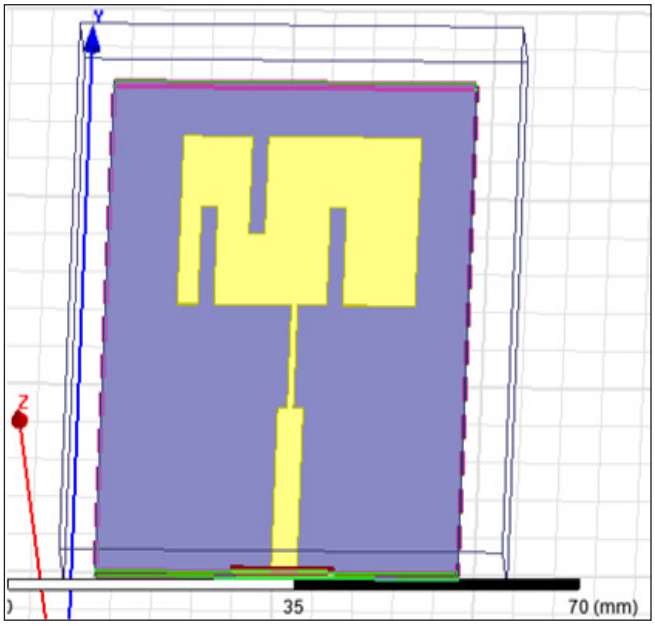

Figure 14.Three Stubs Proposed Design

Directivity

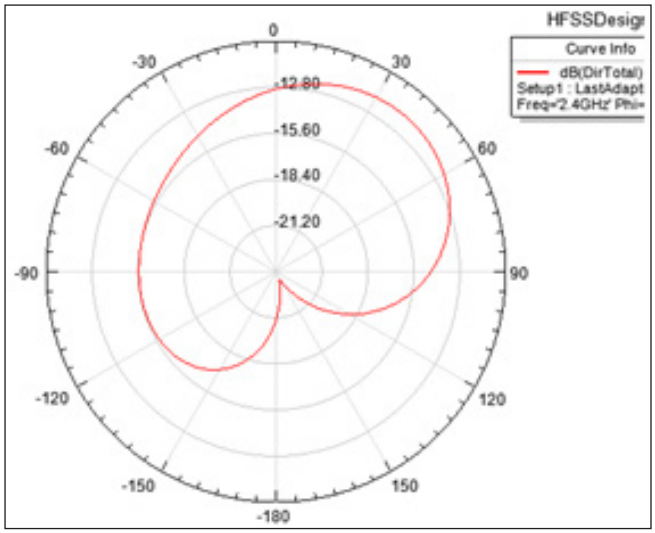

Figure 15.Three Stubs Proposed Design Directivity

Radiation Pattern

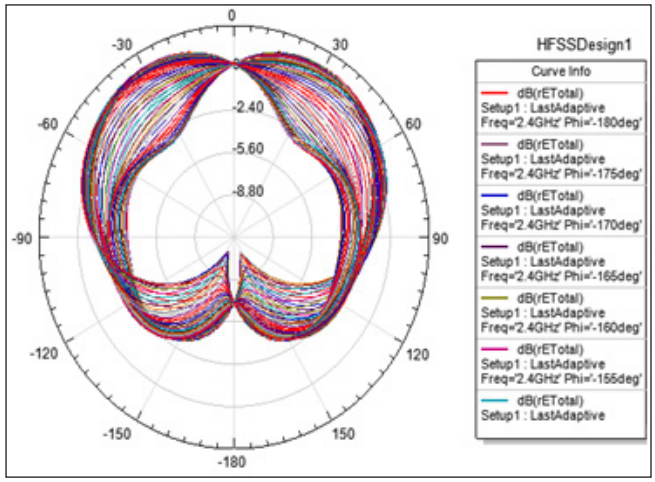

Figure 16.Three Stubs Proposed Design Radiation Pattern

Polar Plot and Gain

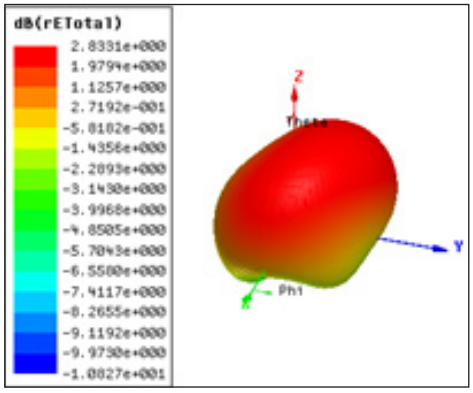

Figure 17.Three Stubs Proposed Design Polar Plot and Gain

Return Loss

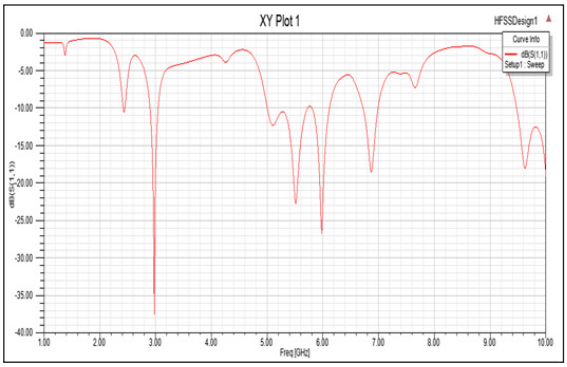

Figure 18.Three Stubs Proposed Design Return Loss

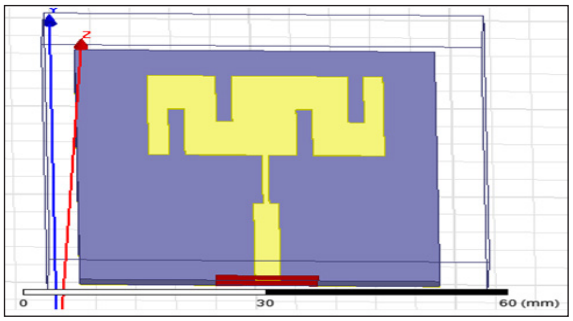

Figure 19.Four Stubs Proposed Design

VSWR

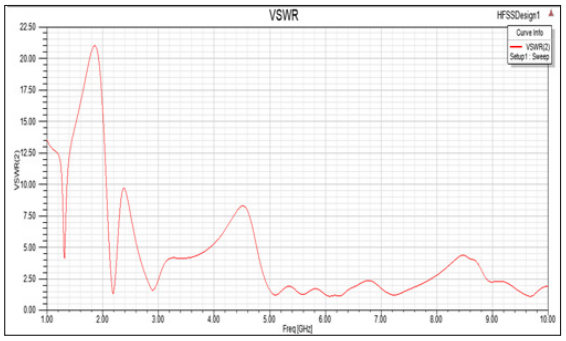

Figure 20.Four Stubs Proposed Design VSWR

Directivity

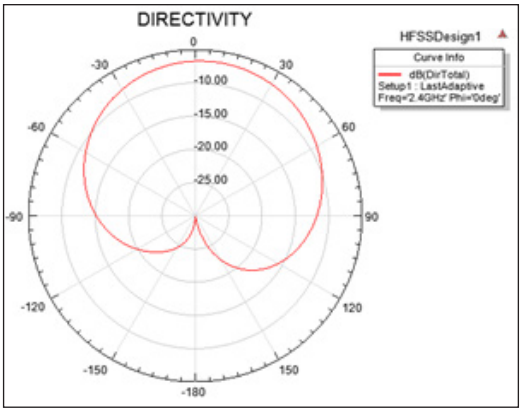

Figure 21.Four Stubs Proposed Design Directivity

Radiation Pattern

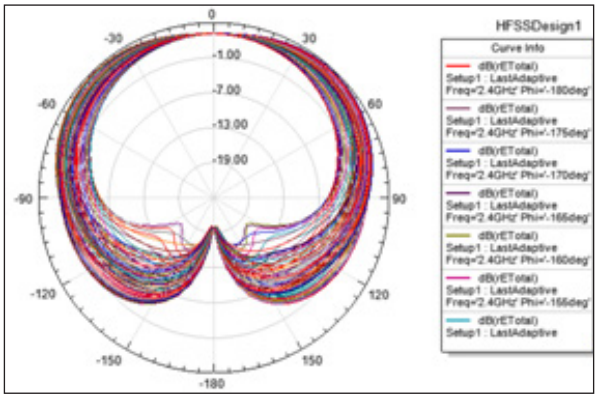

Figure 22.Four Stubs Proposed Design Radiation Pattern

Polar Plot and Gain

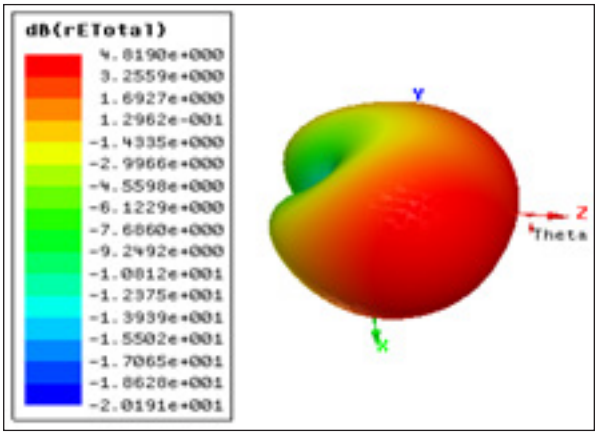

Figure 23.Four Stubs Proposed Design Polar Plot and Gain

Return Loss

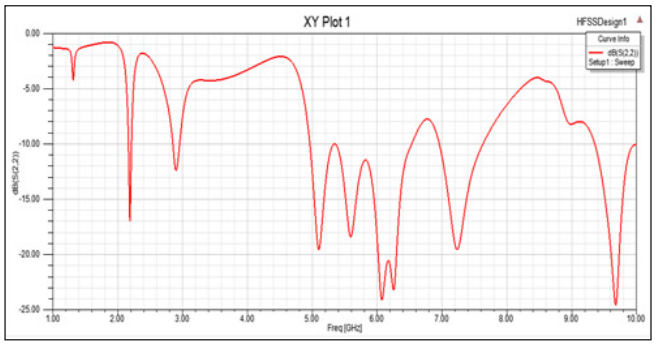

Figure 24.Four Stubs Proposed Design Return Loss

Conclusion

The designed antennas CRMSA and OSRMSA are studied and discussed. The proposed antenna resonates between 2.23 GHz to 9.93GHz. The introduction of open stubs make the OSRMSA to show multiband operation with a maximum gain of about 4.81GHz and better broadside radiation characteristics The design method is simple and this antenna may be useful for C and S applications.

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