

From Gsm To Lte Advanced

From Gsm To Lte Advanced From GSM to LTE Advanced: The Evolution of Mobile Communication Technologies The journey from GSM to LTE Advanced marks a remarkable evolution in mobile communication, transforming how we connect, communicate, and access information worldwide. This progression reflects technological innovations over decades, driven by increasing demand for faster data speeds, improved network reliability, and enhanced user experiences. Understanding this evolution provides insight into the future of wireless communication and the foundational technologies underpinning modern connectivity.

Historical Overview of Mobile Communication Technologies

GSM: The Beginning of Digital Cellular Networks

Global System for Mobile Communications (GSM) emerged in the early 1990s as a standard for digital cellular networks. It replaced analog systems and introduced features like SMS, caller ID, and international roaming. GSM operates on a Time Division Multiple Access (TDMA) scheme, which divides frequency bands into time slots, allowing multiple users to share the same frequency efficiently.

Key Features of GSM:

- Digital voice transmission
- SMS and MMS capabilities
- International roaming support
- Secure communication through encryption

Limitations of GSM:

- Limited data rates (~14.4 kbps)
- High congestion in densely populated areas
- Limited bandwidth for multimedia services

2G and 3G Networks: Expanding Capabilities

The evolution continued with 2G networks like GSM-based GPRS and EDGE, offering enhanced data rates suitable for basic internet browsing and messaging. The advent of 3G networks introduced UMTS and CDMA2000 technologies, significantly increasing data speeds and enabling mobile broadband services.

Highlights of 3G:

- Data rates up to several Mbps
- Video calling and mobile internet
- Improved spectrum efficiency

4G and LTE: High-Speed Mobile Broadband

LTE (Long-Term Evolution) marked a substantial leap forward, providing broadband-quality internet access on mobile devices. LTE utilizes Orthogonal Frequency Division Multiple Access (OFDMA) for downlink and Single Carrier Frequency Division Multiple Access (SC-FDMA) for uplink, optimizing spectral efficiency.

Key Features of LTE:

- Data speeds up to 100 Mbps (downloads)
- Lower latency (~30-50 ms)
- Support for HD video streaming, VoIP, and high-quality multimedia

Limitations of LTE:

- Initial coverage gaps in rural areas
- Network congestion in urban hotspots
- Power consumption concerns for devices

From LTE to LTE Advanced: The Next Step in Mobile Technology

Understanding LTE Advanced

LTE Advanced (LTE-A) is an evolution of LTE, designed to meet the requirements of 4G-Advanced standards set by the 3GPP (3rd Generation Partnership Project). It introduces advanced features to increase data rates, improve network capacity, and enhance coverage and reliability.

Core Objectives of LTE Advanced:

- Achieve peak data rates of up to 1 Gbps for downloads and 500 Mbps for uploads
- Enhance spectral efficiency through carrier aggregation
- Improve latency and overall network responsiveness
- Support for heterogeneous networks (HetNets) and small cells

Key Technologies and Features of LTE Advanced

Carrier Aggregation

Carrier aggregation (CA) combines multiple frequency bands to increase bandwidth and data throughput. This allows devices to access aggregated carriers seamlessly, leading to higher speeds.

Types of Carrier Aggregation:

- Intra-band CA: Aggregates carriers within the same band¹.
- Inter-band CA: Combines carriers across different frequency bands².
- 3

Advanced MIMO (Multiple Input Multiple Output)

LTE-A employs higher-order MIMO configurations, such as 8x8 MIMO, to

enhance data capacity and reliability by transmitting multiple data streams simultaneously. Benefits of Advanced MIMO: Increased spectral efficiency Improved data rates Enhanced signal quality and coverage HetNets and Small Cells Heterogeneous networks integrate macrocells with small cells like picocells and femtocells to improve coverage and capacity, especially in densely populated urban areas. Advantages: Better indoor and urban coverage Higher network capacity Reduced interference through advanced coordination Enhanced Backhaul and Network Architecture LTE-A supports improved backhaul solutions, including fiber and microwave links, to ensure high-capacity data transfer between base stations and core networks, reducing latency and increasing throughput. Benefits of Transitioning to LTE Advanced

1. Significantly Higher Data Speeds LTE-A provides peak data rates an order of magnitude higher than standard LTE, enabling richer multimedia experiences, streaming, and faster downloads.
2. Improved Network Capacity and Efficiency Carrier aggregation and advanced MIMO allow networks to handle more users simultaneously, reducing congestion and improving overall service quality.
3. Reduced Latency Lower latency improves real-time applications such as gaming, video conferencing, and autonomous vehicle communication.
4. Better Coverage and Reliability Heterogeneous networks and small cells extend coverage indoors and in challenging environments, ensuring consistent connectivity.
5. Future-Proof Infrastructure LTE-A lays the groundwork for upcoming technologies like 5G, ensuring compatibility and smooth transition paths.

LTE Advanced and Beyond: The Road to 5G While LTE Advanced represents a significant milestone, the industry is already preparing for the next generation: 5G. 5G networks aim to deliver even higher data rates, ultra-low latency, massive connectivity, and support for emerging technologies like IoT, augmented reality, and autonomous systems. Transition Strategies: Carrier aggregation and MIMO will continue to evolve in 5G Network slicing and virtualization will enable tailored services Integration of LTE and 5G networks for seamless user experience Conclusion The progression from GSM to LTE Advanced reflects ongoing innovation and the relentless pursuit of faster, more reliable wireless communication. LTE Advanced not only enhances current network capabilities but also paves the way for the future of mobile connectivity, including the advent of 5G. As technology continues to evolve, users can expect increasingly sophisticated networks that support the growing demands of digital life, from high-definition streaming to the Internet of Things. Whether you're a tech enthusiast, industry professional, or everyday user, understanding this evolution helps appreciate the incredible advancements that keep us connected in an ever-more digital world.

Question What are the main differences between GSM and LTE Advanced technologies? GSM is a 2G technology primarily designed for voice communication and basic data services, whereas LTE Advanced is a 4G technology offering high-speed data, low latency, and enhanced network capacity, enabling advanced mobile broadband experiences. Why did mobile networks transition from GSM to LTE Advanced? Networks shifted from GSM to LTE Advanced to meet the growing demand for faster internet, better data throughput, improved user experience, and support for modern applications like video streaming and IoT devices. What are the key features introduced with LTE Advanced over GSM? LTE Advanced introduced features such as carrier aggregation, MIMO (Multiple Input Multiple Output), higher modulation schemes, improved spectral efficiency, and lower latency, significantly enhancing mobile data capabilities. How does the transition from GSM to LTE Advanced impact mobile device compatibility? The transition requires devices to support newer LTE bands and technologies; older GSM-only devices may no longer be compatible with modern LTE networks, prompting users to upgrade to newer smartphones supporting LTE Advanced. What challenges are faced during the migration from GSM to LTE Advanced? Challenges include infrastructure upgrades, spectrum reallocation, ensuring seamless coverage, device compatibility issues, and managing the transition

without service disruptions for users. How does LTE Advanced improve network capacity compared to GSM? LTE Advanced uses advanced techniques like carrier aggregation and MIMO, which increase spectral efficiency and enable more data to be transmitted simultaneously, greatly enhancing network capacity over GSM.

5 What is the role of spectrum in transitioning from GSM to LTE Advanced?

Spectrum allocation is crucial; LTE Advanced utilizes wider bandwidths and multiple frequency bands through carrier aggregation, requiring efficient spectrum management to optimize network performance. Will GSM networks completely disappear with the rollout of LTE Advanced? While GSM networks are being phased out gradually as LTE and newer technologies become widespread, some regions may still maintain GSM for legacy devices, but the global trend is toward full migration to LTE and beyond.

From GSM to LTE-Advanced: The Evolution of Mobile Communication Technologies

The journey of mobile communication from the early days of GSM to the sophisticated LTE-Advanced standards marks an extraordinary technological evolution. This progression not only reflects significant advancements in data rates, network efficiency, and service quality but also exemplifies how mobile technology continually adapts to meet the growing demands of users worldwide. In this comprehensive review, we will delve into the key milestones, technical innovations, and the future outlook of this evolutionary path.

--- Introduction to Mobile Communication Generations

Mobile communication has gone through multiple generations, each marked by groundbreaking technological improvements:

- 1G (First Generation): Analog voice communication
- 2G: Digital voice and basic data services
- 3G: Mobile broadband and internet access
- 4G: High-speed data transfer with LTE and LTE-Advanced
- 5G: Ultra-reliable, low-latency connectivity supporting IoT and smart applications

Our focus primarily lies in tracing the development from GSM (Global System for Mobile Communications), which defined 2G, to LTE-Advanced, the pinnacle of 4G technology at its time of inception.

--- GSM – The Foundation of Digital Cellular Networks

Overview of GSM Technology

GSM, introduced in the early 1990s, revolutionized mobile telephony by transforming analog systems into digital networks. Its key features include:

- Digital voice transmission
- SIM card-based subscriber identity
- Standardized worldwide, enabling international roaming
- Basic data services like SMS and GPRS (General Packet Radio Service)

Limitations of GSM

While GSM laid the groundwork, it faced limitations such as:

- Limited data throughput (~14.4 kbps with GPRS)
- Inefficient spectrum utilization
- Lack of support for multimedia services
- Limited spectral efficiency and capacity

--- From Gsm To Lte Advanced

6 Transition to 3G and the Rise of UMTS

Introduction of UMTS and W-CDMA

The move to 3G, exemplified by UMTS (Universal Mobile Telecommunications System), brought:

- Increased data rates (up to 2 Mbps in ideal conditions)
- Improved voice quality
- Support for multimedia applications

Using Wideband Code Division Multiple Access (W-CDMA), UMTS improved spectral efficiency but still faced challenges in meeting the exploding data demand.

--- The 4G Era: LTE and LTE-Advanced

Emergence of LTE (Long Term Evolution)

LTE represented a paradigm shift, focusing on:

- All-IP architecture for both voice and data
- Significantly higher data rates (theoretically up to 100 Mbps downstream)
- Reduced latency
- Simplified network architecture with flat design
- Enhanced spectral efficiency via OFDMA and MIMO

Key features of LTE include:

- OFDMA (Orthogonal Frequency Division Multiple Access) in downlink
- SC-FDMA (Single Carrier Frequency Division Multiple Access) in uplink
- Flexible bandwidth options (from 1.4 MHz to 20 MHz)
- Support for advanced antenna techniques (MIMO)

Limitations of LTE (Initial Releases)

Despite improvements, early LTE faced certain limitations:

- Peak data rates were not fully utilized in real-world conditions
- Network complexity and spectrum fragmentation
- Limited support for heterogeneous networks (HetNets) and carrier aggregation

Advancement to LTE-Advanced

Recognizing the need for further enhancements, LTE-Advanced was introduced as a 4G-Plus

standard, offering: - Higher throughput - Better spectrum efficiency - Support for carrier aggregation, relays, and heterogeneous networks --- Technical Deep Dive: From GSM to LTE-Advanced Spectral Efficiency and Spectrum Utilization One of the key drivers behind LTE-Advanced is optimizing spectrum use: - Carrier Aggregation: Combining multiple carriers (up to 32 in LTE-Advanced) to increase bandwidth and throughput - Enhanced MIMO: Implementation of up to 8x8 MIMO configurations for higher data rates - Coordinated Multi-Point (CoMP): Inter-cell cooperation to improve coverage and spectral efficiency

From Gsm To Lte Advanced 7 Network Architecture Evolution

The architecture evolved significantly: - GSM: Circuit-switched architecture - UMTS: Introduction of Node Bs and RNCs - LTE: Flattened architecture with evolved Node Bs (eNodeBs) - LTE-Advanced: Further densification with small cells, relays, and heterogeneous network support

Radio Access Technologies and Techniques

The transition incorporates several advanced radio techniques: - OFDMA: Efficiently handles multipath propagation and frequency reuse - MIMO (Multiple Input Multiple Output): Uses multiple antennas at both transmitter and receiver ends - Beamforming: Focuses radio signals to improve link quality - Carrier Aggregation: Increases bandwidth and supports higher data rates

Data Rates and Quality of Service

LTE-Advanced targets: - Peak download speeds of 1 Gbps for stationary users - Peak upload speeds of 500 Mbps - Improved latency (< 10ms for certain applications) - Enhanced QoS mechanisms to prioritize services --- Deployment and Challenges

Deployment Strategies

Transitioning from GSM to LTE-Advanced involves: - Infrastructure upgrades and densification - Spectrum management and acquisition - Network planning for seamless handover between legacy and advanced networks - Implementation of small cells and heterogeneous network components

Technical and Regulatory Challenges

Key challenges include: - Spectrum scarcity and fragmentation - Interoperability issues between different network generations - High capital expenditure for infrastructure deployment - Ensuring backward compatibility for legacy devices

Impact on Users and Services

The benefits of LTE-Advanced manifest in: - Faster data speeds enabling high-quality streaming, gaming, and cloud services - Lower latency fostering real-time applications - Improved coverage and reliability - Support for emerging technologies like IoT, autonomous vehicles, and smart cities --- From Gsm To Lte Advanced 8 Future Outlook: Beyond LTE-Advanced

Transition to 5G and 6G

While LTE-Advanced set new benchmarks, the industry is already pushing toward: - 5G New Radio (NR) standards with ultra-low latency, massive connectivity, and higher capacity - Integration of LTE and 5G for seamless user experience (NSA and SA modes) - Research into 6G with anticipated features like terahertz communications, AI-driven networks, and holographic communications

Role of LTE-Advanced in 5G Era

LTE-Advanced remains relevant as: - A foundation for initial 5G deployments - Supporting legacy devices during transition phases - Enhancing existing networks with features like carrier aggregation and MIMO

Emerging Trends

Future developments influenced by LTE-Advanced include: - Dynamic spectrum sharing - Network slicing for tailored services - Integration with satellite and non-terrestrial networks - AI and machine learning for network optimization --- Conclusion

The progression from GSM to LTE-Advanced encapsulates a remarkable journey of technological innovation, driven by the insatiable demand for higher data rates, better coverage, and more reliable services. Each generation built upon the successes and limitations of its predecessors, culminating in LTE-Advanced's sophisticated features that have set the stage for the upcoming era of 5G and beyond. As the landscape of mobile communication continues to evolve, understanding this transformation provides valuable insights into the complexities and opportunities shaping our connected future. --- In summary, the transition from GSM to LTE-Advanced exemplifies the relentless pursuit of better connectivity—characterized by increased capacity, efficiency, and user experience—paving the way for the next generation of wireless innovations. GSM, LTE, LTE Advanced, mobile networks, 4G, 5G,

network evolution, wireless communication, cellular technology, mobile standards

From GSM to LTE-Advanced Pro and 5G From GSM to LTE-Advanced From LTE to LTE-Advanced Pro and 5G LTE for UMTS 4G: LTE/LTE-Advanced for Mobile Broadband An Introduction to LTE An Introduction to LTE LTE and the Evolution to 4G Wireless LTE Advanced Practical Guide to LTE-A, VoLTE and IoT LTE and LTE Advanced The LTE-Advanced Deployment Handbook 4G, LTE-Advanced Pro and The Road to 5G LTE, LTE-Advanced and WiMAX LTE Advanced Pro From GSM to LTE-Advanced Pro and 5G, 3rd Edition LTE - The UMTS Long Term Evolution LTE-Advanced LTE-Advanced Relay Technology and Standardization Radio Protocols for LTE and LTE-Advanced Martin Sauter Martin Sauter Moe Rahnema Harri Holma Erik Dahlman Christopher Cox Christopher Cox Agilent Technologies Harri Holma Ayman ElNashar André Perez Jyrki T. J. Penttinen Erik Dahlman Abd-Elhamid M. Taha Frédéric Launay Martin Sauter Stefania Sesia Sassan Ahmadi Yifei Yuan SeungJune Yi From GSM to LTE-Advanced Pro and 5G From GSM to LTE-Advanced From LTE to LTE-Advanced Pro and 5G LTE for UMTS 4G: LTE/LTE-Advanced for Mobile Broadband An Introduction to LTE An Introduction to LTE LTE and the Evolution to 4G Wireless LTE Advanced Practical Guide to LTE-A, VoLTE and IoT LTE and LTE Advanced The LTE-Advanced Deployment Handbook 4G, LTE-Advanced Pro and The Road to 5G LTE, LTE-Advanced and WiMAX LTE Advanced Pro From GSM to LTE-Advanced Pro and 5G, 3rd Edition LTE - The UMTS Long Term Evolution LTE-Advanced LTE-Advanced Relay Technology and Standardization Radio Protocols for LTE and LTE-Advanced Martin Sauter Martin Sauter Moe Rahnema Harri Holma Erik Dahlman Christopher Cox Christopher Cox Agilent Technologies Harri Holma Ayman ElNashar André Perez Jyrki T. J. Penttinen Erik Dahlman Abd-Elhamid M. Taha Frédéric Launay Martin Sauter Stefania Sesia Sassan Ahmadi Yifei Yuan SeungJune Yi

a comparative introduction to major global wireless standards technologies and their applications from gsm to lte advanced pro and 5g an introduction to mobile networks and mobile broadband 3rd edition provides technical descriptions of the various wireless technologies currently in use it explains the rationales behind their differing mechanisms and implementations while exploring the advantages and limitations of each technology this edition has been fully updated and substantially expanded to reflect the significant evolution in mobile network technology occurring over the past several years the chapter on lte has been extensively enhanced with new coverage of current implementations of lte carrier aggregation mobility management cell reselection and handover procedures as well as the latest developments in 5g radio and core networks in 3gpp it now features additional information on the td lte air interface ipv6 in mobile networks network function virtualization nfv and narrowband internet of things nb iot voice over lte volte is now treated extensively in a separate chapter featuring coverage of the volte call establishment process dedicated bearer setup header compression speech codec and bandwidth negotiation supplementary service configuration and volte emergency calls in addition extensive coverage of voice over wifi and mission critical communication for public safety organizations over lte has been added the wlan chapter now provides coverage of wpa2 professional with certificates for authentication in large deployments such as the global eduroam network and the new wlan 60 ghz air interface bluetooth evolution has been addressed by including a detailed description of bluetooth low energy ble in the chapter devoted to bluetooth describes the different systems based on the standards their practical implementation and design assumptions and the performance and capacity of each system in practice is analyzed and explained questions at the end of each chapter and answers on the accompanying website

make this book ideal for self study or as course material

this revised edition of communication systems from gsm to lte an introduction to mobile networks and mobile broadband second edition wiley 2010 contains not only a technical description of the different wireless systems available today but also explains the rationale behind the different mechanisms and implementations not only the how but also the why in this way the advantages and also limitations of each technology become apparent offering a solid introduction to major global wireless standards and comparisons of the different wireless technologies and their applications this edition has been updated to provide the latest directions and activities in 3gpp standardization up to release 12 and importantly includes a new chapter on voice over lte volte there are new sections on building blocks of a voice centric device building blocks of a smart phone fast dormancy ims and high speed downlink packet access and wi fi protected setup other sections have been considerably updated in places reflecting the current state of the technology describes the different systems based on the standards their practical implementation and design assumptions and the performance and capacity of each system in practice is analyzed and explained questions at the end of each chapter and answers on the accompanying website make this book ideal for self study or as course material

this practical hands on new resource presents lte technologies from end to end including network planning and the optimization tradeoff process this book examines the features of lte advanced and lte advanced pro and how they integrate into existing lte networks professionals find in depth coverage of how the air interface is structured at the physical layer and how the related link level protocols are designed and work this resource highlights potential 5g solutions as considered in releases 14 and beyond the migration paths and the challenges involved with the latest updates and standardization process moreover the book covers performance analysis and results as well as son specifications and realization readers learn about ofdma and how dft is used to implement it link budgeting parameter estimations and network planning and sizing is explained insight into core network architecture is provided including the protocols and signaling used for both data and voice services the book also presents a detailed chapter on the end to end data transfer optimization mechanisms based on the tcp protocol this book provides the tools needed for network planning and optimization while addressing the challenges of lte and lte advanced networks

written by experts actively involved in the 3gpp standards and product development lte for umts second edition gives a complete and up to date overview of long term evolution lte in a systematic and clear manner building upon on the success of the first edition lte for umts second edition has been revised to now contain improved coverage of the release 8 lte details including field performance results transport network self optimized networks and also covering the enhancements done in 3gpp release 9 this new edition also provides an outlook to release 10 including the overview of release 10 lte advanced technology components which enable reaching data rates beyond 1 gbps key updates for the second edition of lte for umts are focused on the new topics from release 9 10 and include lte advanced self optimized networks son transport network dimensioning measurement results

this book focuses on lte with full updates including lte advanced release 11 to provide a complete picture of the lte system detailed explanations are given for the latest lte standards for radio interface architecture the physical layer access procedures broadcast relaying spectrum and rf characteristics and system performance key technologies presented include multi carrier transmission

advanced single carrier transmission advanced receivers ofdm mimo and adaptive antenna solutions radio resource management and protocols and different radio network architectures their role and use in the context of mobile broadband access in general is explained giving both a high level overview and more detailed step by step explanations this book is a must have resource for engineers and other professionals in the telecommunications industry working with cellular or wireless broadband technologies giving an understanding of how to utilize the new technology in order to stay ahead of the competition new to this edition in depth description of comp and enhanced multi antenna transmission including new reference signal structures and feedback mechanisms detailed description of the support for heterogeneous deployments provided by the latest 3gpp release detailed description of new enhanced downlink control channel structure epcch new rf configurations including operation in non contiguous spectrum multi bands base stations and new frequency bands overview of 5g as a set of well integrated radio access technologies including support for higher frequency bands and flexible spectrum management massive antenna configurations and ultra dense deployments covers a complete update to the latest 3gpp release 11 two new chapters on hetnet covering small cells heterogeneous deployments and comp including inter site coordination overview of current status of lte release 12 including further enhancements of local area comp and multi antenna transmission machine type communication device to device communication

an introduction to lte explains the technology used by 3gpp long term evolution the book covers the whole of lte both the techniques used for radio communication between the base station and the mobile phone and the techniques used for signalling communication and data transport in the evolved packet core it avoids unnecessary detail focussing instead on conveying a sound understanding of the entire system the book is aimed at mobile telecommunication professionals who want to understand what lte is and how it works it is invaluable for engineers who are working on lte notably those who are transferring from other technologies such as umts and cdma2000 those who are experts in one part of lte but who want to understand the system as a whole and those who are new to mobile telecommunications altogether it is also relevant to those working in non technical roles such as project managers marketing executives and intellectual property consultants on completing the book the reader will have a clear understanding of lte and will be able to tackle the more specialised books and the 3gpp specifications with confidence key features covers the latest developments in release 10 of the 3gpp specifications including the new capabilities of lte advanced includes references to individual sections of the 3gpp specifications to help readers understand the principles of each topic before going to the specifications for more detailed information requires no previous knowledge of mobile telecommunications or of the mathematical techniques that lte uses for radio transmission and reception

following on from the successful first edition march 2012 this book gives a clear explanation of what lte does and how it works the content is expressed at a systems level offering readers the opportunity to grasp the key factors that make lte the hot topic amongst vendors and operators across the globe the book assumes no more than a basic knowledge of mobile telecommunication systems and the reader is not expected to have any previous knowledge of the complex mathematical operations that underpin lte this second edition introduces new material for the current state of the industry such as the new features of lte in releases 11 and 12 notably coordinated multipoint transmission and proximity services the main short and long term solutions for lte voice calls namely circuit switched fallback and the ip multimedia subsystem and the evolution and current state of the lte market it also extends some of the material from the first edition such as inter operation with other technologies such as gsm umts wireless local

area networks and cdma2000 additional features of lte advanced notably heterogeneous networks and traffic offloading data transport in the evolved packet core coverage and capacity estimation for lte and a more rigorous treatment of modulation demodulation and ofdma the author breaks down the system into logical blocks by initially introducing the architecture of lte explaining the techniques used for radio transmission and reception and the overall operation of the system and concluding with more specialized topics such as lte voice calls and the later releases of the specifications this methodical approach enables readers to move on to tackle the specifications and the more advanced texts with confidence

a practical guide to lte design test and measurement this new edition has been updated to include the latest developments this book presents the latest details on lte from a practical and technical perspective written by agilent's measurement experts it offers a valuable insight into lte technology and its design and test challenges chapters cover the upper layer signaling and system architecture evolution sae basic concepts such as mimo and sc fdma the new uplink modulation scheme are introduced and explained and the authors look into the challenges of verifying the designs of the receivers transmitters and protocols of lte systems the latest information on rf and signaling conformance testing is delivered by authors participating in the lte 3gpp standards committees this second edition has been considerably revised to reflect the most recent developments of the technologies and standards particularly important updates include an increased focus on lte advanced as well as the latest testing specifications fully updated to include the latest information on lte 3gpp standards chapters on conformance testing have been majorly revised and there is an increased focus on lte advanced includes new sections on testing challenges as well as over the air mimo testing protocol testing and the most up to date test capabilities of instruments written from both a technical and practical point of view by leading experts in the field

from the editors of the highly successful lte for umts evolution to lte advanced this new book examines the main technical enhancements brought by lte advanced thoroughly covering 3gpp release 10 specifications and the main items in release 11 using illustrations graphs and real life scenarios the authors systematically lead readers through this cutting edge topic to provide an outlook on existing technologies as well as possible future developments the book is structured to follow the main technical areas that will be enhanced by the lte advanced specifications the main topics covered include carrier aggregation multiantenna mimo transmission heterogeneous networks coordinated multipoint transmission comp relay nodes 3gpp milestones and imt advanced process in itu r and lte advanced performance evaluation key features leading author and editor team bring their expertise to the next generation of lte technology includes tables figures and plots illustrating the concepts or simulation results to aid understanding of the topic and enabling readers to be ahead of the technological advances

essential reference providing best practice of lte a volte and iot design deployment performance and evolution towards 5g this book is a practical guide to the design deployment and performance of lte a volte ims and iot a comprehensive practical performance analysis for volte is conducted based on field measurement results from live lte networks also it provides a comprehensive introduction to iot and 5g evolutions practical aspects and best practice of lte a ims volte iot are presented practical aspects of lte advanced features are presented in addition lte lte a network capacity dimensioning and analysis are demonstrated based on live lte lte a networks kpis a comprehensive foundation for 5g technologies is provided including massive mimo embb urllc mmhc ngen

and network slicing cloudification virtualization and sdn practical guide to lte a volte and iot paving the way towards 5g can be used as a practical comprehensive guide for best practices in lte lte a volte iot design deployment performance analysis and network architecture and dimensioning it offers tutorial introduction on lte a iot 5g networks enabling the reader to use this advanced book without the need to refer to more introductory texts offers a complete overview of lte and lte a ims volte and iot and 5g introduces readers to ip multimedia subsystems ims performs a comprehensive evaluation of volte csfb provides lte lte a network capacity and dimensioning examines iot and 5g evolutions towards a super connected world introduce 3gpp nb iot evolution for low power wide area lpwa network provide a comprehensive introduction for 5g evolution including embb urllc mmte network slicing cloudification virtualization sdn and orchestration practical guide to lte a volte and iot will appeal to all deployment and service engineers network designers and planning and optimization engineers working in mobile communications also it is a practical guide for r d and standardization experts to evolve the lte lte a volte and iot towards 5g evolution

this book presents the technical characteristics of the two radio network interfaces of mobile 4g lte and lte advanced based on release 8 9 and 10 of the 3gpp specifications points covered include a detailed description of various components of the radio interface rrc signaling messages used to establish the connection enabling the security the paging the establishment and the release of dedicated and default support and the handover the pdcp ensures the security of the transmission and allows the recovery during handover and the compression of the headers the rlc protocol defines the transmission modes with or without acknowledgment the mac protocol determines the random access the data transfer the timing advance the scheduling and the discontinuous reception the physical layer includes a description of the methods of multiplexing time frequency and space and the various signals and physical channels

lte advanced is the new global standard which is expected to create a foundation for the future wireless broadband services the standard incorporates all the latest technologies recently developed in the field of wireless communications presented in a modular style the book provides an introductory description for beginners as well as practical guidelines for telecom specialists it contains an introductory module that is suitable for the initial studies of the technology based on the 3gpp release 10 11 and beyond of lte and sae the latter part of the book is suitable for experienced professionals who will benefit from the practical descriptions of the physical core and radio network planning end to end performance measurements physical network construction and optimization of the system the focus of the book is in the functioning planning construction measurements and optimization of the radio and core networks of the release 10 and beyond of the 3gpp lte and sae standards it looks at the practical description of the advanced version of the lte sae how to demystify the lte advanced functionality and planning and how to carry out practical measurements of the system in general the book describes how to do it for the 4g system which is compliant with the itu r requirements

the upcoming 5g specifications from 3gpp to be available in 2018 will include lte advanced pro as well as a new 5g radio access technology this practical and very successful book written by engineers working closely with 3gpp gives insight into the newest technologies and standards adopted by 3gpp with detailed explanations of the specific solutions chosen and their implementation in lte lte advanced and lte advanced pro as well as providing a detailed description of the path to 5g and the associated underlying technologies this edition has been thoroughly revised and updated to reflect the large extensions to lte as introduced in 3gpp

releases 12 and 13 and the role of lte in the upcoming 5g era new to this edition includes updated content on 4g and 5g radio access spectrum for 4g and 5g machine type communication device to device communication license assisted access full dimension mimo small cell enhancements eimta fdd tdd aggregation dual connectivity requirements on and general structure of 5g wireless access addressing the existing and new usage scenarios for 5g technical solutions for the new 5g radio access technology the authors of this book all work at ericsson research and have been deeply involved in 3g and 4g development and standardization they are leading experts in the field and are today actively contributing to the standardization of 4g and 5g within 3gpp the leading book on 3gpp specifications for lte lte advanced and lte advanced pro covering up to and including release 13 written by ericsson engineers who are heavily involved in the development of 3gpp specifications ten new chapters and coverage of all major features introduced with release 12 and 13 two completely new chapters on 5g wireless access including a detailed description of the key technology components under development by 3gpp

a concise introduction to imt advanced systems including lte advanced and wimax there exists a strong demand for fully extending emerging internet services including collaborative applications and social networking to the mobile and wireless domain delivering such services can be possible only through realizing broadband in the wireless two candidate technologies are currently competing in fulfilling the requirements for wireless broadband networks wimax and lte at the moment lte and its future evolution lte advanced are already gaining ground in terms of vendor and operator support whilst both technologies share certain attributes utilizing orthogonal frequency division multiple access ofdma in downlink accommodating smart antennas and full support for ip switching for example they differ in others including uplink technology scheduling frame structure and mobility support beyond technological merits factors such as deployment readiness ecosystem maturity and migration feasibility come to light when comparing the aptitude of the two technologies lte lte advanced and wimax towards imt advanced networks provides a concise no nonsense introduction to the two technologies covering both interface and networking considerations more critically the book gives a multi faceted comparison carefully analyzing and distinguishing the characteristics of each technology and spanning both technical and economic merits a big picture understanding of the market strategies and forecasts is also offered discusses and critically evaluates lte lte advanced and wimax legacy and advanced gives an overview of the principles and advances of each enabling technology offers a feature by feature comparison between the candidate technologies includes information which appeals to both industry practitioners and academics provides an up to date report on market and industry status

this book presents lte evolution towards 5g mobile communication and the emergence of new requirements for mbb mtc and llc services as lte technologies evolve lte advanced pro dramatically increases cell capacity and user data rates for the mbb unicast service such requirements are obtained using full dimension mimo carrier aggregation on either licensed or unlicensed frequency bands and dual connectivity to improve the efficiency of same content delivery to multiple users 3gpp proposes a group communications service over lte and defines mission critical push to talk mcptt for dedicated public safety services complementary low cost and low power modems with enhanced coverage and massive connectivity are emerging thus this book also discusses the need for lte to support low rate transmission and high latency communication for mtc services

a comparative introduction to major global wireless standards technologies and their applications from gsm to lte advanced pro and

5g an introduction to mobile networks and mobile broadband 3rd edition provides technical descriptions of the various wireless technologies currently in use it explains the rationales behind their differing mechanisms and implementations while exploring the advantages and limitations of each technology this edition has been fully updated and substantially expanded to reflect the significant evolution in mobile network technology occurring over the past several years the chapter on lte has been extensively enhanced with new coverage of current implementations of lte carrier aggregation mobility management cell reselection and handover procedures as well as the latest developments in 5g radio and core networks in 3gpp it now features additional information on the td lte air interface ipv6 in mobile networks network function virtualization nfv and narrowband internet of things nb iot voice over lte volte is now treated extensively in a separate chapter featuring coverage of the volte call establishment process dedicated bearer setup header compression speech codec and bandwidth negotiation supplementary service configuration and volte emergency calls in addition extensive coverage of voice over wifi and mission critical communication for public safety organizations over lte has been added the wlan chapter now provides coverage of wpa2 professional with certificates for authentication in large deployments such as the global eduroam network and the new wlan 60 ghz air interface bluetooth evolution has been addressed by including a detailed description of bluetooth low energy ble in the chapter devoted to bluetooth describes the different systems based on the standards their practical implementation and design assumptions and the performance and capacity of each system in practice is analyzed and explained questions at the end of each chapter and answers on the accompanying website make this book ideal for self study or as course material

where this book is exceptional is that the reader will not just learn how lte works but why it works adrian scrase etsi vice president international partnership projects following on the success of the first edition this book is fully updated covering the latest additions to lte and the key features of lte advanced this book builds on the success of its predecessor offering the same comprehensive system level understanding built on explanations of the underlying theory now expanded to include complete coverage of release 9 and the developing specifications for lte advanced the book is a collaborative effort of more than 40 key experts representing over 20 companies actively participating in the development of lte as well as academia the book highlights practical implications illustrates the expected performance and draws comparisons with the well known wcdma hspa standards the authors not only pay special attention to the physical layer giving an insight into the fundamental concepts of ofdma fdma and mimo but also cover the higher protocol layers and system architecture to enable the reader to gain an overall understanding of the system key new features comprehensively updated with the latest changes of the lte release 8 specifications including improved coverage of radio resource management rf aspects and performance requirements provides detailed coverage of the new lte release 9 features including embms dual layer beamforming user equipment positioning home enodebs femtocells and pico cells and self optimizing networks evaluates the lte system performance introduces lte advanced explaining its context and motivation as well as the key new features including carrier aggregation relaying high order mimo and cooperative multi point transmission comp includes an accompanying website containing a complete list of acronyms related to lte and lte advanced with a brief description of each wiley com go sesia theumts this book is an invaluable reference for all research and development engineers involved in implementation of lte or lte advanced as well as graduate and phd students in wireless communications network operators service providers and r d managers will also find this book insightful

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provides a unique focus on radio protocols for lte and lte advanced lte a giving readers a valuable understanding of lte radio protocols this book covers lte long term evolution layer 2 3 radio protocols as well as new features including lte advanced it is divided into two sections to differentiate between the two technologies characteristics the authors systematically explain the design principles and functions of lte radio protocols during the development of mobile handsets the book also provides essential knowledge on the interaction between mobile networks and mobile handsets among the first publications based on the 3gpp r10 specifications which introduces lte a beginning with an overview of lte topics covered include idle mode procedure packet data convergence protocol and public warning systems presents the lte radio interface protocol layers in a readable manner to enhance

the material in the standards publications from an expert author team who have been directly working on the 3gpp standards it is targeted at professionals working or intending to work in the area and can also serve as supplementary reading material for students who need to know how theory on the most extensively used mobile radio interface today is put into practice

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