

# A Dual-Band Circularly Polarized Monopole Antenna for WLAN Application

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**Abstract**— A novel design of monopole antenna with trapezoidal configuration is presented for WLAN application. The proposed antenna provides dual-band circularly polarized at 2.4 and 5.3 GHz frequencies with 6.25% and 2.83% bandwidths, respectively. The antenna is fed through a microstrip feed line and is backed by a finite ground plane with two tuning stubs. The circular polarization for the proposed dual-band antenna is demonstrated by 3-dB axial ratio (AR) spectrum. Simulation results are provided by using two full wave software packages. A soft HFSS and CST microwave studio and the results are compared with each other.

## I. INTRODUCTION

The rapid development of wireless communications urges the need of UWB, dual-band or multiband antennas. Circularly Polarized (CP) printed antennas are widely used in many wireless communication systems such as radio frequency identification (RFID), global positioning systems (GPS), satellite communication systems, dedicated short range communication systems (DSRC), navigation, WIMAX and WLAN [1]–[5]. These types of antennas are very attractive, because of their low profile, light weight and ease of fabrication characteristics.

Generally, the radiation patterns of the printed monopole antennas are linearly polarized (LP); they are difficult to radiate circularly polarized (CP) radiation wave which are generated by two near-degenerated orthogonal resonant modes of equal amplitude and 90 phase difference (PD). Recently many studies on printed monopole antennas with a single feed structure have been reported. To produce single frequency band of operation, [1] has introduced a fractal boundary microstrip antenna resulting in 1.6% of 3 dB axial ratio (AR) bandwidth and [2] has used an annular-ring slot with double-bent microstrip line feed giving 10% 3 dB AR bandwidth. To produce a dual band CP, [3] has employed a combination of slot, beveling and stub either on the monopole antenna or on the ground plane resulting in 2.41–2.56 GHz and 3.31–3.54 GHz bands. Also CPW fed slot antenna loaded with two spiral slots has been reported in [4], resulting in 8.4% and 19.34% bandwidth with respect to 1.6 GHz (RHCP) and 2.2 GHz (LHCP) center frequencies, respectively.

In this paper we present a novel small sized trapezoidal-shaped monopole antenna that can provide dual-band CP

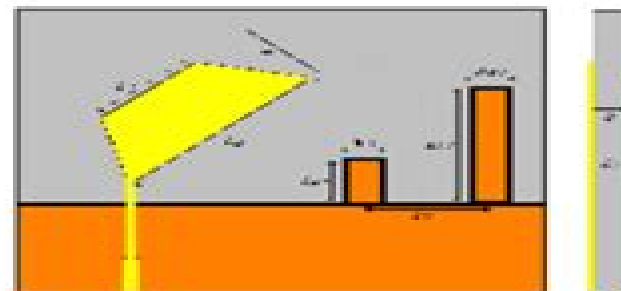


Fig.1. The structure of the single feed trapezoidal-shaped printed monopole antenna with stubs.

radiation for WLAN application. The proposed antenna supports 6.25% CP bandwidth at 2.4 GHz for the lower band and 2.83% CP bandwidth at 5.3 GHz for the upper band. The gain of the proposed antenna is about 2dBi at the lower band and about 0.1 dBi at the upper band which is almost a proper gain for such types of antennas. Also by adjusting the parameters of the antenna the center frequency of both bands can be tuned easily in order to support other applications. Two full wave software packages, Asoft HFSS based on finite element method and CST microwave studio, based on finite integration technique, are used to simulate the proposed antenna. Simulation results are provided and results are discussed.

## II. ANTENNA DESIGN

The proposed antenna consists of four parts. Trapezoidal radiator, microstrip feed line, ground plane and tuning stubs. Geometry of the antenna is depicted in Fig.1. To have dual band operation a trapezoidal-shaped monopole antenna is employed. The design of the trapezoid can be carried out based on the given lower and upper frequency bands. Based on these two frequencies, through the following formula appropriate values for the two side lengths  $L_1$  and  $L_2$  can be obtained:

# Dual Band Circularly Polarized Monopole Antenna For Wlan

**Taimoor Khan, Nasimuddin, Yahia M.M.  
Antar**



## **Dual Band Circularly Polarized Monopole Antenna For Wlan:**

Machine Learning, Deep Learning and Computational Intelligence for Wireless Communication E. S. Gopi, 2021-05-28

This book is a collection of best selected research papers presented at the Conference on Machine Learning Deep Learning and Computational Intelligence for Wireless Communication MDCWC 2020 held during October 22nd to 24th 2020 at the Department of Electronics and Communication Engineering National Institute of Technology Tiruchirappalli India The presented papers are grouped under the following topics a Machine Learning Deep learning and Computational intelligence algorithms b Wireless communication systems and c Mobile data applications and are included in the book The topics include the latest research and results in the areas of network prediction traffic classification call detail record mining mobile health care mobile pattern recognition natural language processing automatic speech processing mobility analysis indoor localization wireless sensor networks WSN energy minimization routing scheduling resource allocation multiple access power control malware detection cyber security flooding attacks detection mobile apps sniffing MIMO detection signal detection in MIMO OFDM modulation recognition channel estimation MIMO nonlinear equalization super resolution channel and direction of arrival estimation The book is a rich reference material for academia and industry **Printed Antennas**

Binod Kumar Kanaujia, Surendra Kumar Gupta, Jugul Kishor, Deepak Gangwar, 2020-11-22 Printed antennas have become an integral part of next generation wireless communications and have been found to be commonly used to improve system capacity data rate reliability etc This book covers theory design techniques and the chronological regression of the printed antennas for various applications This book will provide readers with the basic conceptual knowledge about antennas along with advanced techniques for antenna design It covers a variety of analytical techniques and their CAD applications and discusses new applications of printed antenna technology such as sensing The authors also present special reconfigurable antennas such as ME dipole polarization feeding and DGS The book will be useful to students as an introduction to design and applications of antennas Additionally experienced researchers in this field will find this book a ready reference and benefit from the techniques of research in printed antennas included in this book Following are some of the salient features of this book Covers a variety of analytical techniques and their CAD applications Discusses new applications of printed antenna technology such as sensing Examines the state of design techniques of printed antenna Presents special reconfigurable antennas such as ME dipole polarization feeding and DGS **Circularly Polarized Dielectric Resonator**

**Antennas** Raghvendra Kumar Chaudhary, Rajkishor Kumar, Rakesh Chowdhury, 2021-08-31 This book introduces 5 key feeding techniques such as coaxial probe microstrip conformal strip aperture and coplanar waveguide and covers different shapes of dielectric resonator antennas leading to improvement in circularly polarized CP performance It introduces advancements in the field of dielectric resonator antennas and dielectric resonator antennas DRAs Five different types of feeding techniques i e coaxial probe microstrip conformal strip aperture and coplanar waveguide are described for obtaining

CP followed by two modified shaped DRA sector DRAs Throughout this book rectangular and circular with their modified shapes of the dielectric resonator are utilized providing differing degrees of freedom as well as different variable parameters including length width height radius aspect ratio and dielectric constant which are tuned to obtain the desired antenna parameters

**Intelligent Solutions for Smart Adaptation in Digital Era** Nitasha Hasteer,Christian Blum,Deepti Mehrotra,Hari Mohan Pandey,2025-02-13 This book comprises the select peer reviewed proceedings of the 4th International Conference on Information Technology InCITe 2024 It aims to provide a comprehensive knowledge base highlighting state of the art research and development and best practices for intelligent solutions in the digital era It covers adaptive intelligence decision intelligence artificial intelligence deep learning machine learning data science and enabling technologies for IoT blockchain and other futuristic technologies The content would serve as a rich knowledge repository on information communication technologies neural networks fuzzy systems natural language processing data mining warehousing big data analytics cloud computing social networks and intelligence decision making and modeling information systems IT architectures and security related aspects This book provides a valuable resource for those in academia and industry

*Multifunctional and Multiband Planar Antennas for Emerging Wireless Applications* Jayshri Kulkarni,Chow-Yen-Desmond Sim,Jawad Yaseen Siddiqui,Anisha M. Apte,Ajay Kumar Poddar,Ulrich L. Rohde,2023-12-19 This work focuses on designing multiband printed single Multiple Input Multiple Output MIMO CP antennas for WLAN V2X and NR Sub 6GHz 5G applications It also delves into the design and implementation of a Four Port MIMO antenna for wireless applications addressing theoretical foundations and challenges Additionally the book explores critical aspects of software defined radios SDR including modulation signal processing radio systems TX RX blocks SDR enabled phased arrays and beam hopping techniques with relevance to 5G 6G and IoT applications Features Explores advancements in planar monopole antennas including bandwidth enhancement techniques Analyzes innovative antenna design structures like miniaturized and conformal monopole antennas and discusses modeling and implementation Spotlights WLAN and Wi Fi 6 6E antenna design for next gen laptops with practical insights Addresses the use of triple band antenna arrays for MIMO applications in laptops Focuses on planar antenna advancements for diverse wireless bands and applications Explores multiband printed single MIMO CP antennas for WLAN V2X and NR Sub 6GHz 5G Covers the design and implementation of a Four Port MIMO antenna for wireless applications including theoretical foundations and challenges Explores SDR modulation signal processing radio systems TX RX blocks SDR enabled phased arrays and beam hopping techniques for 5G 6G and IoT applications This book is aimed at graduate students and researchers in electrical and electronic engineering antennas and wireless communication systems

**Recent Advances in Computational Intelligence and Cyber Security** Ashok Kumar Singh,Zeeshan Ali Siddiqui,Siddharth Singh,Amit Kumar Singh,Tanveer J. Siddiqui,2024-07-08 In the ever accelerating tapestry of our digital age the symbiotic relationship between computational intelligence and cyber security has become the linchpin of progress

The relentless pace of technological evolution and the ceaseless emergence of cyber threats demand not only adaptation but also an exploration of the forefronts of innovation and defence Recent Advances in Computational Intelligence and Cyber security is a testament to the exhilarating journey undertaken by researchers practitioners and visionaries in these pivotal fields Within the confines of this book we embark on a captivating exploration of the cutting edge developments that define the current state of computational intelligence and the intricate dance with the ever evolving landscape of cyber security

**Elements of Radio Frequency Energy Harvesting and Wireless Power Transfer Systems** Taimoor

Khan,Nasimuddin,Yahia M.M. Antar,2020-11-13 This book focuses on elementary concepts of both radio frequency energy harvesting RFEH and wireless power transfer WPT and highlights their fundamental requirements followed by recent advancements It provides a systematic overview of the key components required for RFEH and WPT applications and also comprehensively introduces the pioneering research advancements achieved to date The state of the art circuit design topologies for the two different applications are presented mainly in terms of antenna operating frequencies polarization characteristics efficient matching network circuits rectifier topologies and overall rectenna systems The book serves as a single point of reference for practicing engineers and researchers searching for potential sources and elements involved in the RFEH system as well as in the WPT system and need rapid training and design guidelines in the following areas Different sensing elements used in RFEH and WPT Inclusions of mathematical expressions and design problems Illustration of some design examples and performance enhancement techniques

**MIMO Antennas for Wireless Communication** Leeladhar

Malviya,Rajib Kumar Panigrahi,M.V. Kartikeyan,2020-12-15 The desired objective of this book is to investigate diversity and mutual coupling effects on MIMO antenna designs for WLAN WiMAX LTE applications controlled with diversity and ground modification techniques including equivalent circuit diagrams Diversity techniques in MIMO antennas leading to the performance improvement ratings are demonstrated and deliberated The book contributes towards the development of 2 1 VSWR MIMO antennas with diversity techniques for indoor outdoor applications for high data rate QOS and SNR The improved MIMO antenna structures are investigated and presented in this book including part of massive MIMO to provide the important aspects of emerging technology Aimed at researchers professionals and graduate students in electrical engineering electromagnetics communications and signal processing including antenna theory and design smart antennas communication systems this book Investigates real time MIMO antenna designs for WLAN WiMAX LTE applications Covers effects of ECC MEG TARC and equivalent circuit Addresses the coupling and diversity aspects of antenna design problem for MIMO systems Focus on the MIMO antenna designs for the real time applications Exclusive chapter on 5G Massive MIMO along with case studies throughout the book

Optical and Wireless Technologies Vijay Janyani,Ghanshyam Singh,Manish

Tiwari,Antonio d'Alessandro,2019-04-09 This volume presents selected papers from the 2nd International Conference on Optical and Wireless Technologies conducted from 10th to 11th February 2018 It focuses on extending the limits of currently

used systems encompassing optical and wireless domains and explores novel research on wireless and optical techniques and systems describing practical implementation activities results and issues The book will serve as a valuable reference resource for academics and researchers across the globe *Handbook of Research on Design, Deployment, Automation, and Testing Strategies for 6G Mobile Core Network* Satishkumar, D.,Prabhakar, G.,Anand, R.,2022-03-04 To overcome the constraints of 5G for supporting new challenges 6G wireless systems must be developed with new and attractive features These systems are expected to increase performance and maximize quality of service several folds more than 5G along with other exciting features However 6G is still in its infancy and must be explored The Handbook of Research on Design Deployment Automation and Testing Strategies for 6G Mobile Core Network discusses the technological feats used in the new 6G wireless systems It discusses the design automation and uses for industry as well as testing strategies Covering topics such as 6G architecture smart healthcare and wireless communication this major reference work is an excellent resource for computer scientists engineers students and professors in higher education researchers and academicians

**Advances in Computer, Communication and Control** Utpal Biswas,Amit Banerjee,Sukhomay Pal,Arindam Biswas,Debashis Sarkar,Sandip Haldar,2019-02-14 The book discusses the recent research trends in various sub domains of computing communication and control It includes research papers presented at the First International Conference on Emerging Trends in Engineering and Science Focusing on areas such as optimization techniques game theory supply chain green computing 5g networks Internet of Things social networks power electronics and robotics it is a useful resource for academics and researchers alike **Intelligent Systems and Computer Technology** D.J. Hemanth,V.D.A. Kumar,S. Malathi,2020-12-15 Recent developments in soft computation techniques have paved the way for handling huge volumes of data thereby bringing about significant changes and technological advancements This book presents the proceedings of the 3rd International Conference on Emerging Current Trends in Computing Next Generation Soft Computing is a platform for scientists researchers practitioners and academics to present and discuss their most recent innovations trends and concerns as well as the practical challenges encountered in the field The second section Evolutionary Networking and Communications focuses on various aspects of 5G communications systems and networking including cloud and virtualization solutions management technologies and vertical application areas It brings together the latest technologies from all over the world and also provides an excellent international forum for the sharing of knowledge and results from theory methodology and applications in networking and communications The book will be of interest to all those working in the fields of intelligent systems and computer technology **Data Engineering and Applications** Jitendra Agrawal,Rajesh K. Shukla,Sanjeev Sharma,Chin-Shiuh Shieh,2024-08-30 This book comprises select proceedings from the 4th International Conference on Data Engineering and Applications IDEA 2022 The contents discuss novel contributions and latest developments in the domains of data structures and data management algorithms information retrieval and information integration social data analytics IoT

and data intelligence Industry 4.0 and digital manufacturing data fusion natural language processing geolocation handling image video and signal processing ICT applications and e governance among others This book is of interest to researchers in academia and industry working in big data data mining machine learning data science and their associated learning systems and applications

**Next-Generation Antennas** Prashant Ranjan, Dharmendra Kumar Jhariya, Manoj Gupta, Krishna Kumar, Pradeep Kumar, 2021-07-19 NEXT GENERATION ANTENNAS ADVANCES AND CHALLENGES The first book in this exciting new series written and edited by a group of international experts in the field this exciting new volume covers the latest advances and challenges in the next generation of antennas Antenna design and wireless communication has recently witnessed their fastest growth period ever in history and these trends are likely to continue for the foreseeable future Due to recent advances in industrial applications as well as antenna wireless communication and 5G technology we are witnessing a variety of developing and expanding new technologies Compact and low cost antennas are increasing the demand for ultra wide bandwidth in next generation 5G wireless communication systems and the Internet of Things IoT Enabling the next generation of high frequency communication various methods have been introduced to achieve reliable high data rate communication links and enhance the directivity of planar antennas 5G technology can be used in many applications such as in smart city applications and in smartphones This technology can satisfy the fast rise in user and traffic capacity in mobile broadband communications Therefore different planar antennas with intelligent beamforming capability play an important role in these areas The purpose of this book is to present the advanced technology developments and challenges in antennas for next generation antenna communication systems This book covers advances in next generation antenna design and application domain in all related areas It is a detailed overview of cutting edge developments and other emerging topics and their applications in all areas of engineering that have achieved great accuracy and performance with the help of the advancement and challenges in next generation antennas This outstanding new volume Covers all the latest developments and future aspects of antenna communication Is concisely written lucid and comprehensive practical application based with many informative graphics and schematics Will help students researchers as well as systems designers to understand fundamental antenna design and wireless communication Compares different approaches in antenna design *Proceedings of 2nd International Conference on Micro-Electronics, Electromagnetics and Telecommunications* Suresh Chandra Satapathy, Vikrant Bhateja, P. Satish Rama Chowdary, V.V.S.S. Sameer Chakravarthy, Jaume Anguera, 2017-09-06 The book is a collection of best papers presented in the Second International Conference on Microelectronics Electromagnetics and Telecommunication ICMEET 2016 an international colloquium which aims to bring together academic scientists researchers and research scholars to discuss the recent developments and future trends in the fields of microelectronics electromagnetics and telecommunication Microelectronics research investigates semiconductor materials and device physics for developing electronic devices and integrated circuits with data energy efficient performance in terms of speed power consumption and

functionality The book discusses various topics like analog digital and mixed signal circuits bio medical circuits and systems RF circuit design microwave and millimeter wave circuits green circuits and systems analog and digital signal processing nano electronics and giga scale systems VLSI circuits and systems SoC and NoC MEMS and NEMS VLSI digital signal processing wireless communications cognitive radio and data communication *Planar Antennas* Praveen Kumar Malik,2021-10-21 This comprehensive reference text discusses fundamental concepts applications design techniques and challenges in the field of planar antennas The text focuses on recent advances in the field of planar antenna design and their applications in various fields of research including space communication mobile communication wireless communication and wearable applications This resource presents planar antenna design concepts methods and techniques to enhance the performance parameters and applications for IoTs and device to device communication The latest techniques used in antenna design including their structures defected ground MIMO and fractal design are discussed comprehensively The text will be useful for senior undergraduate students graduate students and academic researchers in fields including electrical engineering electronics and communication engineering Advances in Artificial Intelligence and Electronic Design Technologies Zahereel Ishwar Abdul Khalib,Thennarasan Sabapathy,Surentiran Padmanathan,Amiza Amir,Ping Jack Soh,2025-04-15 This book showcases innovative approaches driving advancements in relevant fields such as smart manufacturing Industry 5 0 and robotics This edition of the Springer Studies in Computational Intelligence SCI Series explores cutting edge applications of computational intelligence Designed for engineers industry professionals and applied researchers this book effectively bridges theory and real world implementation Through a diverse collection of case studies and practical examples readers will discover how computational intelligence techniques solve complex challenges across various sectors The book offers actionable deployment strategies empowering professionals to apply these concepts in their fields This book cultivates a holistic approach to innovation and problem solving by synthesizing diverse perspectives within computational intelligence This book is an essential resource for practitioners and researchers It features hands on implementation insights comprehensive coverage of emerging trends and a focus on industry relevant techniques It equips readers with the knowledge and tools to harness computational intelligence tackle real world challenges and drive meaningful progress in their respective domains This book contains 50 papers pertaining to the abovementioned topics providing a rich and diverse exploration of computational intelligence applications and methodologies A Study on Next-Generation Materials and Devices M. S. Vijaya Kumar,K. Srujan Raju,K. Rajakumar,S. Saravanakumar,2025-09-29 A Study on Next Generation Materials and Devices proudly presents the proceedings of the International Conference on Next Generation Materials and Devices ICNMD 2024 held from August 01 03 2024 in Virudhunagar India ICNMD 2024 served as a crucial platform focusing on state of the art research and development in A Study on Next Generation Materials and Devices for sustainable development The diverse program explored major topics such as energy solutions environmental concerns



advanced sensors the role of artificial intelligence and computational approaches for materials design It also delved into biomaterials for medical applications alongside discussions on next generation semiconductors and flexible electronics poised to revolutionize the electronics industry The event covered all the significant verticals related to materials and devices featuring pioneers who shed light on uncharted domains

**Radar and RF Front End System Designs for Wireless Systems** Mehta, Shilpa,Kumar, Rupesh,2024-04-15 The escalating demand for advanced communication sensing and scanning systems across various applications as well as the urgency to comprehend the complexities of RF Frontend systems is more pronounced than ever At the heart of this challenge lies the reconfigurability feature playing a vital role in shaping the current trajectory of wireless technologies The book Radar and RF Front End System Designs for Wireless Systems delves straight into this pressing issue and examines the relentless pace of innovation spurred by a myriad of configuration and design architectures While these advancements hold great promise they also introduce challenges that warrant thorough examination Within the pages of this publication a narrative unfolds that transcends theoretical discourse The book offers a unique opportunity for academic scholars researchers and industry professionals to not only understand the intricacies of RF Frontend systems but also to grapple with the practical challenges posed by their rapid evolution It becomes a guide in navigating this dynamic landscape providing a deep exploration of the issues at hand and paving the way for informed solutions and breakthroughs

**Intelligent Systems Design and Applications** Ajith Abraham,Anu Bajaj,Thomas Hanne,Patrick Siarry,Kun Ma,2024-08-01 This book highlights recent research on intelligent systems and nature inspired computing It presents 47 selected papers focused on Industrial Applications from the 23rd International Conference on Intelligent Systems Design and Applications ISDA 2023 which was held in 5 different cities namely Olten Switzerland Porto Portugal Kaunas Lithuania Greater Noida India Kochi India and in online mode The ISDA is a premier conference in the field of artificial intelligence and the latest installment brought together researchers engineers and practitioners whose work involves intelligent systems and their applications in industry ISDA 2023 had contributions by authors from 64 countries This book offers a valuable reference guide for all industrial specialists scientists academicians researchers students and practitioners in the field of artificial intelligence and industrial applications

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