



LTE, The Way to the Future

HUAWEI TECHNOLOGIES CO., LTD.





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1 Overview

1.1 Executive summary

Global expectations of wireless communication anticipate the advent of LTE. With LTE, what we communicate and how fast and far we communicate will inevitably change for the better. Many of the world's leading Tier

One operators have declared the launch of their next generation networks will be based on LTE. Huawei firmly believes LTE to be the right choice for a new era in mobile communication.

1.2 Strong Demand for Mobile Internet

Drive

Around the world, at every level of personal and business life, wireless has become a ubiquitous facet of daily communication. Reliance on wireless communication increases daily. In business, government, education, and health, users expect the established standards, services and products of fixed broadband, satellite and wireless

to quickly and seamlessly migrate to mobile. What were once future possibilities — mobile broadband and IP wireless linking — are present realities. For worldwide operator success, meeting expectation is no longer an option — it is essential.



1.3 LTE Benefits

LTE will improve network capacity and competence. The physical throughput of LTE is up to 173 Mb/s in downlink with 2×2 MIMO and 84 Mb/s in uplink with 1×2 SIMO per cell (20 MHz, FDD system). Flat architecture can minimize the latency. The user plane's single direction target latency is less than 5 ms while the control plane's latency is less than 100 ms, making it possible for operators to provide fixed services in mobile networks and advancing Fixed Mobile Convergence (FMC). Reduced latency and increased cell edge performance make LTE-driven service even more attractive.

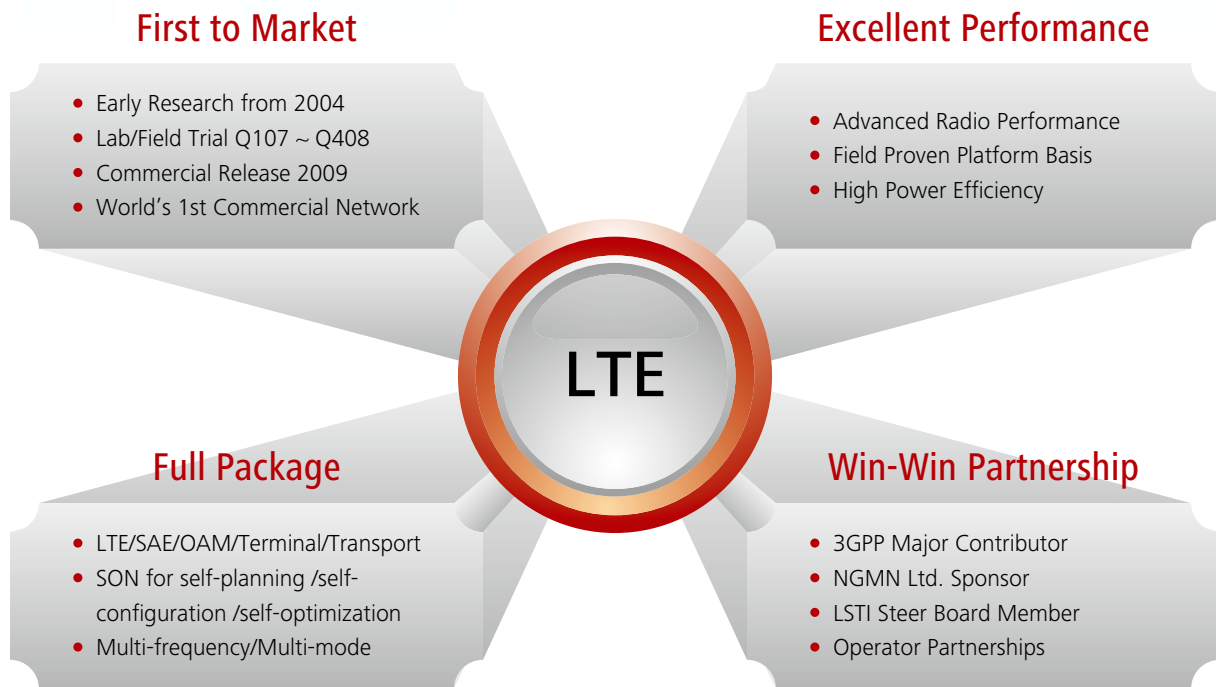
LTE can help operators improve network capacity and

strengthen its competence. The spectral efficiency of LTE in the 3GPP requirement is targeted at 3 to 4 times that of an R6 HSPA in a downlink, and 2 to 3 times that of an uplink. These network capacity improvements make it possible for the operator to accelerate wireless broadband services within an acceptable price range. Network deployment also becomes easier with the flat architecture of LTE. The Self Organization Network (SON) solution introduces the convenience of automated intelligent network maintenance, helping to advance the overall efficiency, stability and security of the network.



2 Huawei's Leading Roadmap to LTE

2.1 Huawei's Innovative LTE Solution

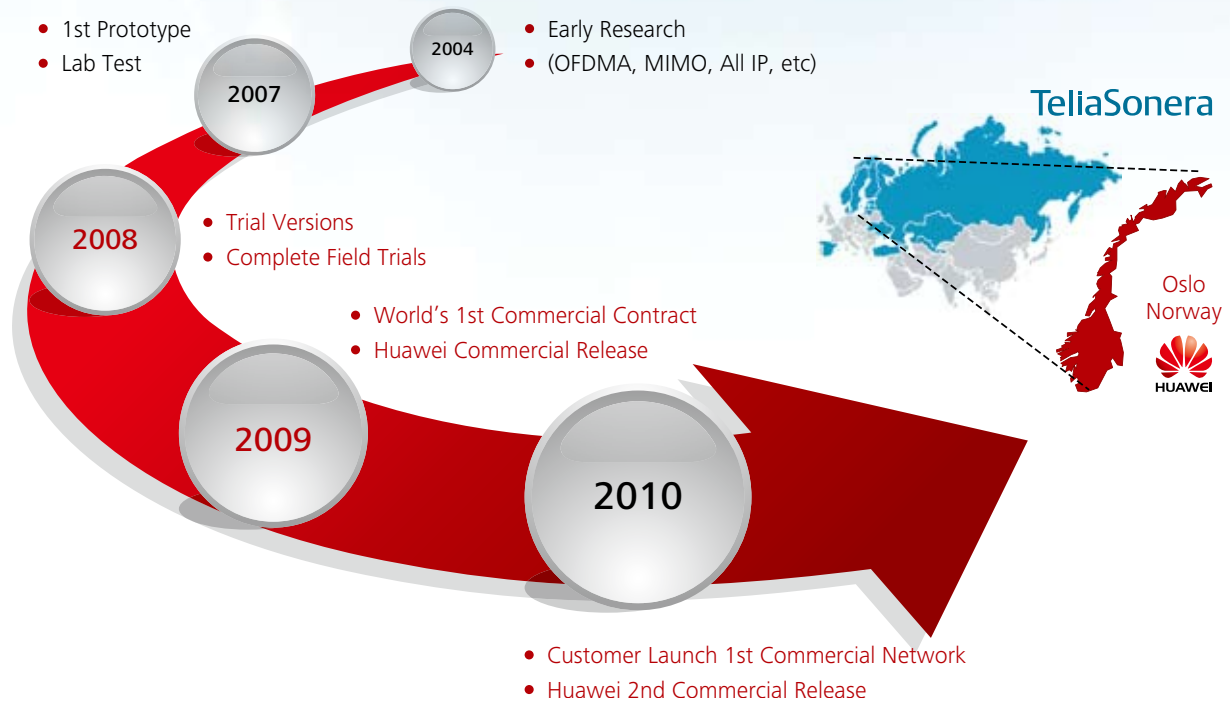


To fulfill the company's long term growth promise to customers, Huawei is committed to leadership in across the board development of LTE. Huawei firmly believes LTE to be critical to global introduction of mobile broadband

services. In the coming months, we will maintain our existing level of investment across GSM, UMTS, CDMA and TD-SCDMA while dedicating added resources to further drive LTE.

Highlights

The First in the Industry:



Huawei started early LTE research more than five years ago. By 2008, Huawei had successfully concluded numerous LTE field tests and trials with China Mobile, SoftBank, Vodafone and other world's leading operators. In 2008, with the introduction of our unified BTS platform for LTE, GSM, UMTS, CDMA and TD-SCDMA, we were the first vendor to demonstrate dual UMTS/LTE, dual CDMA/LTE, and dual TD/LTE mode capabilities. Huawei's multiband and multimode solution now effectively assure operators an ultimately smooth and cost-efficient upgrade from a 2G/3G to a LTE network. In

December of last year, Huawei's efforts were rewarded with the world's first LTE commercial contract, which clearly evidences the dominant position and strength of Huawei's LTE system.

In the second quarter of 2009, Huawei will be among the first wave of vendors to introduce LTE commercial solutions and products. In 2010, Huawei will release a second round of LTE commercial solutions and products. Also in 2010, TeliaSonera will launch their commercial LTE network based on Huawei's technology.

Excellent Performance:



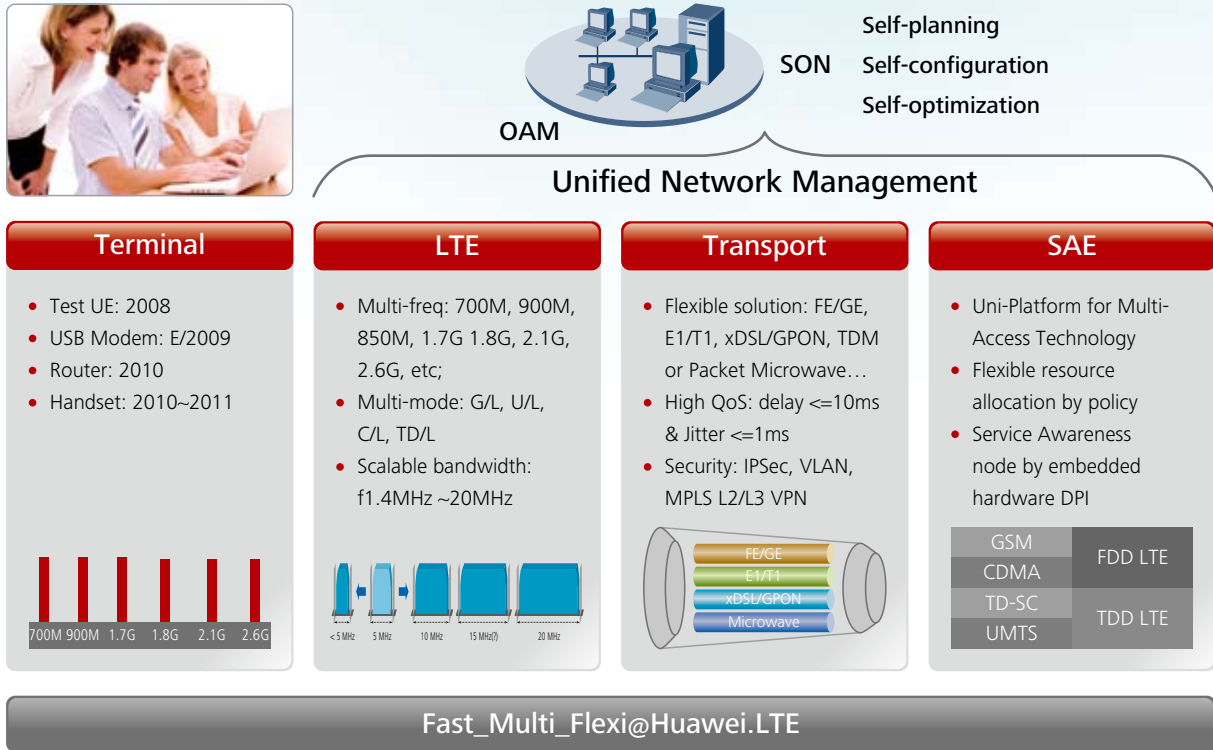
To address the accelerating needs of LTE, we have developed several advanced radio technologies, such as adaptive MIMO, Soft Frequency Reuse and Advanced Receiver-IRC. These key technologies serve to increase radio link reliability, cell capacity and overall coverage of LTE.

To ensure the fastest maturity, Huawei's LTE has been developed based on our existing mature Unified BTS platform. Subsequently, the immediately available LTE solution can result in an All-IP, high speed, low latency and high frequency efficiency mobile network where

LTE technology supports a much higher data rate than conventional 3G/UMTS. Field trials have evidenced Huawei's LTE DL peak data rate at 173 Mb/s with a handover success rate exceeding 99%. In mobility testing, the highest speed exceeded 350 km/h.

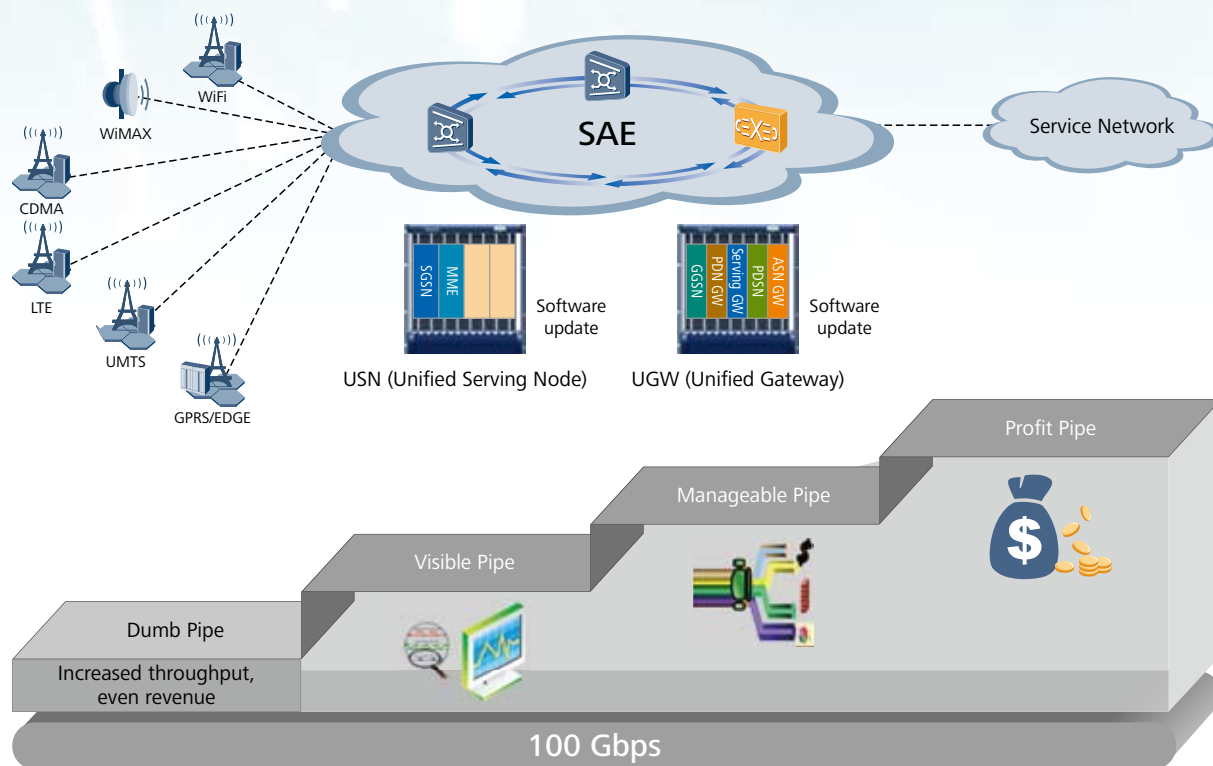
Another first was achieved with Huawei's mastery of high efficiency PA and its application to RF design. Correspondingly, we are now able to reduce e-NodeB power consumption by as much as 23% with an equivalent reduction in OPEX for operators.

Full Package:



Protecting original operator investments and reducing CAPEX, our complete portfolio of end-to-end LTE/SAE solutions, including terminals, OAM, e-NodeBs, ePCs, transport, Rich e-NodeBs and ePCs, can be flexibly deployed to allow smooth upgrade from 2G/3G. Huawei e-NodeBs support multiband and multimode. Multiband includes both 700 Mhz and 900 Mhz frequencies, AWS to 2.6G and Bandwidth from 1.4 Mhz and 3Mhz to 20 Mhz. Huawei is equally committed to the development of

multimode base stations to permit the adoption of multiple air interfaces including UMTS, CDMA, GSM, TD-SCDMA and LTE. The internal interfaces, functionality and manufacturing are all unified for module sharing, thus ensuring future migration and upgrade. The compact size and structure of the unified footprint brings operators the added bonuses of easy site acquisition, lowered site installation costs, reduced energy demand and unified maintenance.



Huawei's SAE solution has three highlights: **Simplicity, Openness and Intelligence.**

Simplicity is the most important requirement for the future network architecture. Huawei is dedicating considerable resources to advancing development of All-IP Flat Networks, Unified Platforms, Multi-Access, SGSN/MME Pool, GGSN/UGW Pool, and SON networks. Huawei's Unified Platform can merge SGSN, AG and MME into one Unified Serving Node, and merge GGSN, PDSN, ASN-GW, PDG, Serving-GW and PDN-GW into one Unified Gateway node. Multi-access provides accesses to 3GPP, 3GPP2, and non-3GPP at the same time. With all these features, Huawei's simplified SAE network will be both reliable and

self-adjusting, with decreasing numbers of nodes and equivalent reductions in CAPEX/OPEX, making overall Operation & Maintenance easier and more efficient.

Openness, The Huawei SAE solution is an open architecture that is fully compliant with 3GPP standards and flexible and scalable deployment for third parties. Designed by distributed architecture, with the centralized policy server and signature DB deployed, the UGW is ultimately flexible when it comes to resource allocation.

Intelligence, Huawei's SAE solution is also based on Intelligent Packet Network. UGW is embedded with dedicated, powerful hardware DPI, and becomes a service awareness node. UGW can also work with a centralized

policy server, PCRF, providing rich and flexible content control, including flow-based charging, online charging, P2P bandwidth control, policy control, and service reporting. Huawei's in-depth knowledge of Radio Network Planning & Optimization has also allowed for development of the GENEX

Series, delivering advanced network planning and optimization. Based on the SON concept, and in response to operator insistence on mobile OSS network integration, we have applied extensive R&D investment to the perfection of unified EMS for 2G/3G/LTE and web-based LMT.

Win-Win Partnership:

- Patent & Patent Application LTE ~15% & SAE ~14%
- 1500+ LTE Proposals
- 1240+ SAE Proposals

- Performance Evaluation
- Requirement Definition



- Proof of Concept
- IODT/IOT
- Friendly Trials

- Operator Partnerships
- Terminal/Chipset Open Vendors Cooperation

Our industry dedication now extends 3GPP to NGMN and LSTI. Representing our advancement of LTE standards, by the end of April 2009, Huawei had submitted more than 1500+ LTE contributions and 1240 SAE contributions. Fifteen percent of all LTE patents are now owned by Huawei. As one of the founding NGMN members, Huawei has established a dedicated team to support NGMN cooperation. The team makes considerable contributions to NGMN white papers and assigned research tasks such as SON, system architecture and network performance.

Huawei is devoted to driving the inter-vendor IODT/ IOT and industry process. In 2007, Huawei joined LSTI and is now a member of the LSTI Steering Board. Huawei expects to increase trial support of LSTI and actively increase open cooperation with terminal vendors and chipset manufacturers.

Between Q107 and Q308, to help us develop and issue mature and stable LTE commercial solutions, we entered into ongoing cooperative agreements with key operators and completed exhaustive LTE field trials.

2.2 Huawei LTE product

Huawei LTE e-NodeB Overview

The lightning-fast development of the mobile communications market poses higher technical requirements on networks. Meanwhile, telecom operators are facing the double challenge of huge OPEX and decreased ARPU. Maintaining acceptable profitability is high on the agenda of operators around the world. Meanwhile, constant innovation remains essential for maintaining competitive edge and realizing increased success.

- Based on the concept of customer-oriented innovation, Huawei presents the 4th generation BTS, which features multiple radio access technologies (RATs) convergence, multiple carriers on one radio carrier (RC), and All-IP within a green oriented solution. Huawei's convergent

SingleRAN network allows all RATs to be applied to a single BTS. SingleRAN makes technology choices and network evolution simple, and greatly reduces the need to physically access sites and the equipment room building, at the same time lowering transmission and other ancillary costs related to OPEX.

- LTE e-NodeBs consist of the indoor macro BTS3900, outdoor macro BTS3900A, distributed base station DBS3900. BTS3900 and BTS3900A will be released in Q210. The BTS3900 family comprises distributed BTS, Macro BTS as well as Micro BTS (not yet planned for LTE). The BTS3900 platform is already used for both GSM and UMTS.



LTE
The Way to the Future

Multimode Convergence and Smooth Evolution

- Based on the unified platform and the modularized RF unit, the 4th generation BTS can implement the convergence of all radio access networks into a SingleRAN network. The BTS supports sharing the same platform with GSM, UMTS, CDMA and TD-SCDMA mode. With boards of different modes plugged into the same BBU, the BTS can work in either single mode or dual mode simultaneously.
- Co-transmission and unified Network Management with GSM, UMTS, CDMA, and TD-SCDMA is enabled.
- All modules support backward compatibility for GSM, UMTS, CDMA and TD-SCDMA, and can smoothly upgrade to LTE.
- LTE BTS adopts a modular and simple structure. The primary modules are classified into the baseband unit and the RF unit. Through flexible combinations of the baseband unit, RF units, and auxiliary devices, various applications such as the macro BTS, DBS, or hybrid site solution can be implemented.

Benefits:

- Simplified technology choice and network evolution
- Reduced investment overlap when building wireless access networks
- Extended equipment life cycle. 2G/3G can smoothly evolve into LTE to reduce operator TCO and enhance competitiveness
- Substantial reduction in the number of sites, size of equipment rooms and need for other auxiliary equipment
- Significant reduction of O&M costs through Co-transmission, unified Network Management, and flexible configuration



Green Communication Design

- Through the overall power saving techniques, power consumption is greatly reduced across the BTS and auxiliary equipment.
 - Advanced power amplification techniques are used to increase the efficiency and decrease energy loss.
 - The working temperature range of the BTS is extended. The air conditioner and power consumption are reduced.
- Integrated energy management techniques further reduce energy consumption and minimize harmful emissions.
- Compact equipment minimizes footprints and facilitates easy network deployment.
- Wind or solar energy can be used as alternate energy sources.

Benefits:

- The power consumption of equipment is reduced.
- The cost and time of construction engineering are reduced.
- Social responsibilities are observed and operator image and reputation are enhanced.
- TCO is reduced, and the profitability of the telecom operator is increased.

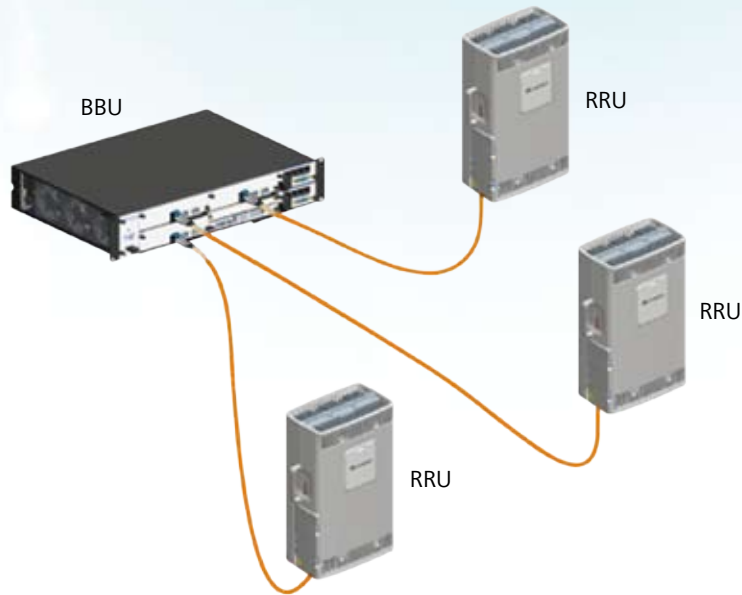
Piloting the Mobile Network to the IP Era

- End-to-end All-IP
 - IP based network elements
 - IP interface
 - IP transmission
- Cutting-edge IP technology
 - Supports IP-over-Ethernet and IP-over-E1/T1.
- Hybrid IP networking is implemented to improve transmission efficiency.
- Based on certificate authentication of the IPSec security technology, 1588v2 achieves frequency and time synchronization, and transmission is automatically set up.

Benefits:

- Minimized transmission costs, advanced transmission efficiencies
- Simplified network structure
- Various service portfolios
- Smooth evolution to future network configuration

DBS3900 LTE



Product Composition

- Baseband unit: BBU
- RF unit: RRU

Highlights

- Advanced performance
 - Advanced MIMO technology, adaptive space reuse and diversity mode, enhancing overall wireless performance
 - Advanced scheduling algorithms support frequency selective scheduling and VoIP for semi-static scheduling
 - Enhanced uplink receiver capacity
 - Dynamic interference coordination, reducing interference from adjacent cells
 - Supporting more than 350-km/h high-speed mobile

users, and eventually supporting up to 450-km/h high-speed mobile users in the near future

- High maturity

The DBS3900 LTE inherits the mature experience in product design and development of Huawei's 4th generation distributed base stations.

- Large capacity and wide usability

One DBS3900 LTE BBU used for LTE supports up to six carriers, a maximum of 3000 users per e-NodeB. The physical throughput of the LTE is up to 173 Mb/s in a downlink with 2×2 MIMO, 64QAM, 20 MHz and 84 Mb/s in an uplink with 1×2 SIMO, 64QAM, 20 MHz per cell.

- Co-Site of 2G and 3G Networks and Smooth Evolution Hardware components, such as power, RF feeders, and transmission ports, can be shared among the DBS3900 LTE and the existing GSM/UMTS/CDMA equipment. Thus,

operators can save on LTE site construction costs and implement smooth network evolution by reusing existing equipment.

The DBS3900 also supports mobility management between the LTE and the existing 2G or 3G networks. This enables operators to deploy a complete LTE overlay solution to work in conjunction with the existing 2G or 3G networks.

- Small size and easy installation

The BBU can be installed on a wall, in a standard 19-inch cabinet or rack. The RRU weighs less than 20 kg. Flexible installation location and low space requirements save site lease costs.

- Flexible Bandwidth Support

The DBS3900 LTE supports channel bandwidths of 5, 10,

15, and 20 MHz in the first release. Thus, the DBS3900 LTE helps to meet the needs of different network operators with different bandwidth allocations, and also allows them to use both existing and new frequency spectrums to provide the different services.

Application Scenarios

Huawei's DBS3900 LTE can be applied to hot spot areas, such as urban, suburban, rural, highway, and indoor coverage.

The BBU can be installed in an idle slot in an indoor rack, cabinet, an outdoor power distribution cabinet, a pole or on the tower, the indoor wall, against the indoor wall or behind a shield on the rooftop. (The RRU does not require space in the equipment room.)

3 Summary

Increasingly committed to promoting industry development and maturity, Huawei will continue to invest heavily in LTE. In similar fashion throughout 2010, Huawei intends to remain ahead of the industry curve by

providing leading edge LTE commercial solutions to allow operators around the world to establish and maintain long-term, competitive LTE leadership.





We've found a way for LTE solutions to give both super-smooth migration and unrivalled performance.

Smooth migration from GSM, UMTS, CDMA, TD-SCDMA to LTE, is now a reality. It is the fastest and safest way to the future, it's a first and it's tested and it's the reason why we have just signed the very first LTE commercial contract in the world.

Please visit huawei.com to find out more about our **LTE solutions**.

