

Cyber Creative Institute Co. Ltd.

# Evaluation of LTE essential patents declared to ETSI

Version 2.0

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# Evaluation of LTE essential patents declared to ETSI Version 2.0

## 1 Objectives

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LTE (Long Term Evolution) is the precursor technology for the 4<sup>th</sup> generation mobile communication services, which succeeds the 3<sup>rd</sup> generation services that are now widely used. In Japan, NTT DOCOMO launched its LTE service in December, 2010, under the name of Xi (pronounced “Crossy”). Other companies have started their services as well, or have announced their service release in the near future<sup>1</sup>.

As for the 3<sup>rd</sup> generation mobile communication systems, mobile carriers adopted different technical standards for their networks, resulting in incompatibility problems. LTE is to be used as a single international standard for the 4<sup>th</sup> generation mobile services and will remedy these problems. Standardization of LTE, like that of W-CDMA, has been being carried out in 3GPP (Third Generation Partnership Project). 3GPP is an international standards development project organized by the standards developing organizations in various countries, such as ETSI (European Telecommunications Standards Institute) in Europe and ARIB (Association of Radio Industries and Businesses) in Japan.

Telecom companies may acquire patents related to the forthcoming standards. For a patented technology to be adopted in standards, its holder has to declare to the organizations in respective country their willingness to make its licenses available to all third parties under fair, reasonable and non-discriminatory (FRAND) terms<sup>2</sup>. This paper aims to evaluate the “patenting power” of participating companies by studying those patents (including patent applications) that are declared to ETSI as being essential to LTE standards.

Although ETSI is a European organization, not only European companies but many non-European ones have declared LTE-essential patents to ETSI, because Europe has long been a large telecom market and has fostered many prominent companies. As such, the number of patents declared by each company should be an important indicator of the company’s “patenting power.”

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<sup>1</sup> Trial/commercial LTE services have been launched or are planned by Telia Sonera (in December, 2009), NTT DOCOMO (in December, 2010), Vodafone (in 2010), Verizon Wireless (in 2010), Softbank(after 2011), AT&T (in 2011), Telecom Italia (in 2011~2012), KDDI (in 2012), T-Mobile (in2012) and Orange (in 2012).

<sup>2</sup> When declaring an essential patent to standards developing organizations such as ETSI or ARIB, the holder is requested to choose one of the following three licensing options:

- (1) Grant licenses free of charge (or disclaim patent rights)
- (2) Grant licenses to other parties on a fair, reasonable and non-discriminatory terms and conditions.
- (3) Others (choose neither of the above)

The second option above is called the FRAND condition.

# 1. Objectives

To evaluate true “patenting power”, the number of LTE-essential patents, as have been declared to and listed by ETSI, is not a good measure, due to the following two reasons.

- Duplicate count of patents

ETSI list contains multiple patents that share a common priority, such as provisional applications in the U.S., divisional applications, or applications to other countries. Divisional applications, which have different scopes, may well be counted separately. But, in most cases, it is more appropriate to count the related patents as a single patent family.

- Difference in declaration policy of each company

According to ETSI policy, companies can declare essential patents at their discretion. ETSI does not confirm or deny that the declared patents are really essential. As a result, the definition of relevance to the standard varies, resulting in considerable difference in the number of the declared patents.

Therefore, this survey estimates the number of truly “essential” patents held by each company, taking the following processes:

- to identify the effective number of declared patents by grouping related patents into a family,
- to select patents to be evaluated from all the declared patents,
- to estimate essentiality ratio (the percentage of standard-relevant patents within all the evaluated patents for each company, and
- to derive the gross number of essential patents, for each company, by multiplying the number of declared patents by the essentiality ratio.

This survey is an updated version of the previous report<sup>3</sup> and is based on the information obtained from the latest ETSI declaration list.

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<sup>3</sup> <http://www.cybersoken.com/xxx>

# 2 Survey results

### 2.1 Identifying the patents subject to analysis

The list of essential, or potentially essential, patents declared to ETSI (hereinafter referred to as “original list”), which was uploaded in March, 2012, was obtained from the ETSI website<sup>4</sup>. An excerpt of this list is shown in Appendix.

The original list simply lists the information notified by companies as provided. As a result, it is difficult to meaningfully compare the number of patents held by each company based on raw data in the original list, due to the following reasons:

- a group of patents, that have been derived from a single patent or applied in different countries, are listed as separate entities, and
- undisclosed patents, such as provisional applications<sup>5</sup> in the U.S., are included in the list.

To overcome these difficulties, we have identified the patents (including patent applications<sup>6</sup>) relevant to our analysis out of the original list in the following way. Specifically, patents to be surveyed have been extracted from the original list in the following manner to create a target list for analysis:

- (a) Extracting only those patents that
  - contains the term “LTE” or “SAE” in the “Essential to projects” column, or
  - contains the term “TS36”, “TS24.301”, “TS23.401”, “TS23.272”, or “TS33.401” in the “Essential to standards YES to ETSI FRAND license” column, provided that the term “3GPP” is contained in the “Essential to projects” column.
- (b) Leaving only one patent among those that have common application number or publication number.
- (c) Deleting patents that were not published as of May, 2012.
- (d) Identifying patent families using a commercial patent database<sup>7</sup> for each patent obtained by the above processes of (a) to (c).

<sup>4</sup> [http://www.etsi.org/deliver/etsi\\_sr/000300\\_000399/000314/](http://www.etsi.org/deliver/etsi_sr/000300_000399/000314/)

<sup>5</sup> A “provisional application” is an application made on the assumption that a formal patent application will be made at a later time. It was introduced in the U.S. in 1995 in order to entitle inventors to the right of priority for national patent. In the provisional application system, formal patent claims are not required because there is no intention to claim any patent rights. In order to mature it into an issued patent the applicant must file or request a formal patent application within one year. Otherwise, the provisional application is considered to have been abandoned.

<sup>6</sup> Not only registered patents but also patent applications are studied in this survey to set the proper scope of work. In a legal sense, “patents”, as stated in the title of this paper, legally refer only to those already registered.

<sup>7</sup> PatBase was used for this purpose. PatBase is a product of RWS and Minesoft, both based in UK.  
<http://www.rws.com/EN/PatBase.html>  
<http://www.iac-academy.co.jp/patbase/index.html>

## 2.Survey results

(e) Representing the patents belonging to the same family by one patent<sup>8</sup>.

As the result, 5,013 patents, or patent families to be exact, have been identified.

This approach makes it possible to count the number of declared patents without being affected by such procedural factors as applications to foreign countries, divisional applications<sup>9</sup> or continuation applications<sup>10</sup>.

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<sup>8</sup> In PatBase, patents are grouped into families if they contain one or more common priorities with other patent(s). In this study, those patents that have the same Family Number (FN) and the same Priority Number corresponding to the Earliest Priority Date are regarded to form a family and they are treated as one, where the Priority Number includes a VLF (Very Large Family) number. VLF (Very Large Family) number refers to the identification number given to a certain portion of a large family (with more than 130 patents) to indicate that it is a portion of the family that has been split.

<sup>9</sup> A "divisional application" refers to an application where a parent application describing more than one invention is split into one or more applications each claiming only a single invention. By utilizing this procedure the applicant can obtain rights for each divisional application which may facilitate the quicker granting of patent rights for certain applications.

<sup>10</sup> A "continuation application" refers to an application that is based on an original patent application (often referred to as a parent application), and has the same priority date and specification as the parent. Continuation applications are often filed so that an applicant may pursue claims to inventions that were disclosed but not allowed in the parent application or may want to pursue additional claims to the parent application. It is a US specific system where the filing date of the parent application can be preserved, provided that no additional statements are made. In Japanese patent system, this is included in the divisional application category.

## 2. Survey results

### 2.2 Application trends

#### (1) Number of patents declared by each company

Figure 1 shows the number of patents (counted on a patent-family-basis; the same applies hereafter) declared by each company for each year. Declaration years were taken from the “Declaration Dates” column in the list. The names of the declaring companies were taken from the “Declaring Companies” column and translated to effective company names, as shown in Table 1. Related company names were mapped to a corresponding effective name. When there were multiple names in the “Declaring Companies” column, left-most one was taken. A total of 43 companies have been identified. One of the noteworthy points, as compared to the previous survey result, is that CATT has newly appeared in the list and taken the 8th position.

Some of the companies started to make declarations as early as 2007 when the standards were still being developed. However, on the whole, the number of declaring companies started to increase after 2009 when standards were fixed and the commercial developments got into full swing. Around that time, the numbers of patents declared by each company also sharply increased. Samsung, Huawei, LG, NEC, and TI increased their declarations in 2011. Sharp, InnvativeSonic, HTC, and CATT newly came in the list in 2011. Samsung and ZTE have been making declarations even in 2012 and are anticipated to continue their declarations.

There seems to be two reasons for these companies to take their actions. One is that FRAND-based patent declarations are mandatory for the patents to be used in standards. The other is that, taking advantage of the openness of the declaration list, companies see it as a good measure to indicate their strategic IP power to the public.

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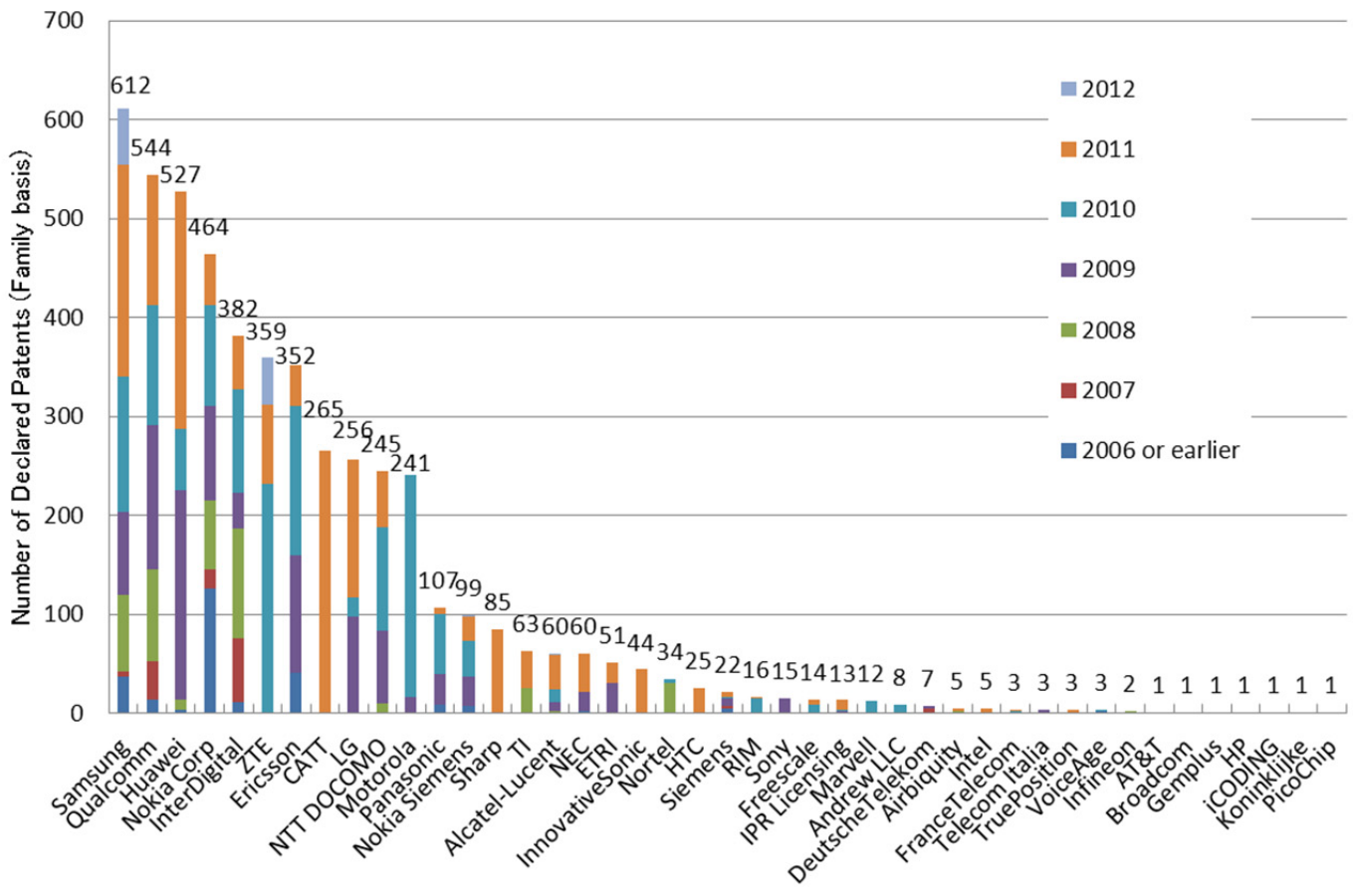


Figure 1 - Declared numbers of patents by company



## 2.Survey results

**Table 1 - Declaring companies**

Name in “Declaring companies” column	Effective Company Name	Country Code
Airbiquity Incorporated	Airbiquity	US
ALCATEL-LUCENT	Alcatel-Lucent	FR
Alcatel-Lucent Shanghai Bell Co., Ltd		
ALCATEL-LUCENT Alcatel-Lucent Shanghai Bell Co., Ltd		
Andrew LLC	Andrew LLC	US
AT&T	AT&T	US
BROADCOM CORPORATION	Broadcom	US
China Academy of Telecommunications Technology (CATT)	CATT	CN
Deutsche Telekom AG	DeutscheTelekom	DE
Telekom Deutschland GmbH		
Telekom Deutschland GmbH TIP Communications LLC Research in Motion Limited		
Ericsson AB	Ericsson	SE
Telefonaktiebolaget LM Ericsson		
Telefonaktiebolaget LM Ericsson Research in Motion Limited		
ETRI	ETRI	KR
France Telecom	FranceTelecom	FR
France Telecom TDF SAS		
Freescale Semiconductor Inc.	Freescale	US
Gemplus SA	Gemplus	FR
Hewlett-Packard, Centre de Competences France	HP	FR
HTC Corporation	HTC	TW
Huawei Technologies Co., Ltd.	Huawei	CN
iCODING Technology Inc.	iCODING	US
INFINEON TECHNOLOGIES	Infineon	DE
Innovative Sonic Corporation	InnovativeSonic	TW
Innovative Sonic Ltd.		
Intel Corporation	Intel	US
InterDigital Patent Holdings Inc.	InterDigital	US
InterDigital Technology Corp.		
IPR Licensing Inc.	IPR Licensing	US
Koninklijke KPN N.V.	Koninklijke	NL
LG Electronics Inc.	LG	KR
LG Electronics Inc. Qualcomm Incorporated		
Marvell Switzerland S.A.R.L	Marvell	BM
MOTOROLA Inc	Motorola	US
MOTOROLA Inc Motorola Mobility Inc.		

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Motorola Mobility Inc.		
NEC Corporation	NEC	JP
NOKIA Corporation	Nokia Corp	FI
NOKIA Corporation Motorola Mobility Inc.		
NOKIA Corporation Qualcomm Incorporated		
NOKIA MOBILE PHONES NOKIA Corporation		
NOKIA Corporation Nokia Siemens Networks Oy	Nokia Siemens	FI
Nokia Siemens Networks GmbH & Co. KG		
Nokia Siemens Networks GmbH & Co. KG NOKIA Corporation Nokia Siemens Networks Oy		
Nokia Siemens Networks GmbH & Co. KG Nokia Siemens Networks Oy		
Nokia Siemens Networks Oy		
Nortel Networks Ltd	Nortel	CA
NTT DOCOMO, INC	NTT DOCOMO	JP
Panasonic Corporation	Panasonic	JP
PicoChip Limited	PicoChip	UK
Qualcomm Incorporated	Qualcomm	US
Research in Motion Limited	RIM	CA
Samsung Electronics Co, LTD	Samsung	KR
Sharp Corporation	Sharp	JP
Siemens AG	Siemens	DE
Sony Corporation	Sony	JP
TELECOM ITALIA S.p.A.	Telecom Italia	IT
Texas Instruments Inc.	TI	US
TruePosition Inc.	TruePosition	US
VoiceAge Corporation	VoiceAge	CN
ZTE Corporation	ZTE	CN

NB) Country code represents the country name where the company's head office is located. Abbreviations are as follows:

BM: BERMUDA, CA: CANADA, CN: CHINA, DE: GERMANY, FI: FINLAND, FR: FRANCE, IT: ITALY, JP: JAPAN, KR: KOREA, NL: NETHERLANDS, SE: SWEDEN, TW: TWIWAN, UK:UNITED KINGDOM, US: UNITED STATES OF AMERICA

Figure 2 is a pie chart showing the percentages of declared patents of companies listed in Figure 1. In order to avoid the chart becoming crowded, twelve companies with less than four declarations have been grouped into "Others", namely Telecom Italia, VoiceAge, FranceTelecom, Infineon, TruePosition, AT&T, Broadcom, Gemplus, HP, iCODING, Koninklijke, and PicoChip.

Samsung has the largest percentage (about 15%) and is followed by Qualcomm, Huawei, and Nokia. The figure shows that declarations are not just limited to a few particular companies but many companies, including Asian companies, have made fairly comparable

## 2.Survey results

numbers of declarations.

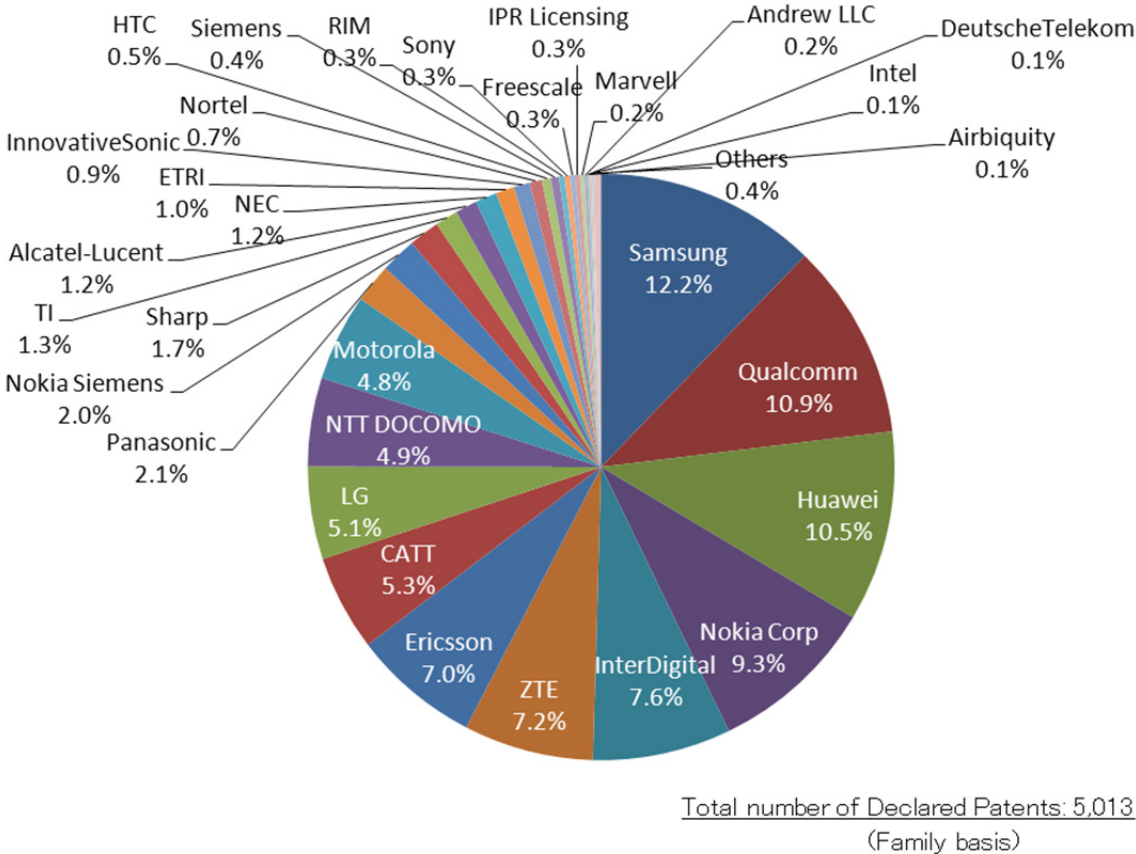


Figure 2 - Percentages of declared patents by company

## 2.Survey results

### (2) Breakdown by application year

Figure 3 shows the numbers of declared patents for each year when the patents were filed. The horizontal axis shows the earliest priority year (i.e. the year in which the application of particular invention was filed for the first time, irrespective of the country it was filed) and the vertical axis shows the number of patents. The current survey results are shown overlaid on the previous results.

- (a) A good proportion of declared patents were filed after 2005, the year when LTE standardization activities began. Especially, those that were filed between 2006 and 2008 are significant. This period coincides with the time when LTE specifications had been being developed before the first version of LTE standards were released in March, 2008.
- (b) The number of declared patents filed in around 1999 is not negligible. The reason for this seems to be that there are common features between the LTE standards and the UMTS (Universal Mobile Telecommunications System) standards that had been studied earlier as 3<sup>rd</sup> generation mobile communication systems.
- (c) The number of declared patents that were filed in 2009 and 2010 have increased, as compared to our previous survey, and the number is expected to grow.

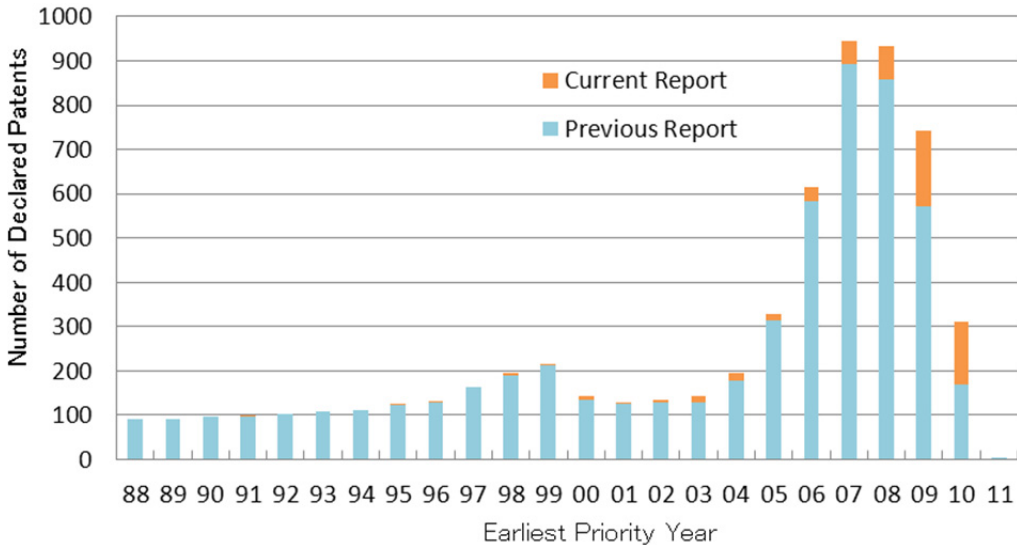


Figure 3 - The number of declared patents for each application year

### (3) Breakdown by company and application year

Figure 4 shows the number of declared patents by company for each application year. The horizontal axis shows the earliest priority year and the vertical axis shows the names of the declaring companies. The circle size is proportional to the number of patent families.

The companies can be roughly grouped into four categories:

- (a) Companies that have declared patents that were filed over many years, from the 1990's to the present: Qualcomm, Ericsson, InterDigital, Motorola, and Nokia
- (b) Companies that have declared patents that were filed mainly after 2005, the year when LTE standardization work began: ZTE, Huawei, NTT DOCOMO, Sharp, Alcatel-Lucent, Freescale, Marvell, InnovativeSonic, HTC, RIM, and CATT<sup>11</sup>.
- (c) Companies that have declared patents whose application were filed prior to 2005 but not afterwards: Nortel, Siemens, Sony, IPR Licensing, Voiceage, HP, iCODING and Koninkijke
- (d) Others

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<sup>11</sup> CATT declares only those patents that are filed after the time LTE standardization began.

## 2.Survey results

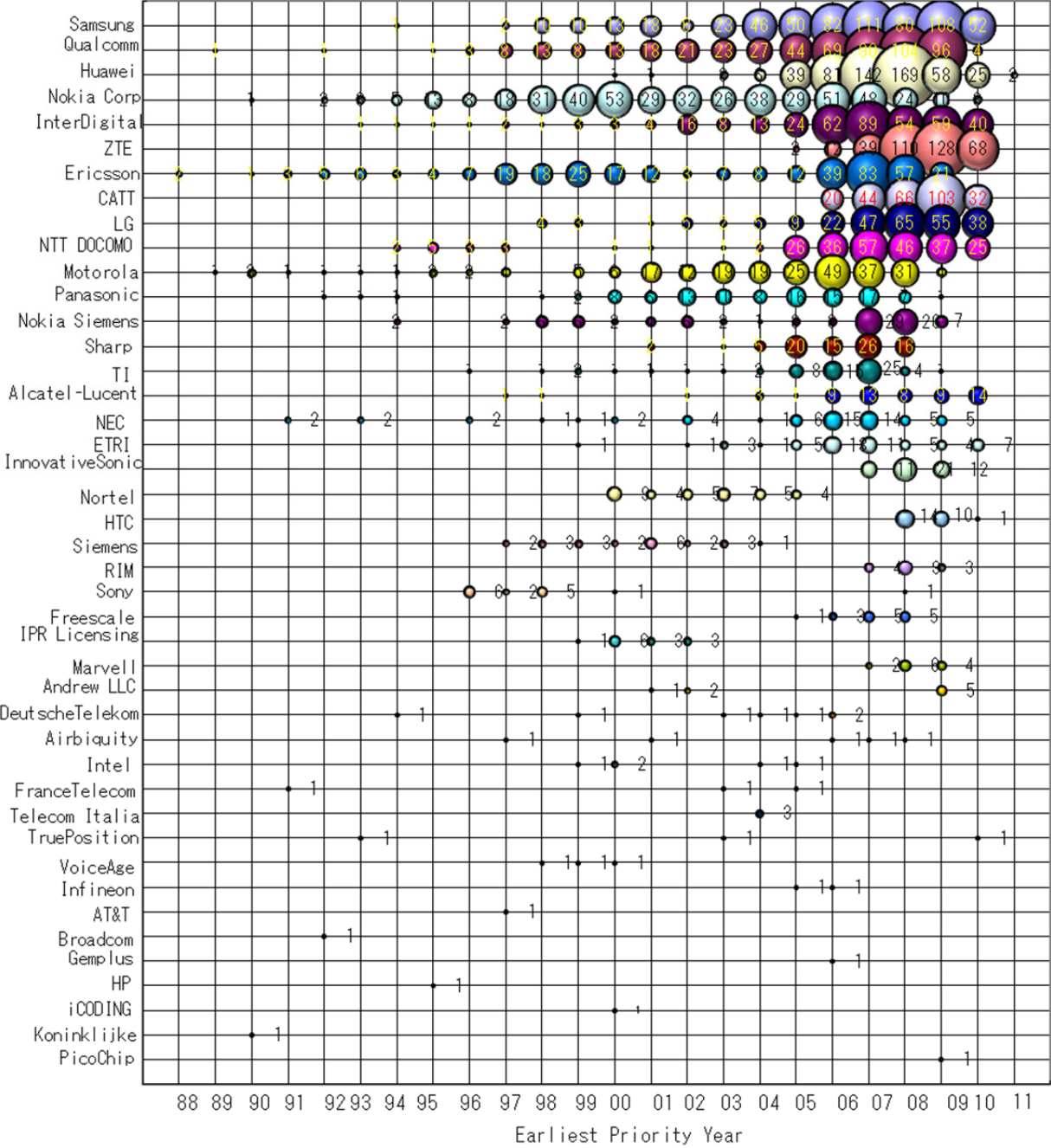


Figure 4 - Analysis of application by company and application year

## 2.Survey results

### (4) Breakdown by application country

Figure 5 shows the number of declared patents for application countries. These numbers are obtained by extracting corresponding patents data from PatBase, and then by counting the patents with the same leading two characters in the application numbers, which signify country codes<sup>12</sup>. The horizontal axis shows the application countries and the vertical axis shows the number of patents. It was identified that applications have been filed in 57 countries. Those countries<sup>13</sup> that have less than ten patents filed are not shown in the figure.

The result shows that US scored the largest number, followed by Patent Cooperation Treaty (WO<sup>14</sup>), China (CN), European Patent Office (EP), Korea (KR), and Japan (JP). This indicates that the filing of applications have been done in countries where major companies are located as well as where big mobile communication markets exist. In the present survey, CATT has contributed to increasing the significance of China.

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<sup>12</sup> Country names and their abbreviations are shown below in descending order of the number of applications:

US: UNITED STATES OF AMERICA, WO: PATENT COOPERATION TREATY,  
CN: CHINA, EP: EUROPEAN PATENT OFFICE, KR: KOREA (REPUBLIC OF), JP: JAPAN,  
AU: AUSTRALIA, IN: INDIA, CA: CANADA, TW: TAIWAN, DE: GERMANY, MX: MEXICO,  
AT: AUSTRIA, RU: RUSSIAN FEDERATION, BR: BRAZIL, IL: ISRAEL, ES: SPAIN,  
AR: ARGENTINA, HK: HONG KONG, NO: NORWAY, FI: FINLAND, GB: UNITED KINGDOM,  
ZA: SOUTH AFRICA, DK: DENMARK, SG: SINGAPORE, PT: PORTUGAL, NZ: NEW ZEALAND,  
EA: EURASIAN PATENT OFFICE, SE: SWEDEN, ID: INDONESIA, UA: UKRAINE, FR: FRANCE,  
MA: MOROCCO, IT: ITALY, AP: AFRICAN REGIONAL INDUSTRIAL PROPERTY ORGANIZATION,  
PL: POLAND

<sup>13</sup> SI: SLOVENIA, HU: HUNGARY, CO: COLOMBIA, CZ: CZECH REPUBLIC, MY: MALAYSIA,  
BG: BULGARIA, EE: ESTONIA, EG: EGYPT, GR: GREECE, TR: TURKEY, CL: CHILE,  
NL: NETHERLANDS, PE: PERU, PH: PHILIPPINES, RO: ROMANIA, SK: SLOVAKIA,  
CH: SWITZERLAND, GE: GEORGIA, HR: CROATIA, IE: IRELAND, VN: VIET NAM

<sup>14</sup> A “WO patent” is an international application filed under the Patent Cooperation Treaty (PCT) of the World Intellectual Property Organization (WIPO). Making a PCT application has the same effect as filing the same application in all PCT member countries. WO patents are internationally unexamined patents and only the publication before examination is made. After making the international application and then submitting the translated texts to the patent office in the respective country, registered patent publication will be issued after successful completion of examinations in each country.

## 2.Survey results

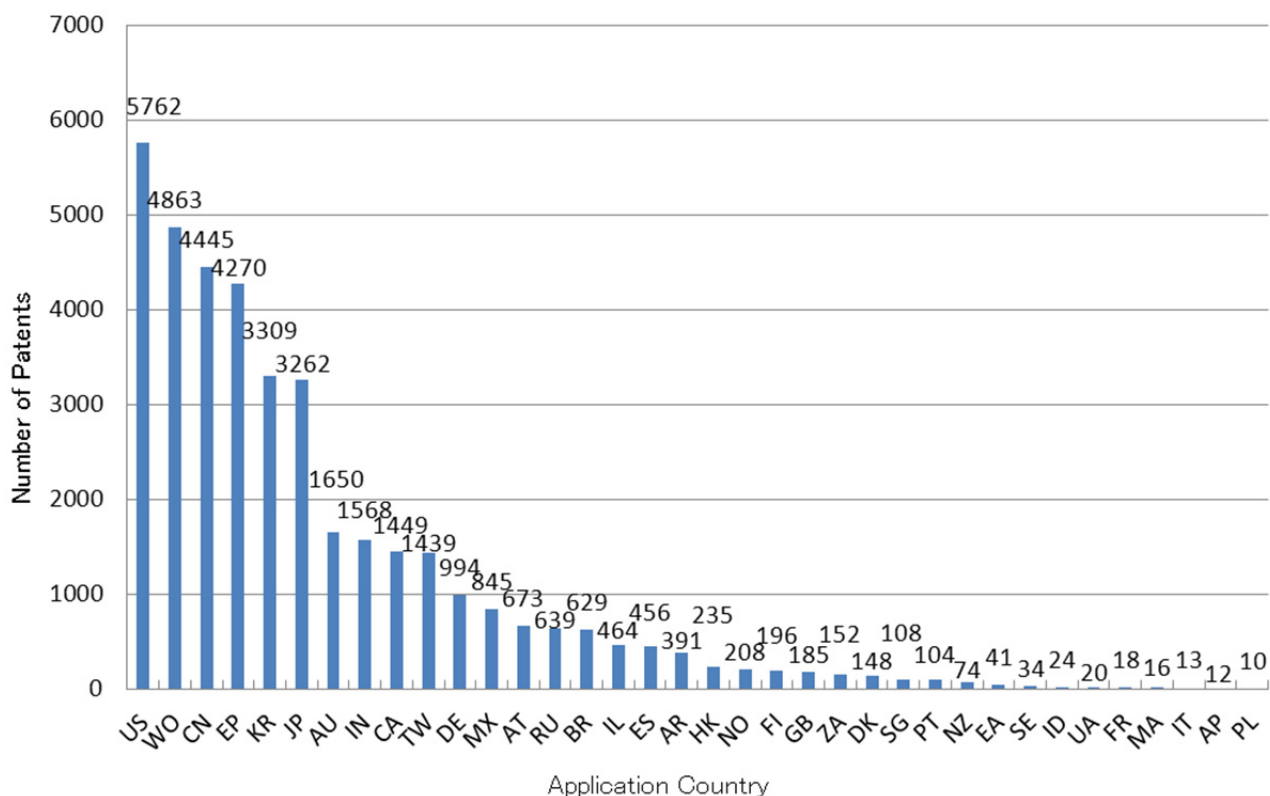


Figure 5- Number of Declared Patents for Application Countries

### (5) Breakdown by company and application country

Figure 6 shows the breakdown by application country for each company. The countries to be studied were taken the same as the previous survey.

The following points are observed.

- Among the top ranking companies, US and European companies, such as Qualcomm, Ericsson, InterDigital, Motorola and Nokia in particular, are filing applications worldwide.
- Japanese and Korean companies' activities are not as strong as those seen in (a) but they are filing applications to foreign countries in a balanced manner, including BRICs.



## 2.Survey results

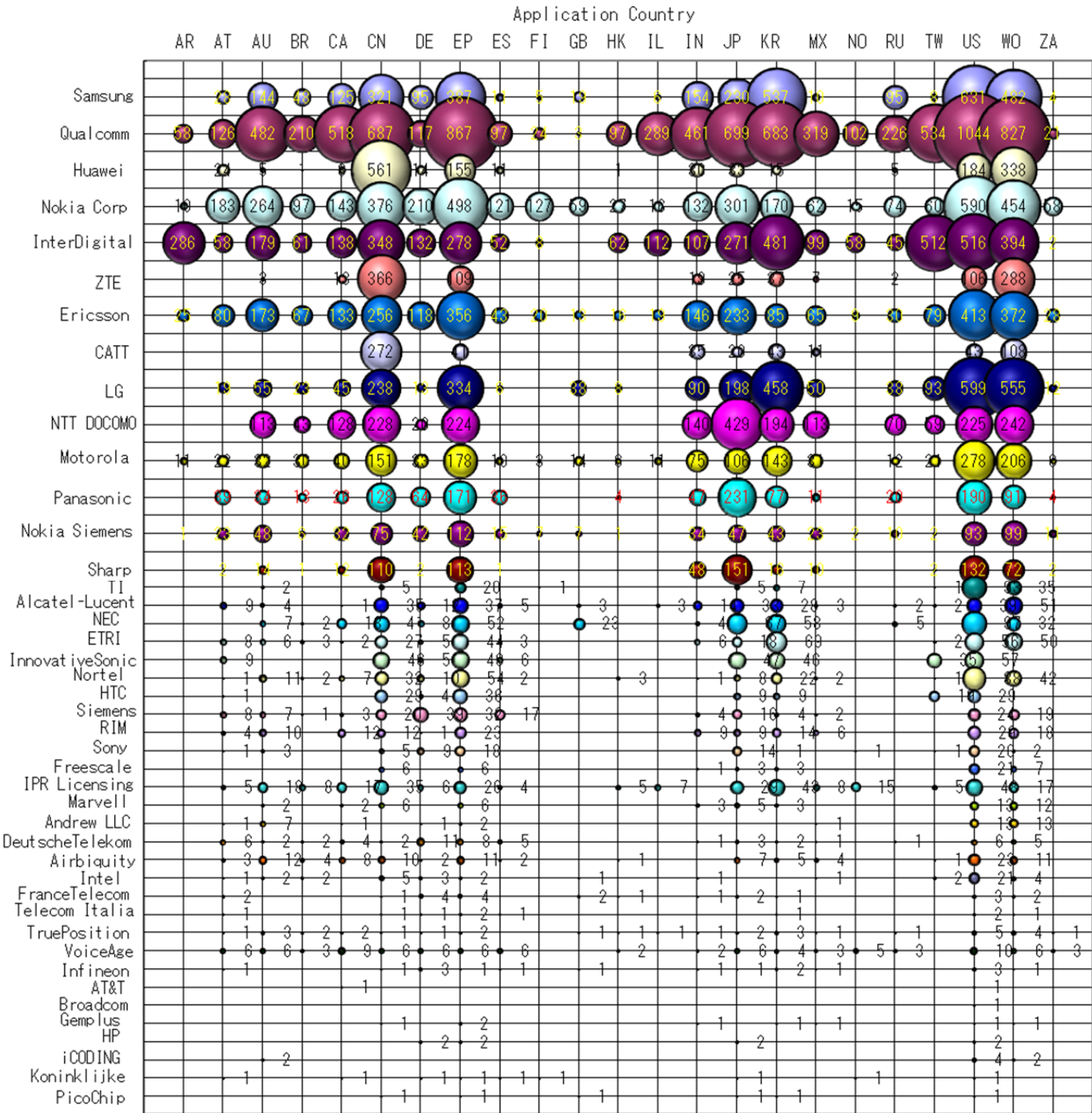


Figure 6 - Breakdown by application country and company

## 2. Survey results

### 2.3 Evaluation of essentiality to standards

Because declarations of patents are done voluntarily by each company, no indications are made whether they are really essential and conforming to standards or they are supplementary in the sense that they simply facilitate implementations. Furthermore, the criteria to decide whether a particular patent is essential or not is up to each company, and the decision is made based on the company's own IPR strategy, to make the most of its IPR assets. In addition to these, ETSI does not evaluate the relevance of the declared patents to the standards. Due to these reasons, the numbers of patents shown in Section 2.2 do not reflect the truly "essential" patents held by each company, and do not meet our survey objectives.

To overcome this difficulty, this survey applies a common set of criteria to see the relevance of declared patents to standard specifications. In this way, we can derive the number of truly "essential" patents based on objective evaluations rather than subjective evaluation done by applicant companies.

#### (1) Evaluation method

Evaluations have been done in the following way.

- (i) For each patent family, a representative patent (a patent that represents a declared patent family) was identified and checked against the standards.
- (ii) In selecting a representative patent, Japanese patent was preferred, followed by US patent, and EP or WO patent (in the order of preference).
- (iii) If the representative patent was a registered one, claims in the registered patent are evaluated. If it was still pending<sup>15</sup>, the latest claim at the time of evaluation was used. In the latter case, the latest claim after amendments was obtained from respective patent information websites (in case of Japan: <http://www.ipdl.inpit.go.jp/Tokujitu/pfwj.ipdl?N0000=118>).
- (iv) If a patent has multiple claims, an independent claim that has the broadest scope was chosen.
- (v) The standards to be checked against were, in principle, the ones indicated in the "Essential to standards YES to ETSI FRAND license" column of the list. However, other standards are also referred to for additional information.
- (vi) Regarding the versions of the standards for reference, in principle, Release 9 (end of March, 2010 version) was used regardless of the version indicated in the "Essential to standards YES to ETSI FRAND license" column of the list. Additionally, Release 10 (end of March, 2011 version) was also used as a supplement.

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<sup>15</sup> Pending means that the application is being processed in the patent office and neither decision nor trial decision has been reached. For instance, until a trial decision of rejection is made, the application is pending at the patent office but, if revocation of the trial decision is launched and the patent is in litigation, the application is not pending at the patent office (pending litigation). Furthermore, if the trial decision of rejection is cancelled by the court decision, the application will again be pending at the patent office.

## 2.Survey results

(vii) Essentialities were determined by classifying a patent into one of three categories, A, B or C, according to its relevance to standards. The definitions of A, B and C are as follows:

- A: The invention contained in the patent matches the standards.
- B: The invention contained partially matches the standards.
- C: The invention contained does not match the standards.

The evaluation works were conducted by technical people. Patents from a company were distributed to separate individuals for evaluation in order to ensure fair evaluations.

### (2) Selection of patents for evaluation

Because of limited evaluation time available, it was not possible to evaluate all of the 5,013 patents. So patents for evaluation were selected from the list according to the following criteria:

- (a) As many companies as possible are to be selected, unless their declarations were made only lately.
- (b) As for companies that have made numerous declarations, around 50 patents each are to be selected.
- (c) Those patents whose specifications are written in Japanese or English are to be selected. If this is not possible, specifications in other languages (e.g. Chinese) are used and evaluations are done based on their English abstract.

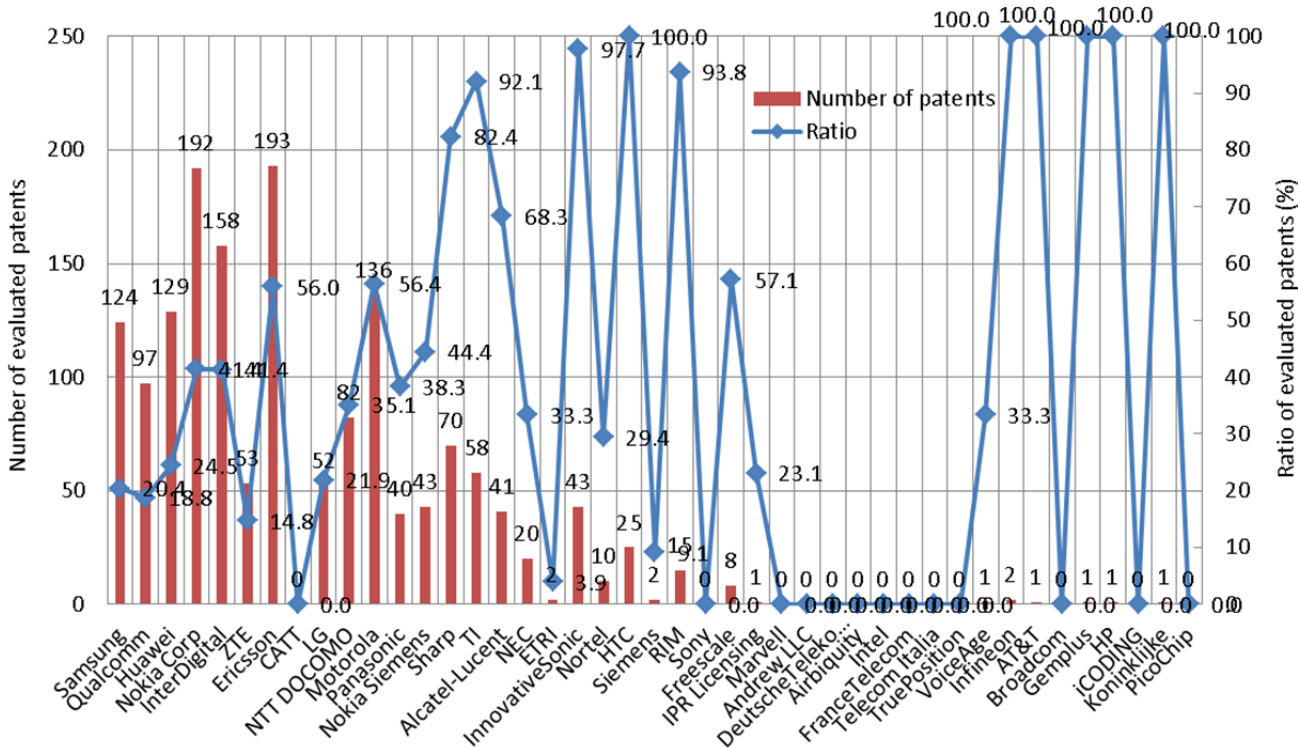


Figure 7 - Numbers and percentages of patents evaluated

## 2. Survey results

In Figure 7 the bar graph shows the numbers of patents selected for evaluation in the study, and the line graph shows the ratio of the number of selected patents to the number of declared patents for each company. The horizontal axis shows company names while the vertical axis on the left shows the number of patents and the one on the right shows the ratio in percentage. In the figure, underlined numbers show the percentages and those without underline show the number of patents that have been evaluated.

For companies listed to the left of LG, the criterion (b) has applies and more than 50 patents have been selected.

It should be noted that the percentage evaluated is somewhat low with ZTE, because the proportion of ZTE's patents written in Chinese is rather high (the number of evaluated patents should be increased for the future by studying the patents applied to US or EP). Qualcomm shows a lower ratio because it has declared a very large number of patents. CATT has been omitted from the current evaluation because the company made its declarations only lately.

Total of 1,601 patents have been evaluated, which amounted to 31.8% of the declared patents (5,013).

### (3) Essentiality evaluation results

Figure 8 shows the essentiality evaluation results for all 1,601 patents. The percentage of those scored "A", which is considered to be truly "essential" for the standards, was 57.7%.

Although all patents studied have been declared to be essential, a certain portion of them are evaluated to be "B" or "C". The main reason for this is considered to lie in the difference in each company's criteria for judging essentiality and its declaration policy. It is likely that those irrelevant patents were declared essential based on the company's IPR strategy even though those patents may have been internally judged to be somewhat short of being essential.

It should be noted that 100% accuracy of the results cannot be guaranteed, due to the intrinsic limitation introduced by the evaluation methods adopted in this survey and limited time available.

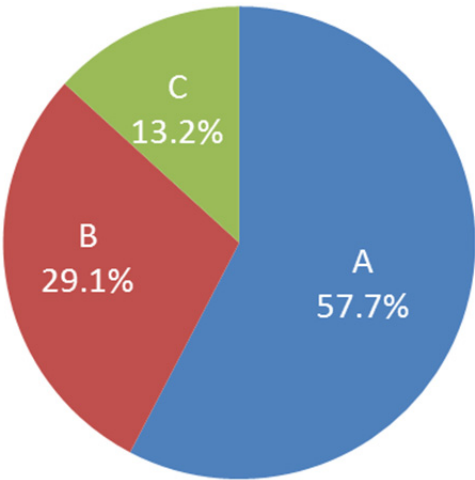


Figure 8 - Essentiality evaluation results

- A: The invention contained in the patent matches the standards.
- B: The invention contained partially matches the standards.
- C: The invention contained does not match the standards.

## 2.Survey results

### (4) Evaluation results for each company

Figure 9 shows the evaluation results for the 1,601 patents for each company. Most companies have more “A”s than “B”s or “C”s. In particular, NTT DOCOMO, ZTE, LG, Nokia Siemens, NEC, Nortel, InnovativeSonic, HTC, and RIM have relatively high “A” ratios.

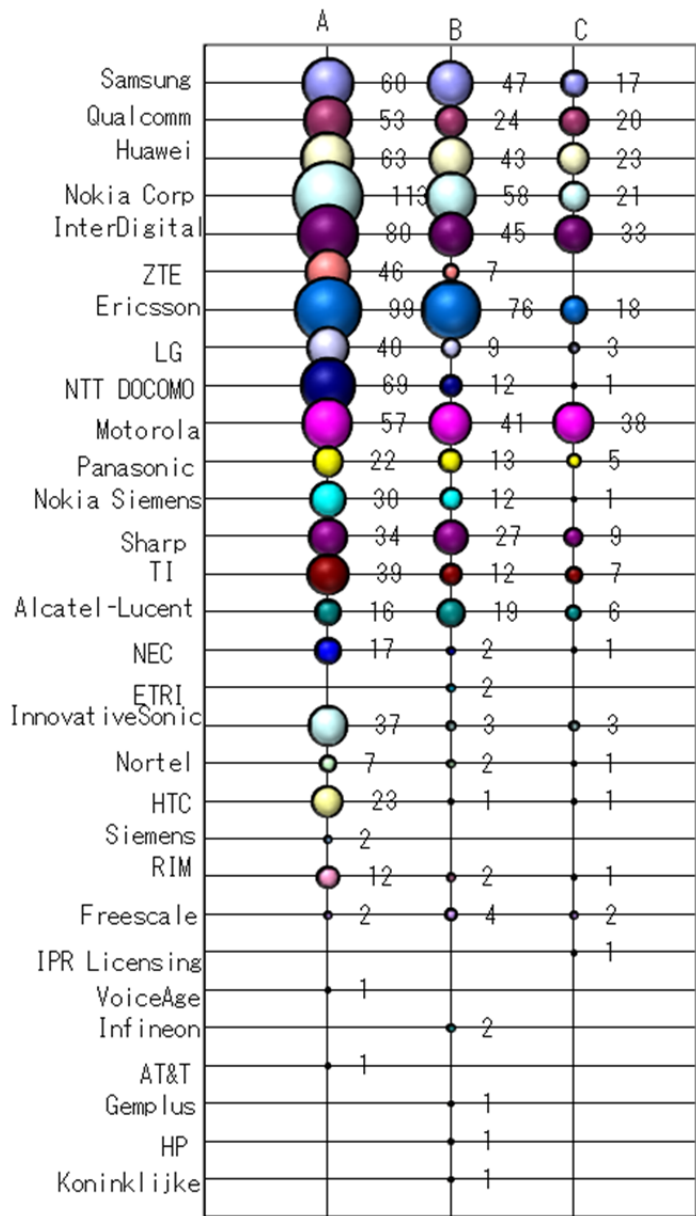


Figure 9 – Essentiality evaluation results by company



## 2.Survey results

### (5) Essentiality ratios based on all the evaluated patents

Figure 10 shows the essentiality ratios (defined as the percentage of patents evaluated as “A” to all the patents evaluated) for each company. The horizontal axis shows the essentiality ratio (%) and the vertical axis shows the company names. Due to space limitation, companies with less than 10 declared patents were omitted.

Companies such as ZTE, NTT DOCOMO, Nokia Siemens, NEC, LG, TI, InnovativeSonic, HTC, and RIM have higher ratios than average (57.7%). One of the reasons for this is considered to be that these companies made declarations for relatively new patents, filed after LTE standardization began.

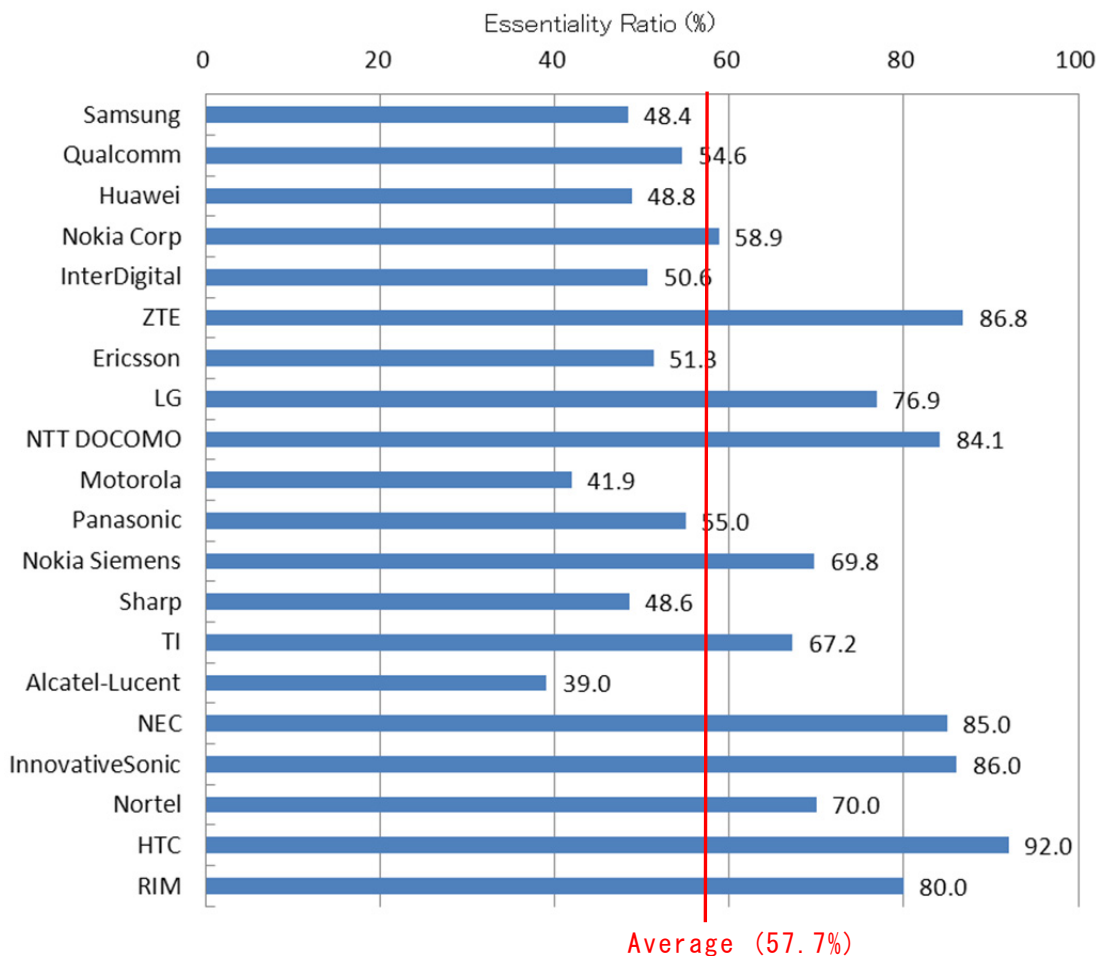


Figure 10 – Evaluation results for each company (essentiality ratio)

### (6) Registration ratios of evaluated patents

In considering the essentiality of the patents, it is necessary to take into account whether the patents under study have already been registered or not. This is to take into consideration the effect of future decline of their relevance during the course of patent

## 2.Survey results

examinations. Figure 11 shows the ratio of registered patents to the total number of patents under evaluation for each company. Results are shown only for those companies that have no less than 10 patents for evaluation.

In Figure 11, patents were counted by referring to their legal statuses in the application country as of the survey period. Therefore, it must be noted that the result does not reflect the legal status as of present nor does it reflect the legal status in those countries pertinent to ETSI declarations. For example, as described in Section 2.3 (1)(ii), in most of the cases, legal status is derived from Japanese patent, if a patent family includes a Japanese one, or from US patent, if the family does not include a Japanese one. So, even for US-based Qualcomm, about 30% of the evaluations were based on the application filed in Japan. In the case where the evaluated were PCT patents, they were treated as non-registered.

With companies whose registration ratio is high, essentiality has been evaluated mainly based on established patents and it is reasonable to assume that the essentiality ratios would not change largely; whereas with those whose registration ratio is low, their ratios may degrade as their patents are examined and their relevance may become lower.

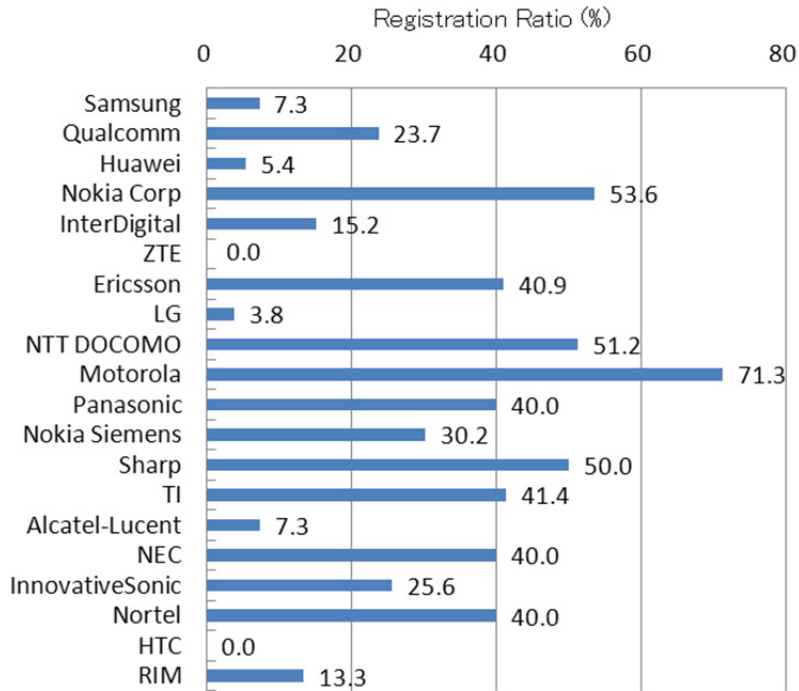


Figure 11 -Registration ratios of patents evaluated

### (7) Essentiality ratios based on registered patents

Figure 12 shows, for each company, the number of registered patents evaluated and essentiality ratio (denoted registration-based essentiality ratio hereafter). Registration-based essentiality ratio pertains to the ratio of A-scored patents against the company's all evaluated registered patents. Line graph with scale on the right side shows registration-based essentiality ratios and bar graph with scale on the left side show the number of



## 2.Survey results

registered patents evaluated.

With companies (Nokia, Ericsson, and Motorola) that have large number of registered patents, registration-based essentiality ratios show lower value than those observed in Figure 10 by 7 to 10 percent. This shows that amendments to patent claims during their examinations have resulted in non-negligible effects on their relevance to standards.

NTT DOCOMO, TI, and InnovativeSonic are remarkable in the sense that they show high registration-based essentiality ratios while possessing a reasonable number of patents. With Samsung, Huawei, ZTE, and LG, in contrast, the numbers of evaluated registered patents are small, and the essentiality ratios seen in Figure 10 might well decrease, affected by the future patent examinations.

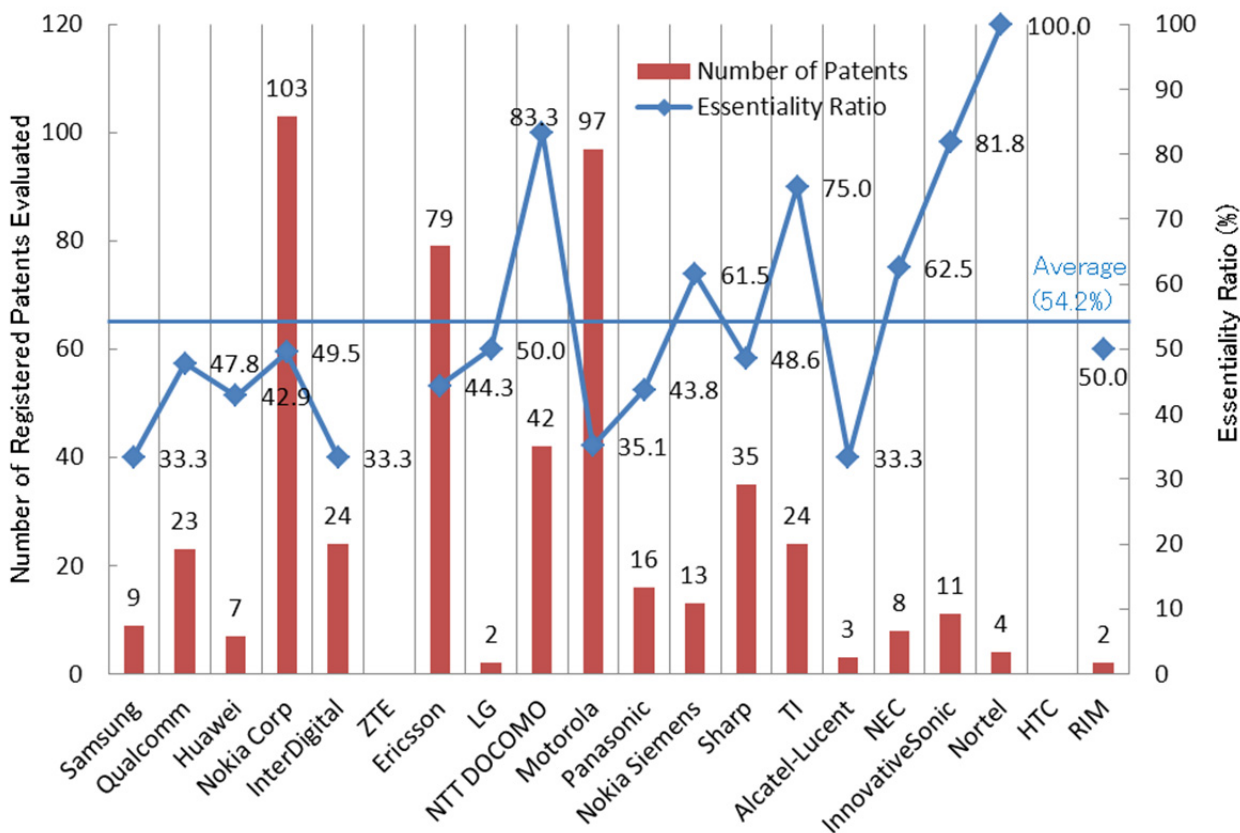


Figure 12 The numbers of registered patents evaluated and registration-based essentiality ratios

## 3. Estimation of the gross numbers of "essential" patents

### 3 Estimation of the gross numbers of "essential" patents

The gross number of "essential" patents held by each company (on a patent family basis) has been estimated by multiplying the number of declared patents (see Table 1 or Figure 1) by the essentiality ratio for each company.

The numbers have been estimated for two cases: in one case, essentiality ratios derived for all evaluated patents are applied, and in the other, those derived for registered patents are applied.

#### (1) Estimation based on all the evaluated patents

The gross number of "essential" patents has been estimated based on the essentiality ratio derived from all the evaluated patents, as shown in section 2.3 (5). The estimation was done, for each company, by multiplying the total number of declared patents by the essentiality ratio. The result is shown in Figure 13.

For those companies (e.g., CATT, ETRI, and Siemens) with which essentiality ratio were not available, due to the fact that evaluation was not conducted in this survey or the number of evaluated patents was small, the average value of 57.7% have been applied.

ZTE is estimated to be number one with 311 "essential" patents followed, by Qualcomm (297), Samsung (296), Nokia (273), Huawei (257), NTT DOCOMO (206), LG (196), InterDigital (193), Ericsson (180), and CATT (152).

Regarding ZTE, Huawei, LG, and Samsung, their low registration ratios (shown in Figure 11) suggest that many of their patents are still in examination phase. Thus, as was mentioned earlier, there may be a possibility that the numbers become smaller due to the restrictive amendments made to patent claims as the result of their patent examinations.

### 3. Estimation of the gross numbers of "essential" patents

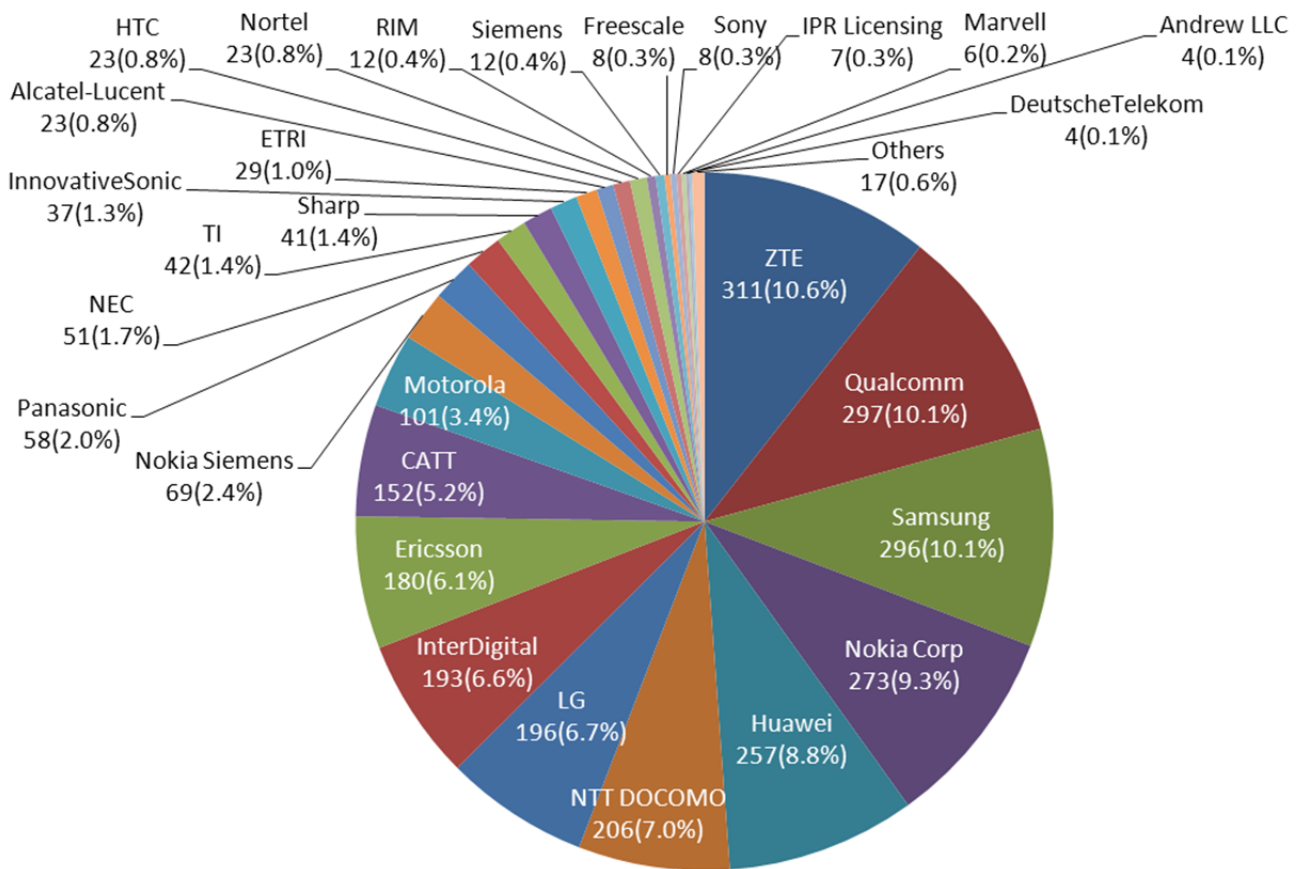


Figure 13 - Estimated number of "essential" patents (based on all evaluated patents)

#### (2) Estimation based on registered patents

The gross number of "essential" patents has been estimated based on the essentiality ratio derived from all the evaluated patents, as shown in section 2.3 (7). The estimation was done, for each company, by multiplying the total number of declared patents by the essentiality ratio. The result is shown in Figure 14.

For those companies the number of registered patents for evaluation was less than six as seen in Figure 12, their essentiality ratios were assumed to be the average value of 54.2%.

The result shows that Qualcomm is estimated to be number one with 260 "essential" patents, followed by Nokia (230), Huawei (256), NTT DOCOMO and Samsung (204 each), ZTE (195), Ericsson (156), CATT (144), LG (139) and InterDigital (127). Because the estimations are based on registered patents, essentiality ratio decreases and estimations show smaller values than those seen in the previous case (Figure 13).

### 3. Estimation of the gross numbers of "essential" patents

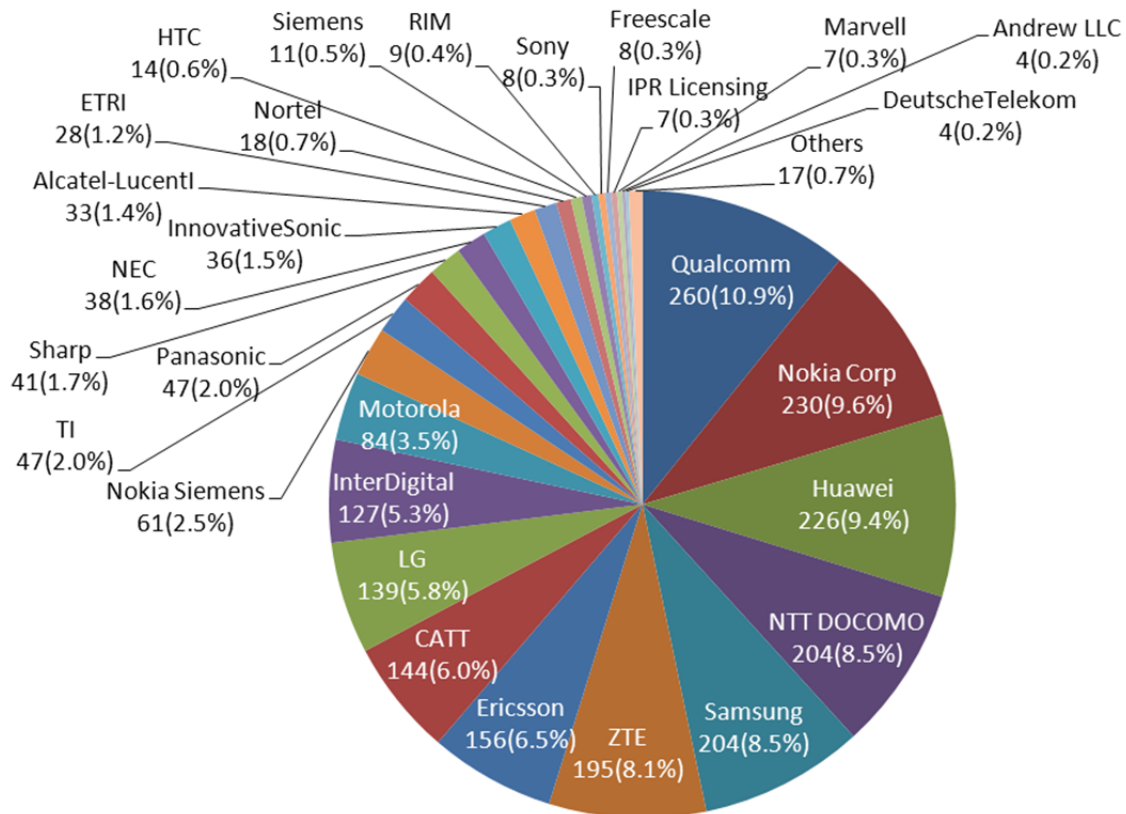


Figure 14 - Estimated number of "essential" patents (based on registered patents)

#### (3) Main features of the major companies

Based on the results shown so far, the main features of the major companies are summarized as follows.

##### i) Qualcomm

Qualcomm has the second largest number of declared patents. It continuously made declarations from as early as 2007 up to 2011. The company's essentiality ratios are slightly lower than average but scores around 50%, resulting in one of the companies with highest number of essential patents. This makes us believe that Qualcomm has been allocating significant resources for analyzing its own patents and actively declaring patents that have exceeded reasonable criteria. It is foreseen that their declarations will further increase in the future. Keeping pace with the company's globalization efforts, Qualcomm is expected to hold many "essential" patents in many countries.

##### ii) Nokia

Nokia has continued its patent declarations from 2006 till 2011. Application dates ranges

### 3. Estimation of the gross numbers of "essential" patents

from around 1990 to the present time. This shows that the company analyzes its patent portfolio and declares those patents that meet its standards. Its patent registration ratio is relatively high and essentiality ratio is at the average level. Globalizing its activities, the company is expected to hold a number of "essential" patents in many countries.

#### iii) Huawei

Huawei started to make declarations after 2008 for patents filed after 2005. The company declared many patents in 2011 and holds a large number of declared patents. The essentiality ratio is lower than average, but not far below 50%, resulting in the significant number of "essential" patents. The patent registration ratio is identified to be low and the future development of the legal status needs to be watched.

#### iv) NTT DOCOMO

NTT DOCOMO made declarations in 2009 and 2010 for its patent applications filed after 2005. The company continued the activity into 2011. The ratio of registered patents is high despite their being newer applications, and their essentiality ratio is very high. This means that NTT DOCOMO possesses a relatively high number of registered "essential" patents so that, when compared with other companies, NTT DOCOMO may deserve a higher position in the essentiality ranking.

#### v) Samsung

Samsung started to make declarations after 2008 for patents filed after 2005. The company declared many patents in 2011 and became the 1st place in terms of declared patents. It continued its declarations into 2012. Because the patents are new, their registration ratio is still low and their essentiality ratio is at the average level. In spite of this fact, because the number of declared patents is large, the number of their "essential" patents is large. Their policy of actively making declarations is evident but there is a chance that the sheer number of "essential" patents may not increase as much as expected, depending on the results of future patent examinations. Therefore, a close watch on the examination status of Samsung's patents will be important.

#### vi) ZTE

ZTE made declarations in a lump in 2010 covering its patents filed after 2006 and have been continuing the activity in 2011 and 2012. Its activity is anticipated to continue on. The number of declarations is comparatively large, and essentiality ratio is high, resulting in the 1st place in the number of "essential" patents. ZTE's characteristic points are that the declaration was made mainly of those patents that had been applied with LTE in mind, and that most of the declared patents are not yet registered. Therefore, depending on the examination results, a certain number of the patents may become non-essential which suggests that the estimated number of "essential" patents held by ZTE might be an overestimate, compared to those of other companies.

#### vii) Ericsson

Ericsson declared its patents mainly around 2009 and 2010. The declarations in 2011 were relatively small, resulting in the low ranking in terms of the number of "essential"

### 3. Estimation of the gross numbers of "essential" patents

patents. The company's registration ratio and essentiality ratio are both at average level. Because their declared patents were filed between around 1990 and the present time, it is likely that Ericsson has conducted a comprehensive analysis of their own patents at certain stages and, during these two years, made declarations for the patents that met their criteria.

#### viii) CATT

CATT made all of its declarations in 2011. This is the first time for the company to be in our survey. It declared the patents that had been applied in the time frame from 2006 to 2010 at one time. The patents were originally filed by Da Tang Mobile or SHANGHAI ULTIMATE POWER. It is desirable to evaluate a reasonable number of patents, filed with Japan, U.S., and Europe, to assess its essentiality ratio.

#### ix) LG

LG made declarations in a lump in 2009 and 2010 for its patents filed between 1998 and 2010. This may be due to that fact that the company analyzes its patent portfolio periodically and declares them at a time. The high essentiality ratio suggests that they have made declarations based on relatively strict internal evaluations on their patents. Note should be made to its low registration ratio so that future examinations would affect the outcome.

#### x) InterDigital

InterDigital continuously made declarations from as early as 2007 up to 2011, resulting in a substantial number of patent declarations. However, both registration ratio and essentiality ratio are lower than other major companies and there are cases that declared patents were rejected in examinations. So, it may be that the number of "essential" patents of InterDigital may not increase so much like the cases of other major companies. Since the number of declarations made by the company has been increasing each other year, the increase may be observed in 2012, following the small declarations in 2011. In this regard, future development should be watched for.

#### xi) Motorola

Motorola made declarations in a lump in 2010 covering its patents filed between 1990 and 2007 and did not make them in 2011. It is estimated that Motorola has spent considerable time to make a comprehensive analysis of its patents and selected those patents to be declared. Among the patents that were evaluated, there were many patents that were filed before 2005, which may have been one of the reasons for Motorola's low essentiality ratio. In order to ensure the consistent evaluations, it may be better to evaluate some additional patents that are applied more lately.



## 4 ■ Summary

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The main results of this survey are as follows:

- i) The original list of essential patents notified to ETSI (original list) was obtained from the ETSI website. By extracting only relevant patents from the list and grouping them into patent families, a total of 5,013 patents were identified to be subject to this study. This is the effective number of declared patents. The number of companies that made declarations was 43.
- ii) Samsung has the largest number of declared patents (612, 12.2%) and is followed by Qualcomm (544, 10.9%), Huawei (527, 10.5%), Nokia (464, 9.3%), InterDigital (382, 7.6%), ZTE (352, 7.2%), Ericsson (352,7.0%), and CATT (265, 5.3%). In the present survey, CATT newly came in the ranking as one of major companies. Declarations are not limited to major companies, but are evenly distributed among many companies. The nationalities of the companies are also evenly distributed among USA, Europe and Asia.
- iii) Many of the declared patents had been filed after 2005, when LTE standardization work began. In particular, the applications filed between 2006 and 2009 are dominant, and the number of declarations made on the applications filed between 1999 and 2004 are also significant. The majority of patents subject to the current survey are those filed in 2009 and 2010.
- iv) Companies can be classified into four types, namely, a) those who have declared patents filed during a long period of time from the early days (around 1990) to now, b) those who have declared patents filed mainly after 2005 (the year when LTE standardization started), c) those who have declared patents filed earlier times, but not after 2005, and d) those who do not fall into any of the above categories.
- v) The countries, where the applications were filed with, were surveyed. Qualcomm, Ericsson, InterDigital, Motorola and Nokia have been filing their applications with various countries in the world. Japanese and Korean companies have also been filing there applications evenly among BRICs and other countries.
- vi) Essentiality has been determined for each patent selected, for evaluation, from 5,013 patents. It has been estimated that 58% of them are truly “essential”, conforming to ETSI standards. With ZTE, NTT DOCOMO NEC, InnovativeSonic, HTC, and RIM, more than 80% of their declared patents are identified to be “essential.”
- vii) Legal statuses of evaluated patents in respective application countries have been

## 4. Summary

studied. The results show that Motorola scores the highest registration ratio of over 70%. Nokia, NTT DOCOMO, and Sharp each scores over 50%, Huawei and Samsung each scores under 10%, and ZTE has no patents legally examined yet. This means that evaluations on Motorola have been done mostly based on claims of registered ones, whereas evaluations on ZTE have been done based on unexamined ones.

- viii) The numbers of “essential” patents have been derived by multiplying the numbers of declared patents by the essentiality ratios. When the ratios are determined based on all the evaluated patents, ZTE is estimated to have the largest number of “essential” patents (311) followed by Qualcomm (297), Samsung (296), Nokia (273), Huawei (257), NTT DOCOMO (206), LG (196), InterDigital (193), Ericsson (180), and CATT (152). Regarding companies such as ZTE and Huawei who have many unregistered patents, those numbers may be reduced because of the possible decline of the essentiality ratio during the course of legal examinations.
- ix) When the essentiality ratios are determined based on registered patents, Qualcomm owns the largest number of “essential” patents (260), followed by Nokia(230), Huawei(226), NTT DOCOMO and Samsung(204 each), ZTE(195), Ericsson(156), CATT(144), LG(139), and InterDigital(127). It should be noted that evaluation samples are small with non-negligible number of companies, and accumulation of samples are important for the future.



## References

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- 1) List of essential, or potentially essential IPRs notified to ETSI  
[http://www.etsi.org/deliver/etsi\\_sr/000300\\_000399/000314/](http://www.etsi.org/deliver/etsi_sr/000300_000399/000314/)
  
- 2) 3GPP standards  
<http://www.3gpp.org/ftp/Specs/html-info/41101.htm>  
Release8: <http://www.3gpp.org/Release-8>  
Release9: <http://www.3gpp.org/Release-9>  
Release10: <http://www.3gpp.org/Release-10>  
Release11: <http://www.3gpp.org/Release-11>
  
- 3) Evaluation of LTE essential patents declared to ETSI, Version 1.0  
<http://www.cybersoken.com/xxxx>

# Appendix 1

Excerpt of ETSI site ([http://www.etsi.org/deliver/etsi\\_sr/000300\\_000399/000314/](http://www.etsi.org/deliver/etsi_sr/000300_000399/000314/))

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Patent information	IPR declaration information				Projects		Standards				
Application number	Publication number	Title	Patent office	Declaring companies	Declaration reference	Declaration dates	Essential to project	Non-essential to project	Essential to standards	Essential to standards	Non-essential to standard
	0 318 033	Digital cellular telecommunica		NEC Corporation	ISLD-199911-001	04/11/1999	GSM (Global System for Mobile communications)		ETS 300 579 TS 05.10 (v4.9.0)		
	Re. 36.309	Digital cellular telecommunica		NEC Corporation	ISLD-199911-001	04/11/1999	GSM (Global System for Mobile communications)		ETS 300 938 TS 04.06 (v5.2.1)		
				GB (UNITED KING)	ISLD-199911-001	04/11/1999	GSM (Global System for Mobile communications)		ETS 300 579 TS 05.10 (v4.9.0)		
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CA19912054849	CA2054849 C	SPEECH P CA (CANADA)		NEC Corporation	ISLD-190001-044	14/01/1997	GSM (Global System for Mobile communications)		TS 06.20		
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DE19926032887T	DE69232887 T2	Sprachcod DE (GERMANY)		NEC Corporation	ISLD-190001-044	14/01/1997	GSM (Global System for Mobile communications)		TS 06.20		
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EP19980124813	EP0910063 B1	Speech pa EP (EPO /Europe)		NEC Corporation	ISLD-190001-044	14/01/1997	GSM (Global System for Mobile communications)		TS 06.20		
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