

## Small Antennas In Portable Devices

Software radio ideally provides the opportunity to communicate with any radio communication standard by modifying only the software, without any modification to hardware components. However, taking into account the static behavior of current communication protocols, the spectrum efficiency optimization, and flexibility, the radio domain has become an important factor. From this thinking appeared the cognitive radio paradigm. This evolution is today inescapable in the modern radio communication world. It provides an autonomous behavior to the equipment and therefore the adaptation of communication parameters to better match their needs. This collective work provides engineers, researchers and radio designers with the necessary information from mathematical analysis and hardware architectures to design methodology and tools, running platforms and standardization in order to understand this new cognitive radio domain.

Explore the potential for nanotechnologies to transform future mobile and Internet communications. Based on a research collaboration between Nokia, Helsinki University of Technology, and the University of Cambridge, here leading researchers review the current state-of-the-art and future prospects for:

- Novel multifunctional materials, dirt repellent, self-healing surface materials, and lightweight structural materials capable of adapting their shape
- Portable energy storage using supercapacitor-battery hybrids

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based on new materials including carbon nanohorns and porous electrodes, fuel cell technologies, energy harvesting and more efficient solar cells • Electronics and computing advances reaching beyond IC scaling limits, new computing approaches and architectures, embedded intelligence and future memory technologies. • Nanoscale transducers for mechanical, optical and chemical sensing, sensor signal processing, and nanoscale actuation • Nanoelectronics to create ultrafast and adaptive electronics for future radio technologies • Flat panel displays with greater robustness, improved resolution, brightness and contrast, and mechanical flexibility • Manufacturing and innovation processes, plus commercialization of nanotechnologies.

Written by a leading expert in the field, this practical new resource presents the fundamentals of electromagnetics and antenna technology. This book covers the design, electromagnetic simulation, fabrication, and measurements for various types of antennas, including impedance matching techniques and beamforming for ultrawideband dipoles, monopoles, loops, vector sensors for direction finding, HF curtain arrays, 3D printed nonplanar patch antenna arrays, waveguides for portable radar, reflector antennas, and other antennas. It explores the essentials of phased array antennas and includes detailed derivations of important field equations, and a detailed formulation of the method of moments. This resource exhibits essential derivations of equations, providing readers with a strong foundation of the underpinnings of electromagnetics and antennas. It includes a complete chapter on the

details of antenna and electromagnetic test and measurement. This book explores details on 3D printed non-planar circular patch array antenna technology and the design and analysis of a planar array-fed axisymmetric gregorian reflector. The lumped-element impedance matched antennas are examined and include a look at an analytic impedance matching solution with a parallel LC network. This book provides key insight into many aspects of antenna technology that have broad applications in radar and communications.

Antennas for Portable Devices John Wiley & Sons

ABSTRACT: Advances in technology have placed a great emphasis on the design of broadband antennas as well as antenna miniaturization to cope with the demands of making electronic and handheld communication devices smaller and more efficient. In this thesis, the design and fabrication of a frequency independent antenna and a narrow-band planar microstrip Balun are presented. An analysis of frequency selective surfaces is also introduced in order to demonstrate their capability to miniaturize antenna thickness. Lastly, s-parameters measurements and efficiency characterization are performed to determine the radiation properties of surface mount chip inductors in order to determine the feasibility of using them as electrically small antennas. Two types of frequency independent antennas are considered due to their planar geometries, the Equiangular and Archimedean spiral antennas. Frequency independent antennas are radiating devices that have frequency independent impedance and

pattern properties because their shape is specified only in terms of angles. The Balun is designed to meet the need of a feeding element for the Archimedean spiral antenna. A Balun is a three port device that connects an unbalanced transmission line such as a coaxial line to a balanced feed line such as the one required by two-arm spiral antennas. The Balun discussed in this work is designed to operate at 2.4 GHz with a 200 MHz bandwidth and to transform the antenna input impedance to a 50-ohm reference impedance. The main characteristics from this device that distinguish it from commercially available structures are its low cost, planarity, and compact footprint. The balancing capability of this Balun is shown by the close agreement between the measured and simulated results. Antennas can be potentially miniaturized in the z-direction by replacing the PEC ground plane separated from the antenna by a  $\lambda/4$  thick substrate with a frequency selective surface (FSS) structure that allows the ground plane conductor to be in close proximity to the antenna without affecting its radiation performance. The FSS layer operating at 2.4 GHz presented in this thesis is static (not tuned) and thus the overall bandwidth reduces approximately to the bandwidth obtained with the narrow-band Balun.

This book presents selected contributions of the Ultra-Wideband Short-Pulse Electromagnetics 7 Conference, including electromagnetic theory, scattering, Ultrawideband (UWB) antennas, UWB systems, ground penetrating radar, UWB communications, pulsed-power generation, time-domain computational

electromagnetics, UWB compatibility, target detection and discrimination, propagation through dispersive media, and wavelet and multi-resolution techniques.

This book focuses on new techniques, analysis, applications and future trends of microstrip and printed antenna technologies, with particular emphasis to recent advances from the last decade. Attention is given to fundamental concepts and techniques, their practical applications and the future scope of developments. Several topics, essayed as individual chapters include reconfigurable antenna, ultra-wideband (UWB) antenna, reflectarrays, antennas for RFID systems and also those for body area networks. Also included are antennas using metamaterials and defected ground structures (DGSs). Essential aspects including advanced design, analysis and optimization techniques based on the recent developments have also been addressed.

**Key Features:** Addresses emerging hot topics of research and applications in microstrip and printed antennas  
Considers the fundamental concepts, techniques, applications and future scope of such technologies  
Discusses modern applications such as wireless base station to mobile handset, satellite earth station to airborne communication systems, radio frequency identification (RFID) to body area networks, etc.  
Contributions from highly regarded experts and pioneers from the US, Europe and Asia  
This book provides a reference for R&D researchers, professors, practicing engineers, and scientists working in these fields.  
Graduate students studying/working on related subjects will find this book as a comprehensive literature for understanding the present

and future trends in microstrip and printed antennas.

**Substrate-Integrated Millimeter-Wave Antennas for Next-Generation Communication and Radar Systems** The first and only comprehensive text on substrate-integrated mmW antenna technology, state-of-the-art antenna design, and emerging wireless applications **Substrate-Integrated Millimeter-Wave Antennas for Next-Generation Communication and Radar Systems** elaborates the most important topics related to revolutionary millimeter-wave (mmW) technology. Following a clear description of fundamental concepts including substrate-integrated waveguides and loss analysis, the text treats key design methods, prototyping techniques, and experimental setup and testing. The authors also highlight applications of mmW antennas in 5G wireless communication and next-generation radar systems. Readers are prepared to put techniques into practice through practical discussions of how to set up testing for impedance matching, radiation patterns, gain from 24GHz up to 325 GHz, and more. This book will bring readers state-of-the-art designs and recent progress in substrate-integrated mmW antennas for emerging wireless applications. **Substrate-Integrated Millimeter-Wave Antennas for Next-Generation Communication and Radar Systems** is the first comprehensive text on the topic, allowing readers to quickly master mmW technology. This book: Introduces basic

concepts such as metamaterials Huygens's surface, zero-index structures, and pattern synthesis Describes prototyping in the form of fabrication based on printed-circuit-board, low-temperature-co-fired-ceramic and micromachining Explores applications for next-generation radar and imaging systems such as 24-GHz and 77-GHz vehicular radar systems Elaborates design methods including waveguide-based feeding network, three-dimensional feeding structure, dielectric loaded aperture antenna element, and low-sidelobe synthesis The mmW is one of today's most important emerging technologies. This book provides graduate students, researchers, and engineers with the knowledge they need to deploy mmW systems and develop new antenna designs with low cost, low loss, and low complexity.

The Complete "Tool Kit for the Hottest Area in RF/Wireless Design! Short-range wireless—communications over distances of less than 100 meters—is the most rapidly growing segment of RF/wireless engineering. Alan Bensky is an internationally recognized expert in short-range wireless, and this new edition of his bestselling book is completely revised to cover the latest developments in this fast moving field. You'll find coverage of such cutting-edge topics as:

- architectural trends in RF/wireless integrated circuits
- compatibility and conflict issues between different short-range wireless systems
- "Zigbee and related new

IEEE standards for short-range communications • latest U.S. and international regulatory standards for spread spectrum, ultra wideband, and other advanced communications techniques Alan Bensky also thoroughly discusses the fundamentals of radio signal propagation, communications protocols and modulation methods, information theory, antennas and transmission lines, receivers, transmitters, radio system design, and how to successfully implement a short-range wireless system. All material has been carefully updated and revised to make it as technically up-to-the-minute as possible. You'll also find coverage of Bluetooth, "Wi-Fi and related 802.11 variants, digital modulation methods, and other essential information for planning and designing short-range wireless hardware and networks. This new edition will, like the first edition, be an invaluable reference for engineers and technical professionals who design, support, market, and maintain short-range wireless communications systems. No other book contains EVERYTHING pertaining to short-range wireless design. Covers all the hot topics like 802.11, Zigbee, Wi-Fi and Bluetooth.

This edited volume contains a selection of refereed and revised papers originally presented at the International Symposium on Signal Processing and Intelligent Recognition Systems (SIRS-2014), March 13-15, 2014, Trivandrum, India. The program committee received 134 submissions from 11 countries. Each paper

was peer reviewed by at least three or more independent referees of the program committee and the 52 papers were finally selected. The papers offer stimulating insights into Pattern Recognition, Machine Learning and Knowledge-Based Systems; Signal and Speech Processing; Image and Video Processing; Mobile Computing and Applications and Computer Vision. The book is directed to the researchers and scientists engaged in various field of signal processing and related areas.

If you are involved in designing and developing small antennas, this complete cutting-edge guide covers everything you need to know. From fundamentals and basic theory to design optimization, evaluation, measurements and simulation techniques, all the essential information is included. You will also get many practical examples from a range of wireless systems, whilst a glossary is provided to bring you up to speed on the latest terminology. A wide variety of small antennas is covered, and design and practice steps are described for each type: electrically small, functionally small, physically constrained small and physically small. Whether you are a professional in industry, a researcher, or a graduate student, this is your essential guide to small antennas.

With the progress and rapid increase in mobile terminals, the design of antennas for these small systems is becoming more and more important. This forward-

looking volume offers professionals current and comprehensive coverage of the design, development, and implementation of small, compact, and lightweight antennas in mobile communication terminals. The book discusses a wide range of communication systems, from Radio-frequency identification (RFID), and near field communications (NFC), to wireless power transmission (WPT) and broadband wireless networks. Engineers learn how to use small antennas in mobile phones, wearable systems, laptop computers, radio watches, and broadband wireless networks such as WLAN and WiMAX. This definite reference covers the critical applications today's professionals need to understand, from antennas for IoT and antenna design for 5G mm-wave devices, to body-centric communication systems and antennas for unmanned aerial vehicles.

Stutzman's 3rd edition of *Antenna Theory and Design* provides a more pedagogical approach with a greater emphasis on computational methods. New features include additional modern material to make the text more exciting and relevant to practicing engineers; new chapters on systems, low-profile elements and base station antennas; organizational changes to improve understanding; more details to selected important topics such as microstrip antennas and arrays; and expanded measurements topic.

This book presents a comprehensive insight into the design techniques for

different types of CP antenna elements and arrays In this book, the authors address a broad range of topics on circularly polarized (CP) antennas. Firstly, it introduces to the reader basic principles, design techniques and characteristics of various types of CP antennas, such as CP patch antennas, CP helix antennas, quadrifilar helix antennas (QHA), printed quadrifilar helix antennas (PQHA), spiral antenna, CP slot antennas, CP dielectric resonator antennas, loop antennas, crossed dipoles, monopoles and CP horns. Advanced designs such as small-size CP antennas, broadband, wideband and ultra-wideband CP antennas are also discussed, as well as multi-band CP antennas and dual CP antennas. The design and analysis of different types of CP array antennas such as broadband CP patch arrays, dual-band CP arrays, CP printed slot arrays, single-band and multi-band CP reflectarrays, high-gain CP waveguide slot antennas, CP dielectric resonator antenna arrays, CP active arrays, millimetre-waveband CP arrays in LTCC, and CP arrays with electronically beam-switching or beam-steering capabilities are described in detail. Case studies are provided to illustrate the design and implementation of CP antennas in practical scenarios such as dual-band Global Navigation Satellite Systems (GNSS) receivers, satellite communication mobile terminals at the S-band, Radio Frequency Identification (RFID) readers at 2.4 GHz, and Ka-band high-speed satellite communication

applications. It also includes the detailed designs for a wideband Logarithmic spiral antenna that can operate from 3.4-7.7 GHz. In addition, the book offers a detailed review of the recent developments of different types of CP antennas and arrays. Presents comprehensive discussions of design techniques for different types of CP antennas: small-size CP antennas, broadband CP antennas, multi-band CP antennas and CP arrays. Covers a wide range of antenna technologies such as microstrip antennas, helix, quadrifilar helix antenna, printed quadrifilar helix antenna, dielectric resonator antennas, printed slots, spiral antennas, monopoles, waveguide slot arrays, reflectarrays, active arrays, millimetre-wave arrays in LTCC, electronically beam-switching arrays and electronically beam-steerable arrays. Reviews recent developments in different types of CP antennas and arrays, reported by industries, researchers and academics worldwide. Includes numerous case studies to demonstrate how to design and implement different CP antennas in practical scenarios. Provides both an introduction for students in the field and an in-depth reference for antenna/RF engineers who work on the development of CP antennas. Circularly Polarized Antennas will be an invaluable guide for researchers in R&D organizations; system engineers (antenna, telecom, space and satellite); postgraduates studying the subjects of antenna and propagation, electromagnetics, RF/microwave/millimetre-wave

systems, satellite communications and so on; technical managers and professionals in the areas of antennas and propagation.

Wireless communications has made a huge leap during the past two decades. The multiple-input-multiple-output (MIMO) technology was proposed in the 1990's as a viable solution that can overcome the data rate limit experienced by single-input-single-output (SISO) systems. This resource is focused on printed MIMO antenna system design. Printed antennas are widely used in mobile and handheld terminals due to their conformity with the device, low cost, good integration within the device elements and mechanical parts, as well as ease of fabrication. A perfect design companion for practicing engineers, this book provides full design examples from literature, along with detailed illustrations for the various antenna geometries. This resource overviews the various applications that currently depend on printed MIMO antennas, and provides design guidelines and remarks throughout the book for guidance.

This book uses the first volume's exploration of theory, basic properties, and modeling topics to develop readers' understanding of applications and devices that are based on artificial materials. It explores a wide range of applications in fields including electronics, telecommunications, sensing, medical instrumentation, and data storage. The text also includes a practical user's guide

and explores key areas in which artificial materials have developed. It includes experts' perspectives on current and future applications of metamaterials, to present a well-rounded view on state-of-the-art technologies.

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 Wearable technology can range anywhere between activity trackers to prosthetics. These new advancements are continuously progressing and becoming a part of daily life. Examining Developments and Applications of Wearable Devices in Modern Society is a pivotal reference source for the most innovative research on the expansion of wearable computing and technology. Featuring coverage on a broad range of topics such as stroke monitoring, augmented reality, and cancer detection, this publication is ideally designed for academicians, researchers, and students seeking current research on the challenges and benefits of the latest wearable devices.

Issues in Electronic Circuits, Devices, and Materials: 2013 Edition is a ScholarlyEditions™ book that delivers timely, authoritative, and comprehensive information about Microwave Research. The editors have built Issues in Electronic Circuits, Devices, and Materials: 2013 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Microwave Research in this book to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Issues in Electronic Circuits, Devices, and Materials: 2013 Edition has been produced by the world's leading scientists, engineers, analysts, research

institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at <http://www.ScholarlyEditions.com/>.

A comprehensive resource to the latest developments of system enhancement techniques of Femtocells, power management, interference mitigation and antenna design LTE Communications and Networks fills a gap in the literature to offer a comprehensive review of the most current developments of LTE Femtocells and antennas and explores their future growth. With contributions from a group of experts that represent the fields of wireless communications and mobile communications, signal processing and antenna design, this text identifies technical challenges and presents recent results related to the development, integration and enhancement of LTE systems in portable devices. The authors examine topics such as application of cognitive radio with efficient sensing mechanisms, interference mitigation and power management schemes for the LTE systems. They also provide a comprehensive account of design challenges and approaches, performance enhancement techniques and effects of user's presence on the LTE antennas. LTE Communications and Networks also

highlights the promising technologies of multiband, multimode and reconfigurable antennas for efficient design of portable LTE devices. Designed to be a practical resource, this text: Explores the interference mitigation, power control and spectrum management in LTE Femtocells and related issues Contains information on the design challenges, different approaches, performance enhancement and application case scenarios for the LTE antennas Covers the most recent developments of system enhancement techniques in terms of Femtocells, power management, interference mitigation and antenna design Includes contributions from leading experts in the field Written for industry professionals and researchers, LTE Communications and Networks is a groundbreaking book that presents a comprehensive treatment to the LTE systems in the context of Femtocells and antenna design and covers the wide range of issues related to the topic.

Mobile and wireless communications applications have a clear impact on improving the humanity wellbeing. From cell phones to wireless internet to home and office devices, most of the applications are converted from wired into wireless communication. Smart and advanced wireless communication environments represent the future technology and evolutionary development step in homes, hospitals, industrial, vehicular and transportation systems. A very

appealing research area in these environments has been the wireless ad hoc, sensor and mesh networks. These networks rely on ultra low powered processing nodes that sense surrounding environment temperature, pressure, humidity, motion or chemical hazards, etc. Moreover, the radio frequency (RF) transceiver nodes of such networks require the design of transmitter and receiver equipped with high performance building blocks including antennas, power and low noise amplifiers, mixers and voltage controlled oscillators. Nowadays, the researchers are facing several challenges to design such building blocks while complying with ultra low power consumption, small area and high performance constraints. CMOS technology represents an excellent candidate to facilitate the integration of the whole transceiver on a single chip. However, several challenges have to be tackled while designing and using nanoscale CMOS technologies and require innovative idea from researchers and circuits designers. While major researchers and applications have been focusing on RF wireless communication, optical wireless communication based system has started to draw some attention from researchers for a terrestrial system as well as for aerial and satellite terminals. This renewed interested in optical wireless communications is driven by several advantages such as no licensing requirements policy, no RF radiation hazards, and no need to dig up roads

besides its large bandwidth and low power consumption. This second part of the book, *Mobile and Wireless Communications: Key Technologies and Future Applications*, covers the recent development in ad hoc and sensor networks, the implementation of state of the art of wireless transceivers building blocks and recent development on optical wireless communication systems. We hope that this book will be useful for students, researchers and practitioners in their research studies.

This comprehensive handbook provides readers with a single-source reference to the theoretical fundamentals, physical mechanisms and principles of operation of all known microwave devices and various radars. The author discusses proven methods of computation and design development, process, schematic, schematic-technical and construction peculiarities of each breed of the microwave devices, as well as the most popular and original technical solutions for radars. Coverage also includes the history of creation of the most widely used radars, as well as guidelines for their potential upgrading. Offers readers a comprehensive, systematized view of all contemporary knowledge, acquired during the last 20 years, on radars and related disciplines; Provides a single-source reference on the physical mechanisms and principles of operation of the basic components of radio location devices, including theoretical aspects of designing the necessary,

high-efficiency electronic devices and systems, as well as key, practical methods of computation and design; Presents complex topics using simple language, minimizing mathematics.

This comprehensive resource covers both antenna fundamentals and practical implementation strategies, presenting antenna design with optimum performance in actual products and systems. The book helps readers bridge the gap between electromagnetic theory and its application in the design of practical antennas in real products. Practical implementation strategies in products and systems will be addressed in order to design antennas in the context of actual product environments, including PCB layout, component placement and casing design. Practical design examples on wearable electronic products are presented with a systematic approach to designing antennas for actual products. The book introduces antenna fundamentals to provide the basic concepts and necessary mathematics on electromagnetic analysis, followed by advanced antenna elements. The concept of electromagnetic simulation is presented. The advantages and disadvantages of different numerical methods in antenna modeling are also discussed. Several commercial antenna design and simulation tools are introduced, allowing hands-on practice of antenna modeling and simulation.

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This ultimate one-stop reference is designed to save you a mountain of work. You get hands-on expertise for every type of mobile antenna base station and terminal system, including its theory of operation, application strengths and weaknesses, performance characteristics, design procedures, analysis techniques, and optimization methods, complete with examples and worked-out calculations at every step.

This new volume provides an abundance of information on new biomedical applications being used today. The book covers a wide range of concepts and technologies, discussing such modern technological methods as the Internet of Things, e-pills, biomedical sensors, support vector machines, wireless devices, image and signal processing in e-health, and machine learning. It also includes a discussion on software implementation for the devices used in biomedical applications. The different types of antennas, including antennas using RF energy harvesting for biomedical applications, are covered as well.

This book highlights technology trends and challenges that trace the evolution of antenna design, starting from 3rd generation phones and moving towards the latest release of LTE-A. The authors explore how the simple monopole and whip antenna from the GSM years have evolved towards what we have today, an antenna design that is compact, multi-band in nature and caters to multiple

elements on the same patch to provide high throughput connectivity. The scope of the book targets a broad range of subjects, including the microstrip antenna, PIFA antenna, and the monopole antenna to be used for different applications over three different mobile generations. Beyond that, the authors take a step into the future and look at antenna requirements for 5G communications, which already has the 5G drive in place with prominent scenarios and use-cases emerging. They examine these, and put in place the challenges that lie ahead for antenna design, particularly in mm-Wave design. The book provides a reference for practicing engineers and under/post graduate students working in this field. For engineers, product designers, and technical marketers who need to design a cost-effective, easy-to-use, short-range wireless product that works, this practical guide is a must-have. It explains and compares the major wireless standards - Bluetooth, Wi-Fi, 802.11abgn, ZigBee, and 802.15.4 - enabling you to choose the best standard for your product. Packed with practical insights based on the author's 10 years of design experience, and highlighting pitfalls and trade-offs in performance and cost, this book will ensure you get the most out of your chosen standard by teaching you how to tailor it for your specific implementation. With information on intellectual property rights and licensing, production test, and regulatory approvals, as well as analysis of the market for wireless products, this

resource truly provides everything you need to design and implement a successful short-range wireless product.

The goal of this thesis is to design and develop a multiband antenna which can be used in portable devices such as tablets. The antennas cover majority of practical wireless communication bands. The antennas were also implemented in MIMO (multiple input multiple output) configuration to increase the data throughput. The antennas show near omnidirectional patterns as well as acceptable antenna efficiency which is essential for any wireless communication system. Full wave analysis of antennas was performed using Ansys High Frequency Structure Simulator (HFSS) v15 software. First of all, two multiband printed loop antennas covering lower GSM 850MHz (824-890MHz), GSM 900MHz (880-960MHz) frequency bands and higher GSM 1800MHz (1710-1880MHz), GSM 1900MHz (1850- 1990MHz), UMTS 2100MHz(1920-2170MHz), LTE 700MHz (698-787MHz), LTE 2300MHz (2305-2400MHz), LTE 2500MHz (2500-2690MHz), Wi-Fi 2.4GHz (2400-2483.5MHz) communications bands were designed and developed on the FR4 printed circuit board (PCB). To evaluate the performance, the antenna was conceptualized and simulated on a small ground plane size. Various simulation results such as impedance matching, 2D/3D radiation patterns, antenna

efficiency, peak gain, etc., are included for the antennas. Once the satisfactory results were obtained, it was implemented on a tablet size (241mm X 186mm) ground plane. Studies were also performed on 2X2 MIMO arrangement on the same circuit space. The envelope correlation coefficient (ECC) was calculated using S-parameters as well as radiation pattern measurement based techniques. Other parameters necessary for MIMO performance such as total active reflection coefficient (TARC), channel capacity, mean effective gain (MEG), capacity loss were also computed based on the simulated and measured data for the final antenna selection. The 2X2 MIMO antenna was prototyped, and experimentally verified to validate the simulation results. Available discrepancy between the simulated and measured results is due to the fabrication and measurement errors.

Mobile data subscriptions are expected to more than double and mobile wireless traffic to increase by more than tenfold over the next few years. Proliferation of smart phones, tablets, and other portable devices are placing greater demands for services such as web browsing, global positioning, video streaming, and video telephony. Many of the proposed solutions to deal with these demands will have a significant impact on antenna designs. Antennas with frequency agility are considered a promising technology to help implement these new solutions. This book provides readers with a

sense of the capabilities of frequency-agile antennas (FAAs), the widely diverse methods for achieving tunability, the current achievable performance, and the challenges still facing FAA designs. This resource explores the many aspects of FAAs, including an examination of the metrics used to evaluate their performance, a review of the most commonly used antenna elements, an in-depth look at the wide variety of mechanisms for achieving tunability, and a comprehensive survey of diverse examples of FAA designs. The focus is on FAAs for wireless mobile communications with applications including handsets, laptops, wireless machine-to-machine communications, as well as larger, fixed designs such as cellular base station antennas.

Now in an completely revised, updated, and enlarged Second Edition, *Small Antennas in Portable Devices* reviews recent significant theoretical and practical developments in the electrically small antenna area. Examining antenna designs that work as well as those that have limitations, this new edition provides practicing engineers and upper level and graduate students with new information on: work on improving bandwidth using spherical helix dipoles; work on electromagnetically coupled structures; exact derivation of the Q for electrically small antennas for both the TE and TM modes; and a new simplified Q formula.

*Ultra Wideband Antennas: Design, Methodologies, and Performance* presents the current state of the art of ultra wideband (UWB) antennas, from theory specific for these

radiators to guidelines for the design of omnidirectional and directional UWB antennas. Offering a comprehensive overview of the latest UWB antenna research and development, this book: Discusses the developed theory for UWB antennas in frequency and time domains Delivers a brief exposition of numerical methods for electromagnetics oriented to antennas Describes solid-planar equivalence, which allows flat structures to be implemented instead of volumetric antennas Examines the impedance matching, phase linearity, and radiation patterns as design objectives for omnidirectional and directional antennas Addresses the time domain signal analysis for UWB antennas, from which the distortion phenomenon can be modeled Includes illustrative examples, design equations, CST MICROWAVE STUDIO® simulations, and MATLAB® plot generations Compares the performance of different UWB antennas, supplying useful insight into particular tendencies and unresolved problems Ultra Wideband Antennas: Design, Methodologies, and Performance provides a valuable reference for the scientific community, as UWB antennas have a variety of applications in body area networks, radar, imaging, spectrum monitoring, electronic warfare, wireless sensor networks, and more.

Offers a comprehensive and practical reference guide to antenna design and engineering for portable devices Antennas are often the most bulky components in many portable wireless devices such as mobile phones. Whilst the demand for ever smaller and more powerful wireless devices increases, as does the importance of

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designing and engineering smaller antennas to fit these devices. Antennas for Portable Devices provides a complete and cutting-edge guide to the design and engineering of small antennas for portable electronic devices such as mobile phone handsets, laptop computers, RFID (radio frequency identification), microwave thermal therapies devices, wearable devices, and UWB (ultra-wideband) based consumer devices. The book addresses practical engineering issues that antenna professionals have to deal with. It explains the immediate demands for existing systems; discusses the antenna technology for the latest and emerging applications, and gives comprehensive coverage of hot topics in the wireless industry. Issues including design considerations, engineering design, measurement setup and methodology, and practical applications are all covered in depth. Antennas for Portable Devices: Covers antennas for all modern portable wireless devices from handsets, RFID tags, laptops, wearable sensors, UWB-based wireless USB dongles and handheld microwave treatment devices Explains how to design and engineer applications for miniaturization of antenna technology, utilising practical case studies to provide the reader with an understanding of systems and design skills Links the basic antenna theory, with design methodology, and engineering design Is amply illustrated with numerous figures and data tables of antenna designs to aid understanding Features contributions from industry and research experts in antenna technology and applications This invaluable resource will provide a comprehensive overview of miniaturizing antenna technology for antenna

engineers in industry, and R&D organizations, graduate students, consultants, researchers, RF professionals, technical managers, as well as practitioners working in the area of consumer electronics, RF systems, wireless communications, or bio-medical devices.

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This book includes the original, peer reviewed research papers from the conference, Proceedings of the 2nd International Conference on Intelligent Technologies and Engineering Systems (ICITES2013), which took place on December 12-14, 2013 at Cheng Shiu University in Kaohsiung, Taiwan. Topics covered include: laser technology, wireless and mobile networking, lean and agile manufacturing, speech processing, microwave dielectrics, intelligent circuits and systems, 3D graphics, communications and structure dynamics and control.

The move toward worldwide wireless communications continues at a remarkable pace, and the antenna element of the technology is crucial to its success. With contributions from more than 30 international experts, the Handbook of Antennas in Wireless Communications brings together all of the latest research and results to provide

engineering professionals and students with a one-stop reference on the theory, technologies, and applications for indoor, hand-held, mobile, and satellite systems. Beginning with an introduction to wireless communications systems, it offers an in-depth treatment of propagation prediction and fading channels. It then explores antenna technology with discussion of antenna design methods and the various antennas in current use or development for base stations, hand held devices, satellite communications, and shaping beams. The discussions then move to smart antennas and phased array technology, including details on array theory and beamforming techniques. Space diversity, direction-of-arrival estimation, source tracking, and blind source separation methods are addressed, as are the implementation of smart antennas and the results of field trials of systems using smart antennas implemented. Finally, the hot media topic of the safety of mobile phones receives due attention, including details of how the human body interacts with the electromagnetic fields of these devices. Its logical development and extensive range of diagrams, figures, and photographs make this handbook easy to follow and provide a clear understanding of design techniques and the performance of finished products. Its unique, comprehensive coverage written by top experts in their fields promises to make the Handbook of Antennas in Wireless Communications the standard reference for the field.

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