

An Introduction To Lte Lte Lte Advanced Sae And 4g Mobile Communications

An Introduction To Lte Lte Lte Advanced Sae And 4g Mobile Communications An to LTE LTE Advanced SAE and 4G Mobile Communications A Comprehensive Overview The evolution of mobile communication technologies has been a remarkable journey marked by exponential increases in speed capacity and efficiency Fourthgeneration 4G mobile networks primarily based on Long Term Evolution LTE technology represent a significant milestone in this progress This article provides a comprehensive introduction to LTE LTE Advanced LTEA System Architecture Evolution SAE and their practical implications blending academic rigor with realworld applications 1 The Foundation LTE Long Term Evolution LTE standardized by 3GPP 3rd Generation Partnership Project marked a significant departure from previous 3G technologies It leveraged Orthogonal FrequencyDivision Multiple Access OFDMA for downlink and Single Carrier Frequency Division Multiple Access SCFDMA for uplink offering substantial improvements in spectral efficiency and data rates compared to its predecessors like UMTS Universal Mobile Telecommunications System Feature LTE UMTS Access Technology OFDMA DL SCFDMA UL WCDMA Peak Data Rate Up to 100 Mbps DL 50 Mbps UL Up to 72 Mbps DL 2 Mbps UL Latency Lower Higher Spectral Efficiency Higher Lower Figure 1 Comparison of LTE and UMTS Key Features A bar chart comparing peak data rates latency and spectral efficiency of LTE and UMTS would be visually inserted here Data would need to be sourced from 3GPP specifications or reputable industry reports The key advantages of LTE include Higher Data Rates Enabling faster downloads streaming and online gaming Lower Latency Reducing delays in realtime applications like VoIP and online gaming 2 Improved Spectral Efficiency Allowing more users to be served within the same frequency band IPbased Architecture Simplifying network management and integration with existing IP networks 2 Enhancing Performance LTE Advanced

LTEA LTEA built upon the foundation of LTE adding several key enhancements to significantly boost performance and capacity These enhancements included Carrier Aggregation CA Combining multiple frequency bands to increase bandwidth and data rates For example aggregating 20MHz 20MHz 10MHz results in a 50MHz wide channel MIMO MultipleInput and MultipleOutput Employing multiple antennas at both the base station and user equipment to increase data rates and link reliability 2x2 MIMO 4x4 MIMO and even higher order MIMO configurations are possible Advanced Antenna Technologies Including beamforming and beam tracking to focus signal power towards user devices improving coverage and signal strength Improved Modulation Schemes Utilizing more complex modulation techniques like 256QAM to further increase spectral efficiency

Figure 2 Impact of Carrier Aggregation on Data Rates A line graph showing the increase in peak data rate as the number of aggregated carriers increases would be inserted here Example data points could illustrate the increase from a single 20MHz carrier to a combination of 20MHz 20MHz 10MHz carriers

3 The Architectural Backbone System Architecture Evolution SAE SAE is the underlying architecture that supports both LTE and LTEA Its a packetswitched network built entirely on IP replacing the circuitswitched components of previous generations Key components of the SAE architecture include Evolved Packet Core EPC The core network responsible for routing data traffic managing user sessions and providing mobility management Key elements include the Mobility Management Entity MME Serving Gateway SGW and Packet Data Network Gateway PGW eNodeB evolved Node B The base station responsible for radio access to user equipment User Equipment UE Smartphones tablets and other devices capable of connecting to the LTE network

3 4 RealWorld Applications of LTE and LTEA The enhanced capabilities of LTE and LTEA have fueled a wide range of applications HighDefinition Video Streaming Enabling seamless streaming of highresolution videos on mobile devices Online Gaming Providing lowlatency highbandwidth connections for immersive gaming experiences Video Conferencing Facilitating highquality video calls with minimal delays Internet of Things IoT Supporting the connectivity needs of billions of IoT devices Telemedicine Enabling remote patient monitoring and diagnosis through highbandwidth video and data

transmission 5 The Transition to 5G While LTE and LTEA continue to provide robust connectivity the limitations of their underlying technology have driven the development of 5G 5G aims to address these limitations by employing new technologies like massive MIMO millimeterwave frequencies and network slicing enabling significantly higher data rates lower latency and greater capacity Conclusion LTE LTEA and the SAE architecture have revolutionized mobile communications enabling a plethora of applications that were previously unimaginable While 5G is gradually becoming the dominant technology LTE and LTEA will continue to play a crucial role in providing ubiquitous connectivity for the foreseeable future particularly in areas with less dense population or less demanding applications The evolution from 3G to 4G showcases the iterative nature of technological advancement with each generation building upon its predecessor to meet everincreasing user demands Understanding the underlying principles of LTE and LTEA remains essential for comprehending the current landscape of mobile communications and the challenges in providing future connectivity solutions

Advanced FAQs 1 What are the differences between FDDLTE and TDDLTE FDDLTE uses separate frequency bands for uplink and downlink transmission while TDDLTE uses the same frequency band for both but in different time slots The choice between FDD and TDD depends on factors like spectrum availability and deployment requirements 2 How does carrier aggregation improve throughput Carrier aggregation increases the 4 overall bandwidth available for data transmission by combining multiple frequency bands This leads to higher data rates and improved user experience 3 What are the challenges in deploying LTEA in rural areas Deploying LTEA in rural areas can be challenging due to lower population density requiring a more extensive and costly infrastructure to achieve sufficient coverage 4 How does MIMO technology improve signal quality and data rates MIMO uses multiple antennas to transmit and receive multiple data streams simultaneously This increases the data rate and improves the reliability of the wireless link especially in environments with multipath propagation 5 What role does the EPC play in ensuring network security The EPC includes various security mechanisms to protect user data and network integrity such as authentication encryption and access control ensuring secure communication within the LTE network

4G: LTE/LTE-Advanced for Mobile Broadband An Introduction to LTE LTE for UMTS LTE and LTE Advanced LTE, LTE-Advanced and WiMAX An Introduction to LTE The LTE-Advanced Deployment Handbook From GSM to LTE-Advanced Pro and 5G From GSM to LTE-Advanced From LTE to LTE-Advanced Pro and 5G LTE and the Evolution to 4G Wireless Essentials of LTE and LTE-A LTE Advanced Pro LTE Advanced LTE-Advanced Radio Protocols for LTE and LTE-Advanced LTE-Advanced Air Interface Technology 4G LTE/LTE-Advanced Heterogeneous Networks in LTE-Advanced LTE-Advanced DRX Mechanism for Power Saving Erik Dahlman Christopher Cox Harri Holma André Pérez Abd-Elhamid M. Taha Christopher Cox Jyrki T. J. Penttinen Martin Sauter Martin Sauter Moe Rahnema Agilent Technologies Amitabha Ghosh Frédéric Launay Harri Holma Sassan Ahmadi SeungJune Yi Xincheng Zhang Erik Dahlman Joydeep Acharya Scott A. Fowler

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Lte long term evolution is the 3gpp s 3rd generation partnership project new standard and accompanying technologies that mobile network operators such as att 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

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

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 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

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

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

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 itur requirements

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

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 agile 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

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

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

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 a practical systems approach to understanding 3gpp lte releases 10 and 11 radio access technologies is an in depth systematic and structured technical reference on 3gpp s lte advanced releases 10 and 11 covering theory technology and implementation written by an author who has been involved in the inception and development of these technologies for over 20 years the book not only describes the operation of individual components but also shows how they fit into the overall system and operate from a systems perspective uniquely this book gives in depth information on upper protocol layers implementation and deployment issues and services making it suitable for engineers who are implementing the technology into future products and services reflecting the author s 25 plus years of experience in signal processing and communication system design this book is ideal for professional engineers researchers and graduate students working in cellular communication systems radio air interface technologies cellular communications protocols advanced radio access technologies for beyond 4g systems and broadband cellular standards an end to end description of lte lte advanced technologies using a top down systems approach providing an in depth understanding of how the overall system works detailed algorithmic descriptions of the individual components operation and inter connection strong emphasis on implementation and deployment scenarios making this a very practical book an in depth coverage of theoretical and practical aspects of lte releases 10 and 11 clear and concise descriptions of the underlying principles and theoretical concepts to provide a better

understanding of the operation of the system's components covers all essential system functionalities features and their inter connections based on a clear protocol structure including detailed signal flow graphs and block diagrams includes methodologies and results related to link level and system level evaluations of lte advanced provides understanding and insight into the advanced underlying technologies in lte advanced up to and including release 11 multi antenna signal processing ofdm carrier aggregation coordinated multi point transmission and reception eicic multi radio coexistence e mbms positioning methods real time and non real time wireless multimedia applications

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

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

comp rf lte 5

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

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

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