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A SWITCHABLE NEAR /FAR- FIELD READER ANTENNA FOR RADIO FREQUENCY RFID APPLICATIONS

R.Ragavi, C. Rajanandhini
Department of Electronics and Communication Engineering
Periyar Maniammai Institute if Science and Technology
Vallam, Thanjavur-613403, India
ragaviragavi1996@gmail.com

Abstract
In this paper a switchable FF (Far field) and NF (Near Field) RFID reader antenna with the proposed. Here four dipole switchable antenna array with reconfigurable feeding network. This leads to strengthen the intensity of the magnetic field in NF zone and improve the FF gain. Here the reconfigurable feeding network is by switching state of PIN diodes. Here PIN diodes, utilized to change phase delay in propagation path so as to change the phase. The antenna is composed of a dipole array and a segmented loop coupled inside. The antenna can generate strong and uniform magnetic field distribution in NF region and high FF gain the antenna possesses good performance in both NF and FF region when the feeding network works at corresponding mode.
Keywords— RFID, Far Field, Near Field

I. INTRODUCTION

An antenna may be a device to transmit and/ or receive magnetic force waves. Magnetic force waves are typically started as radio waves. Most antenna are resonant devices, that operate with efficiency over a comparatively slim wave band. An antenna should be tuned (matched) to identical wave band because the radio system to that its connected, otherwise reception an/or transmission are going to be impaired. In reception an antenna intercepts some of the power of a radio wave in order to produce [1] antenna may be designed to transmit and receive radio waves altogether horizontal directions equally (omnidirectional antennas), or preferentially in a very explicit direction (direction or high gain antennas). An antenna may include parasitic component, parabolic reflectors or horns that serve to direct the radio waves onto beam or alternative desired graphical record. Voltage wave magnitude relation (VSWR) is a sign of the standard match. VSWR is usually abbreviated as SWR. A high VSWR is a sign the signal is mirrored before being radiated by the antenna. VSWR and mirrored power are alternative ways of measuring and expressing identical issue. Information measure may be outlined in terms of radiation pattern or VSWR /reflected power. If information measure is expressed in absolute units of frequency in question are close to 150MHz,450MHz or 825MHz[1].

Percentage as information measure is outlined as,

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FH- FL/ FC BW=100
FH is that the highest frequency within the band
FL is that the lower frequency within the band
FC is that the center frequency of the band

Directionality is that the ability of antenna of focus energy in a very explicit direction once transmittal or to receive higher from a selected direction once receiving. There's a relationship between gain and directionality. We have a tendency to see the phenomena of accumulated directionality once comparison light weight bulb to a spotlight 100-watt concentration is going to offer a lot of light in a very explicit direction than a 100-watt light bulb and fewer light in alternative directions. We have a tendency to might say the spotlight has a lot of directionality than the sunshine bulb. The spotlight resembles an antenna with accumulated directionality. Gain is that the sensible worth of the directionality. The relation between gain and directionality includes a replacement parameter (η) that describes the potency of the antenna [2].

$G = \eta . D$

One methodology of measuring gain is to check the antenna beneath check against a illustrious common place antenna this is often called a gain transfer technique. At lower frequencies, its convenient to use a half wave dipole because the common place with gain usually expressed in dBi. Radiation or antenna pattern describes the relative strength of the radiated field in varied directions from the antenna at a relentless distance. The graphical record may be reception pattern in addition, since it conjointly describes the receiving properties of the antenna. The graphical record is three dimensional, however its tough to show the three dimensions graphical record in a very significant manner. Its conjointly long to live a three dimensional graphical record. Beam dimension describes the angular aperture wherever the foremost vital a part of the facility is radiated.

The graphical record of an antenna maybe a plot of the far-field radiation properties of an antenna as a operate of the abstraction co-ordinates that are such by the elevation angle (θ) and azimuth angle(φ). A lot of specifically it's a plot of the facility radiated from an antenna per unit angle that is nothing however the radiation intensity. It may be planned as a 3D graph or as a second polar or mathematician slice of this 3D graph. Its an especially parameter because it shows the antenna's directionality in addition as gain at varied points in area. Antennas may be classified in many ways that a way is that the waveband of operation. Others embody organic structure and electrical/electromagnetic style. A antenna may be a straight electrical conductor measure half wavelength from finish to finish and connected at the meddle to a radio-frequency (RF) feed line. This antenna, additionally referred to as a jacket, is one among the only sorts of antenna, and constitutes the most RF diverging and receiving part in numerous refined sorts of antenna[3].

Microstrip antenna typically means that an antenna fictional microstrip techniques on a computer circuit board and antenna consists of a patch of metal foil ground plane on the opposite facet of the board. Most microstrip antennas include multiple patches during a two-dimensional array [4]. Horn antenna aimed back at the middle of the reflective dish. The

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reflector contains a diameter of a minimum of many wavelength. Because the wavelength will increase, the minimum needed dish diameter becomes larger[5] Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically-stored information. Passive tags collect energy from a nearby RFID reader's interrogating radio waves. Active tags have a local power source (such as a battery) and may operate hundreds of meters from the RFID reader. RFID-tagged pharmaceuticals can be tracked through warehouses; and implanting RFID microchips in livestock and pets allows for positive identification of animals. RFID tags can be either passive, active or battery-assisted passive. An active tag has an on-board battery and periodically transmits its ID signal[6]

II . METHODOLOGY

A. Antenna design

The most common models for the analysis of microstrip patch antennas area unit the conductor model, cavity model, and full wave model (which embrace primarily integral equations moment method). The conductor model is that the simplest of all and it provides sensible physical insight however its less correct. The cavity model is additional correct and offers sensible physical insight however is complicated in nature. The complete wave models area unit very correct versatile and might treat single components, finite and infinite arrays, stacked components, arbitrary formed components and coupling. it should be noted that in this paper targeted on the conductor model and uses all of the empirical equations this model relies on for simulations. The cavity model isn't at the center in this paper and therefore explained terribly shortly. The strategy of moments is explained very well because it is employed by many field solvers (such as HFSS) for simulations

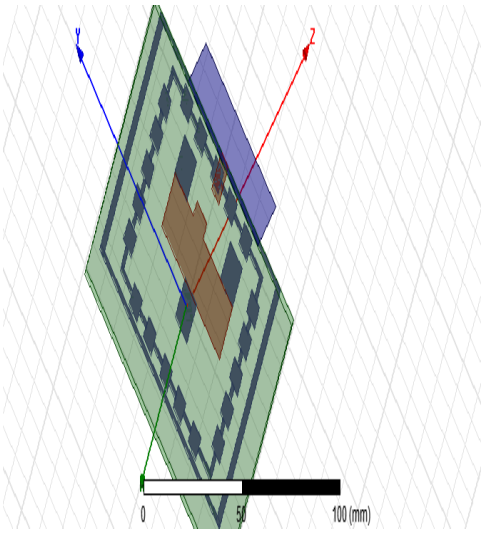

Figure 2.1 Near/Far field Reader Antenna for UHF RFID shown in figure 2.1 in the software part of our paper turned around determination of the radiation diagram and come loss curve of many easy rectangular patch antenna. From the cable model of patch antenna it's clear that the essential parameters

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for the planning of a microstrip patch antenna square measure frequency of operation (f_o) and also the resonant frequency of the antenna should be chosen befittingly.the inslutor constant of the substae (ε_r). a substrate with a high insulator constant reduces the size of the antenna. Height of insulator substrate (h) For the microstrip patch antenna to be utilized in bound applications (such as cell phones) it's essential that it's not large and to make sure this the peak of the insulator substrate can't be over a couple of milli meter. This model represents the microstrip antenna by 2 slots of dimension W and height h, separated by a cable of length L. the microstrip is basically a non homogeneous line of two dielectrics, usually the substrate and air. The cable model is applicable to infinite ground planes solely. However, for sensible concems, it's essential to possess a finite ground plane. The result of all the higher than three factors and also the position of feed purpose on antenna performance was studied by simulating many microstrip patch antennas [7]-[8].

B .HFSS Software

ANSYS HFSS could be a 3D magnetic force (EM) simulation package for planning and simulating high-frequency electronic merchandise like antennas, antenna arrays, RF or microwave parts, high-speed interconnects, filters, connectors, IC packages and computer circuit boards. Engineers worldwide use ANSYS HFSS to style high-frequency, high-speed physics found in communications systems, measuring device systems, advanced driver help systems (ADAS), satellites, internet-of-things (IoT) merchandise and different high-speed RF and digital devices. HFSS (High Frequency Structure Simulator) employs versatile solvers associated an intuitive GUI to allow you alone performance and deep insight into all of your 3D EM issues.

Through integration with ANSYS thermal, structural and fluid dynamics tools, HFSS provides a powerful and complete multi physics analysis of electronic products, ensuring their thermal and structural reliability. HFSS is synonymous with gold standard accuracy and reliability for tackling 3D EM challenges by virtue of its automatic adaptive meshing technique and sophisticated solvers, which can be accelerated through high performance computing (HPC) technology. The ANSYS HFSS simulation suite consists of a comprehensive set of solvers to address diverse electromagnetic problems ranging in detail and scale from passive IC components to extremely large-scale EM analyses such as automotive radar scenes for ADAS systems. Its reliable automatic adaptive mesh refinement lets you focus on the design instead of spending time determining and creating the best mesh.

This automation and guaranteed accuracy differentiates HFSS from all other EM simulators, which require manual user control and multiple solutions to ensure that the generated mesh is suitable and accurate. With ANSYS HFSS, the physics defines the mesh rather than the mesh defining the physics. ANSYS HFSS is the premier EM tool for R&D and virtual design prototyping. It reduces design cycle time and boosts your product's reliability and performance. Beat the competition and capture your market with ANSYS HFSS.

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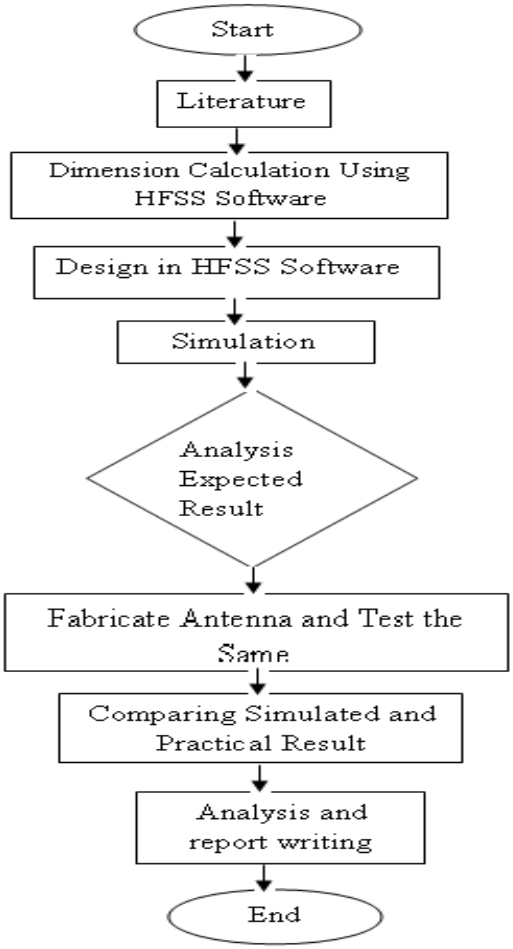
C.Methodology Explanation



In this paper, a oftenest identification (RFID) reader antenna designed for near-field and far-field operation at the European ultrahigh (UHF) band is given. Segmented loop technique is enforced for near-field operation, whereas a patch antenna is enclosed within the loop for far field operation. The operation frequency and radiation properties is changed by using PIN diode. Also, the antenna will add the near-field region having a flat magnetic distribution within the interrogation zone.A comparative study with alternative passive RFID reader typical antennas shows that the left-handed loop achieves stronger close to H-field with sensible resistance matching. Style details, simulated results and a invented model area unit given.

III RESULT AND DICUSSION

A. Return Loss

It is a parameter that indicates the quantity of power that's “lost” to the load and doesn't come as a mirrored image. Thence the RL may be a parameter to point however well the matching between

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the transmitter and antenna has taken place. merely place it's the S11 of an antenna. A graph of s11 of associate antenna vs frequency is termed its come loss curve. For optimum operating such a graph should show a dip at the operative frequency and have a minimum dB worth at this frequency. This parameter was found to be of crucial importance to our project as we have a tendency to wanted to regulate the antenna dimensions for a set operative frequency (say one.9 GHz). a straightforward RL curve is shown in figure 3.1.

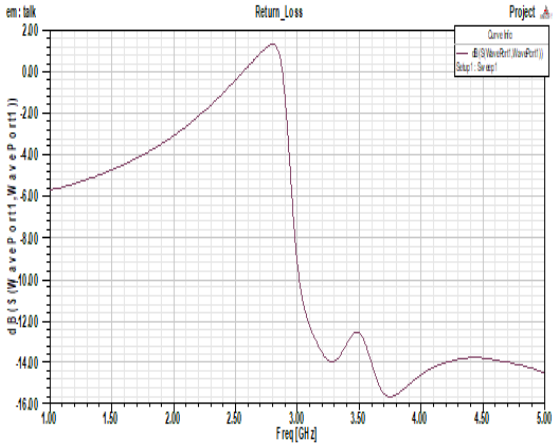

Figure 3.1 Return Loss

Return loss may be a amount typically used at intervals RF circuits wherever electrical resistance matching is very important. The come loss is that the proportion of a sign that's mirrored as results of associate electrical pair. The come loss approach is such as VSWR, voltage stationary wave magnitude relation, however it's wide utilized in applications whenever feeders aren't used, or they terribly short compare with a wavelength and thence the idea of standing waves isn't applicable usually come loss is employed in circuit applications, whereas VSWR is employed in association with feeders transmission lines. it's typically necessary to convert VSWR to come loss or come loss to VSWR. The conversion are often achieved quite simply victimization either easy formulas, or employing a table of values. Come loss and VSWR square (measure) each parameters accustomed measure the match between a feeder and a load though the two quantities are slightly totally different. The VSWR may be a live of the standing waves started in an exceedingly feeder as a results of a pair, whereas the come loss appearance at the quantity of power absorbed by a load once power from a supply is distributed The come loss being the distinction between the incident power and also the mirrored. Seeable of the overlap between the two quantities it's helpful to be ready to convert VSWR to come loss and come loss to VSWR[10]-[13].

A. 3D POLAR PLOT

The center of the patch is taken because the origin and also the feed purpose location is given by the co-ordinates (X_f,X_f) from the origin. The feed purpose should be set at that time on the patch. Whenever the input electrical phenomenon is fifty ohms for the resonant frequency. Hence an endeavour and error methodology is employed to find the feed purpose. For various locations of the feed purpose, the come loss (RL) is compared which feed purpose is chosen wherever the RL is most negative. There exists some extent on the length of the patch wherever the RL is minimum. Thence during this style, Y_f was unbroken constant at zero and solely X_f was be varied to find the optimum feed purpose.

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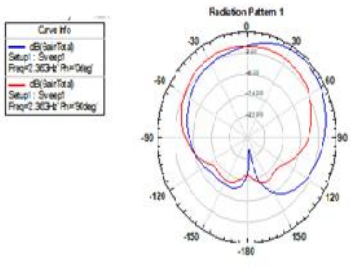
Figure 3.2 3D Polar Plot

Shown in figure 3.2 the first set of simulation results show the result of feed purpose on the come loss curve and graphical record. Once the microstrip patch antenna designed would be placed into a telephone, its orientation would be specified the Z axis would be parallel to the surface of the world. Figure 3.2 shown the 3D graphical record plots fir this simulation. From the figure it become clear to USA that the rear lobe sticking into the cellular phone had to be created as little as attainable and also the main lobe had to be dilated to make sure higher transmission. To make sure this we have a tendency to varied h and ε_r till this occurred. Within the method the result of those parameters on patch dimensions, RL curve and graphical record was studied. These simulation results for this patch and a pair of alternative patches area unit given later during this report. The first induction to the software used for the simulation is presented [14]-[17].

A. Radiation Pattern

Once the antenna sort has been designed and therefore the parameters for the antenna are entered the program calculates the E and H field patterns from this information. The mail program passes off the entered parameter into the acceptable module to perform the sphere and parameters calculation. By employing a modulator system adding new options like new components or arrays, become an arrays, become an easy matter of loading the acceptable module. the then calculates the magnetic and phases of every field element at a user selectable range of points in θ (elevation), φ (azimuth) from the gather information. By variable the amount of points or the step size in every direction the user could increase or decrease the resolution of the pattern being generated. The save smooth, and permits for fine detail once the pattern is additional advanced.



Radiation Pattern

The user may a additionally also for that format they want to examine the pattern displayed in either in a very linear relative format or in a very normalized dB format. Once the normalized dB front is chosen, the user might enter the dynamic vary for information to be shown in figure 3.3. Since in dB format the

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information will vary from zero all the way down to infinite, the way down to show even tiny fluctuations. One in every of the foremost helpful tools within the package permits for the mixture of plane cuts transparency settings for the displayed pattern. Once in every of the 3D plane cuts is chosen, the slider can go from simply showing tiny low slice of the pattern [18]-[19].

IV CONCLUSION

The planned antenna has the benefits of easy structure, low value and straight forward process. The antenna configution, working rule, simulated and measured results are between and mentioned. The antenna will generate sturdy and uniform field distribution in NF region and high FF gain. It proves the antenna possesses smart performance in each NF and FF region once the feeding network works at corresponding mode. We have a tendency to expect that those options of planned antenna are going to be helpful for close to filed RFID applications.

Future Research

The antenna can generate strong and uniform magnetic field distribution in NF region and high FF gain the antenna possesses good performance in both NF and FF region when the feeding network works at corresponding mode. We have future work on increase bandwidth, far-field gain.

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