

LTE 800 (Max. 75 MBit/s)

Frequenz: 800 MHz
10 MHz Bandbreite

Netzbetreiber:
Telekom, Vodafone, O2

Geeignet für ländliche Regionen

LTE 1800 (Max. 150 MBit/s)

Frequenz: 1800 MHz
20 MHz Bandbreite

Netzbetreiber:
Telekom, Eplus

Geeignet für dichter
besiedelte Regionen

LTE 2600 (Max. 150 MBit/s)

Frequenz: 2600 MHz
20 MHz Bandbreite

Netzbetreiber:
Telekom, Vodafone, O2

Geeignet für hochfrequentierte
Orte (z.B.: Bahnhöfe, Stadien etc.)

LTE 800 + LTE 2600

75 Mbit/s + 150 Mbit/s =

225 MBit/s

10 MHz + 20 MHz = 30 MHz

Netzbetreiber: Vodafone, O2

Einsatzbereich: Hotspots

LTE Advanced

zwei Frequenzbereiche
werden zusammen gelegt

LTE 1800 + LTE 2600

150 Mbit/s + 150 Mbit/s =

300 MBit/s

20 MHz + 20 MHz = 40 MHz

Netzbetreiber: Telekom

Einsatzbereich: Hotspots

LTE Advanced mit 4x4 MIMO

Mit 4 Antennen am Sendemast und 4 Antennen am Endgerät
(z.B. Router) kann die Geschwindigkeit verdoppelt werden

2 x 225 MBit/s =
450 MBit/s

2 x 300 MBit/s =
600 MBit/s



Lte Advanced Lte Advanced

CO Houle



Lte Advanced Lte Advanced:

4G: LTE/LTE-Advanced for Mobile Broadband Erik Dahlman, Stefan Parkvall, Johan Skold, 2011-03-21 LTE Long Term Evolution is the 3GPP's 3rd Generation Partnership Project new standard and accompanying technologies that mobile network operators such as AT&T Verizon and TeliaSonera are adopting for their networks To move to higher speed networks that can cater to customer demand for mobile broadband multimedia applications the 3GPP has developed the latest LTE Advanced LTE Release 10 standard which will be fixed in December 2010 This book focuses on LTE and LTE Advanced and provides engineers with real insight and understanding into the why and how of the standard and its related technologies This book is written by engineers from Ericsson the world's leading telecommunications supplier who was heavily involved in the development of the standard Follow up to the very successful 3G Evolution now focusing on LTE and LTE Advanced standard and its accompanying technologies Complete and clear explanation of LTE Advanced by the people who played a leading role in its development which will enable engineers to quickly grasp the latest 3GPP Release 10 standard and implement it in their products Not a contributed book as most others on this topic are this book gives an integrated introduction to the technologies and the standard

LTE for UMTS Harri Holma, Antti Toskala, 2011-03-16 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 Self optimized networks SON Transport network dimensioning Measurement results

LTE and LTE Advanced André Pérez, 2015-11-04 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

An Introduction to LTE Christopher Cox, 2014-05-12 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.

From LTE to LTE-Advanced Pro and 5G Moe Rahnema, Marcin Dryjanski, 2017-09-30. 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.

The LTE-Advanced Deployment Handbook Jyrki T. J. Penttinen, 2015-11-30. 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 de mystify 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 Essentials of LTE and LTE-A Amitabha Ghosh,Rapeepat Ratasuk,2011-08-04 This practical one stop guide will quickly bring you up to speed on LTE and LTE Advanced With everything you need to know about the theory and technology behind the standards this is a must have for engineers and managers in the wireless industry First book of its kind describing technologies and system performance of LTE A Covers the evolution of digital wireless technology basics of LTE and LTE A design of downlink and uplink channels multi antenna techniques and heterogeneous networks Analyzes performance benefits over competing technologies including WiMAX and 802 16m Reflects the latest LTE Release 10 standards Includes numerous examples including extensive system and link results Unique approach is accessible to technical and non technical readers alike From GSM to LTE-Advanced Pro and 5G Martin Sauter,2017-10-23 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

An Introduction to LTE Christopher Cox, 2012-03-08 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 [LTE-Advanced Air Interface Technology](#) Xincheng Zhang, Xiaojin Zhou, 2012-09-05 Opportunities are at hand for professionals eager to learn and apply the latest theories and practices in air interface technologies Written by experienced researchers and professionals LTE Advanced Air Interface Technology thoroughly covers the performance targets and technology components studied by 3GPP for LTE Advanced Besides being an expla **LTE, LTE-Advanced and WiMAX** Abd-Elhamid M. Taha, Najah Abu Ali, Hossam S. Hassanein, 2011-10-27 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 **LTE Advanced Pro** Frédéric Launay, André Perez, 2019-06-03 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 **LTE Advanced** Harri Holma, Antti Toskala, 2012-08-20 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 **LTE-Advanced Relay Technology and Standardization** Yifei Yuan, 2012-07-25 LTE Advanced relay technology and standardization provides a timely reference work for relay technology with the finalizing of LTE Release 10 specifications LTE Advanced is quickly becoming the global standard for 4G cellular communications The relay technology as one of the key features in LTE Advanced helps not only to improve the system coverage and capacity but also to save the costs of laying wireline backhaul As a leading researcher in the field of LTE Advanced standards the author provides an in depth description of LTE A relay technology and explains in detail the standard specification and design principles Readers from both academic and industrial fields can find sections of interest to them Sections 2 4 could benefit researchers in academia and those who are engaged in exploratory work while

Sections 3 4 are more useful to engineers Dr Yifei Yuan is the Technical Director at the Standards Department of ZTE Inc

Heterogeneous Networks in LTE-Advanced Joydeep Acharya, Long Gao, Sudhanshu Gaur, 2014-02-18 A comprehensive summary of theoretical and practical developments in LTE Heterogeneous Networks The last decade has witnessed the proliferation of mobile broadband data and the trend is likely to increase in the coming years Current cellular networks are ill equipped to deal with this surge in demand To satisfy user demand and maximize profits a new paradigm to operate networks is needed Heterogeneous networks that deploy an overlay of small cells with limited coverage and transmit power over a macro coverage area is the solution by providing capacity and coverage where it is needed This book presents a comprehensive overview of small cell based heterogeneous networks within the framework of 3GPP LTE Advanced which is the major enabler of current and future heterogeneous networks The book first establishes the basics of LTE standards 8 10 Wherever relevant the underlying theory of wireless communications is explained and the signaling and protocol aspects of LTE Releases 8 10 are presented Next the book presents a systematic study of the inter cell interference eICIC and FeICIC mechanisms that have been standardized in LTE releases 10 and 11 to mitigate the interference arising in heterogeneous networks From simple blank subframe design and implementation the book discusses more advanced transceiver signal processing and carrier aggregation CA based mechanisms to improve performance Besides data control channel enhancements such as enhanced PDCCH ePDCCH are also discussed Subsequently the book discusses the possibility of base stations being allowed to coordinate to manage interference This technique called CoMP has the potential of vastly improving network performance However several practical challenges first have to be overcome before this potential can be realized The book presents the different CoMP categories introduced in LTE release 11 the required signal processing and the changes that were introduced in Release 11 for supporting CoMP The book then presents the state of the art developments in heterogeneous networks that are currently taking place in 3GPP with the initiation of Release 12 A whole array of new technologies have been introduced such as dynamic switching of small cells new carrier types with reduced control signaling dynamic reconfiguration of TDD LTE joint configuration of TDD and FDD via carrier aggregation and lastly advanced MIMO signal processing with three dimensional beamforming All these technologies will work in unison leading to efficient operations of small cells The authors thus comprehensively summarize the advances in heterogeneous networks over the last couple of years as reflected in various LTE releases and then look ahead at what to expect in the future Fully illustrated throughout and with an accompanying website including Matlab code for simulating heterogeneous networks LTE channel models and References to 3GPP specifications contributions and updates on recent standardization activities The authors being involved in LTE standardization are well placed to give an excellent view on this topic including valuable background and design rationale A comprehensive summary of wireless communications theory and practical developments in LTE heterogeneous networks Authors are experts in this field and are active members in standardization proceedings enabling up

to date coverage of current developments Multiple case studies explain network design optimization of various heterogeneous network deployments Accompanying website includes Matlab code for simulating heterogeneous networks LTE channel models and References to 3GPP specifications contributions and updates on recent standardization activities Essential reading for Engineers and practitioners in wireless industry

4G, LTE-Advanced Pro and The Road to 5G
Erik Dahlman, Stefan Parkvall, Johan Skold, 2016-07-19 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

LTE and the Evolution to 4G Wireless
Agilent Technologies, 2013-02-15 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 **Practical Guide to LTE-A, VoLTE and IoT** Ayman ElNashar, Mohamed A.

El-saidny, 2018-08-27 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 mMTC NGCN 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 mMTC 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 **LTE-Advanced DRX Mechanism for Power Saving** Scott

A. Fowler, Abdelhamid Mellouk, Naomi Yamada, 2013-09-03 Resource allocation and power optimization is a new challenge in multimedia services in cellular communication systems To provide a better end user experience the fourth generation 4G standard Long Term Evolution Long Term Evolution Advanced LTE LTE Advanced has been developed for high bandwidth mobile access to accommodate today s data heavy applications LTE LTE Advanced has adopted discontinuous reception DRX to extend the user equipment s battery lifetime thereby further supporting various services and large amounts of data transmissions By introducing the basics of mathematical analysis and performance evaluation of power saving mechanisms in 3rd generation partnership project 3GPP LTE and LTE Advanced networks the authors of this book aim to describe novel algorithms which could have better performance capabilities than previous methods Chapter 1 gives the basic theory description of the 3GPP LTE network and 3GPP DRX power saving mechanism empirical measurements of LTE network

traffic and an overview of the basic LTE DRX model in the field of power saving techniques Chapter 2 provides steps for deriving a 2 state analytical model up to a 4 state DRX model The third and final chapter summarizes alternative methods for the implementation of LTE DRX Radio Protocols for LTE and LTE-Advanced SeungJune Yi,SungDuck Chun,YoungDae Lee,SungJun Park,SungHoon Jung,2012-08-23 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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Lte Advanced Lte Advanced Introduction

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