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CASE STUDY ON MICROSTRIP SLOTTED ANTENNAS

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ABSTRACT

The role of Antenna in any Communication system is to provide a perfect interface between the system and free space in order to couple the signal between transmitter and receiver. The Microstrip antenna is one type of interface, which is widely used in wireless transceivers since it has very low profile. In order to achieve wide band, Ultra Wide Band (UWB), ISM band, multi-band and low–loss in matching, the Microstrip slotted antenna is very suitable one. This paper provides the result of various type of Microstrip antennas. The information provived in this paper is very much useful for a communication system designer and RF Engineer.

KEYWORDS: Microstrip Sloted Antenna, UWB, ISM Band, Multiband, Low–Loss Matching

INTRODUCTION

The Microstrip antennas are low profile antennas, their dimensions are maximally in centimeter scale. Their nature is very much easier to integrate with MMIC, Hybrid IC and other RFIC technologies too. It can support for more than one type of coupling such as Microstrip feed, Inserted feed and Co-axial etc. The Figure (1) shows the basic module of Microstrip antenna and Figure (2.a to 2.c) shows the signal feeding which are used in microstrip antennas.

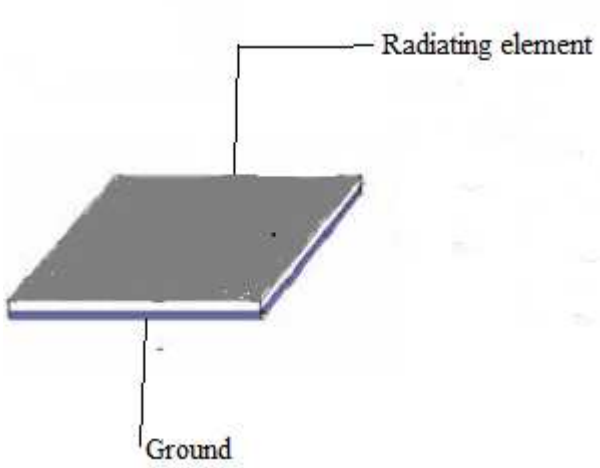

Figure 1: The Basic Module of Microstrip Antenna

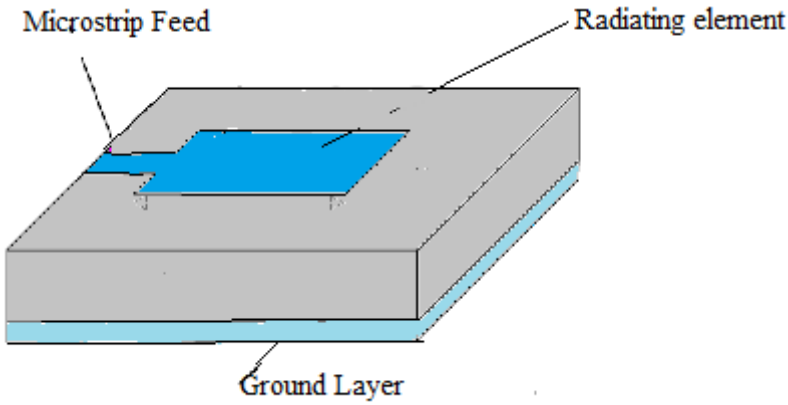

Figure 2 a: Microstrip Antenna with Microstrip Feed

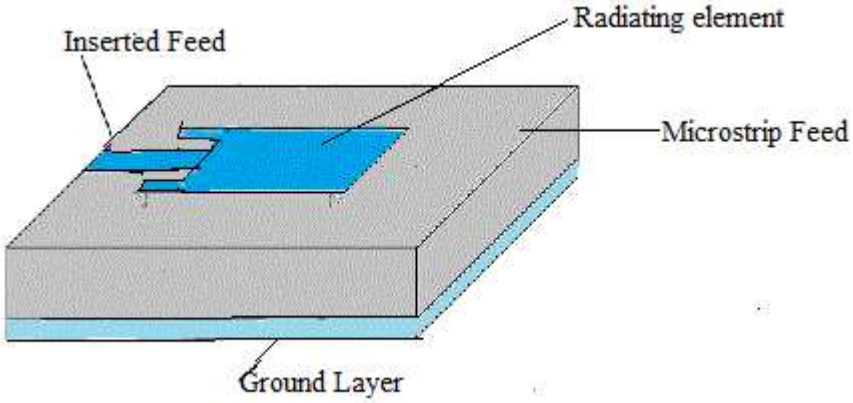

Figure 2 b: Microstrip Antenna with Inserted Feed

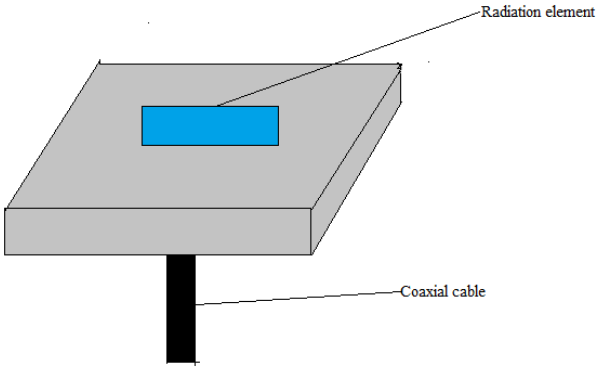

Figure 2 c: Microstrip Antenna with Coaxial Feed

The slot in microstrip antenna is normally but with removal of some portion of radiating conductor with a particular shape and dimensions. The below figure (3.a to 3.c) shows some examples of basic slot models over radiating conductor of microstrip antennas

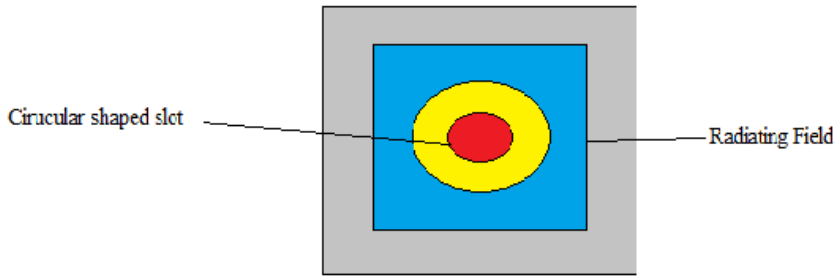

Figure 3 a: Circular Shaped Sloted Antenna

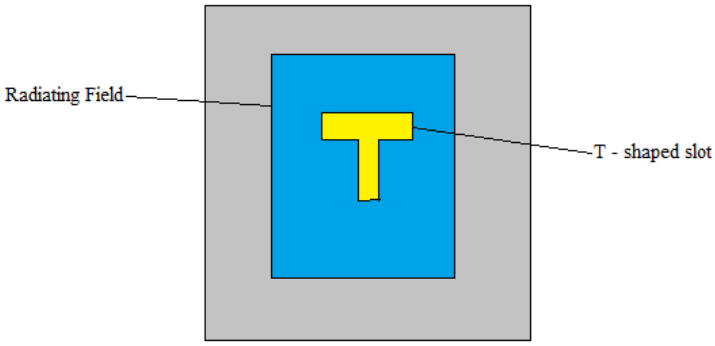

Figure 3 b: T–Shaped slotted Antenna

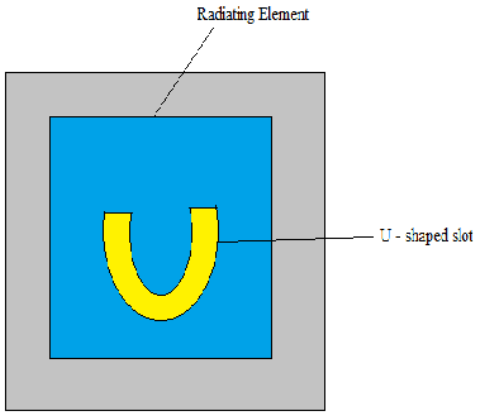

Figure 3 c: U–Shaped Slotted Antenna

Because of this slot and its shape in radiating portion of microstrip antenna results different range of frequency of operation and variation in signal matching accurancy and effects on low loss and maximum power radiation so that it can be strongly recommended for UWB, ISM band, multiband applications and for efficient wireless transceivers.

Design Overview of Microstrip-Slotted Antenna

A microstrip slotted antenna consisting of two cases of design consideration. The first one is about the basic microstrip antenna, which includes the model selection, material selection, feed selection are all according to the application specific matters. The second is about the slot, which includes type of slot and physical dimensions of slot in order to meet the radiation results.

In case of simple microstrip antenna design the following nine steps might he followed such as 1. Specify the application, 2. Find the expected EM outcome of that application, 3. Select the suitable substrate "ε_r", 4. Study the substrate parameters thoroughly, 5. Design the antenna, 6. Simulate antenna using a high frequency simulator software tool, 7. Verify the results, 8. Fabricate and test the antenna, 9. Compare the simulated results and tested results, if satisfied then the antenna is ready.

In case of slot design over the radiator, the following three steps are followed. 1. Select the type of slot, 2. Obtain the slot's physical dimension, 3. Optimize it by synthesizing, once if the radiation results are satisfied then the microstrip slotted antenna is ready for proto type.

Application of Microstrip Slotted Antenna

The Microstrip-slotted-antenna are widely used in UWB application in the range of (3.1 GHz – 10.6 GHz), (3.4 GHz – 4.8 GHz) and (6 GHz to 8.5 GHz). The UWB spectrum widely used in various medical applications and short distance data transfer applications. The feature of UWB is larger Bandwidth, which can support for carrying very huge amount of data per second but the transmitting power is restricted by FCC and other licensing authorities of in each and every country. The transmitting power is about 0.5mW and less than that. So it will come up to 230 feet or less than that, net coverage is very small area only.

Another one wider use of Microstrip slotted antenna in ISM band applications. There are more than ten frequency bands are comes under ISM band such as 6.78 MHz, 13.58 MHz, 27.12 MHz, 40.68MHz, 433.920 MHz, 915 MHz, 2.45 GHz, 5.8 GHz, 24.125 GHz, 61.25 GHz, 122.5 GHz, 245 GHz. These ranges are widely used in Industry, Scientific, Medical, Security, WLAN, Bluetooth and RFID applications.

Study Results of Microstrip Sloted Antenna

- J. A Circular disk U-shaped sloted gives S_{11} = -21 dB at 3GHz for Bluetooth and WLAN applications [1].
- A T-shaped slotted microstrip antenna can feature with circular polarization and high input matching, the S11 = -63.53 dB [2]. It is used in modern wireless communication systems operate at 3.96 GHz.
- An Elliptical slotted microstrip antenna can feature with circular polarization and the return loss is about -40 dB at 7GHz to 7.4GHz [3].
- A Diamond shaped slotted microstrip circular patch antenna provides S_{11}= -33 dB at 7.5 GHz which can be suitable for satellite communications [4].
- A rectangular type microstrip antenna with semi-ring shaped slot provides S_{11}= -22 dB at 2.89 GHz and is can provides dual band result [7].
- The serrated-edge N-shaped slotted microstrip antenna feature S_{11} = -21 dB at 2.1 GHz which can be used for WLAN, WMAN and Blothtooth applications [6].
- A Trapezoidal patch provided with V shaped [4] and inverted V shaped slots result S_{11} = -37 dB at 5.5 GHz for WiMAX application at -25 GHz to 3.54 GHz forUWB application respectively[8].

- A W-shaped and inverted V-shaped sloted microstrip antenna can perform at 10.6 GHz with S_{11} = -40 dB [8].
- An E – shaped microstripsloted patch provides S_{11} = -23 dB with wideband of frequency operation [9].
- A rectangular patch with star shaped antenna can give S_{11} = -35 dB used for UWB applications [10].
- A S-Sloted Microstrip antennS_{11}= -23 dB works in ISM band [11].
- A Dual feed and Triangular sloted Microstrip antenna S_{11} = -24 dB in ISM band [12].

CONCLUSIONS

Here it is conclude that the slotted microstrip antenna has very low profile, which can used for short distance low power transmission, and hence it is mostly preferred for a specific application in UWB, ISM and multiband wireless communication systems. In this study, most of the cases, the S_{11} = - 60dB to -20 dB which conveys that the input impedance matching is easily obtainable and hence the Microstrip slotted antennas are high efficient for Wireless Communications.

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