

Competitiveness Assessment for LTE infrastructure vendors, 2010 Annual Report

2010 LTE Market Overview

In 2009, only a minority of operators around the globe were early adopters of Long Term Evolution (LTE) as an initial trial. However, the commercial development of LTE had entered an embryonic stage by the end of 2010. Leading operators from various regions of the world have put a stake in the ground on LTE from laying inflated expectation and well-publicized concept on LTE. Our market tracker shows that up to the end of 2010, there are 18 LTE networks of 12 countries rolled out in commercial. While nearly 200 operators participated in network testing or under being tested in both TDD and FDD, with 80% of the operators distribute in North America, Europe and Asia Pacific. More and more operators embark on deploying and testing LTE on a small-scale. The LTE industry chain is under gradual improvement as well. Commercially available products have been launched by key players like Ericsson, Huawei, ZTE, Nokia Siemens Networks (NSN), Alcatel-lucent (ALU), etc. In terms of terminal, 2 new types of handsets have been introduced by Samsung and over 10 kinds of multi-mode datacards are commercially available in the market. The maturity of industry chain marks a significant prelude to LTE products entering into an initial phase.

Operators to seize one step ahead in LTE, but with limited deployment

In 2009, TeliaSonera launched the world's first commercial LTE network in Sweden and Norway. By 2010, major operators around the globe such as Verizon, MetroPCS, NTT, CSL, A1 and Vodafone have announced their LTE commercial launches in Europe, North America and Asia Pacific.

Albeit more and more operators have regarded LTE as the future evolving direction of network deployment and implementation, the LTE business model has not been well-defined and the network deployment remains in a small-scale. For example, Verizon, the largest operator in U.S., rolled out its 4G network in 38 cities and more than 60 commercial airports; NTT DoCoMo in Japan launched its LTE services in three major cities of Tokyo, Nagoya and Osaka.

Key operators took the first lead, small players not to be outdone

The spectrum bands like 2.6GHz, 1.8GHz and digital dividend spectrum are mainly for

FDD-LTE, and 2.6GHz and 2.3GHz for TDD-LTE. In 2010, Germany, Japan, Netherlands, Denmark and other countries held 4G spectrum auctions, and the United Kingdom, Poland, Vietnam, Malaysia, Chile and other countries have announced to officially issue 4G licenses in 2011.

New technology has drawn tremendous attention of the industry, but the limited spectrum resources and the high price have become the operators' major misgivings in the development of LTE: Will LTE introduce new opportunities for operators and enhance their competitive edge? As the development of LTE is currently in the initial stage, key operators took the first lead with rapid LTE commercial deployments, while small players were not to be outdone by sharing their network and resources to join the race. For example, Tele 2 had a partnership with Telenor on a joint venture, Net-4-Mobility for LTE network rollout (commercial services expected to launch in November, 2010); TeliaSonera Estonia and Elisa had an agreement on network sharing to launch commercial service during mid-December, 2010; Mobyland Poland was in a tie with CenterNet to implement the LTE technology; Genius Brand, a joint venture has been built by PCCW and Hutchison3 to offer LTE services; Tajikistan's Indigo, a subsidiary of Swedish telecoms group TeliaSonera has announced that it will launch LTE services in tandem with its sister company, Somoncom.

Early fruit born in LTE terminal development, the categories have yet to be enriched

In 2010, the LTE terminal industry has been in rocketing development, among which Samsung unveiled two LTE-enabled handsets, which blazed the trail in the miniaturization of LTE terminal. Multi-mode LTE data cards introduced by vendors, namely, LG, Motorola, Samsung, Nokia, ZTE and Huawei provide a basic safeguard for the further development of LTE. However, there is a huge distance between the LTE data card and the relatively mature 3G EV-DO, HSPA+, and multi-mode smart phone will be the main trend in the development of terminal.

Competition among LTE vendors heats up, Ericsson, Huawei, ZTE, NSN showcase prowess

The most exciting thing in 2010 of the LTE industry chain was that LTE vendors Ericsson, Huawei, ZTE and NSN participated in approximately 200 LTE commercial rollouts and tests throughout the whole year. These vendors, in 2010, were faced with the inspection from global operators, showcased and proved their forte in an all-round way. In this annual report, we evaluate and analyze the leading vendors of LTE network infrastructure by tracking the performance in various aspects of the key operators in the long run.

Competitiveness assessment for LTE infrastructure vendors

We rated the qualifying LTE infrastructure vendors worldwide using various criteria including industrial contribution, market competitiveness, product competitiveness and solution competitiveness. As shown in *Table1* Ericsson ranked first in the overall performance with the result of 4.75; next comes Huawei with 4.70 and ZTE captured the bronze with 4.55.

Table1. Competitiveness ranking for leading LTE infrastructure vendors

| Vendor | Overall Rating | Industrial Contribution | | Market Competitiveness | | Product Competitiveness | | Solution Competitiveness |
|-----------------|----------------|-------------------------|--------|------------------------|----------------------|-------------------------|------------|--------------------------------|
| | | Vision | Patent | Incremental Contract | Cumulative Customers | Comprehensive | | Integrated Solution Competence |
| | | | | | | Product | Competence | |
| Weight | 100% | 15% | 10% | 15% | 15% | 25% | | 20% |
| Ericsson | 4.75 | 5 | 4.8 | 5 | 4.5 | 4.7 | | 4.6 |
| Huawei | 4.73 | 4.2 | 4.8 | 4.7 | 5 | 4.8 | | 4.8 |
| ZTE | 4.55 | 4 | 4.6 | 4.5 | 4.8 | 4.6 | | 4.7 |
| NSN | 4.53 | 4.2 | 5 | 5 | 4.3 | 4.5 | | 4.4 |
| ALU | 3.68 | 3.8 | 3 | 4 | 3.5 | 3.7 | | 3.8 |
| NEC | 2.84 | 3 | 2 | 3 | 2.5 | 2.8 | | 3.3 |

Source: OVC, 2011

Industrial contribution assessment

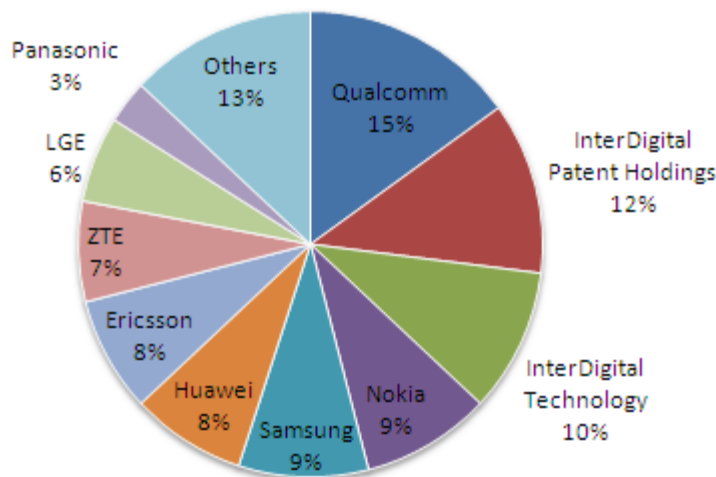
Major vendors exerting every possible effort to push forward their products and technology innovation is the essential element for leading the way to leverage the development of LTE industry. The operators' acceptance of the LTE industry in 2010 is attributed to the impetus of the industry by the top 5 equipment vendors led by Ericsson, particularly in the encouraging process of the products commercialization and improvement of standard patents. Our analysis on the industrial contribution mainly focuses on two aspects, the vision of the industry and the patents.

Contribution to vision of the industry: Ericsson is undoubtedly the pace setter, which will hold all the aces in the subsequent 3 to 5 years in the researching field of innovative technology. During the early 2010 Mobile World Congress in Barcelona, Ericsson and Telefonica presented a demonstration of LTE with a speed of 1 Gps in the downlink, compared with merely 100Mbps demonstrated by other vendors'. ZTE has made considerable contributions to TD-LTE in the evolution from TD to LTE. In addition, ZTE was the first to put forward and commercially deploy Software Defined Radio (SDR), as well as to drive LTE to support voice by applying Evolved Packet Core (EPC) and IP Multimedia Subsystem (IMS) solutions. Huawei initiated the Single-RAN solution and elevated LTE-Advanced to 1.2Gbps. NSN and LG Electronics have achieved an LTE downlink data transmission rate of 100 Mbps to accelerate the commercial application of Class3 LTE terminals. All of these innovations on

creating new LTE technologies reinforced the confidence in the sustainable development of the industry.

Contribution to patents: Intellectual Property Rights (IPR) database of the European Telecommunications Standards Institute (ETSI) shows that the application for the 2010 LTE patents unfolds a flourishing scene of “a hundred flowers in bloom”. Most notably, apart from Qualcomm and other chipset manufacturers, Nokia, Ericsson, ZTE as well as other vendors have submitted nearly 3500 patents. The number of essential patents for LTE standards possessed by Samsung and Nokia accounts for a share of 9% respectively (see *Figure 1*), which enables them to rank among the top ones; Ericsson and Huawei on 8% each; ZTE leaps to the TOP5 with a share of 7% in the overall essential patents. The statistics indicate that the difference among major LTE vendors is fairly small in terms of the contribution to patent. The development of standard patent displays a tendency of diversification.

Figure 1: LTE Essential Patents Condition from ETSI Website in Dec 2010



Source: OVC, 2010

Market competitiveness assessment

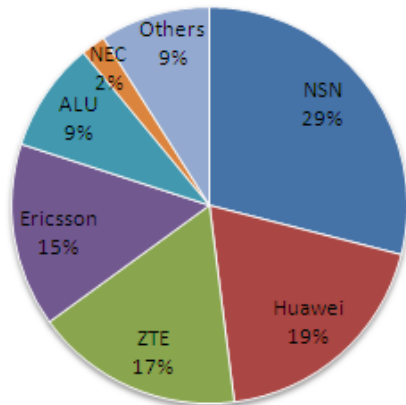
The market competitiveness of LTE vendors is assessed from the aspects of incremental commercial contracts and the amount of cumulative customers, all of which reflects the capability to utilize the current market opportunity and the potential to develop in future.

Incremental commercial contracts: In 2010, there were about 40 newly-added LTE commercial contracts worldwide, among which NSN ranks Top 1 with the market share of 29%, as *Figure 2* details, with Huawei and ZTE ranking Top 2 and Top 3 for the share of 19% and 17% respectively. It is worthy of mention that ZTE shows a rapid progress this year by gaining a strong momentum to rise up to Top3 in the share of both incremental commercial contracts

and cumulative customers(see *Figure 3*). Although Ericsson is the Top 4 vendor by contract, an enormous high quality is embedded to make Ericsson the front-runner in the game. It's been noticed that ALU experiences a weakening momentum while NEC makes remarkable achievements in the domestic market in Japan.

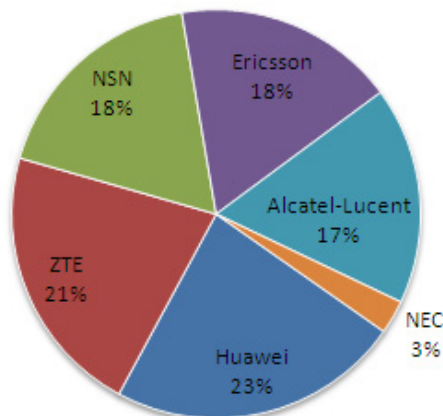
In 2010, NSN's main incremental commercial contracts included those with Verizon, KDDI, LGU+,TeliaSonera,Shaw,LightSquared,A1,TDC,DT, Elisa, etc; Ericsson contracted with AT&T,Verizon,DOCOM,Vodafone,A1,EMT,TDC and so forth; Huawei co-operated with T-mobile Austria, Belgacom, Mobyland and CenterNet, Vodafone, DT, MTS, Wind, VNPT, etc; ZTE collaborated with CSL, H3G Austria, H3G Sweden, Megacom, Promonte, Sonaecom, Pannon and so on; ALU mainly worked with K-Mobile and AT&T, etc.

Figure 2: Incremental market share by newly-added commercial contract number, 2010



Source: OVC, 2011

Figure 3: Market share by accumulative commercial contract number, 2010



Source: OVC, 2011

Cumulative customers: According to GSA's statistics, the number of global LTE operators exceeds 180. Vendors' accumulation on customers reflects the unborn commercial prospects

of potential clients. Concerning the cumulative customers, Huawei won the laurel in the commercial application and tests from 70 operators, followed by ZTE ranking Top 2 with 65 cumulative clients. No wide gap occurs among level 3 vendors: NSN, Ericsson and ALU, while NEC shows apparent disparity in customer accumulation. *Table 2* gives detailed ratings for the vendors.

Table 2 Vendors market competitiveness assessment

| Vendor | Ericsson | NSN | Huawei | ZTE | Alu | NEC |
|------------------------------|----------|-----|--------|-----|-----|-----|
| Commercial contracts in 2010 | 5 | 5 | 4.7 | 4.5 | 4 | 3 |
| Cumulative customers | 4.5 | 4.3 | 5 | 4.8 | 3.5 | 2.5 |

Source: OVC, 2011

Product competitiveness assessment

We evaluated each vendor's LTE products competitiveness in terms of coverage, capacity, serialization, portfolio and evolution. The rating takes account of product capabilities of both FDD and TDD.

Coverage: There is a minor difference among vendors, but Ericsson, Huawei and ZTE performed comparatively better in operators' LTE test.

Capacity: Ericsson, Huawei and ZTE enjoys a certain level of advantages, with other vendors in a low capacity

Serialization: Ericsson and Huawei own the most comprehensive product portfolio in FDD-LTE, which doesn't distant them much from other vendors. Huawei and ZTE hold the most complete TDD-LTE product portfolio.

Portfolio: ZTE is the first vendor to unveil SDR for commercial application which supports CL, GL, UL dual mode and GUL tri-mode in a unified hardware platform; furthermore, it's also technology-friendly to TDD-LTE vendors in the same platform. Currently, Huawei is able to produce similar products, but not as mature as those of ZTE, while Ericsson and NSN's products do not support CL; ALU is not in harmony with TDD-LTE.

Evolution: This involves a variety of technology evolving to LTE and the interoperability between assorted technologies and LTE. The progress Ericsson made in the technology evolution is beyond comparison. ZTE and Huawei can support various technology evolutions in the most comprehensive way, as summarized in *Table 3*.

Table 3 LTE Vendors product competitiveness assessment

| Vendor | Capacity | Coverage | Portfolio | Serialization | Evolution | Average |
|----------|----------|----------|-----------|---------------|-----------|---------|
| HW | 5 | 5 | 4.5 | 5 | 4.5 | 4.8 |
| Ericsson | 4.8 | 5 | 4 | 4.8 | 5 | 4.7 |
| ZTE | 4.6 | 4.8 | 5 | 4.5 | 4.2 | 4.6 |
| NSN | 4.5 | 4.5 | 4.5 | 4.7 | 4.5 | 4.5 |
| ALU | 4 | 4.2 | 3.5 | 3 | 4 | 3.7 |
| NEC | 3 | 4 | 1 | 3 | 3 | 2.8 |

Source: OVC, 2011

Comprehensive solution competence assessment

This segment, as *Table 4* indicates, mainly evaluates and compares E2E(End to End), SON (self organizing networks), Customization, TCO (total cost of ownership) of whole LTE network in the comprehensive solution of major vendors.

E2E: With the self- research and development capability, Huawei and ZTE have been equipped with complete set of solutions including LTE wireless infrastructure, core network, transmission and terminals. With the acquisition of Moto and co-operation with LG on terminal, NSN consolidated its E2E solutions. Ericsson and ALU remain devoid of terminal solutions. NEC is in short of transmission solution.

TCO of whole LTE network: With a more advanced product portfolio based on unified platform and cost control than other vendors, ZTE and Huawei accomplished multi-mode solution with low TCO, and both have positioned in the forefront of the race. For multi-mode, there is no need to change BBU frame. Only by adding baseband boards and software upgrade can the equipment support different standards. Hence, the cost only spent in the board and software upgrade has been considerably reduced in contrast with module accumulation solutions. ZTE is the best player in controlling the TCO of whole LTE network.

SON: The long term accumulation of mobile communication enables Ericsson more merits in SON. HW, ZTE and NSN have slight difference in SON. With the LTE commercialization, the gap between the players is constantly narrowing.

Customization: Ericsson has an overall consideration from every angle in solutions that are broadly representative for European high-end operators. ZTE has made a remarkable achievement in the customization for particular clients, e.g. to provide customized base station, voice solutions based on EPC+IMS, intellectual pipe channel for refinement operation, which offers multi-connections for 2G/3G/LTE/Wi-Fi, etc.

Table 4 LTE Equipment vendors Integrated Solutions Assessment

| Vendor | E2E | Full network TCO | SON | Customization | Average |
|----------|-----|---------------------|-----|---------------|------------|
| HW | 5 | 4.8 | 4.7 | 4.5 | 4.8 |
| ZTE | 5 | 5 | 4.2 | 4.6 | 4.7 |
| Ericsson | 4.2 | 4 | 5 | 5 | 4.6 |
| NSN | 4.5 | 4 | 4.8 | 4.2 | 4.4 |
| ALU | 4 | 3.5 | 4.2 | 3.5 | 3.8 |
| NEC | 3 | 4 | 3 | 3 | 3.3 |

Source: OVC, 2011