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Analysis of Rectangular Micro Strip Antenna Operating at 2.45 Ghz and 5.2 Ghz for WLAN Application using FR4 Substrate

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Abstract:This paper presents an experimental miniaturized rectangular microstrip antenna operating at both 2.45 GHz and 5.2 GHz frequency bands. Antenna element excitation amplitudes are taken to be constant. The obtained radiation patterns provide effective communication. Units of the system are presented in detail and their architecture is explained. A phase calibration is used to re-establish the system. Measurements of radiation patterns is presented and are compared with calculated patterns.
Keywords: Microstrip, patch antenna, WLAN, radiation patterns.

1. INTRODUCTION:

Wireless local area network (WLAN) is an innovation which consolidated PC network with wireless correspondence innovation. The 2.4 GHz recurrence band in the Industrial Scientific Medical (ISM) band can be utilized in the WLAN condition. Due to the advancement of wireless correspondence innovation and the utilization of the recurrence groups without the requirement for approval, the use of WLAN is winding up increasingly more broad being basic piece of the WLAN framework, the recieving wire ought to be basically adjusted to the improvement of WLAN correspondence innovation.

2. ABOUT HFSS:

HFSS is a High Frequency Structure Simulator .It is superior full wave electromagnetic field test system 2D planar and 3D volumetric latent gadget demonstrating which takes focal points of commonplace Microsoft windows GUI(Graphical User Interface). It incorporates recreation representation strong demonstrating and robotization in simple strides with a procedure to learn condition.
Double recurrence microstrip radio wires with the utilization of electromagnetic reproduction programming High Frequency Structure Simulator (HFSS). The two radio wires receive customary FR4 material as a dielectric substrate, with the benefits of ease and little size. The principal recieving wire receives microstrip line encouraging, and the radio wire radiation fix is made out of a collapsed rectangular emanating dipole which diminishes the reception apparatus size, and two symmetrical rectangular patches situated on the two sides of the rectangular transmitting patch.
Another recieving wire is a microstrip fix reception apparatus bolstered by coaxial line, and the span of

the radio wire is lessened by opening a ventured notch on the two edges of the fix and a collapsed space inside the fix. Recreation tests demonstrate that the two planned reception apparatuses have a higher addition and an ideal transmission trademark in the working recurrence go, which is as per the prerequisites of WLAN correspondence which can be reached out to RADAR and GPS applications even.

3. MICROSTRIP ANTENNA:

Minimal effort, low profile and are effectively created so it is commonly utilized in portable applications. Essentially Microstrip component comprises of ground plane and a territory of metallization over the ground plane alongside help combinely named as Microstrip fix which is fundamentally comprising all attributes of reception apparatus. The supporting component is called as substrate material which is set between the fix and the ground plane. By and large the execution qualities of the reception apparatus relies upon the substrate material and its physical parameters.
Microstrip reception apparatuses are regularly utilized where shortcoming and adaptation capacity to the host surfaces are the key necessities since the fix recieving wires can be straightforwardly imprinted on to a circuit board. These are winding up increasingly mainstream in the cell phone showcase.

4. FEATURES:

- They are simple to fabricate, easy to modify and customize and closely related to microstrip antennas.

- Microstrip patch antenna consists of a radiating patch on one side of a dielectric substrate which has a ground plane on the other side.
- It may have square, rectangular, circular, triangular or elliptical shape.Theoretically it can be of any other continuous shape.The most common used geometry is rectangular.
- Square patches -Pencil beam
- Rectangular patches-Fan beam
- The size of micro strip antenna is inversely proportional to frequency

5. CONSTRUCTION:

Patch antenna consists of a rectangular metal patch on a dielectric coated ground plane -usually a very thin metallic patch placed on a small fraction of wavelength above a ground plane .The strip and the ground plane are separated by a dielectric sheet.
The radiating element and the feed lines are usually photo etched on the substrate. The feed line also is a conducting strip of smaller width. Linear and circular polarization can be obtained with micro strip antennas. As the thickness of microstrip is very small the wave generated within the dielectric substrate under reflection to some extent when they arrive at the edge of the strip.

6. LIMITATIONS:

- Very inefficient as only a small fraction of energy is radiated behaves more like a cavity rather than radiation.
- Very narrow frequency bandwidth mainly controlled by characteristics of parallel plate transmission line.
- Single or multiple feeds can be used to increase directivity.

7. DESIGN PROCEDURE:

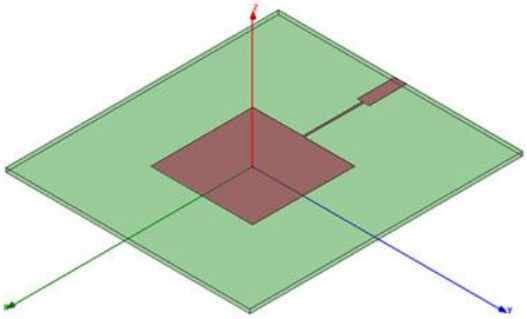

Fig1. Micro strip antenna design in HFSS

The designed antenna is an 2×1 linear array.The first step in the design is to specify the dimensions of a single microstrip patch antenna. In order to design insert HFSS design icon and click on it then a page will be displaced by 3 axes. It consist 6 tools but we mainly use 2 tools. They are BOX and CYLINDER.

i) BOX: BOX is used for designing and drawing substrate.
ii) CYLINDER: It is used to give the co-axial field to antennas.
iii) Rectangle, **Circle, Polyhedron, Ellipse** The patch conductor can be assumed at any shape, but generally simple geometries like this which simplifies the analysis and performance prediction
iv) Among **Unite, Substract, Intersect, Spilt, Imprint** we mainly use unite and Substract. We use Unite to unite 2 components or rectangle or 2 different patches. If you want to include rectangular slot to Substract 2 different patches
v) Select desired **Material**
vi) PANNEL: For moving antenna
vii) ROTATE: For viewing each and every side of antenna.
viii) We use Undo, Redo to go to the previous step.
ix) Units we use to draw the antenna are **mm** only as antennas are of small size.
x) For designing an antenna choose a desired application (frequency should be known).
xi) Components: Substrate, Ground, Patch.
xii) For drawing a substrate: We use box. Click on box and place it in the centre and then drag it.
xiii) Main think to consider while drawing substrate is that thickness because results may vary. The thickness to be considered is **1.6mm**.
xiv) For drawing Ground alone you have to choose rectangle and draw it. It should be always at the bottom i.e., on the substrate.
xv) Patch should be always on the top of substrate. For drawing patch we can choose any tool.
xvi) To create a transmission line/feedline
Rectangular patch element is chosen as the array element (as commonly used in microstrip antennas).
Fix trademark parameters are the length L, the width w, and the thickness h. To meet the underlying structure prerequisites (working recurrence = 2.45 GHz, and shaft width = 90) different diagnostic rough methodologies might be utilized.
The length and width of the fix are determined at first by the connections demonstrate the geometry utilizing microstrip fix reception apparatus number crunchers of inset feed microstrip exhibit radio wire with two fixes in the cluster. The fix is empowered electromagnetically utilizing 50 ohm SMA connector.
An inset feed smaller scale strip recieving wires is intended to resound at 2.45 GHz recurrence with dielectric consistent (εr) = 4.4, substrate thickness h=1.588 mm, L=6 mm, W=8.88 mm on a ground plane. All components of the radio wire are in mm.
Give us a chance to consider single fix recieving wire is structured with fix measurements L = 28.8662 mm, W =37.2600 mm for reverberating recurrence of 2.45 GHz. The transfer speed for the recieving wire is

around 2GHz . Agent results for the VSWR reaction, S-parameter and radiation designs.

8. RESULTS:

HFSS is used for simulation and various parameters of micro strip antenna are found using this.

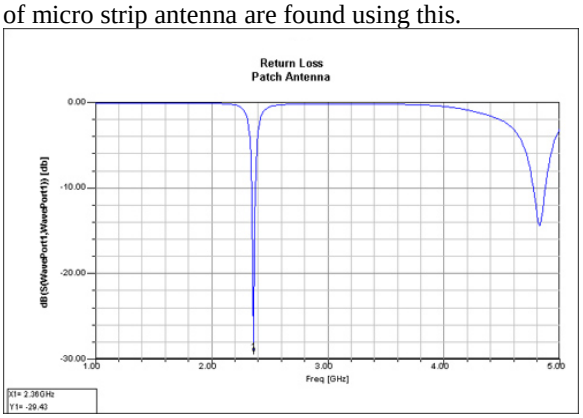

Fig 2: Return of Micro strip antenna at 2.4 GHz

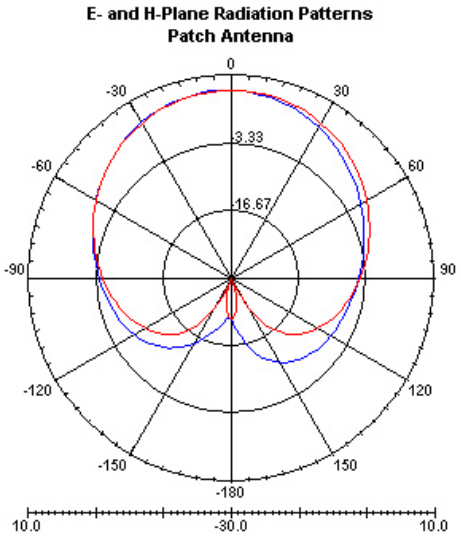

Fig 3: E -plane (blue) and H -plane (red) far -field patterns.

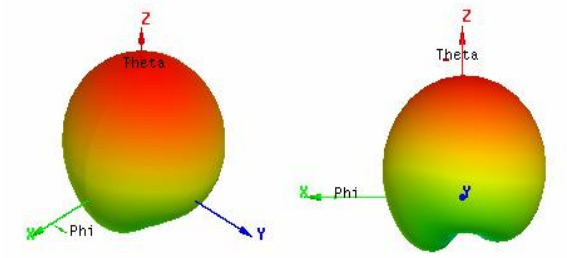

Fig 4: Three -dimensional(3D) far -field patterns.

9. CONCLUSION AND FUTURE OUTLOOK

An experimental miniaturized Dual-Band microstrip patch antenna is developed in this Paper.The use of operating at both 2.45 GHz and 5.2 GHz frequency bands. If processing to control of radiation pattern characteristics is been monitored. Framework gives radiation designs steerable primary projections and nulls at pre-indicated positions inside the azimuth district 0◦ ↔ 180◦.The plausibility of utilizing the created scaled down double band microstrip fix reception apparatus for WLAN and a lot all the more intriguing applications being considered.

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