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GSM/3G MARKET/TECHNOLOGY UPDATE



3GPP Long Term Evolution (LTE) delivers capacity and data rate speed, data throughput enhancements and low latency, to support new services and features requiring higher levels of capability and performance. Business users and consumers

today browse the Internet or send and receive e-mails using HSPA-enabled notebooks, or with HSPA modems and dongles, and send/receive video or music on 3G/HSPA phones. LTE is the next step in the user experience, which will enhance more demanding applications such as interactive TV, mobile video blogging, advanced games and professional services. Downlink and uplink data rates are significantly higher, supported by the necessary network architecture and technology enhancements. LTE reduces the cost per Gigabyte of data delivered, which is essential to address the mass market. The new system supports a full IP-based network, and harmonization with other radio access technologies.

LTE standardization – which covers both FDD and TDD modes, is complete and approved by 3GPP within Release 8, and is the basis for initial LTE deployments worldwide.

7 commercial LTE systems are launched:

TeliaSonera - Norway
 TeliaSonera - Sweden
 MTS - Uzbekistan
 Ucell - Uzbekistan
 Mobyland and CenterNet - Poland
 MetroPCS - USA
 Mobilkom - Austria

Evolution to LTE report (GSA) - October 26, 2010

LTE is on track, attracting global industry support. Modern infrastructure solutions offer an easy upgrade path to LTE. With the HSPA mobile broadband ecosystem in place, LTE is the natural migration choice for GSM/HSPA network operators. As a result of collaboration between 3GPP, 3GPP2 and IEEE, there is a roadmap for CDMA operators to evolve to LTE as their clear mobile broadband system of choice.

The majority of LTE commitments and deployments are for the paired spectrum (FDD) mode. The LTE TDD mode for unpaired spectrum is complementary and key for several markets. LTE TDD also provides a future-proof evolutionary path for TD-SCDMA, another 3GPP standard. An LTE TDD demonstration network is live at the 2010 World Expo, Shanghai with several leading vendors being involved, with the results confirming they are ready and that the technology is ready to go.

The uptake of LTE is a global phenomenon. All existing 3G technologies can harmonize to LTE. With LTE we have one single global standard, which in turn will secure and drive even higher economies of scale and also simplify roaming.

156 operators in 64 countries are investing in LTE

- 113 LTE network commitments in 46 countries
- 43 additional pre-commitment LTE trials
- At least 55 LTE networks are anticipated to be in commercial service by end 2012

Evolution to LTE report (GSA) – October 26, 2010

GSA believes that LTE will be the choice for many more operators and be introduced according to business needs. Several more operators are testing/trialing LTE and further announcements from them are expected. Availability of new spectrum, particularly in the 2.6 GHz and Digital Dividend bands (700, 800 MHz), is a crucial factor for LTE deployments in many countries, as well as regulatory conditions, and will directly determine deployment and service launch dates in most markets.

Spectrum for LTE deployments

LTE can be deployed in existing 2G and 3G system spectrum, as well as utilize new spectrum such as 2.6 GHz currently being allocated in many parts of the world, and the 700 MHz band which was auctioned as part of the Digital Dividend, starting in the USA. Initial deployments in Japan are using 800 MHz, 1.5

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GHz and 1.7 GHz depending on the operator, and according to the local situation. There is also high interest in opportunities for LTE deployments using frequencies released by spectrum re-farming, e.g. in the GSM 900 MHz band and the 1800 MHz band which are now being relaxed by regulators (e.g. in Europe) to enable mobile broadband services using technologies such as LTE. There are high expectations in Europe and elsewhere to access additional UHF bands from the Digital Dividend (800 MHz), to enable LTE to be globally deployed efficiently over large geographical areas, and to improve in-building coverage.

LTE ensures a smooth evolution from current 3GPP and 3GPP2 systems, and is a major step towards IMT-Advanced (i.e. 4G). LTE includes many features originally considered for a future 4G system and utilizes a new radio air interface technology - Orthogonal Frequency Division Multiple Access (OFDMA) to provide several key benefits, including significantly increased peak data rates, increased cell edge performance, reduced latency, scalable bandwidth, co-existence with GSM/EDGE/UMTS systems, and lower CAPEX/OPEX costs.

Targets for LTE include:

- Instantaneous downlink peak data rate of at least 100 Mb/s within 20 MHz allocation (5 bps/Hz)
- Instantaneous uplink peak data rate of 50 Mb/s (2.5 bps/Hz within a 20MHz uplink allocation)
- Downlink: average user throughput per MHz, 3 to 4 times Release 6 HSDPA
- Uplink: average user throughput per MHz, 2-3 times Release 6 Enhanced Uplink
- E-UTRAN optimized for low mobile speed: 0-15 km/h. Higher mobile speed between 15-120 km/h should be supported with high performance. Mobility across the cellular network shall be maintained at speeds 120 km/h-350 km/h (or even up to 500 km/h depending on the frequency band)
- Spectrum flexibility: scalable to operate in 1.4, 2.5, 5, 10, 15 and 20 MHz allocations: Uplink and downlink...paired and unpaired
- Co-existence with GERAN/3G on adjacent channels; with other operators on adjacent channels; overlapping or adjacent spectrum at country borders; handover with UTRAN & GERAN

LTE radio network products incorporate several features to simplify building and management of next-generation networks. Plug-and-play, self-configuration and self-optimization simplify and reduce network rollout and management cost. LTE will be deployed alongside simplified, IP-based core and transport networks that are easier to build, maintain and introduce services on.

The 3GPP core network has also undergone System Architecture Evolution (SAE) in the same timeframe as LTE, optimizing it for packet mode and, in particular, for the IP-Multimedia Subsystem (IMS), which supports all access technologies, including fixed wire-line access. This allows:

- Improvements in latency, capacity, throughput
- Simplification of the core network, and optimization for IP traffic and services, and expected growth
- Simplified support & handover to non-3GPP access technologies

The result is the evolved packet system (EPS) that consists of the core network part, the evolved packet core (EPC) and the radio network evolution part, the evolved UTRAN (E-UTRAN), i.e. LTE. The EPS is also standardized within 3GPP Release 8 (completed March 2009) and is the baseline for implementations.

LTE TDD Systems

LTE TDD is the perfect choice for providing high speed mobile broadband access in unpaired spectrum. It is an integral part of the 3GPP standards implementing a maximum of commonalities with LTE FDD and offering comparable performance characteristics at similarly high spectral efficiency. LTE TDD is a real complement to LTE FDD. Within the globally assigned IMT spectrum bands for mobile (broadband) communication, there are significant spectrum resources suitable for LTE TDD usage across a wide range of frequencies. Amongst these, the largest contiguous bands are at 2.3 GHz (100 MHz) and within the 2.6 GHz band (e.g. 50 MHz according to the CEPT band plan).

Due to the recognized demand for radio technologies for unpaired spectrum bands and based on the commonalities as explained above, LTE TDD will be able to exploit global economies of scale similar to LTE FDD. The availability of spectrum and the

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technical pre-requisites allow a short time to market. Hence, it is likely that LTE TDD will become a globally accepted technology, and provide an excellent evolution path for TD-SCDMA and WiMAX™ networks. Furthermore, LTE FDD and LTE TDD have a clear smooth evolution towards LTE-Advanced.

The growing number of LTE TDD operator commitments, system maturity, and the expanding eco-system are detailed further in this report.

Will HSPA+ deployments delay LTE rollout?

Many operators will invest in both HSPA+ and LTE. GSA sees no evidence of HSPA+ uptake delaying commitments to deploy LTE. The success of HSPA/HSPA+ in delivering mobile broadband will fuel demand to support more customers and for even higher data throughputs including for new applications, which LTE delivers. LTE brings the opportunity for additional spectrum in Digital Dividend (700, 800 MHz) and 2.6 GHz spectrum, initially giving comparable throughput capacity and performance, and will continue to improve and also benefit from larger bandwidth deployments (up to 20 MHz) and later evolution to LTE-Advanced.

LTE network commitments, trials and plans: global round-up

Americas

USA

On September 21, 2010 **MetroPCS**, a regional carrier, became the first operator to launch LTE in the United States. MetroPCS also offered the world's first commercially available 4G LTE enabled handset, the Samsung Craft™. Service was launched initially in Las Vegas, then extended to Dallas/Forth Worth (launched September 29, 2010) and Detroit (October 20, 2010). The Samsung SCH-R900/Craft is also the first multi-mode CDMA-LTE handset. LTE network rollouts are planned for later this year and early 2011 in the remaining MetroPCS U.S. markets, including Boston, Atlanta, Jacksonville, Los Angeles, New

York, Miami, Orlando, Philadelphia, Sacramento, San Francisco and Tampa.

Verizon Wireless is deploying LTE in 700 MHz for commercial launch in Q4 2010. A total of 38 cities and 110 million people will be covered by end 2010 i.e. 70% of the population. Verizon's LTE network will additionally cover 60 commercial airports. The LTE network will cover 200 million people by 2012, and 285 million in 2013, which would equal the current 3G network coverage. The launch will be supported by dongles and datacards, with smartphones and tablets arriving around May 2011.

AT&T Mobility is expected to launch LTE in mid-2011, and will require that infrastructure supports 700 MHz and AWS spectrum. The company plans to cover 70-75 million pops by end 2011 and is investing US\$ 700m this year in LTE deployment. Trials are underway in Baltimore and Dallas. AT&T confirmed plans to introduce Voice over LTE technology by 2013. As with Verizon's LTE launch this year, voice service will initially operate over AT&T's 3G network, which is being upgraded to HSPA+ shortly.

T-Mobile USA is also committed to LTE deployment.

Bay Area Regional Interoperable Communications System (BayRICS) vision was established by the 10 Bay Area Counties and 3 core cities, of San Francisco, Oakland, and San Jose in 2006 through the creation of a strategic plan with the goal of providing voice and data interoperability throughout the Bay Area region. BayRICS is a state of the art communications system-of-systems. Bay Area Wireless Enhanced Broadband (BayWEB) is the broadband component of BayRICS which has acquired 700 MHz in which an LTE-based public safety system will be deployed. An infrastructure vendor has been announced (July 2010). The public safety LTE system will be installed this year and is targeted to be operational in early 2011.

Cellcom, a US regional carrier serving customers throughout the Wisconsin and Michigan areas, is deploying an LTE network. **Cellular South** acquired 700 MHz spectrum for virtually all of Mississippi and Tennessee and most of Alabama and plans to deploy LTE in the future.

CenturyTel will deploy LTE in 700 MHz from 2010.

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Cable operator **Cox Communications** has confirmed plans to deploy LTE and completed initial LTE tests in Phoenix, Arizona and San Diego using AWS and 700MHz spectrum.

Leap Wireless began testing LTE in June 2010 ahead of a planned commercial network deployment.

Aircell will launch LTE in 2011 to boost the capacity of its in-flight network.

Clearwire Corp. has requested 3GPP to standardize LTE TDD for operation in the band 2496 – 2690 MHz and is currently trialling TDD and FDD in Phoenix, Arizona. Clearwire has reported nearing download speeds of 50 Mbps using 10 MHz channels for uplink and downlink, increasing to 90 Mbps using 20 MHz. The company quoted as saying that the trial showed true broadband speeds and high-quality, HD-video would be among new services that will be offered.

As part of a \$32.1 million stimulus grant, **Commnet Wireless, LLC** will develop and operate an LTE network in the Navajo Nation. The grant, plus partial matching funds, will provide broadband infrastructure access to the Navajo Nation across Arizona, New Mexico and Utah, enabling fixed and mobile service for over 30,000 households (c. 135,000 people) and 1,000 businesses in 15 of the largest communities in the Navajo Nation, including Window Rock, Shiprock, Kayenta, Chinle, and Tuba City. The project will also provide high-capacity connectivity on the combined middle-mile backbone to 49 more tribal communities.

Greenfield operator **Lightsquared** plans to build the first US wholesale only LTE network, and has selected its infrastructure supplier.

Public Service Wireless is deploying a commercial LTE system in central and south-west Georgia

Texas Energy Network (TEN) plans to deploy a nationwide LTE wireless broadband network, initially targeting the oil and gas industries. A demonstration is planned in New Mexico at end August 2010.

Canada

Rogers Wireless is evaluating LTE technology, and on October 6, 2010 announced the launch of a comprehensive LTE trial in the Ottawa area, initially

using AWS spectrum. Rogers is working with the regulatory, Industry Canada, to secure a development license to also use 700 MHz spectrum for the trial.

Bell Canada and **Telus** have launched a joint HSPA+ network, which will later be upgraded to LTE.

MTS Allstream is deploying HSPA+ which provides the company with an efficient upgrade path to LTE

Sasktel said its HSPA+ network futureproofs and positions the company well for future LTE deployment

Shaw Communications has selected its infrastructure supplier for planned LTE deployment in current AWS spectrum, as well as future frequency bands to be auctioned in Canada. Shaw said commercial launch targets late 2011.

Regulator Industry Canada is preparing to auction 700 MHz and 2.6 GHz spectrum in 2012.

Argentina

Telefonica completed lab trials of LTE in March 2010, achieving a peak DL data speed of 95 Mbps. **Personal** has tested LTE in the Puerto Madero area.

Brazil

Anatel will auction 120 MHz of 2.6 GHz spectrum, expected mid-2013, while giving operators the option to deploy LTE earlier should they acquire an MMDS operator who currently holds spectrum. The 2.6 GHz band had previously been allocated to MMDS operators for pay TV, and they will keep 70 MHz.

Chile

Entel PCS completed the first LTE trial in Latin America, at the Universidad de Chile. **Movistar** demonstrated LTE at Connect 2009. Regulator Subtel hopes to launch a 2.6 GHz auction procedure in December 2010, with up to 140 MHz being granted in 2011. LTE services could be launched in 2012.

Colombia

UNE EPM recently won 50 MHz of spectrum in the 2.6 GHz band and plans to launch mobile broadband services using LTE technology in 2H 2011.

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Jamaica

Claro is reported to be deploying an LTE system.

Mexico

Telefonica Movistar and **Telcel** have each undertaken testing of LTE technology. LTE was also demonstrated during Campus Party 2010 in Mexico.

The Mexican government plans to auction 700 MHz and 2.6 GHz. In a Decree published on September 2, 2010 in the Diario Oficial de la Federación, President Calderon stated that the 700 MHz band should be freed up for mobile broadband use, and said that digital TV switchover should be completed by 2015 (this is 6 years ahead of the current plan).

Puerto Rico

According to reports, the first LTE call was completed by **Claro** in San Juan on October 12, 2010.

Asia Pacific and Oceania

Australia

Telstra has been trialing LTE since May 2010, comprising not only urban, but also rural evaluations and extensive laboratory trials. Working with 3 vendors, in June 2010 Telstra announced that in one trial it had successfully achieved network speeds of 100 Mbps over a distance of 75 km in the 2.6 GHz band. In July, Telstra announced the completion of another LTE trial in the 1800 MHz band, in Victoria. The 1800 MHz trial includes tests of throughput using MIMO antenna configurations as well as several advanced features including Inter Cell Interference Coordination to reduce radio network interference and improve throughput, and Self Organizing Networks where LTE network technology automatically optimizes its performance, reducing operating costs while improving customer service.

Optus announced in July 2010 the successful demonstration of LTE in 10 MHz of 2100 MHz spectrum in metropolitan Sydney. During extensive field testing, using pre-commercial USB dongles, peak download speeds exceeding 50 Mbps and

upload speeds of 20 Mbps were achieved. A second phase of testing, utilizing 1800 MHz, is planned.

Vodafone Hutchison Australia (VHA) recently confirmed results of its LTE1800 trial being conducted near Newcastle, NSW using 10 MHz of spectrum in the 1800 MHz band. Further trials are planned.

In June 2010 the Australian Government confirmed it would release 126 MHz of digital dividend spectrum (694 – 820 MHz) due to be cleared by end 2013.

China

China Mobile is building its TD-SCDMA network so that sites and other elements are reusable for LTE TDD. A trial LTE TDD network at the 2010 World Expo, Shanghai, realized a peak downlink rate of over 80 Mbps in 20 MHz carrying uplink and downlink traffic. The first high-definition LTE TDD video call including handover has been demonstrated at the Ministry of Industry and Information Technology (MIIT) test lab in Beijing.

China Telecom is continuing to invest in CDMA and plans to launch LTE service. According to recent reports, the company aims to integrate LTE operation with CDMA in 17 provinces by the end of 2010.

In Hong Kong SAR, 2 x 15 MHz blocks of 2.6 GHz spectrum was obtained via auction each by China Mobile (**Peoples Phone**), Genius Brand (**Hutchison Telecom/PCCW JV**) and **CSL Limited**.

CSL Limited has completed deployment of an LTE/DC-HSPA+ network, with DC-HSPA+ over the entire territory (100% of sites) and LTE all over the territory in the busiest sites. The company strategy is for dual mode LTE/DC-HSPA+ devices. Efforts are focused on accelerated testing of dual mode devices, to allow commercial launch when CSL determines that the devices provide satisfactory performance. CSL Limited has also confirmed to GSA that the network is ready for commercial service, and full commercial launch will be announced later. The LTE network currently uses 2.6 GHz spectrum.

Some 1800 MHz sites have been equipped for LTE and are used for testing. More 1800 MHz sites will be converted next year as availability of LTE1800 user devices improves.

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PCCW is deploying LTE for commercial launch in 2011.

SmarTone-Vodafone plans to deploy LTE re-using its current GSM spectrum.

India

The BWA auction (which allows use of either LTE TDD or WiMAX™ in unpaired 2.3 GHz spectrum), opened with 11 companies bidding for 2 blocks in each of the 22 circles. The government had earlier allocated one 20 MHz unpaired spectrum block each to **MTNL** and **BSNL**.

Infotel Broadband (95% owned by Reliance Industries) was the only pan-India winner. **Aircel** won in 8 circles. **Tikona Digital** won spectrum in 5 circles. **Qualcomm** and **Bharti Airtel** won 4 circles each. Qualcomm gained spectrum in the key circles of Delhi, Mumbai, Haryana and Kerala and recently announced Global Holding Corporation and Tulip Telecom as initial shareholders for its LTE venture for network deployment. On October 19, 2010 Nokia Siemens Networks announced the successful demonstration in India of a video call over LTE TDD on commercial hardware. The call was made by Gurdeep Singh, CEO of **Aircel**.

Indonesia

Telkomsel, **XL Axiata**, and **Indosat** have been trialling LTE technology and propose to deploy LTE networks should spectrum become available in 2013.

Japan

LTE operators use 1.5 GHz (**DoCoMo** and **Softbank Mobile**), 1.5 GHz + 800 MHz (**KDDI**), and 1.7 GHz (**eMobile**). DoCoMo plans commercial LTE launch in December 2010, initially serving Tokyo, Nagoya and Osaka areas, and later rolling out nationwide. eMobile also plans to launch LTE in 2010.

KDDI is committed to deploying LTE and will continue to operate its CDMA network for voice traffic. KDDI has 20 MHz of spectrum for LTE and is working on technical interoperability issues to ensure the network can fall back to CDMA2000 1x for incoming voice calls during a data session held over LTE. The cellco is looking to launch LTE commercially in 2012 is

targeting national mobile broadband coverage to 96.5% of the country by end of 2014.

Malaysia

Maxis is trialling LTE in the Klang Valley. In July 2010 LTE with peak download speed of 60-104 Mbps was demonstrated, using 10 MHz and 20 MHz channels.

Celcom has commenced LTE technical trials

DiGi plans to launch LTE in 2.6 GHz by 2013

WiMAX™ operator **Asiaspace** is exploring deployment in the near future of LTE TDD in the 2.3 GHz band.

The regulator, MCMC, plans to allocate blocks of 2.6 GHz spectrum for LTE, and is also consulting on re-farming 850/900/1800 spectrum. According to press reports, Packet One Networks (P1) and REDtone are amongst the operators who have said they will receive frequencies in the 2.6 GHz band, and they are in the process of submitting detailed business plans regarding their proposed use of the spectrum. Further spectrum allocations to additional operators are understood to be in process.

New Zealand

Telecom New Zealand is committed to LTE, and will be making decisions with regards to technology trials and choices around the end of 2010. **Vodafone New Zealand** has confirmed its commitment to LTE. The Commerce Commission has indicated willingness to discuss infrastructure sharing for LTE. New spectrum for LTE is not expected to be available before 2013.

The Philippines

Smart Communications and **Globe Telecom** have conducted LTE trials. **Pitell** is seeking the remaining 3G license in the country to deploy LTE services.

Singapore

StarHub is trialling LTE. **M1** has completed a 100 Mbps data call on its trial LTE network. **SingTel** is trialling LTE in Singapore, and overseas with carriers in which it holds stakes i.e. SingTel Optus (Australia), Telkomsel (Indonesia), Globe Telecom (Philippines).

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South Korea

SK Telecom, KT & LG Telecom are deploying LTE.

SK Telecom has confirmed commercial LTE services will start in 2011, and be nationwide by 2013. KT also plans to invest in LTE in 2011. LG Telecom is targeting nationwide LTE coverage by 2013.

Taiwan

Chunghwa Telecom (CHT) is firmly committed to LTE, and conducted trials to test functionalities, evaluate performance, and interworking testing with local companies. Commercial network deployment is expected to start from 2012 depending on spectrum availability. In July 2010 Ericsson and CHT showcased results from a joint LTE field trial including demonstrations of indoor and outdoor mobility tests, application services as well as CHT's in-house LTE Simulator. The trial also opened up the local device industry for IoT testing. A workshop was conducted with the Institute for Information Industry to foster the Taiwan ICT industry and speed up development for LTE. In October 2010 CHT announced it is undertaking LTE technical trials together with Alcatel-Lucent, using 2.6 GHz and 700 MHz spectrum.

CHT has also completed LTE tests on the high-speed rail system using both TDD and FDD modes in the 2.6 GHz band.

The National Chiao Tung University together with Nokia Siemens Networks conducted a trial of LTE TDD earlier this year.

FarEasTone and **China Mobile** are co-operating on an LTE TDD trial network in Taipei.

Vietnam

The regulator (MIC) has given authority to **FPT Telecom** to test LTE in Hanoi and HCM City. A small trial system has now been deployed.

Vietnam Data Communication Company (VDC) is also conducting a trial, partnering with Russian company Antares.

According to reports MIC is also considering granting permits to test LTE to **VNPT** and **Viettel**.

Europe

Armenia

VivaCell-MTS plans to deploy LTE in 2010.

ArmenTel (Beeline/Vimpelcom) is planning to deploy LTE following a successful trial in Kazakhstan.

Austria

Austrian telecoms regulator TKK completed the auction of 2.6 GHz spectrum on September 20, 2010, raising €39.5m from the four incumbent operators - **Telekom Austria, Hutchison, T-Mobile** and **Orange**. 14 paired and 9 unpaired frequency blocks were offered. License conditions require coverage of at least 25% of the population by 2013.

Telekom Austria launched LTE in Vienna on October 19, 2010 with 49 base station sites in Vienna, and 3 sites in St. Pölten. The LTE mobile broadband price plan - A1 Broadband LTE, offers 30 Gbytes of data for €90 per month.

T-Mobile Austria launched a 60-cell site pilot LTE network in Innsbruck in July 2009. **3 Austria** is upgrading its network for LTE, and expects to have the capability to offer LTE to customers from 2011.

Belgium

MVNO and cable operator **Telenet** is trialing LTE in Mechelen, ahead of the 2.6 GHz auction expected in Sept 2010. **Mobistar** is also testing LTE, reaching 60 Mbps downlink and latency of 18 ms.

Denmark

An auction of 2500-2690 MHz and 2010-2020 MHz spectrum was completed on May 10, 2010, with spectrum being awarded to **Hi3G Denmark ApS; TDC A/S; Telia Nätjänster Norden AB; and Telenor A/S**. TDC has stated it could have a pre-commercial trial network running in 2010.

On October 12, 2010 the regulator Telestyrelsen announced that Hi3G Denmark had been granted 900 and 1800 MHz spectrum, which could be used to deploy 2G, 3G or LTE technologies nationally.

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Estonia

EMT has established an LTE test network in Tallinn and made the first data connection in February 2010.

Tele2 Estonia is also undertaking LTE tests.

Finland

2.6 GHz licenses for LTE were awarded in an auction ending 23 November 2009:

- **Elisa** obtained a 20-year license for 50 MHz. On June 2, 2010 Elisa launched a pre-commercial trial in Helsinki
- **TeliaSonera** also acquired a 20-year license for five blocks of 2 x 5 MHz in the 2.6 GHz band and launched an LTE network on June 2, 2010 for pre-commercial use in the city of Turku. Network expansion will depend on local market conditions
- **DNA** obtained 40 MHz of 2.6 GHz spectrum

Elisa considers LTE1800 as a promising option for many markets since it covers 2x the area compared to deploying in 2.6 GHz, and would be ready for mass market only a short time after 2.6 GHz (LTE1800 devices are estimated by Elisa as coming 6-12 months after LTE2600).

France

France Telecom Orange has deployed a trial LTE network in Paris, initially with 10 MHz bandwidth supporting both FDD and TDD modes, upgraded to 20 MHz in May 2010. FDD-TDD co-existence tests are on-going. Service launch is expected in 2012 subject to availability of 2.6 GHz and 800 MHz spectrum. **SFR** has awarded an infrastructure contract to upgrade and expand its 2G/3G networks and start LTE trials. **Bouygues Telecom** is trialing LTE1800 in 10 MHz bandwidth using 2x2 MIMO at a number of sites in Orléans.

On July 27, 2010 the regulator ARCEP launched a public consultation on ways of allocating frequencies in the 800 MHz and 2.6 GHz bands for mobile broadband services. This consultation builds on extensive work conducted over several months by ARCEP, in consultation with all stakeholders. Submissions were required by September 13, 2010, after which ARCEP plans to finalize its proposals and

to launch proceedings by end 2010, with a view to allocating 800 MHz and 2.6 GHz spectrum between Spring and early Summer 2011.

Germany

After 224 rounds the spectrum auction ended on May 20, 2010 and covered 360 MHz in 4 bands: 800 MHz (digital dividend), 1800 MHz, 2.1 GHz, 2.6 GHz. All 4 incumbents acquired 2.6 GHz to be used for LTE. **Telefonica O2, Vodafone** and **Deutsche Telekom** (but not **E Plus**) additionally acquired 800 MHz spectrum which they will use for LTE. The 800 MHz spectrum raised €3.576 billion, i.e. over 81.5% of the auction's total value. Vodafone and Deutsche Telekom are testing and deploying LTE in 800 MHz. **Deutsche Telekom** has selected its infrastructure and services partner and expects to launch LTE800 by end 2010. O2 has announced a pilot LTE network in Halle, starting network deployment in September 2010 in 2.6 GHz and 800 MHz spectrum. The pilot network will be operational by end 2010, but it is not planned to operate it commercially in the first phase.

Vodafone has selected two technology partners and announced plans to eventually upgrade all base stations in Germany to LTE. Work started on the LTE upgrade at the end of September, and by next year 1,500 base stations will incorporate LTE technology. The company has also launched an LTE-focused website and hotline for customers. www.vodafone.de/turbo-internet

O2 deployed an urban pilot network in Munich in September 2010. Rural pilot networks in Teutschenthal (near Halle) and Ebersberg (near Munich) using 800 MHz spectrum will be activated in November 2010. O2 customers will be able to try out the LTE network in December 2010. Construction of the commercial network, comprising up to 1,500 base stations, and commercialization of the service will begin across Germany in 2011.

Greece

Cosmote has undertaken basic LTE functionality tests in 900 MHz and 1800 MHz spectrum and has requested spectrum for deploying a pilot LTE network at its technical and network headquarters in the Marousi and Chalandri areas near to Athens.

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Hungary

Telenor (ex-Pannon) has selected its infrastructure partner to build a commercial LTE trial network.

Magyar Telekom (T-Mobile) is also trialing LTE. The National Media and Telecoms Authority has confirmed that tenders for mobile broadband and Internet service licenses in the 450 MHz and 900 MHz bands, which may see a new market entrant, will be held in 2010. Hungary has 3 mobile operators: Magyar Telekom, Telenor Magyarország, and Vodafone Hungary.

Ireland

LTE TDD testing has been performed by Ericsson. **Hutchison 3 Ireland** is trialing 21 Mbps and 42 Mbps HSPA+ in 2010 on the way to launching LTE services by end 2011.

ComReg is now consulting on use of 800 and 900 MHz bands (closes October 15, 2010).

Italy

Telecom Italia has launched the 2nd phase of LTE testing in Turin. **Wind** announced its infrastructure supplier for a commercial LTE network deployment

Jersey

Clear Mobitel announced on September 17, 2010 that the company has been granted a license to test and develop LTE in the 2.6 GHz band in Jersey.

Kazakhstan

Kcell announced on July 29, 2010 installation of an LTE base station in Astana to showcase LTE capabilities, and intends to deploy a commercial LTE network. On April 26, 2010 **Beeline** announced completion of LTE tests in 700 MHz, and in October 2010 announced launch of a live LTE pilot in Amaly.

Latvia

Bite, **Tele2** and **LMT** are reported to be interested in acquiring 2.6 GHz spectrum, though it may not be auctioned until 2012 or 2013. **Bite** plans to trial LTE in 2011 in 2.6 GHz spectrum. CDMA operator **Triatel** is testing LTE in the 800 MHz band.

Lithuania

Omnitel is testing LTE, reaching 52 Mbps peak DL.

Bite Lithuania plans to trial LTE in 2011 in 2.6 GHz spectrum. 2.6 GHz spectrum may be awarded in 2011.

Moldova

Orange Moldova conducted a 2-day public LTE demonstration in Chisinau in July 2010.

Netherlands

2.6 GHz spectrum was auctioned in April 2010 and resulted in spectrum being awarded to incumbents **KPN**, **Vodafone**, **T-Mobile**, and newcomers **Ziggo 4** and **Tele2**. Tele2 has built a trial network in Diemen and Amsterdam. The unpaired spectrum was unsold.

Norway

TeliaSonera launched the world's first LTE networks in Oslo and Sweden in December 2009 as reported earlier in this report.

TeleNor is committed to commercial deployment and is trialing LTE in Oslo.

The regulator NPT has confirmed that 790-862 MHz spectrum will be allocated for mobile broadband, and on September 21, 2010 launched a consultation on the future use of wireless microphones (which currently often use 800 – 820 MHz).

Poland

On September 7, 2010 the world's first LTE system in 1800 MHz spectrum (LTE1800) was commercially launched by **Mobyland** and **CenterNet**. The service uses the maximum standardized 20 MHz bandwidth. The company is targeting to have 700 base stations in operation covering over 7 million people by 2010.

Mobyland and **CenterNet** are also testing LTE TDD in 2.5 GHz band in Aleksandrów Łódzki and Łódź.

Polish regulator UKE (Urząd Komunikacji Elektronicznej) has launched a tender process for 2.6 GHz and digital dividend (790-862 MHz) spectrum,

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which will enable operators to deploy LTE. The auction is expected mid-2011. UOKiK (Office of Competition and Consumer Protection) has approved plans by PTK Centertel (Orange) and P4 (Play) to create a combined LTE network, and this new JV will be allowed to bid in the forthcoming 2.6 GHz auction.

Portugal

Portugal Telecom has been undertaking trials of LTE in Portugal (via **TMN**) and Brazil (via **Vivo**) ahead of planned launches. On March 30, 2010 TMN gave a public demonstration of LTE in Lisbon.

Optimus is replacing its network infrastructure initially in four regions of central Portugal which could provide a migration path to LTE.

Vodafone Portugal wants to deploy LTE by end of 2011, the company announced during an LTE demonstration in Porto in April 2010, subject to the regulator, ANACOM, releasing more spectrum.

On September 28, 2010 ANACOM approved the draft decision on the designation and availability of 790-862 MHz spectrum for providing mobile services. Allocation before 2015 depends on co-ordination on technical and geographical conditions, particularly with Spain and Morocco. This draft decision has been opened for general consultation, with comments required by November 3, 2010. Multiple spectrum band auctions – including 800 MHz, 1800 MHz, 2.1 GHz and 2.6 GHz, may be conducted in 1H 2011.

Russia

The Communications Ministry has identified four LTE test regions, and testing should be completed by April 1, 2011.

Five operators - **MTS**, **Vimpelcom**, **Tele2**, **Megafon** and **Svyazinvest**, are reported to be interested in deploying LTE. 1800 MHz looks to be a promising band, depending on developments elsewhere, including how the eco-system develops.

BWA operator **Yota** has announced plans to shift from WiMAX™ to LTE TDD and plans to launch the first LTE base stations in Moscow and St. Petersburg in 2011. The company plans a transition to LTE in more cities in the future.

MegaFon and **Rostelecom**, general partners of the Sochi 2014 Winter Olympic Games, have successfully tested their LTE networks close to the key Sochi site of Roza Khutor. LTE capabilities will be showcased during the 2014 Games, with full scale LTE tests commencing in February 2011. Rostelecom plans to conduct LTE trials in 2.3 - 2.4 GHz spectrum (LTE TDD) in two other Russian cities this year. **MegaFon** showcased an LTE data call at the IX International Investment Forum in Sochi in September 2010.

Spain

Telefonica has conducted LTE field tests at its Madrid Demonstrations Center and is trialing LTE on its networks in Argentina, Brazil, Czech Republic, Germany, Mexico, Peru, Slovak Republic, Spain, and the UK. **Vodafone Spain** showcased LTE in Barcelona at the 2010 Mobile World Congress.

The Ministry of Industry, Tourism and Commerce launched in June 2010 a consultation on the re-allocation of spectrum in the 2.6 GHz band (also re-farming of 900 and 1800 MHz) potentially in 2011.

Sweden

TeliaSonera launched the world's first LTE networks in Stockholm and Norway (Oslo) in December 2009.

Tele2 Sweden and **TeleNor Sweden** are jointly building an LTE network (Net4Mobility). The JV includes spectrum sharing in 900 MHz and 2.6 GHz. LTE launch is targeted by end 2010.

Regulator PTS plans to allocate 790–862 MHz for mobile broadband. PTS is working on the assignment process. An auction is planned February/March 2011.

Switzerland

Orange has announced plans to enhance coverage and higher capacities for mobile data and voice services, including an LTE demo platform for customers and partners in 2010, and preparations for LTE introduction (subject to availability of spectrum and user devices) from 2011. **Swisscom** has been running an LTE test network in Grenchen, since September 2010, and plans commercial launch of LTE services in 2011.

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Turkey

Turkcell has been trialing LTE technology.

Ukraine

MTS-Ukraine will conduct an LTE trial in 2H 2010.

United Kingdom

O2 has tested LTE in 2.6 GHz spectrum, achieving peak data throughputs of 135 Mps DL and 64 Mbps UL in the lab and field, and lower latency. O2 has been trialing LTE800 in Carlisle since mid 2010.

Clear Mobitel is trialing LTE for rural mobile broadband access using 800 MHz in Cornwall; 300 businesses are participating. If successful, the company will seek a license for commercial rollout as a new market entrant.

Ofcom is expected to auction 800 MHz & 2.6 GHz spectrum in the UK in late 2011.

Uzbekistan

MTS announced on July 28, 2010 commercial launch of the first LTE system in the CIS and Central Asia, in Tashkent and plans significant coverage expansion in coming months.

Ucell commercially launched LTE in Tashkent in August 2010.

Middle East and Africa

Bahrain

Zain Bahrain confirmed in August 2009 plans to deploy LTE, the first announcement in the region.

The company showcased the region's first LTE call in March 2010, claiming a download speed of 70 Mbps.

Egypt

Vodafone Egypt is trialing LTE technology and has achieved 100 Mbps D/L and 47 Mbps U/L speeds.

Jordan

Zain Jordan is planning to trial LTE this year and commercial launch by 2011. Regulator TRC is inviting comments from incumbents on future LTE licenses.

Kenya

Safaricom announced in August 2010 that the company would commence a pre-commitment LTE trial within next two months using existing spectrum.

Libya

Al Madar announced plans to deploy a LTE network.

Oman

Omantel showcased LTE TDD to visitors to the Salalah Tourism Festival in July 2010

Saudi Arabia

STC is deploying LTE. **Zain** commenced deployment in Q2 2010 in Riyadh in the 2.6 GHz band.

Etisalat completed LTE testing in March 2010.

South Africa

Vodacom is showcasing LTE and reportedly has 1,000 LTE-ready sites, with launch planned "when handsets become available".

MTN is trialing LTE in South Africa.

Cell C has also asked regulator ICASA for 2.6 GHz spectrum.

The lack of suitable spectrum is understood to be a big restraining factor in rolling out LTE networks.

UAE

Following successful trials, **Etisalat** plans to commercially launch LTE service by end 2010.

The company showcased LTE at Gitex Technology Week in Dubai.

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GSM/3G MARKET/TECHNOLOGY UPDATE**LTE TDD: summary of network plans, commitments, trials, deployments***(referencing information contained in this report)***CHINA**

LTE TDD is being showcased by China Mobile and leading industry partners at the World Expo 2010, Shanghai. The large-scale trial network covers the whole 5.28 sq.km site, outdoors and in 9 pavilions and 2 demonstration centers. Several products supporting the trial network are launched or planned including WWAN cards, routers and dongles. Key milestones achieved in the trial include:

- Demonstration of LTE TDD HD video telephone in single 20 MHz spectrum with peak downlink speeds of up to 80 Mbps
- Demonstration of VOD, video communication, and other high-speed mobile broadband apps
- Demonstration of 24-channel video streaming
- Mobile HD video conferencing between the trial network and another location
- Inter-Operability Test of multiple LTE TDD USB dongles in a single mobile network cell

China Mobile is establishing 3 further trial LTE TDD networks separately in Qingdao, Xiamen and Zhuhai.

FRANCE

Orange has deployed a trial LTE network in Paris, initially with 10 MHz bandwidth supporting both FDD and TDD modes, upgraded to 20 MHz in May 2010. FDD-TDD co-existence tests are on-going.

IRELAND

LTE TDD testing has been performed under the ComReg trial and test license program.

INDIA

India is a key market for LTE TDD following the BWA spectrum auction. Qualcomm through its JV with local partners is committed to LTE TDD and anticipates commercial service from 2011. Some other BWA spectrum winners are finalizing their technology choice, so more winners may also choose LTE TDD.

MALAYSIA

WiMAX™ operator Asiaspace currently owns a license to provide wireless technology services on the 2.3 GHz band, and is exploring the deployment in the near future of LTE TDD technology.

JAPAN

Softbank Mobile (Japan) is reported to be considering LTE TDD in 2.5 GHz spectrum it owns.

OMAN

Omantel showcased LTE TDD to visitors to the Salalah Tourism Festival in July 2010

POLAND

Mobyland and CenterNet are testing LTE TDD in 2.5 GHz band in Aleksandrów Łódzki and Łódź.

RUSSIA

Yota is shifting from WiMAX™ to LTE TDD and plans to launch the first LTE base stations in Moscow and St. Petersburg in 2011. The company plans a transition to LTE in more cities in the future.

Rostelecom plans to conduct LTE trials in 2.3 - 2.4 GHz spectrum (LTE TDD) this year.

TAIWAN

CHT has also completed LTE tests on the high-speed rail system using both TDD and FDD modes, using the 2.6GHz band.

The National Chiao Tung University together with Nokia Siemens Networks conducted a trial of LTE TDD earlier this year.

FarEasTone and China Mobile are co-operating on an LTE TDD trial network in Taipei.

USA

Clearwire has requested 3GPP to standardize LTE TDD for operation in the band 2496 – 2690 MHz and on August 4, 2010 announced plans for technology trials to test both LTE TDD and LTE FDD.

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113 LTE network commitments in 46 countries (October 26, 2010: GSA)

Country	Operator	Expected launch
Norway	TeliaSonera	Launched 15.12.09
Sweden	TeliaSonera	Launched 15.12.09
Uzbekistan	MTS	Launched 28.07.10
Uzbekistan	UCell	Launched August 2010
Poland	Mobyland and CenterNet	Launched 07.09.10
USA	MetroPCS	Launched 21.09.10
Austria	Mobilkom Austria	Launched 19.10.10
Armenia	Vivacell-MTS	2010
Canada	Telus	2010
Canada	Bell Canada	2010
Finland	TeliaSonera	2010
Germany	Deutsche Telekom	2010
Japan	NTT DoCoMo	2010
Japan	Emobile	2010
Russia	Yota	2011
Sweden	TeleNor Sweden	2010
Sweden	Tele2 Sweden	2010
USA	CenturyTel	2010
USA	Verizon Wireless	2010
UAE	Etisalat	2010
Canada	Rogers Wireless	2010-11
China	China Mobile	2010-11
Germany	Vodafone	2010-11
Hong Kong	PCCW	2010-11
Hong Kong	CSL Limited	2010-11
USA	Cox Comms	2010-11
South Africa	Vodacom	2011
Canada	Shaw Communications	2011
Colombia	UME EPM	2011
Denmark	3 Denmark	2011
Denmark	TDC	2011
Denmark	TeleNor	2011
Denmark	Telia Danmark	2011
Germany	O2 (Telefonica)	2011
India	Qualcomm India LTE Venture	2011
Ireland	Hutchison 3	2011
Japan	Softbank Mobile	2011
Jordan	Zain	2011
Portugal	TMN	2011
Portugal	Vodafone Portugal	2011
Russia	Rostelecom	2011
South Korea	LG Telecom	2011
South Korea	KT	2011
South Korea	SK Telecom	2011
Switzerland	Orange	2011
Switzerland	Swisscom	2011
USA	AT&T Mobility	2011
USA	Aircell	2011
USA	BayRICS	2011
Austria	T-Mobile	2011-12
Austria	Hutchison 3	2011-12
Austria	Orange	2011-12
France	Orange	2012
Japan	KDDI	2012
Taiwan	Chunghwa Telecom	2012
Malaysia	DiGi	2013
Australia	Optus	To be confirmed
Australia	Telstra	To be confirmed
Australia	VHA	To be confirmed
Bahrain	Zain	To be confirmed
Brazil	Vivo	To be confirmed
Canada	MTS Allstream	To be confirmed
Canada	Sasktel	To be confirmed
Chile	Entel PCS	To be confirmed
Chile	Movistar	To be confirmed

China	China Telecom	To be confirmed
Estonia	EMT	To be confirmed
Estonia	Tele2	To be confirmed
Finland	DNA	To be confirmed
Finland	Elisa	To be confirmed
France	SFR	To be confirmed
Germany	E Plus	To be confirmed
Hong Kong	SmarTone-Vodafone	To be confirmed
Hong Kong	Hutchison 3	To be confirmed
Hong Kong	China Mobile	To be confirmed
Hungary	Telenor Magyarország	To be confirmed
Italy	Telecom Italia	To be confirmed
Italy	Wind	To be confirmed
Jamaica	Claro	To be confirmed
Jersey	Clear Mobitel	To be confirmed
Kazakhstan	Kcell	To be confirmed
Kuwait	Zain	To be confirmed
Latvia	Bite	To be confirmed
Latvia	Tele2	To be confirmed
Latvia	LMT	To be confirmed
Libya	Al Madar	To be confirmed
Malaysia	Asiaspace	To be confirmed
Netherlands	KPN	To be confirmed
Netherlands	Vodafone	To be confirmed
Netherlands	T Mobile	To be confirmed
Netherlands	Ziggo 4	To be confirmed
Netherlands	Tele2	To be confirmed
New Zealand	Telecom NZ	To be confirmed
New Zealand	Vodafone NZ	To be confirmed
Norway	TeleNor	To be confirmed
Philippines	Piltel	To be confirmed
Russia	Svyazinvest	To be confirmed
Saudi Arabia	Zain	To be confirmed
Saudi Arabia	STC	To be confirmed
Saudi Arabia	Etisalat (Mobily)	To be confirmed
Singapore	M1	To be confirmed
Singapore	SingTel	To be confirmed
Singapore	StarHub	To be confirmed
South Africa	Cell C	To be confirmed
UK	Vodafone	To be confirmed
USA	Cellcom	To be confirmed
USA	Cellular South	To be confirmed
USA	Lightsquared	To be confirmed
USA	T-Mobile USA	To be confirmed
USA	Commnet Wireless	To be confirmed
USA	Leap Wireless	To be confirmed
USA	Texas Energy Network	To be confirmed
USA	Public Service Wireless	To be confirmed

PLUS

43 pre-commitment LTE trials

(October 26, 2010: GSA)

In addition to the above referenced LTE network commitments, a further 43 “pre-commitment trials” have been identified in this report.

These trials are listed on the following page

43 pre-commitment LTE trials

(October 26, 2010: GSA)

Country	Operator
Argentina	Telefonica
Argentina	Personal
Belgium	Mobistar
Belgium	Telenet
Brazil	Telefonica
Czech Republic	O2 (Telefonica)
France	Bouygues Telecom
Egypt	Vodafone
Greece	Cosmote
Hungary	Magyar Telekom (T-Mobile)
Indonesia	Telkomsel
Indonesia	XL Axiata
Indonesia	Indosat
Latvia	Bite
Latvia	Triatel
Lithuania	Bite
Lithuania	Omnitel
Kazakhstan	Vimpelcom
Kenya	Safaricom
Malaysia	Maxis
Malaysia	Celcom
Mexico	Telcel
Mexico	Telefonica
Moldova	Orange Moldova
Oman	Omantel
Peru	Telefonica
Philippines	Globe Telecom
Philippines	Smart
Puerto Rico	Claro
Russia	MTS
Russia	Vimpelcom
Russia	Tele2 Russia
Russia	Megafon
Slovak Republic	O2 (Telefonica)
South Africa	MTN
Spain	Telefonica
Turkey	Turkcell
UK	O2 (Telefonica)
UK	Clear Mobitel
Ukraine	MTS-Ukraine
USA	Clearwire
Vietnam	FPT Telecom
Vietnam	VDC

Note: Many LTE trials are on-going worldwide. A trial is usually a scheduled activity prior to planned commercial deployment. Sometimes an operator has agreed to undertake a trial but not decided i.e. *committed* to launch a commercial service. The above Table lists cases where a trial is announced but a firm commitment from the operator for a post-trial commercial rollout has not yet been made.

Voice over LTE – One Voice initiative

Leading operators, network equipment vendors and handset developers agreed on a common method for

handling voice and SMS traffic over LTE, using 3GPP specifications for IMS. They formed the One Voice initiative to promote this solution. The **GSMA VoLTE** (Voice over LTE) initiative was formally announced at the Mobile World Congress on 15th February 2010.

In establishing the VoLTE initiative, GSMA has adopted the work of the One Voice Initiative as the basis of the work to lead the global mobile industry towards a standard way of delivering voice and messaging services for Long-Term Evolution (LTE). Using IP Multimedia Subsystem specifications developed by 3GPP as its basis, GSMA has expanded upon the original scope of One Voice work to address the entire end-to-end voice and SMS ecosystem by also focusing on Roaming and Interconnect interfaces, in addition the interface between customer and network.

The work of GSMA VoLTE encompasses:

- The continuity of voice calls when a customer moves from LTE coverage to an area where LTE coverage is not available (this is achieved through Single Radio Voice Call Continuity, or SR-VCC).
- Optimal Routing of bearers for voice calls when customers are Roaming.
- The establishment of commercial frameworks associated with Roaming and Interconnect for services implemented using VoLTE definitions
- Capabilities associated with the model of Roaming Hubbing
- A thorough security and fraud threat audit

LTE/SAE Trial Initiative (www.lstforum.org)

Leading vendors and operators have joined forces under the *LTE/SAE Trial Initiative* to demonstrate the potential of LTE/SAE through joint tests, including radio performance, interoperability, field tests and full customer trials.

A Proof of Concept activity consolidated measurements from leading equipment vendors to show that the targets for performance are achievable. In addition to peak rates and minimum latency, results reveal the 'real world' performance that operators will be able to offer to end-users.

Growing LTE eco-system

Mobile phones, computer and consumer electronic devices including notebooks, netbooks, UMPCs, gaming devices, cameras, and PMPs will have embedded LTE connectivity. A huge growth in M2M applications enabled by LTE is forecast. Since the LTE standard supports hand-over and roaming to existing mobile networks, most devices will ensure ubiquitous mobile broadband coverage from day one.

- Single mode (LTE) and multi mode (LTE/HSPA) modems are in the market
- The Verizon Wireless LTE launch will be supported by 700 MHz dongles and datacards, with smartphones and tablets arriving around May 2011.
- The first LTE phone is launched (on the MetroPCS network, operating in AWS spectrum)
- Several test equipment manufacturers provide LTE test platforms and solutions
- The Global Certification Forum, a partnership between network operators, device manufacturers and the test industry, has been developing the global certification scheme for LTE devices since March 2008 (www.globalcertificationforum.org)

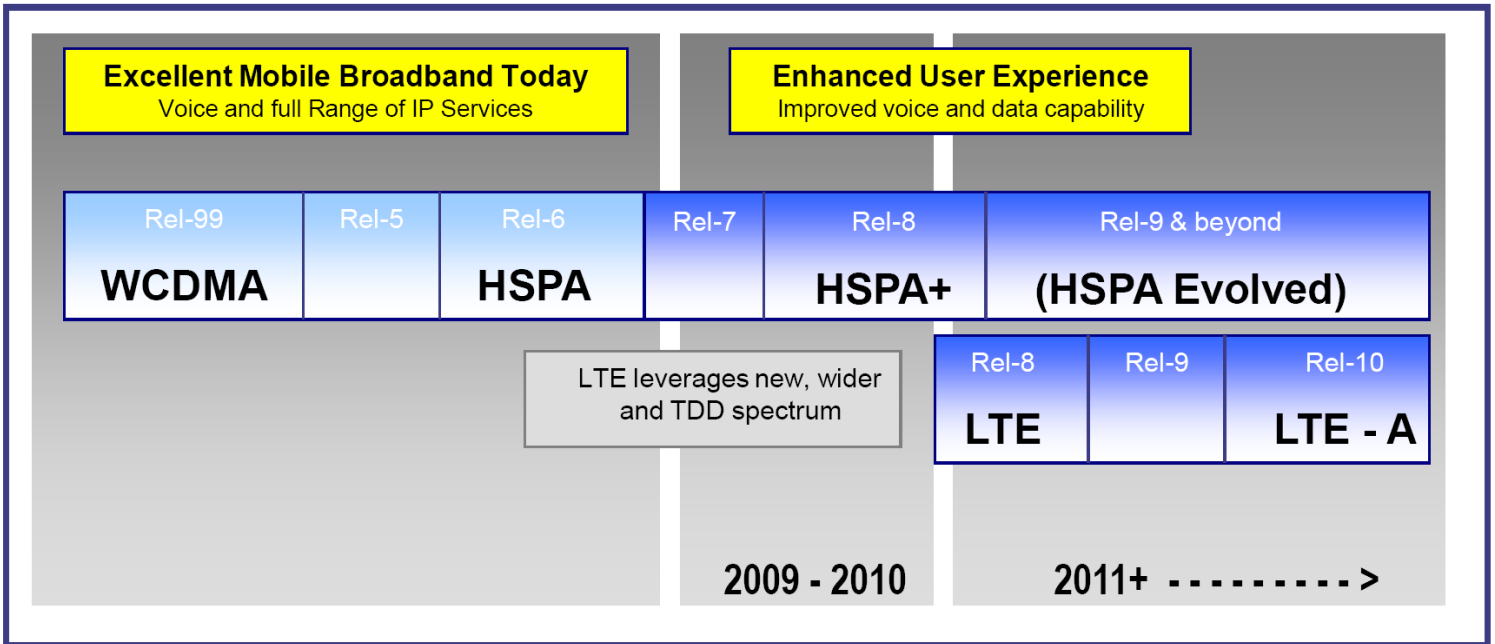
The LTE standard comprizes TDD and FDD modes. Most equipment is the same for FDD and TDD modes, as only radio units differ. In addition to the FDD devices already launched by a number of suppliers, several leading companies have indicated early availability of LTE TDD chipsets capable of operating in 2.3/2.5 GHz spectrum. Some devices support multi-mode operation e.g. LTE FDD and TDD, HSPA/HSPA+, EDGE and TD-SCDMA. A selection of LTE-capable chipsets, platforms and user devices is listed below:

Supplier	Model name	Form factor
4M Wireless	PS100 UE protocol stack	Software
Altair Semi	FourGee™ 3100/6200	Chipset
Altair Semi	FourGee™ 6150 for TDD	Chipset
Beceem	BCS500 LTE FDD/TDD and WiMAX™	Chipset
Continuous Computing, picoChip, Cavium Networks	LTE femtocell reference design	Chipset reference design
Huawei	E398 LTE/GSM/HSPA 2.6 GHz, 900 MHz	USB modem
Icera	Dual mode HSPA/LTE soft modem	Chipset
Innofidei	LTE TDD	Chipset, USB modem

Infineon	SMARTi™ LU LTE / 3G / 2G multimode RF Transceiver	Chipset
LG	LD100	USB modem
LG	M13 test device CDMA EV-DO/LTE dual mode band 13	USB modem
LG	LTE handset modem chip	Chipset
MediaTek	LTE mobile terminal platform licensing arrangement with NTT DoCoMo	Chipset
MimoOn	mi!MobilePHY™ 3GPP Release 8 software stack supporting FDD and TDD	Software
Motorola	FDD LTE USB-LTE 7110	USB modem
Nokia	RD-3 multi mode	USB modem
Qualcomm	MDM9200 (WCDMA-HSPA, HSPA+ and LTE)	Chipset
Qualcomm	MDM9600 (CDMA2000 1X, EV-DO Rev. B, SV-DO, SV-LTE, WCDMA-HSPA, HSPA+ and LTE)	Chipset
Qualcomm	MSM8960 (CDMA2000 1X, EV-DO Rev. B, WCDMA-HSPA, HSPA+ and LTE)	Chipset
Runcom	Chipset	Chipset
Samsung	GT-B3710 (2.6 GHz)	USB modem
Samsung	GT-B3730 (LTE/2G/3G)	USB modem
Samsung	N150 10 inch with Kalmia LTE chipset	Netbook
Samsung	SCH-r900 multi-mode CDMA-LTE handset	Handset
Sequans	SQN3010 LTE TDD being prepared for sampling	Chipset
Sierra Wireless	AirPrime MC7750 LTE, EV-DO, HSPA+	Module
Sierra Wireless	AirPrime MC7700 LTE, HSPA+	Module
Sierra Wireless	AirPrime MC7710 LTE, HSPA+	Module
ST-Ericsson	M700 LTE quad band	Chipset
ST-Ericsson	M710 multi mode LTE quad band	Chipset
Synopsys	LTE TDD Model Library	Software
Tata Elxsi	LTE Femto/Pico eNodeB solution compliant to 3GPP Rel 8 & Femto Forum specs	Chipset reference design
Toshiba	T130 13.3 inch: choice of 4 Intel LTE ULV processors	Notebook
Wavesat	Odyssey 9000 family	Chipset
ZTE	AL600 LTE/UMTS/EV-DO	USB modem
ZTE	AL620 LTE/UMTS/EDGE	USB modem
ZyXEL	ZLR-2070S	Router

LTE devices and platforms (October 26, 2010: GSA)

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The Roadmap for LTE

Some Industry market forecasts

- **Strategy Analytics:** the global LTE handset market will reach 150 million sales units by 2013
- **ABI Research:** by 2013 operators will spend over \$8.6 billion on LTE base stations infrastructure
- **Juniper Research:** LTE enabled netbooks and tablets will be used by 1 in 5 LTE subscribers by 2015
- **Juniper Research:** The number of people who subscribe to LTE wireless broadband services is expected to reach 300 million by 2015, compared with 500,000 this year
- **Ericsson:** 50 billion connections by 2020. These devices will be connected via HSPA and LTE and will be used for both machine-to-machine applications and consumer devices

LTE-Advanced accepted by ITU for next generation mobile broadband (IMT-Advanced)

- Improved spectrum efficiency**
- Support for wider bandwidth: Up to 100 MHz**
- Downlink transmission scheme**
 - Improvements to LTE by using 8x8 MIMO
 - Data rates 100 Mbps high mobility, 1 Gbps low mobility
- Uplink transmission scheme**
 - Improvements to LTE; data rates up to 500 Mbps
- Reduced latency**
- Relay functionality**
 - Improving cell edge coverage
 - More efficient coverage in rural areas
- Backward compatibility and interworking with LTE and other 3GPP legacy systems**

Key requirements of an IMT-Advanced system

3GPP made a formal submission to the ITU in October 2009, proposing that LTE Release 10 & beyond (LTE-

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Advanced) be evaluated as a candidate for IMT-Advanced. 3GPP plans to complete LTE-Advanced specifications by 2010/2011.

On October 20, 2010 LTE-Advanced was accepted as a 4G technology at the Chongqing meeting of ITU-R Working Party 5D, having successfully completed

Steps 4 through 7 of the IMT-Advanced process in ITU-R, complying with - or exceeding, the ITU established criteria in all aspects.

Final ratification of the full IMT-Advanced technology family will occur at the ITU-R Study Group 5 meeting in November 2010.

Further reading:

3GPP: www.3gpp.org/LTE-Advanced

LTE-Advanced – Evolving LTE towards IMT-Advanced

www.ericsson.com/res/thecompany/docs/journal_conference_papers/wireless_access/VTC08F_jading.pdf

Beyond Mobile Broadband: What Is LTE-Advanced & What Will It Offer to Your Network

- a presentation on the key drivers and steps towards 4G with 3GPP LTE-Advanced, timelines for standardization activities, key features and benefits www.gsacom.com/gsm_3g/info_papers.php4

About GSA

GSA (Global mobile Suppliers Association) represents GSM/EDGE/WCDMA-HSPA/LTE suppliers, providing reports, facts, analysis and information explaining market developments and trends. GSA-organized seminars facilitate enhanced dialog between operators, members and developer communities.

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dotMobi site: <http://gsacom.mobi>

ETSI has registered "LTE" as a trademark for the benefit of the 3GPP Partners. GSA is a Market Representation Partner in 3GPP

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