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Theodore

Rappaport

Wireless

Communication

Solution Manual

Wireless C  
ommunicati  
on

Solution

Manual

Wireless

technology is a

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Rappaport

truly

revolutionary

paradigm shift,

enabling

multimedia

communications

between people

and devices from

any location. It

also underpins

exciting

applications such

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Rappaport

as sensor

Wireless

networks, smart

Communication

homes,

Solution Manual

telemedicine, and

automated

highways. This

book provides a

comprehensive

introduction to

the underlying

theory, design

techniques and

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analytical tools of wireless communications, focusing primarily on the core principles of wireless system design. The book begins with an overview of wireless systems and standards.

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The characteristics of the wireless channel are then described, including their fundamental capacity limits.

Various modulation, coding, and signal processing

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schemes are then discussed in detail, including state-of-the-art adaptive modulation, multicarrier, spread spectrum, and multiple antenna techniques. The concluding

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chapters deal with multiuser communications, cellular system design, and ad-hoc network design. Design insights and tradeoffs are emphasized throughout the book. It contains

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many worked  
examples, over  
200 figures,  
almost 300  
homework  
exercises, over  
700 references,  
and is an ideal  
textbook for  
students.

Building on his  
classic edition,



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Rappaport covers the fundamental issues impacting all wireless networks and reviews virtually every important new wireless standard and technological development. He illustrates each

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key concept with practical examples, thoroughly explained and solved step by step.

This book will provide a comprehensive technical guide covering

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fundamentals,  
recent advances  
and open issues in  
wireless

communications  
and networks to  
the readers. The  
objective of the  
book is to serve as  
a valuable  
reference for  
students,

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educators,

Wireless  
scientists, faculty

Communication

members,

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researchers,

engineers and

research

strategists in

these rapidly

evolving fields

and to encourage

them to actively

explore these

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broad, exciting

and rapidly

evolving research

areas.

In October 1993,

the Rutgers

University

Wireless

Information

Network

Laboratory hosted

the fourth

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WINLAB  
Workshop on  
Third Generation  
Wireless

Information

Networks. These  
events bring  
together a select  
group of experts  
interested in the  
long term future  
of Personal

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Communications,  
Mobile  
Computing, and  
other services  
supported by  
wireless telecom  
munications  
technology. This  
is a fast moving  
field and we  
already see, in  
present practice,

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realizations of  
visions articulated  
in the earlier  
Workshops. In  
particular, the  
second generation  
systems that  
absorbed the  
attention of the  
first WINLAB  
Workshop, are  
now commercial



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products. It is an interesting reflection on the state of knowledge of wireless communications that the debates about the relative technical merits of these systems have not yet been

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resolved.

Meanwhile, in the  
light of United  
States

Government

announcements in

September 1993

the business and

technical

communities must

confront this year

a new generation

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of Personal

Wireless

Communications

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Services. Here we

have applications

in search of the

best technologies

rather than the

reverse. This is a

rare situation in

the information

business. Today's

advanced

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planning and  
forward looking  
studies will  
prevent  
technology  
shortages and  
uncertainties at  
the end of this  
decade. By then,  
market size and  
public  
expectations will

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surpass the  
capabilities of the  
systems of the  
mid-1990's. Third

Generation

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Infonnation

Networks will

place greater

burdens on

technology than

their

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predecessors by  
offering a wider  
range of services  
and a higher

degree of service  
integration.

Millimeter Wave  
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Wireless Sensor  
Networks

Modern Wireless

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Fundamentals and

Applications

Wireless  
Communication  
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Microwave

Devices and

Circuits

*Provides necessary*

*training in the field*

*of mobile*

*communications.*

*This text explains*

*the general*

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*principles of how wireless systems work, how mobility is supported, what the underlying infrastructure is and what interactions are needed among different functional components.*

*Designed as a textbook appropriate for undergraduate or*



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*graduate courses in*

*Computer Science*

*(CS), Computer*

*Engineering (CE),*

*and Electrical*

*Engineering (EE),*

*Introduction to*

*Wireless and Mobile*

*Systems third*

*edition focuses on*

*qualitative*

*descriptions and the*

*realistic*

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*explanations of  
relationships*

*between wireless  
systems and*

*performance*

*parameters. Rather*

*than offering a*

*thorough history*

*behind the*

*development of*

*wireless*

*technologies or an*

*exhaustive list of*

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*work being carried out, the authors help*

*CS, CE, and EE*

*students learn this*

*exciting technology*

*through relevant*

*examples such as*

*understanding how*

*a cell phone starts*

*working as soon as*

*they get out of an*

*airplane. Important*

*Notice: Media*

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*content referenced within the product description or the product text may not be available in the ebook version.*

*Written by pioneers of the concept, this is the first complete guide to the physical and engineering principles of Massive MIMO.*

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*Assuming only a basic background in communications and statistical signal processing, it will guide readers through key topics in multi-cell systems such as propagation modeling, multiplexing and de-multiplexing, channel estimation,*

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*power control, and performance evaluation. The authors' unique capacity-bounding approach will enable readers to carry out effective system performance analyses and develop advanced Massive MIMO techniques and*

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*algorithms.*

*Numerous case studies, as well as problem sets and solutions*

*accompanying the*

*book online, will*

*help readers put*

*knowledge into*

*practice and acquire*

*the skill set needed*

*to design and*

*analyze complex*

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*wireless*

Wireless

*communication*

Communication

*systems. Whether*

Solution Manual

*you are a graduate*

*student, researcher,*

*or industry*

*professional working*

*in the field of*

*wireless*

*communications,*

*this will be an*

*indispensable guide*

*for years to come.*



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*"Professor Andreas  
F. Molisch,  
renowned*

*researcher and*

*educator, has put  
together the*

*comprehensive  
book, Wireless*

*Communications.*

*The second edition,*

*which includes a*

*wealth of new*

*material on*

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Communication

Solution Manual

*important topics,  
ensures the role of  
the text as the key  
resource for every  
student, researcher,  
and practitioner in  
the field."*

*—Professor Moe*

*Win, MIT, USA*

*Wireless*

*communications has*

*grown rapidly over*

*the past decade*

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*from a niche market  
into one of the most  
important, fast  
moving industries.*

*Fully updated to  
incorporate the  
latest research and  
developments,*

*Wireless  
Communications,  
Second Edition  
provides an  
authoritative*

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Solution Manual

*overview of the  
principles and  
applications of  
mobile*

*communication  
technology. The  
author provides an  
in-depth analysis of  
current treatment of  
the area, addressing  
both the traditional  
elements, such as  
Rayleigh fading,*

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*BER in flat fading channels, and equalisation, and more recently emerging topics such as multi-user detection in CDMA systems, MIMO systems, and cognitive radio. The dominant wireless standards; including cellular, cordless*

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*and wireless LANs;  
are discussed.*

*Topics featured  
include: wireless  
propagation  
channels,  
transceivers and  
signal processing,  
multiple access and  
advanced  
transceiver  
schemes, and  
standardised*

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*wireless systems.*

*Wireless*  
Combines

*Communication*  
mathematical

*Solution Manual*  
descriptions with

*intuitive*

*explanations of the*

*physical facts,*

*enabling readers to*

*acquire a deep*

*understanding of the*

*subject. Includes*

*new chapters on*

*cognitive radio,*

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*cooperative  
communications  
and relaying, video  
coding, 3GPP Long  
Term Evolution, and  
WiMax; plus  
significant new  
sections on multi-  
user MIMO,  
802.11n, and  
information theory.  
Companion website  
featuring:*



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*supplementary  
material on 'DECT',*

*solutions manual*

*and presentation*

*slides for*

*instructors,*

*appendices, list of*

*abbreviations and*

*other useful*

*resources.*

*Mobile Wireless*

*Communications*

*Theory and Design*

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*of Digital*

*Wireless*

*Communication*

*Solution Manual*

*5G Mobile and*

*Wireless*

*Communications*

*Technology*

*MIMO-OFDM*

*Wireless*

*Communications*

*with MATLAB*

This volume

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presents an overview of computer-based simulation models and methodologies for communication systems. Topics covered include probability, random, process, and estimation theory and roles in

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Communication  
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the design of  
computer-based  
simulations.  
Discover the  
concepts,  
architectures,  
components, tools,  
and techniques  
needed to design  
millimeter-wave  
circuits for current  
and emerging

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wireless system

applications.

Wireless  
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Focusing on

applications in 5G,

connectivity, radar,

and more, leading

experts in radio

frequency

integrated circuit

(RFIC) design

provide a

comprehensive

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treatment of cutting-edge physical-layer technologies for radio frequency (RF) transceivers - specifically RF, analog, mixed-signal, and digital circuits and architectures. The full design chain is

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covered, from  
system design  
requirements  
through to building  
blocks,  
transceivers, and  
process  
technology. Gain  
insight into the key  
novelties of 5G  
through  
authoritative

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chapters on  
massive MIMO  
and phased  
arrays, and learn  
about the very  
latest technology  
developments,  
such as FinFET  
logic process  
technology for RF  
and millimeter-  
wave applications.



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This is an essential reading and an excellent reference for high-frequency circuit designers in both academia and industry.

MIMO-OFDM is a key technology for next-generation cellular communications

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(3GPP-LTE,  
Mobile WiMAX,  
IMT-Advanced) as  
well as wireless

LAN (IEEE

802.11a, IEEE

802.11n), wireless

PAN (MB-OFDM),

and broadcasting

(DAB, DVB, DMB).

In MIMO-OFDM

Wireless

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Communications  
with MATLAB®,  
the authors  
provide a  
comprehensive  
introduction to the  
theory and  
practice of wireless  
channel modeling,  
OFDM, and MIMO,  
using MATLAB®  
programs to

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simulate the  
various techniques  
on MIMO-OFDM  
systems. One of

the only books in  
the area dedicated  
to explaining  
simulation aspects

Covers

implementation to  
help cement the  
key concepts Uses

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materials that have  
been classroom-  
tested in  
numerous

universities

Provides the  
analytic solutions  
and practical  
examples with  
downloadable  
MATLAB® codes  
Simulation

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examples based  
on actual industry  
and research  
projects

Presentation slides  
with key equations  
and figures for  
instructor use

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with MATLAB® is

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a key text for  
graduate students  
in wireless  
communications.

Professionals and  
technicians in  
wireless

communication  
fields, graduate  
students in signal  
processing, as well  
as senior

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undergraduates

majoring in

wireless

communications

will find this book a

practical

introduction to the

MIMO-OFDM

techniques.

Instructor materials

and MATLAB®

code examples



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available for

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imo

The area of

personal and

wireless

communications is

a burgeoning field.

Technology

advances and new

frequency

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Communication

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allocations for  
personal  
communication  
services (PCS) are  
creating numerous  
business and  
technical  
opportunities. It is  
becoming clear  
that an essential  
requirement for  
exploiting

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opportunities is the ability to track the dramatic changes in wireless

technology, which is a principal aim of this book.

Wireless Personal Communications: Research Developments places particular

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emphasis on the areas of signal processing, propagation and spread-spectrum, and emerging communication systems. This book contains new results on adaptive antennas for capacity

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improvements in wireless communication systems, as well as state-of-the-art information on the latest technical developments.

Also included are several chapters which discuss the impact of defense

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conversion on the wireless industry, and related competitive issues.

The six parts of the book each focus on a distinct issue in wireless communications.

Part I contains several tutorial chapters on key

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areas in wireless communications.

The first chapter is on radio wave

propagation for

emerging wireless

personal

communication

systems. Chapter

two contains a

comprehensive

study of emerging

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DSP-based  
interference  
rejection  
techniques for  
single channel  
(antenna) systems.

Chapter three  
deals with spread  
spectrum wireless  
communications,  
explaining the  
concept of spread



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spectrum,

Wireless  
modeling

Communication

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spread spectrum,

and current

applications and

research issues for

spread spectrum

systems. Part II

focuses on digital

signal processing

and spread

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spectrum, two  
Wireless  
Communication  
Solution Manual  
means of creating  
interference and  
multipath robust  
communications.

Part III concerns  
propagation

aspects of wireless  
communications.

Part IV discusses  
the performance of  
emerging wireless

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systems. Part V describes the opportunities and pitfalls of defense conversion from the perspective of several U.S. defense firms that have successfully made the transition to commercial

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wireless. The final section discusses a number of competitive issues regarding personal communication services.

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Technologies: New

MultiMedia

Systems

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Research

Wireless  
Developments

Communication

Solution Manual

Concepts and Key

Architectures

With Applications

to Wired and

Storage Systems

State of the Art

*Wireless channels are*

*becoming more and*

*more important, with*

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Wireless

Communication

Second Edition

and satellite

*communications. To*

*this end, algorithmic*

*detection aspects*

*(involved in the physical*

*layer) will become*

*fundamental in the*

*design of a*

*communication system.*

*This book proposes a*

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*unified approach to detection for stochastic channels, with particular attention to wireless channels. The core idea is to show that the three main criteria of sequence detection, symbol detection and graph-based detection, can all be described within a general framework. This implies that a detection*

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Rappaport

*algorithm based on one*

*criterion can be*

*extended to the other*

*criteria in a systematic*

*manner. Presents a*

*detailed analysis of*

*statistical signal*

*detection for digital*

*signals transmitted over*

*wireless*

*communications*

*Provides a unifying*

*framework for*

*different signal*



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Rappaport

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Solution Manual

*detection algorithms,*

*such as sequence*

*detection, symbol*

*detection and graph-*

*based detection,*

*important for the*

*design of modern*

*digital receivers*

*operating over mobile*

*channels Features the*

*hot topic of graph-*

*based detection*

*Detection Algorithms*

*for Wireless*

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Solution Manual

*Communications  
represents a novel  
contribution with  
respect to the current  
literature, with a unique  
focus on detection  
algorithms, as such it  
will prove invaluable to  
researchers working in  
academia and industry  
and in the field of  
wireless  
communications, as well  
as postgraduate students*

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*attending advanced  
courses on mobile  
communications.*

*The First Practical  
Guide to Advanced  
Wireless Development  
with ZigBee*

*Technologies Supported  
by more than a hundred  
companies, the new  
ZigBee standard  
enables powerful new  
wireless applications  
for safety, security, and*

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*control, ranging from smart energy to home automation and medical care to advanced remote control. ZigBee Wireless Sensor and Control Network brings together all the knowledge professionals need to start building effective ZigBee solutions. The only simple, concise guide to ZigBee architecture, concepts,*

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Security Manual

*networking, and applications, this book thoroughly explains the entire ZigBee protocol stack and covers issues ranging from routing to security. It also presents detailed, practical coverage of ZigBee features for home automation, smart energy networking, and consumer electronics.*

*Topics include •*

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*Fundamental wireless concepts: OSI Model, error detection, the ISM Band, modulation, WLAN, FHSS, DSSS, Wireless MANs, Bluetooth, and more • ZigBee essentials: applications, characteristics, device types, topologies, protocol architecture, and expanded ZigBee PRO features •*

*Physical layer: includes frequency bands, data rate, channels, data/management services, transmitter power, and receiver sensitivity • MAC layer: data/management services, MAC layer information base, access methods, and frames • Network layer: data entities, NIB, device*

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*configuration, starting network, addressing, discovery, channel scanning, and more •*

*Application support sublayer and*

*application layer:*

*includes profiles,*

*cluster format,*

*attributes, device*

*discovery, and binding •*

*ZigBee network*

*security: includes*

*encryption, trust center,*



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System Manual

*security modes, and  
security management  
primitives • Address  
assignment and routing  
techniques • Alternative  
technologies: 6lowpan,  
WirelessHART, and Z-  
wave*

*In this book, the state-  
of-the-art and future  
vision of wireless  
communications is  
presented in the form  
of a number of new*

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*services. Wireless  
personal*

*communications is*

*clearly a different*

*service than today's*

*cellular radio or*

*cordless telephone, but*

*there is an evolutionary*

*connection between the*

*three services. This book*

*addresses questions*

*about what features of*

*personal*

*communication services*

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Systems Manual

*(PCS) will be met by existing or enhanced digital cellular radio technology. The regulatory and standards aspects of wireless communications are currently in a crucial stage of their formulation. A section of the book is devoted to the opinions of representatives from*

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*regulatory agencies and standards organizations on the future of this critical area. One of the most intriguing questions about the future of wireless communications has to do with the choice of multiple access technique. The trade offs between time division multiple access (TDMA) and code*

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*division multiple access (CDMA) have been the topic of many a heated discussion amongst members of the wireless community. This book presents a thorough discussion of a number of the topics which are instrumental in making a fair comparison of TDMA and CDMA; these topics include: analytical performance*

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*evaluation techniques,  
capacity studies,  
equalization  
requirements, and  
shared spectrum  
comparisons. Many of  
the technologies  
associated with wireless  
personal  
communications are  
reaching the design  
stages. This book  
presents a number of  
alternatives for designs*

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*of both base stations and user terminals. Some of the key questions of equalization, control channel requirements, multi-path diversity and channel allocation strategies have been addressed. Invariably, system designs and performance are tied to the characteristics of the radio channel. This*

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System Manual

*book introduces several novel techniques for predicting propagation and system performance in a variety of indoor and outdoor environments. These techniques include analytical as well as computer simulation algorithms for predicting signal strenghts and other channel parameters*



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Communication

Solution Manual

*based on the local  
topographical features.*

*This book serves as an  
excellent reference  
source and may be used  
as a text for advanced  
courses on wireless  
communications,  
cellular radio, or digital  
mobile radio.*

*The Definitive Guide to  
LTE Technology Long-  
Term Evolution (LTE)  
is the next step in the*

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*GSM evolutionary path beyond 3G technology, and it is strongly positioned to be the dominant global standard for 4G cellular networks. LTE also represents the first generation of cellular networks to be based on a flat IP architecture and is designed to seamlessly support a variety of different*

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Second Edition

*services, such as  
broadband data, voice,  
and multicast video. Its  
design incorporates  
many of the key  
innovations of digital  
communication, such as  
MIMO (multiple input  
multiple output) and  
OFDMA (orthogonal  
frequency division  
multiple access), that  
mandate new skills to  
plan, build, and deploy*

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*an LTE network. In  
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*of LTE in a tutorial*

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*comprehensive overview*

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*Following the same*

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*their recent*

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*Multicarrier  
modulation theory and  
practice: OFDM system  
design, peak-to-average  
power ratios, and SC-  
FDE solutions*

*Frequency Domain*

*Multiple Access:  
OFDMA downlinks, SC-  
FDMA uplinks,  
resource allocation, and  
LTE-specific  
implementation*

*Multiple antenna*

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*techniques and*

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*tradeoffs: spatial*

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*diversity, interference*

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*multiplexing, and*

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*MIMO LTE standard*

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*protocol, channel*

*structure, and physical*

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*channel processing:*

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*modulation mapping,*

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*antenna processing, and*

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equalization, and

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wireless networks  
can achieve  
security while  
retaining the  
broadcast nature  
of the system,***

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with mmWave.***

***They deliver  
exceptionally  
clear and useful  
guidance for  
newcomers, as  
well as the first***

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***complete desk  
reference for  
design experts.***

***The authors  
explain mmWave  
signal  
propagation,  
mmWave circuit  
design, antenna  
designs,  
communication  
theory, and  
current standards***



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**(including IEEE  
802.15.3c,**

**Wireless HD, and  
ECMA/WiMedia).**

**They cover**

**comprehensive**

**mmWave wireless**

**design issues, for**

**60 GHz and other**

**mmWave bands,**

**from channel to**

**antenna to**

**receiver,**

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***introducing  
emerging design  
techniques that  
will be invaluable  
for research  
engineers in both  
industry and  
academia. Topics  
include***

***Fundamentals:  
communication  
theory, channel  
propagation,***

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***circuits,  
antennas,  
architectures,  
capabilities, and  
applications***

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***communication:***

***baseband***

***signal/channel***

***models,***

***modulation,***

***equalization,***

***error control***

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***coding, multiple  
input multiple  
output (MIMO)  
principles, and  
hardware  
architectures  
Radio wave  
propagation  
characteristics:  
indoor and  
outdoor  
applications  
Antennas/antenn***

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***a arrays,  
including on-chip***

***and in-package***

***antennas,***

***fabrication, and***

***packaging Analog***

***circuit design:***

***mmWave***

***transistors,***

***fabrication, and***

***transceiver***

***design***

***approaches***

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***Baseband circuit design: multi-gigabit-per-second, high-fidelity DAC and ADC***

***converters***

***Physical layer:***

***algorithmic***

***choices, design***

***considerations,***

***and impairment***

***solutions; and***

***how to overcome***

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**clipping,  
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**Higher-layer**

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**relaying,**

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**transmission, and**

**multiband**

**considerations 60**

**GHz**

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**standardization:**

**IEEE 802.15.3c**

**for WPAN,**

**Wireless HD,**

**ECMA-387, IEEE**

**802.11ad,**

**Wireless Gigabit**

**Alliance (WiGig)**

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***universe of applications. It shares the latest advances in science and engineering paving the way towards a large plethora of new applications in such areas as infrastructure protection and***

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***security, healthcare, energy, food safety, RFID, ZigBee, and processing. Unlike other books on wireless sensor networks that focus on limited topics in the field, this book is a broad introduction that covers all the***

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***major technology,  
standards, and  
application topics.***

***It contains***

***everything readers  
need to know to  
enter this***

***burgeoning field,  
including current  
applications and  
promising***

***research and  
development;***

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**communication  
and networking  
protocols;  
middleware  
architecture for  
wireless sensor  
networks; and  
security and  
management. The  
straightforward  
and engaging  
writing style of this  
book makes even**

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***complex concepts  
and processes  
easy to follow and  
understand. In  
addition, it offers  
several features  
that help readers  
grasp the material  
and then apply  
their knowledge in  
designing their  
own wireless  
sensor network***

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**systems: \***

***Examples illustrate  
how concepts are  
applied to the  
development and  
application of \*  
wireless sensor  
networks \****

***Detailed case  
studies set forth  
all the steps of  
design and  
implementation***



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***needed to solve  
real-world  
problems \****

***Chapter***

***conclusions that  
serve as an***

***excellent review by  
stressing the***

***chapter's key  
concepts \****

***References in each  
chapter guide***

***readers to in-depth***

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***discussions of  
individual topics  
This book is ideal  
for networking  
designers and  
engineers who  
want to fully  
exploit this new  
technology and for  
government  
employees who  
are concerned  
about homeland***

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***security. With its examples, it is appropriate for use as a coursebook for upper-level undergraduates and graduate students.***

***This textbook takes a unified view of the fundamentals of wireless***

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***communication  
and explains  
cutting-edge  
concepts in a  
simple and  
intuitive way. An  
abundant supply  
of exercises make  
it ideal for  
graduate courses  
in electrical and  
computer  
engineering and it***

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***will also be of  
great interest to  
practising  
engineers.***

***The move toward  
worldwide wireless  
communications  
continues at a  
remarkable pace,  
and the antenna  
element of the  
technology is  
crucial to its***

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**success. With  
contributions from  
more than 30**

**international**

**experts, the**

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**Antennas in**

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**brings together all**

**of the latest**

**research and**

**results to provide**

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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**

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***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***



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***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***

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***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***

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***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***

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***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***

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***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***

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**the standard**

**reference for the**

**field.**

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**Electronics**

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**Link Design and**

**System**

**Performance**

**Wireless and**

**Mobile**

**Communications**

**Smart Antennas**

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## **Steel Design**

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*Focusing on the fundamentals of wireless communications and networking, this book introduces readers to an overview of the salient features of first and second generation*



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wireless

Wireless

cellular

Communication

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for the third

generation, with

a road map. It

identifies the

problems that

cause

information loss

in point-to-

point signal

transmission

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*through the wireless channel, and discusses techniques suitable for minimizing the information loss. With an acceptable transmission quality, the text proceeds to cover wireless*

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*communications  
in a cellular  
setting,  
treating the  
ramifications in  
terms of  
capacity  
maximization,  
support for  
multi-user  
transmissions,  
mobility  
management to  
facilitate user*

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*roaming, and*

Wireless

*global*

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*wireless/wirelin*

*e interworking.*

*For individuals*

*beginning their*

*study of*

*electrical and*

*computer*

*engineering.*

*STEEL DESIGN*

*covers the*

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*fundamentals of structural steel design with an emphasis on the design of members and their connections, rather than the integrated design of buildings. The book is designed so that*

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*instructors can easily teach LRFD, ASD, or both, time-permitting. The application of fundamental principles is encouraged for design procedures as well as for practical design, but a*

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*theoretical*

Wireless

*approach is also*

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*provided to*

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*enhance student*

*development.*

*While the book*

*is intended for*

*junior-and*

*senior-level*

*engineering*

*students, some*

*of the later*

*chapters can be*

*used in graduate*

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*courses and*

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*practicing*

*engineers will*

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*to be an*

*essential*

*reference tool*

*for reviewing*

*current*

*practices.*

*Important*

*Notice: Media*

*content*

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*within the  
product*

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*may not be*

*available in the  
ebook version.*

*For cellular*

*radio engineers*

*and technicians.*

*The leading book*

*on wireless*

*communications*

*offers a wealth*

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*of practical  
information on  
the  
implementation  
realities of  
wireless  
communications.  
This book also  
contains up-to-  
date information  
on the major  
wireless  
communications  
standards from*

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*around the world. Covers every fundamental aspect of wireless communications, from cellular system design to networking, plus world-wide standards, including ETACS, GSM, and PDC. .*

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*Ultrawideband  
(UWB)*

*Communication  
systems offer an  
unprecedented  
opportunity to  
impact the  
future  
communication  
world. The  
enormous  
available  
bandwidth, the  
wide scope of*

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*the data rate /  
range trade-off,  
as well as the  
potential for  
very low-cost  
operation  
leading  
to pervasive  
usage, all  
present a unique  
opportunity for  
UWB systems to  
impact the way  
people and*

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*intelligent*

Wireless  
*machines*

Communication and

Solution Manual  
*interact with th*

*eirenvironment.*

*The aim of this*

*book is to*

*provide an*

*overview of the*

*state of the art*

*of UWBsystems*

*from theory to*

*applications.*

*Due to the rapid*

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*progress of mult  
idisciplinary*

*UWB research,*

*such an*

*overviewcan only*

*be achieved by*

*combining the*

*areas of*

*expertise of sev*

*eralscientists*

*in the field.*

*More than 30*

*leading UWB*

*researchers and*

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*practitioners*

*have contributed*

*to this book*

*covering the*

*major topics*

*relevant to UWB.*

*These topics*

*include UWB*

*signal*

*processing, UWB*

*channel*

*measurement and*

*modeling, higher-*

*layer protocol*



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*issues, spatial aspects of UWB signaling, UWB regulation and standardization, implementation issues, and UWB applications as well*

*as positioning.*

*The book is targeted at advanced academic*

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*researchers,*

*Wireless*

*wireless*

*designers, and*

*graduate*

*students wishing*

*to greatly*

*enhance their*

*knowledge of*

*allaspects of*

*UWB systems*

*Communication*

*Networks*

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*Principles and  
Practice*

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*Systems*

*Digital*

*Communications*

**A comprehensive  
introduction to the  
fundamentals of design  
and applications of  
wireless  
communications  
Wireless**

*Page 227/234*

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**Communications Systems starts by explaining the fundamentals needed to understand, design, and deploy wireless communications systems. The author, a noted expert on the topic, explores the basic concepts of signals, modulation, antennas, and propagation with a**

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**MATLAB emphasis.**

**The book emphasizes**

**practical applications**

**and concepts needed**

**by wireless engineers.**

**The author introduces**

**applications of wireless**

**communications and**

**includes information**

**on satellite**

**communications, radio**

**frequency**

**identification, and**

**offers an overview**

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Second Edition

**with practical insights  
into the topic of  
multiple input multiple  
output (MIMO). The  
book also explains the  
security and health  
effects of wireless  
systems concerns on  
users and designers.  
Designed as a practical  
resource, the text  
contains a range of  
examples and pictures  
that illustrate many**

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**different aspects of  
wireless technology.**

**The book relies on  
MATLAB for most of  
the computations and  
graphics. This**

**important text:**

**Reviews the basic  
information needed to  
understand and design  
wireless**

**communications  
systems Covers topics  
such as MIMO**

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Solutions Manual

**systems, adaptive  
antennas, direction  
finding, wireless  
security, internet of  
things (IoT), radio  
frequency  
identification (RFID),  
and software defined  
radio (SDR) Provides  
examples with a  
MATLAB emphasis to  
aid comprehension  
Includes an online  
solutions manual and**



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selected topics Written

for students of

engineering and

physics and practicing

engineers and

scientists, Wireless

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Systems covers the

fundamentals of

wireless engineering in

a clear and concise

manner and contains

many illustrative

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**examples.**

**Fundamentals of LTE**

**Principles of**

**Communication**

**Systems Simulation**

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**Networks**

**Ad Hoc Wireless**

**Networks**