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1. Executive Summary – 4G Operators Update 1H 2010

Verizon's LTE Plans on track, all set to launch services in November 2010. Verizon is all set to launch LTE in 25-30 markets before year end (Boston and Seattle by 15th, November), covering about 100m citizens. It is expected that operator will launch 4G iPhone in Q1, 2011. Verizon and AT&T now controls over 69% of US mobile data market and has seen biggest jump in data revenues along with Softbank, AT&T and DoCoMo(11%) in first Half 2010.

AT&T announced their 4G partners to build LTE network. AT&T announced their plans to build LTE network, and contracted Alcatel Lucent and Ericsson as their LTE equipment suppliers. However the operator believes that LTE has its own time to come and may not be ready for a large scale deployment in near future. The operator is adopting a middle strategy to upgrade their current network to HSPA+ and LTE later.

T-Mobile all set with HSPA+ to answer immediate data demand. T-Mobile has rolled out HSPA+ services in more than 25 major metropolitan areas in last four month's time to extend its 3G networks which will support 21 Mbps peak data rates. Their new HSPA+ network covers 75 million populations, and plans to cover 185 million people by the end of this year.

Clearwire has been expanding the network so fast that it has become the biggest construction company in the US. Clearwire strives to reach 2 Million customers by end of 2010. The network is now available in 44 markets in US covering over 50 million people. Things will get really interesting later in 2010 when Clearwire and Sprint take their 4G mobile broadband network to New York City, Los Angeles, Boston, Denver, Minneapolis, the San Francisco Bay Area, Miami, Cincinnati, Cleveland and Pittsburgh for a 120 million person strong data footprint.

Reliance Industry marked its entry in telecom with nationwide BWA spectrum in India, after completion of five year agreement with younger brother. The operator paid close to \$2.6 billion to win 2.3 GHz (20 MHz) nationwide spectrum in the country.

Qualcomm pumped \$1 billion to protect TD-LTE: Qualcomm won 2.3 (20 MHz) GHz spectrum in four telecom circles of India in the recently held BWA spectrum auctions. Qualcomm's final bid was INR 4912.54 crore or approximately USD 1.045 billion.

The Battle of LTE and WiMAX is fierce in India after auctions: Qualcomm protected entry of WiMAX in India by winning four circles and all the other players like Aircell, Bharti, Augere and Tikona is watching Reliance controlled Infotel's move for BWA technology choice.

Infotel holds the future of WiMAX in India. The WiMAX camp spearheaded by Samsung, Huawei and ZTE is convincing Infotel for immediate WiMAX deployment to enter market in similar timelines as 3G. Their strategy is not impending from the fact that they do not have a LTE roadmap, but rather their eagerness to enter the agreement with Infotel and secure their mobile data business and do away with competition from Ericsson, ALU and Nokia. Ericsson, Nokia, ALU and Qualcomm is taking every possible step to avoid WiMAX deployment in India.

LTE TDD Devices Availability for Indian BWA Operators: Our research indicates that the commercial availability of TD-LTE chipsets will start as early as Q3, 2010 by handful of suppliers and majority would be ready by Q1-2011 or later. Most reasonably it will at least take three to six months for ODM's to supply finished products. Expect first commercial shipment of TD-LTE chipsets after Q2/Q3-2011.

Teliasonera became world's first operator to launch LTE network. Teliasonera launched two commercial markets last year covering about 400,000 people in the two countries' capitals, Oslo and Stockholm. TeliaSonera has nationwide 4G/LTE licenses in Sweden, Norway, Finland and Denmark. During the first half year 2010, TeliaSonera has also opened up 4G for pilot customers in Finland, Denmark, Lithuania, Estonia and Latvia.

NTT DOCOMO LTE Plans on track, all set to launch services in December 2010: NTT DoCoMo has been at the cutting edge of the mobile data evolution by creating new markets and it is aiming to launch its LTE service in December 2010. DoCoMo plans to invest in the region somewhere around JPY343 billion in its new LTE network. The operator has indicated installation of 20,700 Base Station covering 51.10% of area by 2014. It strives to acquire massive 17.7 Million consumers in their new 4G network by 2014.

KDDI announced LTE plans and contracted Motorola and NEC to supply LTE equipment. KDDI Corp. has awarded contracts to Motorola and NEC Corp for the supply of base stations and ancillary equipment to build its next generation long term evolution (LTE) network. KDDI announced its plan stating investment of 515 Billion Yen in new LTE Network which will start in November 2011 and likely to reach full coverage by 2012. The operator has indicated installation of 29,361 Base Station covering 96.5% of area by 2014. It strives to acquire 9.84 Million consumers in their new 4G network by 2014.

UQ WIMAX growing steadily, 7000 base stations live on air. UQ Communications is already ahead of its deployment schedule as compared to LTE, and plans to cover 55% of the Japanese population (most major cities) by the end of March 2010, with the goal of covering more than 90% of the Japanese population by FY2012.

Softbank of Japan looks set to be the first major operator (outside of Philippines) with more revenues coming from data services than voice. Softbank is upgrading its 3G networks to support 42 Mbps Dual Carrier HSPA to cater its rapidly growing data business. Softbank plans to invest in the region somewhere around JPY207.3 billion in its new LTE network. The operator has indicated installation of 9,000 LTE Base Station covering 60.63% of the area by 2014. It strives to acquire 5.41 Million consumers in their new 4G network by 2014.

LTE-Advanced & IEEE 802.16m WiMAX both officially selected as 4G standard by ITU . LTE-Advanced and IEEE 802.16m WiMAX satisfied the ITU requirements as 4G standard, effectively being selected as the ITU 4G standards during ITU-R WP5D meeting which was held from June 9 through 16 in Vietnam

Korea Telecom plans LTE in 2011, it continues to expand WiBRO in five metropolitans and plans 27,000 WiFi Hotspots by September 2010. KT announced plans in May 2010 that it will work with electronic giants such as Samsung and LG-Ericsson for a high-speed LTE network. Investment for the LTE network could start in 2011 .

New investments are expected in Korea to promote WiBRO Adoption. KT to expand WiBRO in five metropolitans markets and established a joint venture with Samsung and Intel to promote WiBRO.

CMCC begins LTE trials with Shanghai expo, but for all practical purpose may only start large scale LTE deployment in 2012. CMCC kicked of TD-LTE network with shanghai expo. Motorola, ALU, Huawei, Sequans, ALU, ST Ericsson, ZTE , Nokia and Ericsson is trailing their equipment.

CMCC rolled out 108,000 TD-SCDMA base stations and acquired 7.69 million 3G subscribers. China Mobile set up 108,000 base stations in total, with a combined investment of over CNY90 billion (USD13.16 billion) by the end of March 2010 claimed 7.69 million 3G subscribers, from its total user base of 780 million.

2. US Market Update

Verizon Wireless is upbeat about their LTE plans and the operators has made clear that it will have live LTE services on November 15 and its own 4G iphone in January. Verizon and AT&T now account for 69% of the market data services revenues and 62% of the subscription base. Verizon and AT&T accounted for 60% of the increase in data revenues in Q4 2009.

In a significant milestone, Verizon Wireless edged past NTT DoCoMo, the mobile data revenue leader since the late nineties. By the end of the year, China Mobile and AT&T are also likely to cross their Japanese counterpart in quarterly mobile data service revenues.

According to the company the first LTE services in the US will go live in mid-November in Verizon's targeted launch sites, the downtown areas of Boston and Seattle. This would be in line with the carrier's pledge to go commercial in the fourth quarter, though slightly later than some had expected. Verizon has said it will launch LTE in 25-30 markets before year end, covering about 100m citizens.

It is anticipated that services will go live with data-only devices, notably dongles and PC cards, and with tiered data plans. It is not clear whether Verizon will initially offer single-mode devices only, or have a dual-mode product from day one. The possibility of dual mode devices with fall back option of Ev-Do/CDMA is not ruled out. Interestingly Qualcomm has announced support of dual mode devices in their MDM 9600 chipsets. ODM's have indicated support of dual mode devices.

Common LTE supported bands and peak data rates

	Supported Bands						Peak Data Rate
LTE	700	850	900	1800	2100	2600	LTE - 100 Mbps DL/50 Mbps UL
WCDMA/HSPA	850	900	1900	2100	NA	NA	HSPA - 42 Mbps DL/11 Mbps UL WCDMA - 384 Kbps
GSM/GPRS/EDGE	850	900	1800	1900	NA	NA	GPRS - 48Kbps(DL/UL) EDGE- 384 Kbps @ MCS9(UL/DL)

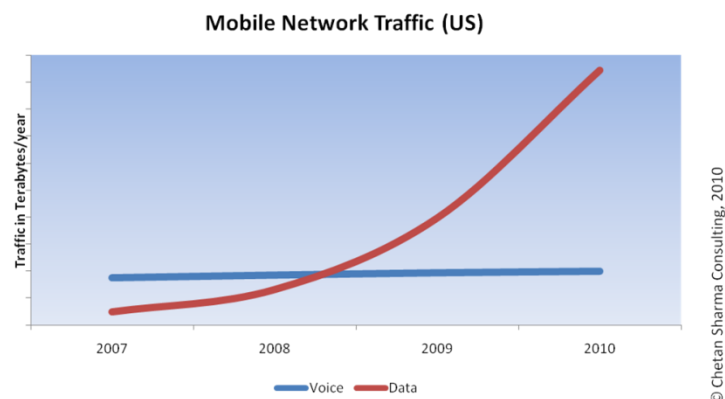
Verizon Wireless may launch up to five LTE phones by next May as per Verizon Wireless CEO Lowell McAdam . The LTE phones supplier may include Motorola, HTC, LG and BlackBerry maker Research in Motion.

From infrastructure perspective Verizon is using Alcatel-Lucent gear in Boston and Ericsson equipment in Seattle. Both the supplier is providing equipment for remaining cities. Other suppliers such as Starent Networks and Nokia Siemens Networks are also providing equipment to

Verizon. Initial devices are being supplied by LG and Samsung which will soon be supplemented by ST-Ericsson, Motorola and Qualcomm.

Verizon says smartphone owners currently use about 700MB of data per month, and the company will switch to tiered pricing with LTE 4G networks with explosion in data traffic due to video downloads, video conferencing, and other bandwidth-intensive applications. Recent reports from Clearwire indicated that their users are consuming averagely 7 GB of data in their new WiMAX Network. Verizon's LTE network is expected to deliver consistent 5-12 Mbps based on the test conducted by them in Boston with Alcatel Lucent.

Data Growth has prompted AT&T and T-Mobile to immediately upgrade its network to HSPA+. Verizon is aggressively building LTE. Sprint is building WiMAX and has seen some early success with HTC EVO.



Verizon Wireless is taking a proactive approach to fuel LTE ecosystem through many collaborative initiatives, including;

- 4G Venture Forum – Verizon Wireless recently created this new entity that brings together a number of highly regarded venture capital funds, along with its primary infrastructure providers, to quickly identify and commercialize innovation that will harness 4G wireless networks. The 4GVF is a collaboration of Verizon Wireless; highly-regarded venture funds including Alcatel-Lucent Ventures, Charles River Partners, New Venture Partners, North Bridge Venture Partners, Norwest Venture Partners (NVP) and Redpoint Ventures and both Alcatel-Lucent and Ericsson, the primary network infrastructure providers for Verizon Wireless' upcoming 4G Long Term Evolution (LTE) network.
- Verizon LTE Innovation centre for early development of both traditional and non-traditional products to help the consumer electronics and other industries quickly brings products to market for use on 4G LTE networks.
- Verizon Developer Community and V CAST Apps – A robust group of application developers that can take advantage of the company's scale and distribution to market their applications to Verizon Wireless customers through its forthcoming application store.

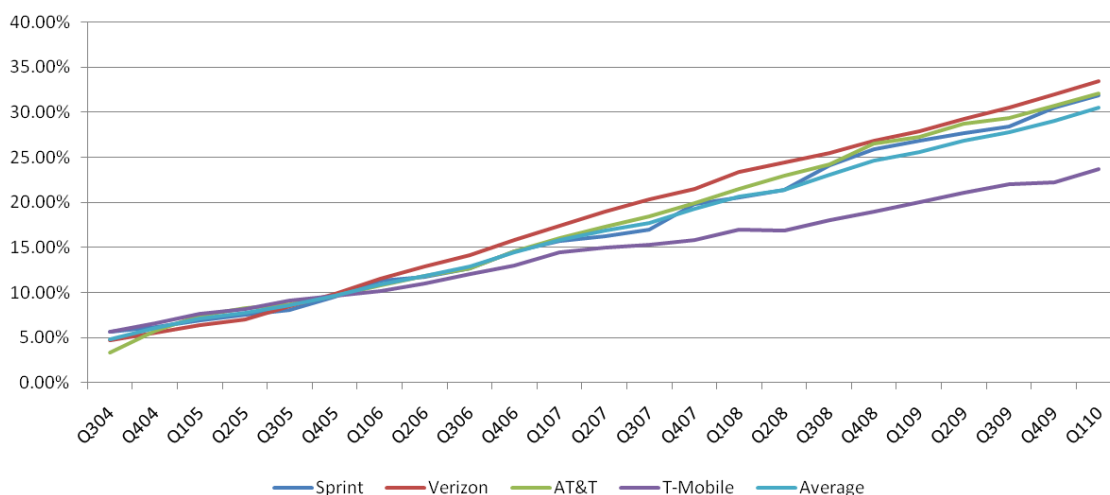
- Strategic Partnership with Google – Both companies will devote substantial resources to accelerate delivery of leading-edge innovation that leverages the Verizon Wireless network and the best of the Android open platform to put unique applications in the hands of consumers quickly.

AT&T announced their 4G partners to build LTE network. AT&T announced their plans to build LTE network with the announcements that Alcatel Lucent and Ericsson will be the equipment supplier for its 4G network. Market quickly reacted with AT&T's choice with an explanation owing to their strategy of leveraging existing supplier. It will also help AT&T for an easy interlocking with 3G networks and service continuity predicts analysts.

However the operator believes that LTE has its own time to come and may not be ready for a large scale deployment in near future. The operator is adopting a middle strategy to upgrade their current network to HSPA+ and LTE later. AT&T is not only speeding up its HSPA networks in the interim period before it has widespread 4G, but keeping pace with T-Mobile, which has an aggressive strategy to move to HSPA+. By contrast, Verizon Wireless denied recent reports that it would also have a mid-speed strategy, deploying EV-DO Rev B to upgrade its current network and fill in short term or permanent gaps in LTE coverage. Rev B can achieve peaks around 14Mbps. Sprint also said to be looking at Rev B to enhance its 3G network outside the areas where it provides 4G services via its Clearwire WiMAX venture, though it has not commented on these reports.

The US Wireless data service revenues grew 5% Q/Q to \$12.5B in Q110. Compared to Q109, the mobile data service revenues grew 22%.

US Wireless Market: Data as % of ARPU (2004-10)



Source: Chetan Sharma Consulting, 2010

Clearwire has been expanding the network so fast that it has become the biggest construction company in the US. It strives to reach 2 Million customers by end of 2010. The network is available in 44 markets in US covering over 50 million people. Later this year several large market launches

including New York City and Los Angeles will put their network reach upwards of 120 million people. The company is steadily expanding network and beating analyst's prediction. Clearwire highlighted that last quarter net addition was greater than entire year for 2009. The consumer base, stands near to 1 Millions subscribers and it is growing at a very fast rate to reach 2 Million subscribers before Verizon even starts their 4G services in US. The company also indicated that it was on pace to reach EBITDA profitability in its first three launched WiMAX markets of Portland, OR, Las Vegas and Atlanta. Things will get really interesting later in 2010 when Clearwire and Sprint take their 4G mobile broadband network to New York City, Los Angeles, Boston, Denver, Minneapolis, the San Francisco Bay Area, Miami, Cincinnati, Cleveland and Pittsburgh for a 120 million person strong data footprint.

In a statement to the move of AT&T's decision to abandon unlimited data plans, clearwire posted *"While large wireless carriers are moving away from unlimited data plans or signalling a desire to do so, Clearwire continues to offer unlimited data plans on a faster, open 4G network. You might ask why Clearwire can do this, while larger incumbents can't. The answer is simple. We have an all-IP network and unrivalled spectrum position, providing unmatched capacity to deliver mobile data. To put it in terms of old landline technology, our "pipe" is much bigger – several times that of incumbent carriers."*

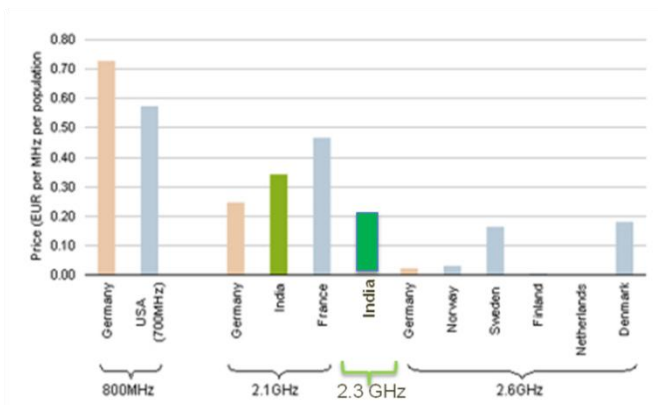
The HTC EVO 4G from Clearwire became the first phone to run on a 4G network in US. Early estimates are indicating that Sprint could have sold about 320,000 EVO 4Gs the day it was released, which would set the record for most single day phone sales for Sprint if the numbers are correct. The phone received some interesting forward looking comparisons against iPhone4. The operators is said to launch second 4G phone from SAMSUNG with dual mode support of CDMA/WiMAX. According to Android central blog, Sprint will get Samsung model called Epic 4G. This will have a WiMAX radio, front facing camera and slide-out Qwerty keyboard.

T-Mobile all set with HSPA+ to answer growing data demand. T-Mobile has rolled out HSPA+ service to more than 25 major metropolitan areas in last four month's time to extend its 3G networks to support 21 Mbps peak Data Rates. T-Mobile HSPA+ network is covering 75 million people, and plans to cover 185 million people by the end of this year. News blog suggested that T-Mobile was planning to upgrade to 42-Mbit/s HSPA+ in 2011. Updating the network to support 42-Mbit/s HSPA+ will require the operator to update its cell-sites with new multi-antenna (MIMO) base stations to hit the higher speeds.

T-Mobile USA plans to launch the first smartphone for its newly upgraded evolved High-Speed Packet Access Plus (HSPA+) network in September. The device will be manufactured by High Tech Computer Corp. (HTC) and will run on Android operating system. The handset is understood to be the world's first HSPA+ smartphone, and it will be the first phone that is made to handle T-Mobile's upgraded 3G networks with peak downlink network speeds of up to 21 Mbit/s.

3. India Market Update

For the first time India had auctioned telecoms spectrum, or radio airwaves, the life blood of mobile firms operations. In past 2G licences and spectrum came bundled with operators who would buy licences. The spectrum fetched nearly US\$ 22 Billion and government received almost thrice the estimated amount before the start of auction. The surplus money raised with spectrum action was in the range of US\$ 14 Billion US\$. It is estimated that the 2.1 GHz spectrum in India was one of the costliest among the nations and fetched exorbitantly high prices only next to US 700 MHz spectrum. Post the Auctions, where Government of India has been able to garner record revenues, focus has now shifted on all other spectrum which can be auctioned in the second stage. GoI has also floated a consultation paper for spectrum below 1 GHz band for mobile data application showing their intention of allocating more spectrums.



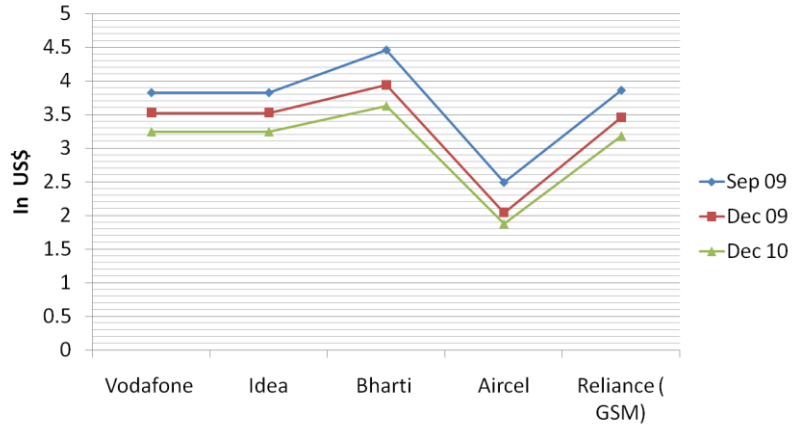
Spectrum per Euro - MHz for different countries. Indian 2.3 GHz BWA spectrum was costliest among other nations.

Voice ARPU down turn continued: Indian wireless Industry has witnessed heavy competition among operators and Voice ARPU continues to show downward trend. ARPU declined around 8 % over last quarter to reach levels of \$3.62. Uninor, Videocon, MTS , Stel an Etisalat were the new entrants in Indian GSM market making a total of 14 GSM operators in the country. New entrants has fuelled price war, and adopted a loud campaigning supported by a dynamic pricing and attractive plans to attract consumers.

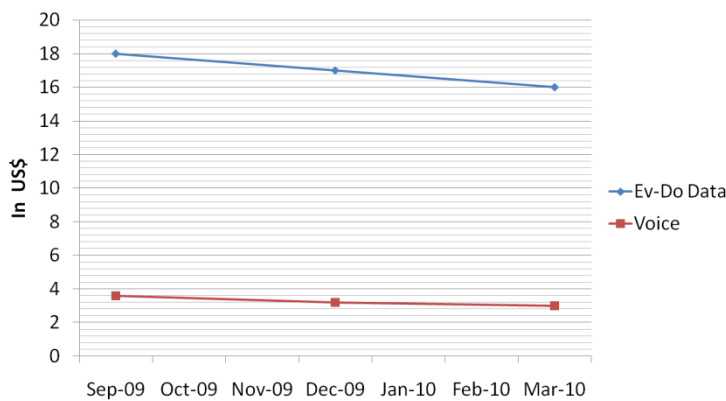
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In Q1 2010, Bharti Airtel was leading wireless operator in country with average ARPU of US\$ 3.62.

Bharti Leading Voice ARPU charts, followed by Vodafone, Idea and Reliance.



Mobile Data has shown promise during last quarter. Wireless Data Market especially driven by Ev-DO networks from TATA, MTS, Reliance and BSNL is growing steadily with Average ARPU above \$12 , roughly 4 times of voice ARPU. It is expected that Mobile data will grow at a faster rate after the availability of 3G networks. New HSPA based services is expected to be commercial by December 2010 and huge uptake of mobile data is expected.



Existing Ev-Do dongle based services from TATA and Reliance indicating 4 times higher revenues compared to voice.

Bharti Become the fifth biggest cellphone company by subscriber with acquisition of Zain. The centre of attention was Bharti Airtel's \$9 billion acquisition of African operations from Kuwait's Zain in a deal that makes the Indian firm the world's fifth biggest cellphone company by

4G Operators Report 1H-2010

subscribers and It aims to have 100 million subscribers and \$5 billion a year in revenue in Africa by 2012/13 as per Mr. Manoj Kohli, chief executive of its international unit.

In Indian 3G spectrum auctions, Bharti Airtel paid close to \$2.6 billion to win prime circles of 3G spectrum in the country. It is highly probable that Bharti may continue to use equipment gears from Nokia Siemens and Ericsson in their 3G network. Notably Ericsson and Nokia are their existing 2G equipment suppliers; out of the total 2G business, Ericsson owns nearly 66% and remaining 33% by Nokia. Bharti recently awarded expansion of their 2G networks to Ericsson worth \$1.3 Billion and NSN with \$ 700 million.

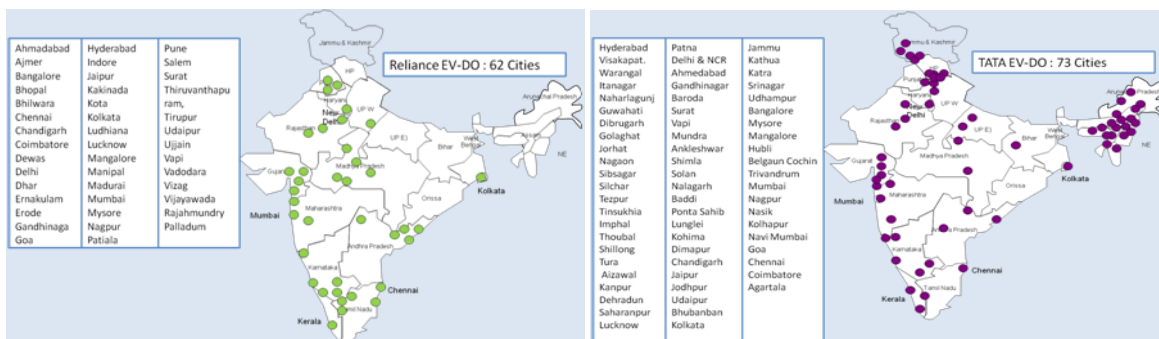
The commercial negotiation of 3G equipment gears and selection of infrastructure partners are underway as per industry insiders. It is anticipated that Bharti will try to launch their 3G services for commercial use by December 2010. Operator would certainly like to be among the first to have 3G services in country. India's biggest operator is roping on HSPA technology for initial network rollout and may subsequently introduce HSPA+ for improving capacity in select area.

Circles	Price (in Cr)	Vodafone	Bharti	Reliance	Tata	Idea	Aircel	Stel	MTNL/ BSNL
Delhi	3316.93	Y	Y	Y					Y
Mumbai	3247.07	Y	Y	Y					Y
Maharastra:	1257.82	Y			Y	Y			Y
Gujrat	1076.06	Y			Y	Y			Y
AP	1373.14		Y			Y	Y		Y
Karnataka	1579.91		Y		Y		Y		Y
Tamilnadu	1464.94	Y	Y				Y		Y
Kolkata	545.26	Y		Y			Y		Y
Kerala	312.48				Y	Y	Y		Y
Punjab	322.01			Y	Y	Y	Y		Y
Hariyana	222.58	Y			Y	Y			Y
UP(E)	364.57	Y				Y	Y		Y
UP(W)	514.04		Y		Y	Y			Y
Rajasthan	321.03		Y	Y	Y				Y
MP	258.36			Y	Y	Y			Y
West Beng	123.63	Y	Y	Y			Y		Y
Himachal P	37.23		Y	Y		Y		Y	Y
Bihar	203.46		Y	Y			Y	Y	Y
Orissa	96.98			Y			Y	Y	Y
Assam	41.48		Y	Y			Y		Y
NE	42.3		Y	Y			Y		Y
J&K	30.3		Y	Y		Y	Y		Y
Circles Won		9	13	13	9	11	13	3	22
Total Price (Cr)		11618.86	12295.46	8586.04	5864.29	5768.59	6500.46	337.67	16751.58
Total Price (Billion USD)		2.420596	2.561554	1.788758	1.221727	1.20179	1.354263	0.070348	3.489913

Vodafone and Reliance will consolidate their mobile data business with 3G Services in India. Vodafone paid close to \$2.5 billion to win nine prime circles of 3G spectrum in the country. It is highly probable that Vodafone may continue to use equipment gears from Nokia Siemens and Ericsson in their new 3G network. Notably Ericsson and Nokia are their existing 2G equipment suppliers; out of the total 2G business, Nokia owns nearly nineteen circles and remaining three by Ericsson.

Reliance paid close to \$1.5 billion to win thirteen circles of 3G spectrum in the country. Huawei is their existing GSM supplier and may continue to supply 3G equipment. NSN and others are also bidding aggressively to grab the share of equipment supply for Reliance Communications.

Reliance Ev-Do network is now available in more than 60 cities of the country.



Reliance and TATA Ev-Do network got time to market advantage in mobile data business and demonstrated impressive growth and significantly higher ARPU's as compared to voice.

TATA Teleservices successfully launched new GSM services (TATA DoCoMo) in highly competitive Indian market. In March 2009, Tata Teleservices Limited (TTSL) announced about their agreement on a strategic alliance with Japanese Operator DoCoMo, under which DOCOMO will acquire 26 per cent of TTSL's stock for approximately Rs 13,070 crore (US \$2.7 billion). Subsequently, the company launched their first GSM service in July 2009. It was a run away success for TATA DoCoMo. They led new subscriber additions for consecutive six months beating analysts and industry predictions. "Infact, Tata Teleservices has doubled its subscribers in the last 12 months since launching the GSM service. Company have now emerged as the fifth-largest telecom operator in the industry, with over 70 million subscribers. Tata Teleservices is seeing rapid growth and one company official expects the Indian telecom business to reach 100 million subscribers by the end of 2010.

Tata Teleservices won spectrum in 9 circles and paid approximately \$ 1.3 billion to exchequer for 3G spectrum. Huawei ZTE, and Nokia is their existing 2G supplier and may become preferred supplier for 3G services. Tata Tele has a commercial EV-DO network in more than 70 cites and their flexibility to offer both GSM and CDMA is paying off well. The operator is in talks with ZTE, ALU, Huawei and Samsung to supply Rev B equipment to strengthen their data services.

Meanwhile, ZTE and ALU were among those conducting Rev B trials for Tata Teleservices in India. TATA has nationwide CDMA spectrum, which it can leverage to strengthen their mobile data services in areas where they do not have access to 3G spectrum.

Reliance Industries marked its entry in telecom with acquiring nationwide BWA spectrum after completion of five years agreement with younger brother. In Indian BWA spectrum auctions, Infotel(RIL) paid close to \$2.6 billion to win 2.3 GHz nationwide spectrum in the country. After winning the spectrum, RIL chairman, Mr. Mukesh Ambani said: "We see this as the next wave of value creation opportunity in the wireless broadband space." His firm is paying INR48bn (\$1.02bn) for 95% of Infotel, a fairly low cost route into the Indian broadband wireless market. "We believe this will polevault India's economy into the digital world at an accelerated pace while creating next generation tools that will enhance productivity and create world class consumer experiences," he added.

Operator	No. of Circles	Name	Bid Price (US\$ in B)
Infotel(RIL)	22(all)	All	2.56B
Qualcomm	4	Delhi, Mumbai, Kerala, Haryana	1 B
Bharati-Airtel	4	Kolkata, Maharashtra, Karnataka, Punjab	.66 B
Aircell	8	Andhra Pradesh, Tamil Nadu, West Bengal, Bihar, Orissa, Assam, North East, J&K	.68 B
Tikona`	5	Gujarat, UP, Rajasthan, HP	.21 B
Augere	1	MP	.024B
BSNL/MTNL	22	All	2.56B

Infotel promoted by Reliance won nationwide BWA spectrum. TATA Communications, Reliance communications and Vodafone quit due to exorbitantly high spectrum prices.

Qualcomm pumped \$1 billion to protect TD-LTE: Qualcomm announced that they have won 2.3 GHz spectrum in four telecom circles of India. Qualcomm was one of 11 bidders participated in the BWA auction and has won one 20 MHz slot of spectrum in the circles of Delhi, Mumbai, Haryana and Kerala. Qualcomm's final bid was INR 4912.54 crore or approximately USD 1.045 billion.

Qualcomm executives, on their part, say they are talking to partner with 3G operators so that they can use their 20 Mhz spectrum in LTE to provide high quality data services, instead of becoming an independent service operator. Qualcomm believes LTE can be overlaid on existing 2G and 3G networks and seamless services can be offered without the call or data getting cut while you move from one to the other network.



The Battle of LTE and WiMAX was intense in Indian BWA spectrum auctions: Qualcomm was the first to announce and protect the deployment of TD-LTE by winning spectrum in four circles. The LTE camp got euphoric as Reliance controlled Infotel expressed their interest towards LTE. All the other players like Aircell, Bharti, Auzere and Tikona is watching Reliance controlled Infotel's move for BWA deployment.

The WiMAX camp spearheaded by Samsung, Huawei and ZTE will try to convince Infotel for immediate WiMAX deployment to enter market in similar timelines as 3G. The strategy is not impending from the fact that they do not have a LTE roadmap, but rather their eagerness to enter the agreement with Infotel and secure their mobile data business. The same suppliers are also involved in developing TD-LTE gears which Infotel can later use to upgrade their network to TD-LTE.

The companies which are involved in TDD LTE infrastructure system development are ALU, Ericsson, Motorola, Huawei, ZTE, Nokia and Samsung to name few.



TD-LTE would not be in commercial production stage before 2013. To reach the same stage of readiness with an ecosystem such as WiMax (802.16e) would take at least another four years

Rao, chairman, WiMax Forum



WiMax as a broadband technology has been deployed in large scale across the globe, and has a robust ecosystem support where both service and end user devices are affordable.

A Sethu Raman, executive director, product and solution, Huawei



At present India is offering 20 MHz of BWA spectrum for future mobile broadband rollout in this band. It is common knowledge that WiMax requires 30 MHz to work effectively, so TD-LTE is a better technology for India

Jaikishan Rajaraman, senior director, GSM Association

Huawei, ZTE, Samsung and WF proclaiming WiMAX for immediate deployment. NSN, Ericsson, GSMA and Qualcomm betting everything on TDD-LTE. Motorola equivocal on their stance.

WiMAX supporters, meanwhile, argue that TD-LTE is not the right choice of technology. C S Rao, chairman, WiMAX Forum India, says "Operators have no choice but to adopt WiMAX if they are interested in promoting broadband over the next two years, since they will not have any TD-LTE

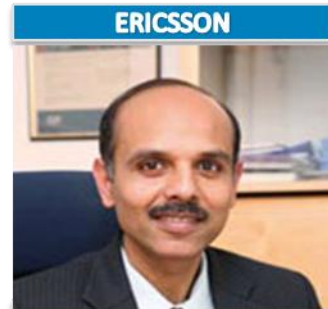
devices till such time". "WiMAX has been there for four years now. TD-LTE is yet to start anywhere in the world, leave alone FD LTE (which is a 4G rather than a 3.5G or 3.9G technology like TD-LTE).



In India's unpaired 2.3 GHz spectrum, TD-LTE is the technology best suited to complement current and upcoming 3G deployments and address India's demand for high bandwidth broadband services
Kanwalinder Singh , president, Qualcomm India and South Asia



Since both are 4G technologies, they should be positioned as per need. All technology growth will be driven as per demand
Subhendu Mohanty , country head, home & network mobility business, India, Motorola



WiMax in the Indian 20 MHz BWA allocations, with severe interference issues, resulted in substantial capacity and performance losses
P Balaji, VP, marketing & strategy, Ericsson Indi

In our earlier articles we wrote that a long term strategy revolving around TD-LTE for operators may be an option worth exploring as our data shows that initial TD-LTE Device ecosystem is not expected to be ready before Q2/3- 2011 for a economical deployment. Operators must be apprised about the challenges that crop in becoming worlds first TD-LTE network and test ground.





LTE TDD Devices Availability: The most interesting of all is the LTE TDD device ecosystems. Let me report some broad timelines based on my data which I have captured over period of time talking to industry experts and analysis reports. The commercial availability of chipsets will start as early as Q3, 2010 and most of supplier would be ready by Q1-2011 or later. Most reasonably it will at least take one quarter more for ODM's to supply finished products i.e. Q2-2011 or later.

PARAMETER	Chipset 1	Chipset2	Chipset3	Chipset4	Chipset5	Chipset6
Engg. Samples	Q2, 2010	Q3, 2010	Q3, 2010	Q3,2010	Q2,2010	Q4, 2010
Commercial Availability	Q3, 2010	Q2, 2011	Q1, 2011	Q1,2011	Q4,2010	Q1, 2011
ODM Readiness	Q1, 2011	Q2, 2011	Q2-2011	Q2-2011	Q2-2011	Q2-2011

Qualcomm is expected to provide the first commercial samples followed by Sequans, ST Ericsson, Altair and Innofidei.

We have learnt from wimax that time to complete device interpretability's cannot be shortened beyond a specific period of time and hence the devices ecosystem would most likely to be ready by Q2-2011. Only USB dongles are expected in this time frame. Operator's risk of becoming test ground for TD-LTE networks can not ruled out. Expect additional one quarter for Indoor Devices

LTE TDD Smartphone's : The commercial availability of chipsets for handsets and Smartphones is not expected before Q2- 2011. Most reasonably it will at least take three to six months additional for ODM's to supply finished products. It is reasonable to expect readiness of handsets by 2012.

PARAMETER	Chipset1	Chipset2	Chipset3	Chipset4	Chipset5	chipset6
Engg. Samples			NO PIC	NO PIC		
Commercial	Q4 2010	Q1 2011	Q2 2011	Q3,2011	Q2,2011	Q1,2011
ODM Readiness	Q1 2011	No Info	2012	Q4, 2011	Q4,2011	Q2,2011
	Q2 2011	No Info	No Info	No Info	Q1,2012	Q3-Q4,2011

Qualcomm is expected to provide first commercial samples and TD-LTE handsets are expected by 2012.

4. Chinese Market Update

China Mobile launches first TD-LTE trial in Shanghai Expo. China Mobile has launched the world's first trial TD-LTE network at Shanghai World Expo, using Huawei's solution. The trial network consists of 17 outdoor TD-LTE base stations made by Huawei Technologies completely covering the 5.28 square kilometre of Shanghai expo and will be used to provide mobile high-definition multimedia services.

Notably, China mobile has endorsed TD-LTE as their natural evolution path form home grown TD-SCDMA technology. The operator has further announced that it will establish three experimental TD-LTE (time division-long term evolution) networks separately in three coastal cities – Qingdao, Xiamen and Zhuhai – beginning the third quarter of 2010, according to the China-based *China Business News* to promote TD-LTE adoption.

Motorola demonstrated end to end readiness to support LTE TDD with USB dongle devices in Shangai Expo. In a parallel move, Nokia Siemens Networks has inaugurated a TD-LTE Open Lab at its Hangzhou R&D facility and are trailing their base stations with China Mobile .Sequans is known to be selected by CMCC to provide TDD-USB dongles. Alcatel-Lucent (Alca-Lu) has announced that it has achieved record speeds on China Mobile's TD-LTE trial network, which is being installed to support the 2010 World Expo in Shanghai. ZTE, Ericsson and ST-Ericsson are working towards demonstrating a working system at Shanghai World EXPO in 2010.

China Mobile continues phase four rollout of their TD-SCDMA networks, targets nationwide coverage. China Mobile sent bidding invitations to telecoms equipment vendors at the end of last

month, kicking off a long-awaited tender for the phase four deployment of its 3G TD-SCDMA network. China Mobile is expected to procure around 98,000 base stations for the TD-SCDMA network, close to the total number in the previous projects. In the previous three TD-SCDMA network construction projects, China Mobile set up 108,000 base stations in total, with a combined investment of over CNY90 billion (USD13.16 billion).

CMCC rolled out 108,000 TD-SCDMA base stations and acquired 7.69 Million 3G subscriber.

China Knowledge reports that China Mobile will more than double the number of TD-SCDMA base stations to 200,000 this year in a push to expand its 3G coverage nationwide. Last year China Mobile rolled out 108,000 base stations and by the end of March 2010 claimed 7.69 million 3G subscribers, from its total user base of 780 million.



China Mobile plans to double the number of TD-SCDMA base stations to 200,000 this year in a push to expand its 3G coverage nationwide.

4G in European Market

TeliaSonera became world's first operator to launch LTE network. TeliaSonera launched two commercial markets last year covering about 400,000 people in the two countries capitals, Oslo and Stockholm. TeliaSonera has nation wide 4G/LTE licenses; in Sweden, Norway, Finland and Denmark. During the first half year 2010, TeliaSonera has also opened up 4G for pilot customers in Finland, Denmark, Lithuania, Estonia and Latvia.

TeliaSonera continues the build out of 4G in Sweden and Norway. The common 4G/LTE core network will be delivered by Ericsson and the radio equipment by Ericsson and Nokia Siemens Networks. TeliaSonera's current 4G networks cover the central city areas of Stockholm and Oslo. The 4G network roll-out will continue to Sweden's 25 largest municipalities and recreation areas and to Norway's four largest municipalities to offer communication services for the future. The

agreement with Ericsson and Nokia Siemens Networks cover network roll out during 2010 and 2011. Huawei supplied the 4G equipment in Oslo's network.

The first devices are single mode supporting 2.6 GHz LTE only. The operator has promised free exchange of device to dual mode 3G/4G when it is available during second quarter 2010. TeliaSonera have secured deliveries from Samsung for dual mode 4G/LTE modems which will support 3G and 2G from second quarter 2010.

TeliaSonera choose to adopt tiered Pricing model. In Sweden, their 3G mobile data packages for USB dongles include 179 Swedish kronor (US\$25) per month for up to 5 Gbytes per month; 229 Swedish kronor (\$32) per month for up to 10 Gbytes; and 319 Swedish kronor (\$44) for up to 20 Gbytes.

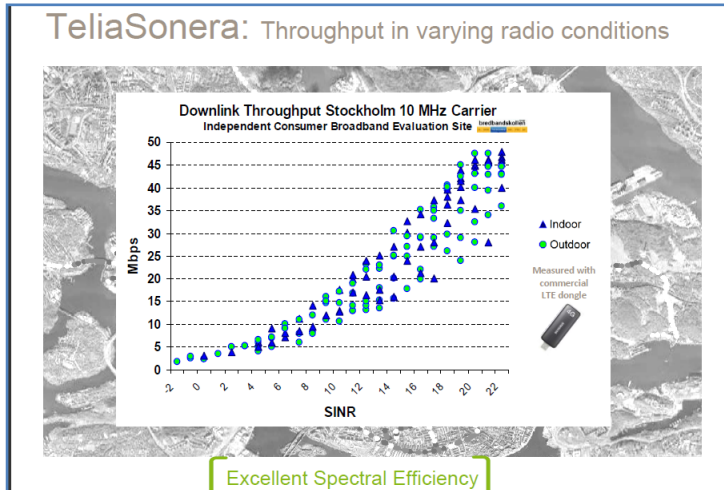
For Long Term Evolution (LTE) dongle users -- since TeliaSonera is in fact the world's first operator to launch LTE services -- there is a package for up to 30 Gbytes for 599 Swedish kronor (\$78.35) per month, which is now on special offer for just 4 Swedish kronor (that's less than a dollar) per month. However, their 4G mobile data packages for USB dongles include 179 Swedish kronor (US\$25) per month for up to 5 Gbytes per month; 229 Swedish kronor (\$32) per month for up to 10 Gbytes; and 319 Swedish kronor (\$44) for up to 20 Gbytes and 599 Swedish Kronor for 30 GB data.

TeliaSonera LTE Tiered Pricing Model						
Download Highest Speed	6 Mbps	2 Mbps	2 Mbps	6 Mbps	10 Mbps	80 Mbps
Upload Highest Speed	1 Mbps	0.5 Mbps	.5 Mbps	1 Mbps	1 Mbps	40 Mbps
Free Usage / Month	-	2 GB	5 GB	10 GB	20 GB	30 GB
Additional Cost per GB	-	\$6.75	\$6.75	\$4.016	\$4.016	\$4.016
Monthly Tarrif	-	\$5.09	\$23.38	\$29.92	\$41.67	78.35

TeliaSonera FDD Network Performance: Northstream conducted trials in Teilasonera network and they were able to see performance of around 25Mbps regularly with a few bursts up above 40Mbps. For a first-generation 4G network, that's more like it -- it's an encouraging sign both for TeliaSonera's customers and for LTE.

In a parallel move **SwissQual**, the independent Swiss network quality measurement company, has carried out drive testing on the new TeliaSonera LTE network in Stockholm. The measurements were made using the Samsung Kalmia LTE 4G modem mounted in the **SwissQual** Diversity Optimizer platform. The drive test collected very interesting measurement results from the new TeliaSonera 4G data service. Downlink data throughputs up to 47 Mbps and TCP latency as low as 20 ms were recorded. This is approximately 5 times better than the performance typically seen in 3G HSPA+ networks. Nevertheless these networks are unloaded and average data rate in 10 Mhz FDD may fall something between 5 to 12 Mbps in downlink and upto 5 Mbps in Uplink with significantly less latency. *One of the biggest improvements observed in TeliaSonera network was*

latency in the range of 20 millisecond and significantly higher throughputs in uplink as compared to their 3G counterpart.



LTE throughputs in TeliaSonera network were showing peaks upto 45 Mbps in outdoors.

In U.S. , the new 4G network from Sprint today is seeing average user speeds in the range of 4-6 Megabyte range, sparks to 6-8Mb and peaks to over 10Mb. Verizon tested LTE in Boston with nearly 10Mbps downlink and over 2Mbps on the upstream.

5. 4G in Asia -Japan

NTT DOCOMO LTE Plans on track, all set to launch services in December 2010 : Japan's top mobile phone carrier by subscribers, NTT DoCoMo Inc., is aiming to launch its LTE service in December 2010 . DoCoMo plans to invest in the region somewhere around JPY343 billion in its new LTE network. The operator has indicated installation of 20,700 Base Station covering 51.10% of area by 2014. It strives to acquire massive 17.7 Million consumers in their new 4G network by 2014. The country's largest operator expects video services to drive LTE usage and boost revenues. NTT DoCoMo will introduce LTE at 2GHz initially, but later plans to also use the 1.5GHz spectrum band. DoCoMo's 2G network will go dark in 2012.





NEC , Fujitsu , Panasonic/NSN and Ericsson is their Radio suppliers, and SAE partners are NEC and Fujitsu/NSN. Fujitsu was selected by NTT **DOCOMO**, INC. as a vendor for developing a mobile data communications terminal based on LTE technology.

Fujitsu announced in March that it has begun shipping next generation mobile base station systems to DoCoMo, ahead of its planned launch of Long Term Evolution (LTE) services in December 2010.

NEC announced earlier this month that it has started shipping low power radio LTE base stations to NTT DoCoMo. The LRE devices offer a low-power solution and can be deployed indoors to enhance radio signal coverage in areas not reached by outdoor base stations. The vendor's LRE

devices are compatible with DoCoMo's LTE and W-CDMA standards and allow accelerated communication speeds through the adoption of multiple-input and multiple-output (MIMO) technology.

NTT DoCoMo, has announced that pre-commercial tests to verify its 4G Long Term Evolution (LTE) network are underway in and around Tokyo, ahead of the scheduled full-blown commercial launch this December.

Operators					
Requested band		1.7GHz band/10MHz	1.5GHz band/15MHz	1.5GHz band/10MHz	1.5GHz band/10MHz
3.9G and others	Adopted technology	DC-HSDPA LTE (5MHz,2x2MIMO)	LTE (15MHz,2x2MIMO)	DC-HSDPA LTE (5MHz,2x2MIMO)	LTE (10MHz,2x2MIMO)
	Introduction band	1.7GHz band (DC-HSDPA,LTE)	1.5GHz / 2GHz band (LTE)	1.5GHz band (DC-HSDPA) 2GHz band (LTE)	800MHz / 1.5GHz band (LTE)
	Pilot launch	September 2010~	July 2010~	January 2011~	November 2011~
	Commercial launch	September 2010~	December 2010~	July 2011~	December 2012~
	Number of BSs/ Area cover ratio (till 2014)	6,388 / 75.2%	20,700 / 51.10%	9,000 / 60.63%	29,361 / 96.5%
	Capital investment (till 2014)	64.4 billion yen	343 billion yen	207.3 billion yen	515 billion yen
	Subscribers (till 2014)	2.95 million	17.7 million	5.41 million	9.84 million

KDDI announced LTE plans and contracted Motorola and NEC to supply KDDI's LTE equipment.

Japan's second largest mobile operator by subscribers KDDI Corp has awarded contracts to Motorola and NEC Corp for the supply of base stations and ancillary equipment to build its next generation long term evolution (LTE) network. KDDI announced its plan stating investment of 515 Billion Yen in new LTE Network which will start in November 2011 and likely to reach commercialization by 2012. The operator has indicated installation of 29,361 Base Stations covering 96.5% of area by 2014. It strives to acquire 9.84 Million consumers in their new 4G network by 2014.

KDDI is also major stake holder (32.26%) in japan's WiMAX service provider. UQ is currently providing WiMAX services in Central area of All Government-designated major cities and prefectural Capitals, in accordance with their original construction plan. UQ Communications has announced that the number of base stations reached **7,013 in 447 municipalities by now.**

Softbank of Japan looks set to be the first major operator (outside of Philippines) with more revenues coming from data services than voice¹.

Softbank is upgrading its 3G networks to support 42 Mbps Dual Carrier HSPA to cater its rapidly growing data business. This is an interim step towards their LTE strategy. Softbank may start deployment of LTE in 2GHz somewhere in between 2011-2012. Softbank plans to invest in the region somewhere around JPY207.3 billion in its new

¹ Chetan Sharma, <http://www.chetansharma.com/>

network. The operator has indicated installation of 9,000 Base Station covering 60.63% of the area by 2014. It strives to acquire 5.41 Million consumers in their new 4G network by 2014.

Operator claimed that they have witnessed Japan's largest increase in the number of new mobile subscriptions," says Junichi Miyakawa, Executive Vice President, Director and CTO of Softbank Mobile. *"Data traffic is growing rapidly every month. In order to meet this increased demand and to ensure continued user quality, we have decided to invest in an upgrade of our mobile broadband network"*

The operator has said to contracted Ericsson as the main supplier to upgrade its network. Ericsson is delivering RBS6000 HSPA/LTE multi standard base stations, and the rollout services to upgrade the network with multi-carrier HSPA technology which provides network speeds up to 42Mbps for the most data dense areas in Japan: the Tokyo, Kansai and Tokai (Nagoya) regions.

Softbank also recently acquired control of the national 2.5GHz spectrum held by bankrupt Willcom and could run WiMAX, TD-LTE or XGP technology in that, to add to its own LTE strategy. The operator is seriously exploring TD-LTE as per Fierce Wireless.

UQ WiMAX growing steadily, 7000 base stations live on air. UQ Communications is at the forefront of its WiMAX deployment schedule, and plans to cover 55% of the Japanese population (most major cities) by the end of March 2010, with the goal of covering more than 90% of the Japanese population by FY2012.

UQ differentiates itself from other tier1 mobile operators like NTT, KDDI and Softbank by promoting its services as huge pipe for unlimited internet, faster than HSPA, EV-DO and has MVNO business models as their key differentiators. UQ also introduced different plans for different kinds of consumers. UQ offers its services as low as US\$4 (called UQ step) and unlimited internet at US\$49.2(UQ Flat). UQ Wi-Fi is free for its user and UQ single day pass costs \$6.7. UQ is on way to deploy the nationwide WiMAX and by Q1, 2010 they have deployed more than 7103 base stations. It plans to deploy 20000 Base Stations by 2012.

料金プラン比較		
UQ Step 1日100MBプラン	UQ Flat 完全無制限プラン	UQ 1 Day 1日無制限プラン
※料金はプラン	2009年2月28日提供開始	2009年10月1日提供開始
380円 ~4,980円/月	4,480円/月	600円/日
<ul style="list-style-type: none"> ※使った月・使わない月がある方 ※ご加入時に、毎月どのくらい利用するか不明な方(コンスタントに利用をされる方から少ない方) ※テキストのメールだけをご利用の方 	<ul style="list-style-type: none"> ※家でも外でも毎月たくさんご利用される方 ※毎月コンスタントにご利用される方 	<ul style="list-style-type: none"> ※試しに利用してみたい方 ※出張等、必要な時だけ利用したい方 ※利用した日数分だけお支払いしたい方

UQ offers its services as low as US\$4 (called UQ step) and unlimited internet at US\$49.2(UQ Flat). UQ Wi-Fi is free for its user and UQ single day pass costs \$6.7.

Samsung is supplying majority of the Macro Base Stations for UQ project. Hitachi is supplying the ASN-GW and we learned that R6 handover between Samsung and Hitachi is completed by now. The other supplier of base station is NEC and handovers between Samsung and NEC is completed in UQ labs. Toshiba, Sony, Panasonic, Onkyo, Lenovo and Acer are shipping products based out of Intel. Other suppliers of devices are Modacom, NECAT, IO Data, Oki . Over 95% of the devices in UQ network are dongles and embedded laptops. Samsung is supplying in-building solution in UQ to cover Railways stations (JR 44 Station), Airports (Haneda, Narita) , Convention centre (Tokyo Big Site, Makuhari, Mess , pacific yokhama) , hotels and stores. UQ is also using Kyocera based **WiMAX/WiMAX repeaters** to improve in building coverage.

By Q1, 2010, UQ has reported some 300,000 customers. UQ's President Mr. Takashi Tanaka said that UQ WiMAX is really fast and most of the places they are offering speeds up to 10 mbps in downlink. Their peak achievable data rates in good radio conditions with category 5 HARQ is over 20 mbps. Network entry and success rates observed nearly 100% in good radio conditions and over 95% in cell edges. Handover latency is in the range of 60-70 ms, which is better than the current 3G networks deployed in Japan. Network connection time is fairly fast and it is in the range of 2 seconds. IP allocation from DHCP servers may take additional 5-10 second and mostly depend on radio conditions. Performance results reported from UQ's commercial wimax network is very close to what technology promises to deliver.

6. 4G in Korea

LTE-Advanced & IEEE 802.16m WiMAX both officially selected as 4G standard by ITU. According to Korea Communications Commission (KCC), both LTE-Advanced and IEEE 802.16m WiMAX satisfied the ITU requirements as 4G standard, **effectively being selected as the ITU 4G standards** during ITU-R WP5D meeting which was held from June 9 through 16 in Vietnam. According to ITU, the details of the standard specifications will be finalized by March, 2011 and ITU will officially endorse them as international 4G standards in February, 2012.

Better known as WiMAX Evolution in other countries, the WiBro Evolution's research has been led by Samsung Electronics and the state-funded Electronics and Telecommunications Research Institute. WiBro Evolution is expected to be 10 times faster the high-speed downlink packet access technology adopted by the current 3G mobile phones. The initiative for technology standardization was taken forward by the Telecommunications Technology Association in Korea, which worked in cooperation with groups based in other nations such as Japan and the U.S.

New investments are expected in Korea to promote WiBRO Adoption. Samsung, a WiBro equipment maker, plans to invest in two new WiBro-related companies. The two are Korea Mobile Internet Consortium, which recently applied for new mobile network licensing with an initial capital of 410 billion won, and WiBro Investment Company, a 320 billion won(\$ 267 Million) joint venture to be established by Samsung, Intel and KT to sell and lease WiBro equipment. The two companies look to launch a nationwide WiBro service, which is currently limited to the Seoul metropolitan area.

Korea Telecom plans LTE in 2011, it continues to expand WiBRO in five metropolitans and plans 27,000 WiFi Hotspots by September 2010. KT announced plans in May 2010 that it will work with electronic giants such as Samsung and LG-Ericsson for a high-speed LTE network. Investment for the LTE network could start in 2011 .

KT to expand WiBRO in five metropolitans markets and established a joint venture with Samsung and Intel to promote WiBRO : Notably, KT launched the world's first commercial WiBro service in 2006, which was developed by Samsung and state-run Electronics and Telecommunications Research Institute. However, Korea's much-vaunted wireless technology has drawn less than 400,000 subscribers mainly because of limited coverage that is mostly concentrated in the Seoul metropolitan region. Mobile carriers have been reluctant to invest in WiBro networks, worrying that they would cannibalize revenue from their expensive 3G wireless networks.

The company plans to expand its mobile WiMax coverage to beyond Seoul , particularly in the five new metropolitan regions, and connect them with Wi-Fi networks so that the people access broadband like internet anywhere. It is also expected that WiBRO services will get commercialize in Osaka and Nagoya for commercial launch in the second half of 2010. KT has as well announced Goba WiMAX romaing between US , Japan and Korea to start in second half of 2010.

In the local market, SKT has a meagre 30,000 WiBro subscribers at of the end of 2009. KT has attracted 340,000 WiBro subscribers, according to its latest figure.

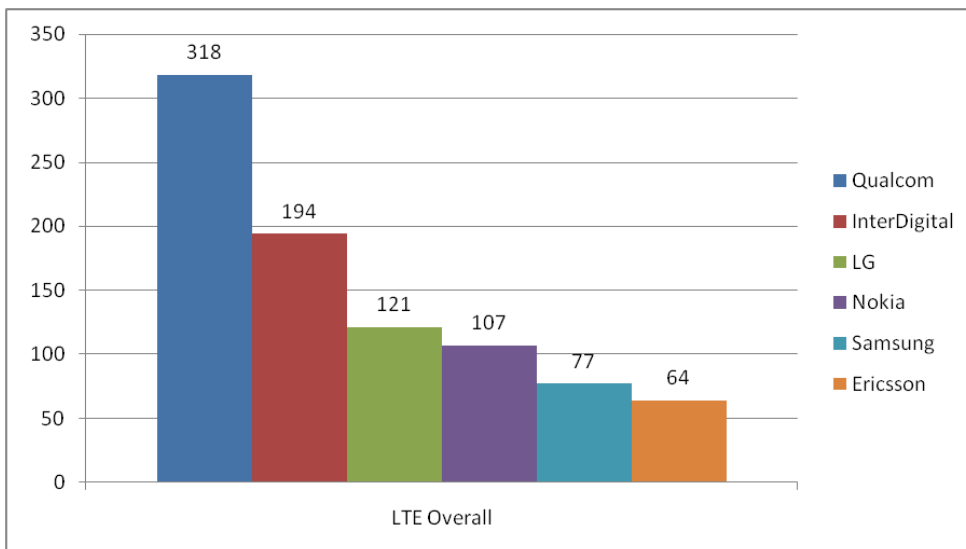
7. Is WiMAX losing to LTE – Tracking TD-LTE Ecosystem



Qualcomm²: It is expected that Qualcomm MDM 9600 chipset family will be the first to provide TD-LTE trial samples to device manufacturers. The chipset proposed and developed by Qualcomm will include dual-mode (TDD & FDD) and HSPA+, WCDMA, GPRS, EDGE, GSM compatible. MDM9200 supports UMTS, HSPA+ and LTE, while the MDM9600 supports CDMA2000® 1X, EV-DO Rev. B, SV-DO, SV-LTE, UMTS, HSPA+ and LTE. All of the new chipsets of Qualcomm family supports FDD LTE and TDD LTE modes and different carrier bandwidths, and are capable of using orthogonal frequency division multiple access (OFDMA) and multiple-input and multiple-output (MIMO) antenna technology to support peak data rates of up to 100 Mbps on the downlink and 50 Mbps on the uplink.

Devices will support channel bandwidths upto 20 Mhz and mostly ship with 2x2 MIMO configurations. **Commercial availability of chipsets from Qualcomm is expected in Q4, 2010.** ODM’s like AnyData and Band-rich has indicated Q2/Q3 2011 timeframe for commercial shipment.

Qualcomm is leading LTE Device essential Patents landscape: Qualcomm is leading patent landscape with 26% of overall LTE patents followed by Interdigital. Most of the Qualcomm’s patents are in the LTE chipset segment. LTE patent portfolios are researched for US market leader among LTE product manufactures³. To find the key IPR holders for the LTE patents, a keyword search of the USPTO patent data base has been performed. For completeness, patent data in the lists of patents declared essential to 3GPP LTE appear at the ETSI IPR Online website is also included. **As of April 10 2010, there were total of 1227 (786 patents from the ETSI IPR Online website and 441 patents from the keyword search) issued patents and published patent applications.**



² Qualcomm , <http://bit.ly/crySgT>

³ Alex Ghee , www.techipm.com

SAMSUNG and LG LTE TDD Chipset Update:

Samsung and LG electronics LTE TDD roadmap is not very firm and publicly announced, however the both the suppliers have very important role to play in 4G devices segments. The Samsung LTE device (Model name: GT-B3710) is expected to be the world's first LTE device which is commercially available in Teliasonera Network at Sweden and Norway regions. The USB stick incorporates Samsung's in-house developed LTE modem chips, branded Kalmia, and supports 2.6GHz band for LTE service. **LG and Samsung is also partnering** in other first LTE networks in US and Japan.



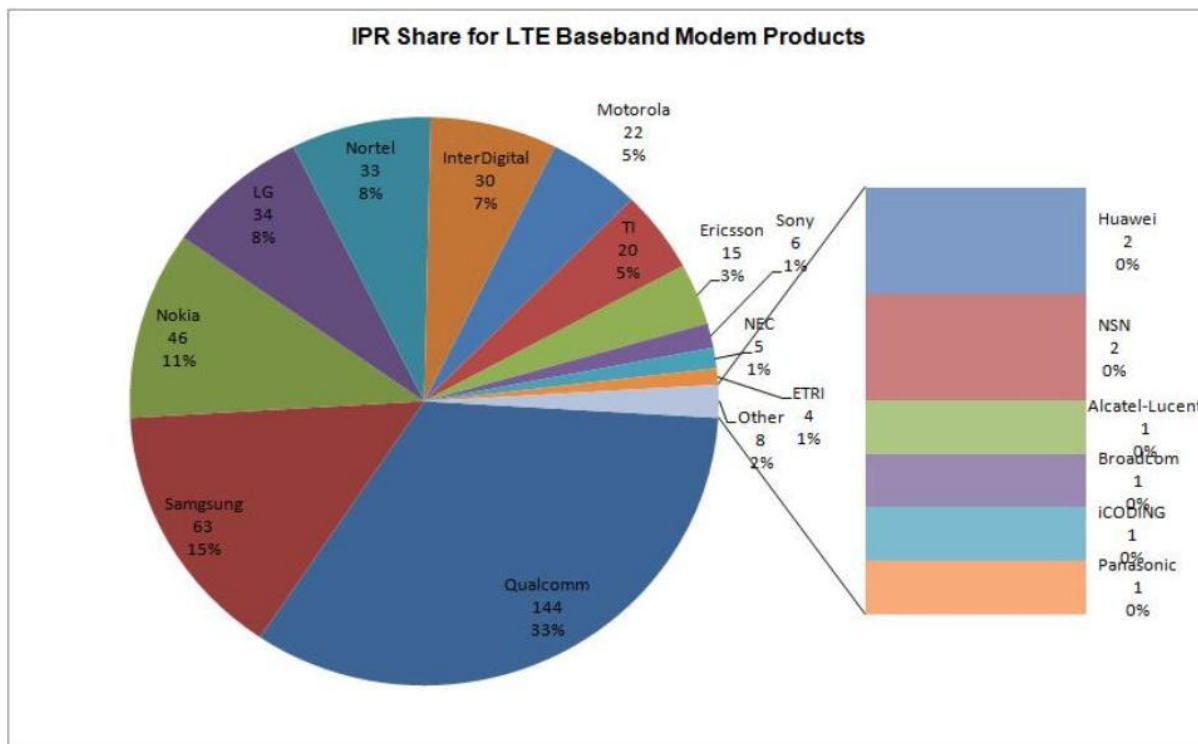
In Mobile World Congress 2010, Samsung Electronics demonstrated live video streaming via the company's own LTE network equipment on the Samsung netbook N150. Samsung also introduced the dongle type device GT-B3710 equipped with LTE baseband modem. In recent TechIPm's analysis for LTE essential patent candidates (published patent applications and issued patents in the United States (USPTO) before March 1, 2010), Samsung ranked the second in IPR share for LTE baseband modem products. Essentiality analysis of the Samsung's LTE IPR also showed high quality of Samsung's LTE patent portfolios.

LG Electronics recently announced that its LD100 data modem has become LTE modem device to receive Telecom Engineering Center (TELEC) certification in Japan. LG already had an approval from the FCC in the US before the TELEC certification. In recent TechIPm's analysis for LTE essential patent candidates, LG ranked 4th in IPR share for LTE baseband modem products. Essentiality analysis of the LG's LTE IPR also showed the highest quality of LG's LTE patent portfolio among IPRs shareholders.



LTE digital baseband for 3GPP standard specifications consists of two core parts: OFDM/MIMO Modem (TS36.211+TS36.213) and Channel Coder (TS36.212). Analysis⁴ for the top IPR shareholders for LTE baseband modem products shows that Qualcomm (144, 33%) is the leader followed by Samsung (63, 15%), Nokia (46, 11%), LG (34, 8%), and Nortel (33, 8%) as of Feb. 28, 2010.

⁴ Techipm , www.techipm.com



Altair's Four Gee3100 and 6200 RFIC⁵ :



Altair's FourGee-3100(Baseband) and FourGee-6200(RFIC) TD-LTE chipset will likely be available for trial in Q4, 2010. Commercial availability of chipsets is expected somewhere around Q2-2011. Altair chipset will support the following configuration in the initial release.

- 2.3GHz TDD single mode LTE
- One Transmit Two Receive architecture
- Maximum Tx power 23dBm
- Rx Sensitivity - -98dBm (QPSK1/3, dual ANT @ 20MHz)
- Maximum antenna gain -1dBi
- Maximum throughput DL 100Mbps/ UL 50Mbps (UE CAT3)
- Support USB2.0

The initial release of Altair chipsets will support DL MIMO (SFBC and Spatial-multiplexing base on patented maximum likelihood decoding), but does NOT support UL transmit diversity techniques and beam forming in the current release. UL Tx diversity will be supported in next phase.

⁵ Altair-semi , <http://bit.ly/9IHctG>

ST Ericsson⁶ :



Our primary research reveals that ST Ericsson TD-LTE chipsets for trial should be ready by Q4 2010. The following multi-technology support is expected in the M700 chipsets. Platform can also be upgraded to support TD-SCDMA with new software.

LTE access

- LTE FDD/TDD
- LTE UE Class 3
- DL 100 Mbps and UL 50 Mbps
- MIMO (2x2/4x2) and RX diversity
- Flexible bandwidth (1.4 – 20 MHz)
- CS Fallback Voice, Single Radio VCC
- Emergency call

HSPA access

- DL 42 Mbps
- HSDPA Cat. 20 (MIMO & 64QAM)
- HSDPA Cat. 24 (DC & 64QAM)
- UL 11 Mbps
- HSUPA DC (Dual Cell)
- CPC and CS over HS Advanced interference cancelling receiver (SIC & Type3i)
- GSM/GPRS/EDGE access
- GPRS MSC 33
- EGPRS MSC 33

TD-SCDMA access

- Considered for future platform variant (SW upgrade)

Sequans



Sequans gained their 4G experience through WiMAX . Company is consolidating their WiMAX experience in developing LTE based products as both the technology have a lot in common. It is expected that Sequans can quickly develop a working trial systems in 2.3 (Band 40) and 2.5 (Band 38) GHz as they have prior experience in these bands. Motorola and Alcatel lucent ventures, led a round of financing to foster the company's long term evolution (LTE) program. The new LTE product line from sequans will be based on SQN 3010 Baseband and Maxim MAX2839 RF device. One of the key advantage for Sequans and other new entrants from WiMAX fraternity like Beceem and Wavesat has developed an ecosystem of manufacturers from Taiwan who specialize in making data centric devices.

It is expected that Sequans Semiconductor will have trial chipsets ready in Q2-2010 for Bands 40 & 38. The commercial availability of chipsets is expected in Q1-2011.

⁶ ST Ericsson , <http://bit.ly/baHta0>