NOVATEUR PUBLICATIONS
International Journal Of Research Publications In Engineering And Technology [IJRPET]
ISSN: 2454-7875
VOLUME 2, ISSUE 9, Sep. -2016

DESIGN OF CIRCULAR, SQUARE AND RECTANGULAR MICROSTRIP PATCH ANTENNA

MOHINI GONDHALEKAR (CHITALE)
PROF. NILIMA KOLHARE
Electronics & Telecommunication Department Government Engineering College Aurangabad,
MR. ANIRUDDHA KULKARNI

ABSTRACT:

In this paper the three different shapes for microstrip antennas had been analyzed in great detail to address modern generation need. While performing experiment microstrip antennas were preferred with transmission line model, cavity model and partly full wave model (which includes the primarily integral equations/moment method). Out of three transmission line model is the simplest and more important it possesses the good physical strength but it has a disadvantage of less accuracy. When compared to transmission line model cavity model is more accurate but its physical design is complex in nature. Best suited model will be full wave models they are extremely accurate versatile and can treat single elements, finite and infinite arrays, stacked elements, arbitrary shaped elements and coupling.

INTRODUCTION:

There are a number of parameters that are useful when simulating the MSA. These parameters are quite important in analyzing the energy that is delivered to the load in the form of radiation versus how much energy the source is producing. Ideally, the antenna impedance should match the characteristic impedance of the transmission line so that all of the source energy is available at the load for radiation.

When the load impedance does not match the characteristic impedance of the transmission line, part of the voltage will be reflected back down the line reducing the available energy for radiation. To analyze the performance of MSA, various parameters can be obtained using Ansoft's HFSS-13. The main parameters such as S11, gain, input impedance, 2-D & 3-D radiation patterns, E & H field distributions, current distribution and VSWR etc. are obtained using HFSS results options.Out of these various parameters only three parameters are measured practically i.e. S11, Smith chart & VSWR.

- **THE PARAMETER (S11)**

Power will not deliver to the load and it is returned back of the power, that is called loss, and this loss that is returned is called the return loss. Larger return loss indicates higher power being radiated by the antenna which eventually increases the gain. Basically, as patch antenna offers high Q factor, it is shown by narrow U-shape curves for three microstrip patch antennas resonating at 2.45GHz having a maximum return loss. As a standard practice, the value of S11 Should be less than (-10dB), considering 10 % reflection.

- **RADIATION PATTERN**

The radiation pattern is defined as "a mathematical function or a graphical representation of the radiation properties of the antenna as a function of space coordinates" The radiation pattern of microstrip Patch Antenna is the power radiated or received by the antenna in this case it is radiated. It is the function of angular position and radial distribution from the antenna.

The radiation pattern for three designed microstrip patch antenna is shown in figures. The only simulated results are shown figures.

- **GAIN**

The gain of the antenna is the quantity which describes the performance of the antenna or the capability to concentrate energy through a direction to give a better picture of the radiation performance. This is expressed in dB, in a simple way we can say that this refers to the direction of the maximum radiation. Figure shows the simulated result of gain of the proposed antenna. The maximum achievable gain is shown by red color shade and the side by chart gives numerical values. The only simulated results are shown figures.

- **VSWR**

The VSWR is an important specification for all communication devices. It measures how well an antenna is matched to the cable impedance where the reflection, $|\Gamma|= 0$. This means that all power is transmitted to the antenna and there is no reflection. Ideally VSWR should be 0. But in actual practice, it is in the range of 0-1 is considered good one. And values are considered satisfactory. The VSWR is also plotted versus frequency which is shown in figures.

SIMULATION RESULTS:

The following figures show the simulated parameters of three antennas (CMSA, square MSA and rectangular MSA. - The simulation results of rectangular patch antenna with water slab on it and with salt solution are shown below.- Additionally, simulated near E-field for water and salt solution are shown below.

SIMULATION RESULTS FOR CMSA:

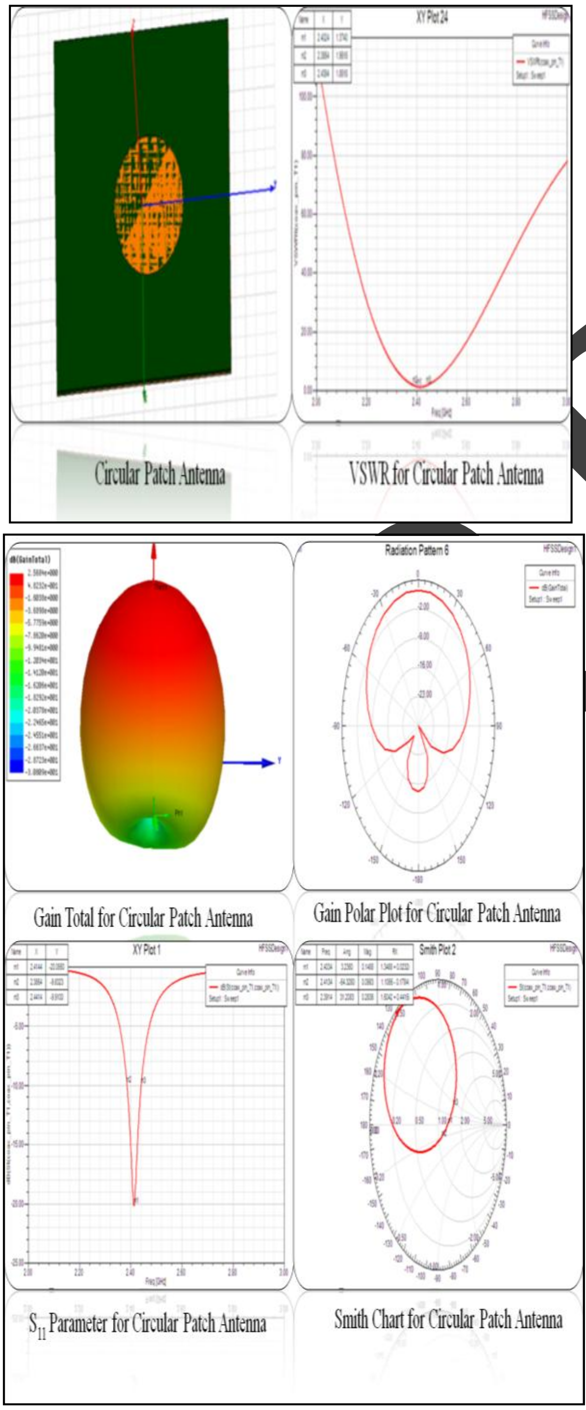

Fig. No. 1. Different simulation Results for CMSA

SIMULATION RESULTS FOR SQUARE PATCH ANTENNA:

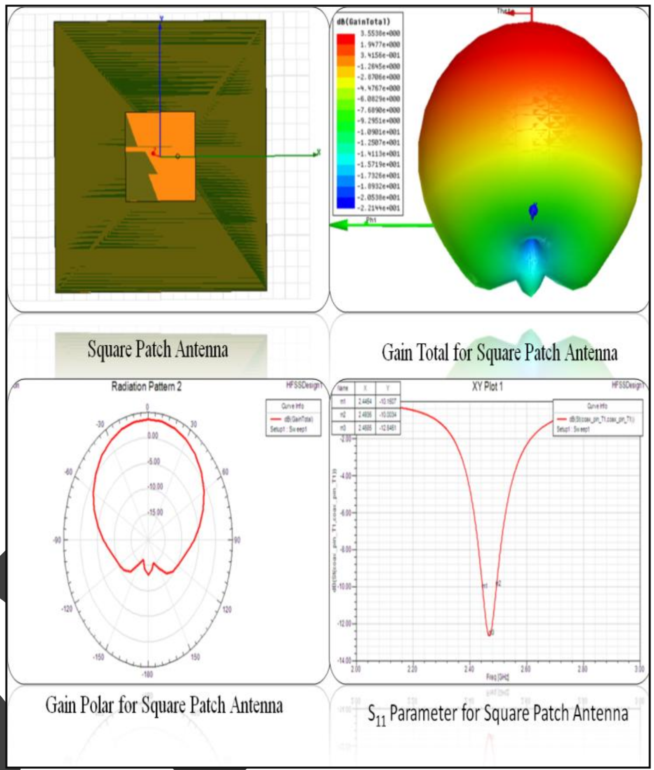

Fig. No.2. Various simulation Results for Square Patch Antenna

SIMULATION RESULTS FOR RECTANGULAR PATCH ANTENNA:

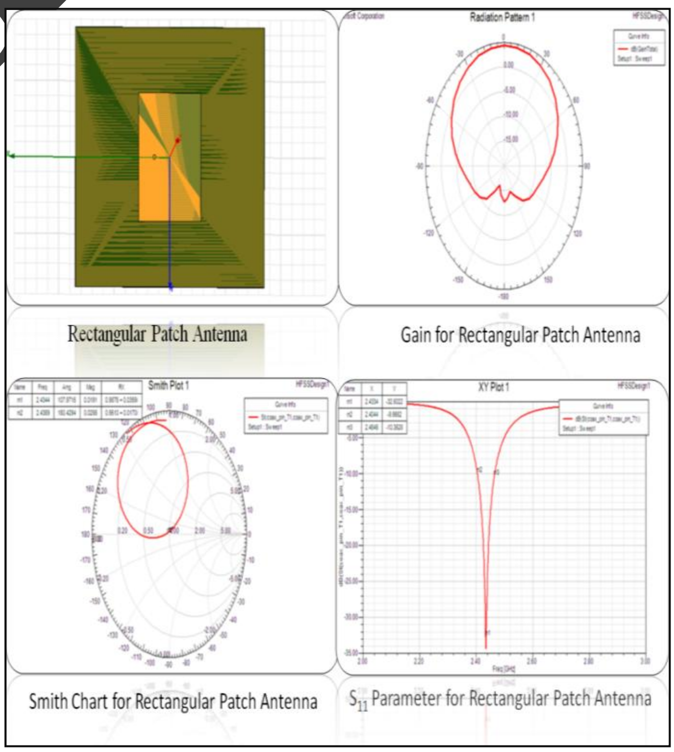

Fig. No.3. Various simulation Results for Rectangular Patch Antenna

DESCRIPTION OF THE SYSTEM SETUP FOR PERFORMANCE:

The System Setup consists of VNA, ZVH8 model, 8GHz of ROHDE & SCHWARTZ for the measurement of antenna parameters. The various parameters are measured using VNA.

PROPOSED EXECUTION STEPS OF THE SYSTEMS:

1. ANTENNA PARAMETER MEASUREMENT:

- Step1: Initially VNA port is calibrated.
- Step2: Using standard procedure Parameters are measured. Multiple marker frequencies were inserted while measuring different parameters.
- Step 3: The graphical representation is saved in .Set file & such files were saved in USB storage device. Then the .set files were opened using ZVH view software to analyze the results.

HARDWARE TESTING (PRACTICAL) RESULTS:

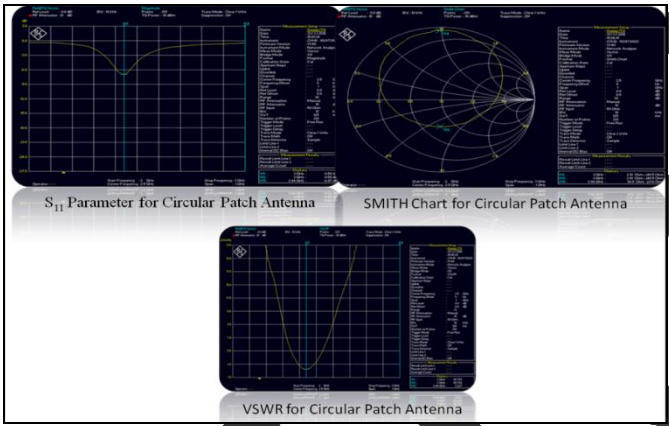

Fig. No.5. S_{11}, VSWR, Smith Chart Parameters for Circular Patch Antenna

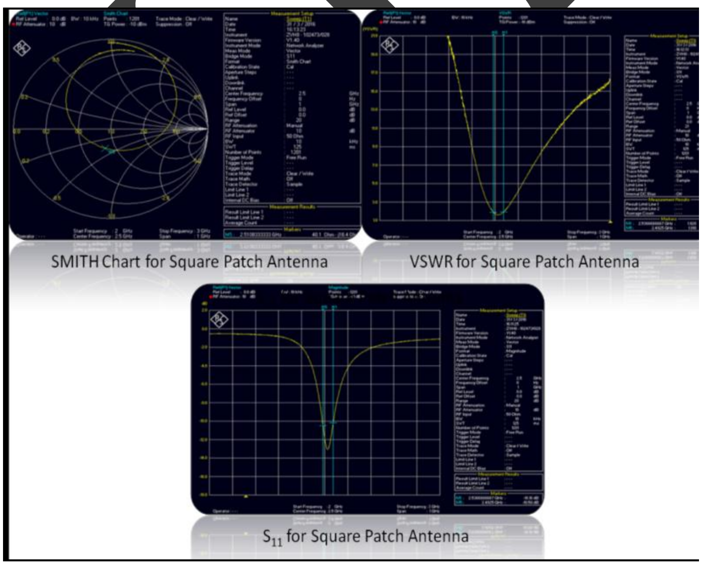

Fig. No.6. S_{11}, VSWR, Smith Chart Parameters for square Patch Antenna

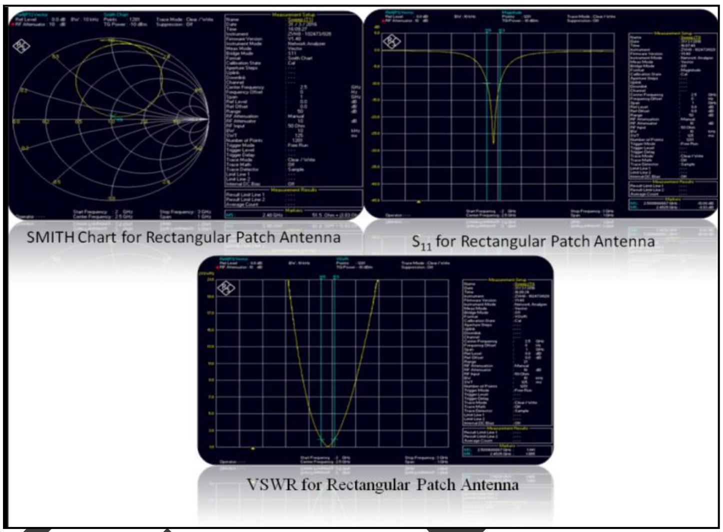

Fig. No.7. S_{11}, VSWR, Smith Chart Parameters for rectangular Patch Antenna

Table 1: Summary of Simulation and Actual Hardware Tested Result

Parameter of Antenna	Circular	Square			Rectangular	
	Simulation Results	Practical Results	Simulation Results	Practical Results	Simulation Results	Practical Results
MAX U	0.0012808		0.0011387		0.002164	
Peak Directivity	4.4235		5.2241		5.3895	
E-field	2996.2	------ ---	3028.7	------ ---	4042.5	------ ---
H-field	8.3214		8.5845		9.6493	
Gain	2.6		3.6		4.3	
S_{11} (dB)	-9.9	-6.9	-12.64	-10.5	-32	-10
VSWR	1.8		2.22	1.91	1.404508363	1.95

CONCLUSION:

Hardware for circular, square and rectangular types is made and different test were carried out and obtained results are listed in figures. From the obtained actual parameters of hardware testing of three antennas (CMSA, square MSA and rectangular MSA), it is seen that

For CMSA, S11 value is -6.9dB which less than -10 dB. The square MSA and rectangular MSA the practical results are in good agreement with simulated results.

REFERENCES:

1) R. G. Malech, "The reflectarray antenna system", 12th Ann. Antenna Symp. *USAF Antenna Res. Develop. Program*, University Illinois.
2) R. E. Munson, H. Haddad and J. Hanlen, *Microstrip reflectarray antenna for satellite communication and RCS enhancement or reduction*, Aug. 1987.
3) D. M. Pozar and D. H. Schaubert, Microstrip Antennas: The Analysis and Design of Microstrip Antennas and Arrays, 1995, IEEE Press.
4) F. J. Harackiewicz, Electromagnetic radiation and scattering from microstrip antennas on anisotropic substrates, 1990
5) C. A. Balanis, *Antenna Theory*, 1982, Wiley.
6) D. M. Pozar, "Analysis of finite arrays of printed dipoles", *IEEE Trans. Antennas Propagat.*, vol. AP-33, pp. 1045-1053, Oct. 1985.
7) H. D. Syrigos, "Backfire feed antenna beats cassegrain design", Microwave Syst. News, Oct. 1983.
8) E. F. Knott, J. F. Shaeffer and M. T. Tuley, Radar Cross Section, 1985, Artech House.
9) S. D. Targonski and D. M. Pozar, "Analysis and design of a microstrip reflectarray using patches of variable size", *IEEE Int. Symp. Antennas Propagat.*, pp. 1820-1823, June 1994.
10) D. C. Chang and M. C. Huang, "Microstrip reflectarray antenna with offset feed", Electron. Lett., vol. 28, pp. 1489-1491, July 1992.