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Review Paper on Design of a Coplanar Integrated Microstrip Antenna for ITS Applications

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Abstract - *This paper presents a novel low-profile coplanar microstrip antenna for intelligent transportation system applications (ITS). Technology has made its way into Intelligent Transportation Systems (ITS) as the Vehicle-to-Vehicle (V2V) and Vehicle to-Infrastructure (V2I) paradigms .The geometry consist of Square-ring patch antenna and a center-fed square-ring loaded patch antenna. A coplanar simple coaxial-fed method used in the directional coupled square-ring patch antenna; the square-ring used to load the center-fed square patch antenna with a vertical linear polarization used for ITS application.*

***Key Words*: Square-ring, WiMAX, DSRC.**

1. INTRODUCTION

The rapid development of wireless communication systems increases different services essential in modern life. They are integrated to collaborate with each other. It is important to improve the efficiency of the antenna to a accomplish requirement for the various applications using the same antenna [1].

In the U.K., emerging 4G high-performance (free service) unlicensed 5470–5725 MHz band (WiMAX) Worldwide Interoperability for Microwave Access mobile technology IEEE 802.16e has considered as a potential candidate for use in ITS [1]. ITS adopt traveling information in moving vehicles over highways. This information used to reduce environmental impact and to improve the transportation safety. Road safety an important issue because many people lose life in road accidents. Vehicle safety needs to go beyond the traditional safety technology in place which is mostly passive in nature such as seat belts and air bags .DSRC is a wireless communication technology which has been developed for the enhancement of safety of the transport system. It operates at (5.85-5.925 GHz) 5.9 GHz band[2].To support safe and efficient mobility of vehicles. The next step to further improve the transportation system of today is to make the vehicles and roadside infrastructure more intelligent by making them communicates with each other. This new ability will help find new solutions to current problems like traffic congestion, vehicle accident, monitoring of adherence to traffic rules and alerting the responsible authorities of any traffic rule violation or accident for immediate management [3].GPS is usually integrated to collaborate with the terrestrial ITS service. Furthermore, according to IEEE communication standards, time synchronization obtained by GPS is required for ITS services. Therefore, the automotive market requires compact, high-performance, and cheap solutions that accommodate GPS/ITS services with the smallest volume mounted on the roof of a vehicle. In [4], Dual-feed microstrip antenna for integrated GPS/ITS operation has presented. Due to poor impedance matching and the large size, the four-layer structure is difficult to employ.

In this paper, present a coplanar integrated microstrip antenna solution for ITS services, which is about 40% less than the electrical size of the antenna. The design is being developed to satisfy not only ITS service but also 5.8-GHz DSRCS band. The geometry of the proposed ITS multifunctional antenna employs only a single dielectric layer, which is easy to fabricate and assemble in compliance with the space limitation requirements of the automotive market.

1.1 LITERATURE

A) I.J. Garcia Zuazol et.al. Antennas suitable for Intelligent Transport Systems (ITS) are overseen. The antennas serve a narrow-band high performance unlicensed 5.470-5.725 GHz WiMAX deployed over a full-duplex bi-directional optical link. The system is composed of 3-RFports aimed to support

Adaptive Antenna System (AAS), Multiple-Input Multiple-Output (MIMO) and Sectorization, for communications of about 70 ~ 100 Mbps over micro-cells along highways to moving vehicles incorporating a Ultra Wide Band (UWB) network of 480 Mbps. A design study has been carried out to assess the most cost-effective while efficient antenna units. The effects among antennas seen as interferers are also considered

B) Nishesh Tiwari et.al.Design and simulation of a microstrip patch antenna for 5.9 GHz dedicated short range communication system (DSRC) is presented in this paper. DSRC is a wireless communication technology which has been developed for the enhancement of safety of the transport system. It operates at band (5.85-5.925 GHz). It provides 75 MHz of bandwidth. The designed antenna shows good return loss of -17.5 dB at 5.9 GHz and provides a gain of 8 dBi. The simulation is performed using SEMCAD X electromagnetic simulation tool. The proposed antenna is suitable for DSRC applications.

C) Sadiki Lameck Kusyama et.al.Today's transport system has evolved from horse driven carriages and paved roads to a more complex road transport system made up of a variety of vehicles and other infrastructure, all put in place in order to support safe and efficient mobility of vehicles. The next step to further improve the transportation system of today is to make the vehicles and roadside infrastructure more intelligent by making them communicates with each other. This new ability will help find new solutions to current problems like traffic congestion, vehicle accident, monitoring of adherence to traffic rules and alerting the responsible authorities of any traffic rule violation or accident for immediate management. Speed limit violation and inefficiency accident information dissemination in public road transport are recognized as one of the causes leading to traffic accidents and the failure of emergency Medical Services personnel to reach the victim during the so-called "Golden Hour" after the accident in Tanzania. This paper surveys the current system being used for speed management and Accident Reporting management in Tanzania. It also suggests recommendations for the implementation of systems that will effectively influence driving speeds and accident reporting management thereby significantly increase public transport safety.

D) Gh. Z. Rafi et.al.This letter describes the concept, design, and measurement of a low-profile integrated microstrip antenna for dual-band applications. The antenna operates at both the GPS L1 frequency of 1.575 GHz with circular polarization and 5.88 GHz with a vertical linear polarization for dedicated short-range communication (DSRC) application. The antenna is low profile and meets stringent requirements on pattern/polarization performance in both bands. The design procedure is discussed, and full measured data are presented.

E) Sourav Dhar et.al.This paper presents a review for the development of Intelligent Transportation System (ITS) worldwide and the use of Smart Antennas in ITS. This review work also discusses the usual problems in ITS and proposes the solution of such problems using smart antennas.

F) Mohammad J. Almalkawi. In this communication, a low-cost circularly polarized wire antenna exhibiting improved gain performance for Dedicated Short Range Communications (DSRC), vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications is presented. The proposed antenna comprises a Y-shaped quarter wavelength monopole antenna surrounded by two iterations of eight conductive arched walls acting as parasitic elements to enhance the overall antenna gain and to shape the radiation pattern in the H-plane. A hemispherical radome shell is added to protect the antenna structure and its effect on the antenna performance is discussed. The designed antenna demonstrates antenna gain of 8.2 dB with omnidirectional far-field radiation pattern in the H-plane. The gain of the proposed antenna is also compared with the characteristic of the stand-alone Y-shaped monopole to highlight the advantages of the proposed approach.

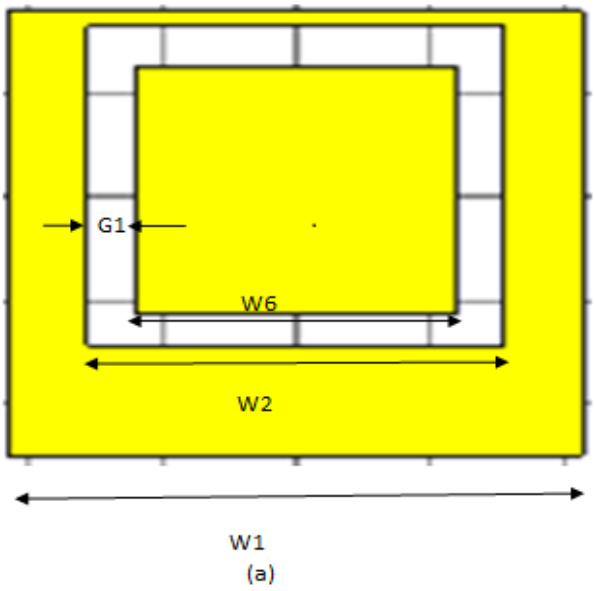
1. PROBLEM FORMULATION

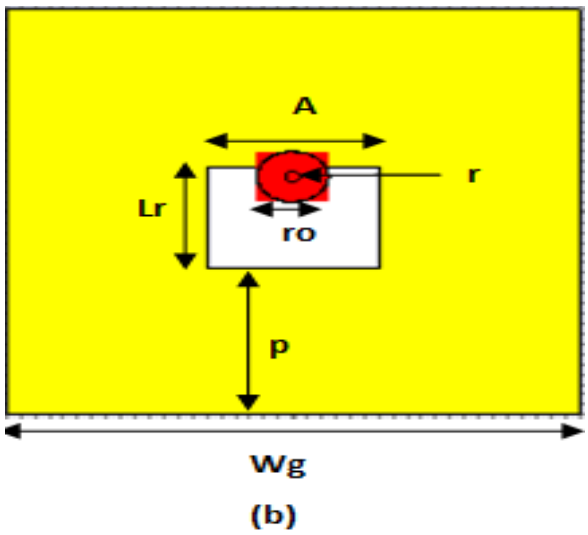
Intelligent transportation systems application used to provide innovative services relating to different modes of transport and traffic management advanced applications without embodying intelligence. This enables various users to be better informed and make safer, more coordinated, and 'smarter' use of transport networks. The geometry of the proposed ITS antenna employs only a single dielectric layer, which is easy to fabricate and assemble in compliance with

the space limitation requirements of the automotive market. Dual-feeding mechanism more complex and larger size at the feeding network. A typical single-fed technique is simple and flexible.

2. ANTENNA DESIGN

The basic geometry of the proposed integrated antenna shown in Fig. 1. The antenna must support ITS 5.8-GHz frequency band with the vertical polarized omnidirectional pattern. The design consisted of two radiators: a square patch and a square-ring patch, which are both placed on a single-layer substrate with 4.3 a dielectric constant and area of a square ground plane is 40×40 mm. For the square-ring patch, antenna size is smaller than that of the conventional square. Dual feeding mechanism has more complex geometry and larger size at the feeding network. Hence single-fed technique used for producing a vertical polarization wave and it involves the use of asymmetrical slit at the ground plane to increase the bandwidth of the antenna. In this paper, ITS service requires an omnidirectional pattern with vertical polarization in the azimuth plane. More specifically, the radiated field has the only component and is invariable for all as monopole-like radiation pattern and which ensure coverage along low elevation planes. The low-profile microstrip patch antennas with monopole-like radiation are a good candidate and a lower profile than the conventional quarter-wavelength monopole antenna. Nevertheless, the TM mode is a higher-order mode and which has poor impedance matching and a high-quality factor value. The coaxial probe feed to Port for ITS operation is placed at the center of the inner square patch. This feed can place at anywhere inside the patch to match with its input impedance which is a major advantage of this feeding. Fabrication of this feeding method is easy and has low spurious radiation. The outer square ring is also utilized to load the center-fed square patch antenna to improve impedance matching. The technique loading with enhanced bandwidth is inspired by the (ARL) annular ring loaded patch antennas. The optimum bandwidth and impedance matching of the integrated ITS antenna can achieve by adjusting the width of the narrow slot and the diameter of the probe. The dimensions notations and of the proposed antenna found in Table I.





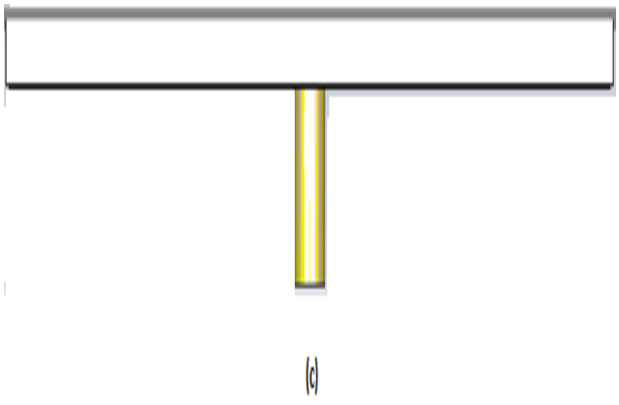


TABLE I

DIMENSIONS OF THE PROPOSED ANTENNA (MILLIMETERS)

Parameters	Values(mm)	Parameters	Values(mm)
Wg	40	Mt	0.01
Lg	40	t	0.02
W1	24	X	5.6
L1	24	Y	11.5
W2	18	r	0.5
L2	18	ro	2.5
W6	16	p	14.5
L6	16	A	12
G	0.7	Lr	10
h	1.6		

3. CONCLUSION

In this paper, survey of the past research works which mainly focuses on different feeding technique and impedance matching technique. The design of a novel coplanar antenna for operation (ITS) with prescribed pattern and polarization described in this paper. Moreover, the square ring is utilized to load the center-fed square patch antenna for ITS application with a vertical linear polarization, which considerably increases the fractional bandwidth with a height of 1.6 mm.Size of antenna & cost is reduced due to the use of FR4 substrate. The motivation for this work to devise a novel solution for integrating services into one antenna with compact size and low-cost fabrication.

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