Cyber Creative Institute Co. Ltd.

Evaluation of LTE essential patents declared to ETSI

Version 3.0

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Table of contents

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1 Objectives

Mobile communication service is migrating from the third generation (3G) to LTE (Long Term Evolution) rapidly. In Japan, NTT DOCOMO launched the first LTE service in Japan, in December 2010, under the name of Xi (pronounced "Crossy"). The number of Xi subscribers exceeded 12 million as of April 2013.

In contrast, the number of subscribers of FOMA, a 3G service, declined below 60 million and decreasing. It shows that the migration to LTE is in progress.

In April 2012, ITU-R (Radio communication Sector of International Telecommunication Union) recommended two technologies as standards for the fourth generation mobile communication (IMT-Advanced), i.e., LTE-Advanced and WiMAX2[1]. Of the two technologies, LTE-Advanced allows for the use of telecommunications services of high-speed, large-capacity, while maintaining compatibility with the current LTE, and is expected to be used widely in the future. NTT DOCOMO plans to start its commercial service in 2015 in Japan.

Standard specifications for LTE-Advanced and LTE have been being carried out in the Third Generation Partnership Project (3GPP), which is an international standards development project organized by the standards developing organizations[2] in various countries. Keeping pace with the standardization activities, a number of patents have been filed by companies involved in the standardization. For a patented technology to be adopted in standards, its holder has to declare[3] to the organizations, in relevant countries, its willingness to make its licenses available to all third parties under fair, reasonable and non-discriminatory (FRAND) terms.

This paper evaluates the number of patents that are essential to LTE and LTE-Advanced standards based on the patents declared to ETSI.

Although ETSI is a European standards developing organization, not only European

[1] WirelessMAN-Advanced: IEEE 802.16m regulation that IEE has been considering, and developed WiMAX (IEEE 802.16a) and mobile WiMAX (IEEE 802.16e).

[2] Major standards developing organizations are included as follows:
ETSI (European Telecommunications Standards Institute) in Europe, and ARIB (Association of Radio Industries and Businesses) in Japan.

[3] 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.

companies but many non-European ones have declared their patents as essential to LTE. This is because Europe has long been a large telecom market and has fostered many prominent companies. As such, the number of patents declared to ETSI, by participating companies, should be an important indicator of the company's "IPR[4] power."

ETSI discloses the list of patents that have been declared, by member companies, as essential to LTE standards. To evaluate true "IPR power", however, simply counting the number of declared patents, as listed in the ETSI list, is not a good measure, due to the following two reasons.

- Duplication of the same invention
  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. With divisional applications, those, which have different scopes, may well be counted separately. But, in most cases, it is more appropriate to count them as a single patent family.

- Difference in company's criteria for declaration
  According to ETSI policy, companies can declare essential patents at their discretion. ETSI does not confirm or deny whether the declared patents are really essential or not. As a result, the definition of relevance to the standard varies, resulting in considerable differences in the number of the declared patents.

In order to cope with these difficulties, this survey, first, sorts out the ETSI list, by grouping the patents on a patent family basis, to derive the effective set of declared patents to be used for evaluation. It, then, evaluates the resulting set based on common criteria to determine the number of truly essential patents.

This survey is done based on the patents contained in the latest ETSI declaration list and is an update to our previous report[5].

[4] IPR: intellectual property right
[5] Evaluation of "LTE essential patents declared to ETSI" Version 1.0
Evaluation of "LTE essential patents declared to ETSI" Version 2.0
(Refer to http://www.cybersoken.com/research/lte.html)

2 Survey results

2.1 Identifying the patents subject to analysis

The list of patents under current study (hereinafter called as "original list") is the one uploaded by ETSI in November, 2012, which is available from the ETSI website[6].

The original list simply lists the patents notified by companies as provided, and is not suitable for the meaningful comparison of the numbers of patents held by companies. The reasons for this are as follows:

- A group of patents, that have been derived from a single invention or applied in different countries, are listed as separate entries, and
- Undisclosed patents, such as provisional applications[7] in the U.S., are included in the list.

To identify the relevant patents (including patent applications[8]) for our analysis, we have consolidated the inter-related patents into one entity on a patent-family-basis, and produced a list of independent patents.

Concrete procedures are as follows:

(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 the patents that had not been published by the end of November, 2012 (or filed by the end of May, 2011).

[6] http://www.etsi.org/deliver/etsi_sr/000300_000399/000314/

[7] 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.

[8] 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.

(d) Identifying the patent family for each patent obtained by the above processes of (a) to (c), using a commercial patent database[9].
(e) Determining a representative patent, for each patent family, that represents the member patents in the family.

By applying the above procedures, 5,919 patents, or patent families to be exact, have been identified as the subjects for our evaluation.

[9] PatBase was used for this purpose. PatBase is a commercial patent database that was co-developed by RWS and Minesoft in UK.
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.

2.2 ETSI declaration 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 are taken from the "Declaration Dates" column in the list. If "Declaration Date" includes multiple dates, the earliest one is taken. The names of the declaring companies are taken from the "Declaring Companies" column and translated to effective company names, as shown in Table 1. Related company names are aggregated to a corresponding effective name. A total of 49 companies have been identified.

Some of the companies started their declarations as early as 2007 when the standards were still being developed. However, on the whole, the number of declaring companies started increasing 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, and Pantech newly came in the list in 2012.

Apple and Sharp are worth noting. Figure 1 shows that Apple declared in 2008, 2011 and 2012. The declarations in 2008 were the ones that Nortel declared at that year, which Apple obtained from Nortel and re-declared in 2012. In effect, Apple made its first declarations in 2012. Apple has a relatively large number of declarations (total of 78). Sharp also made a remarkable number of declarations in recent years (189 in two years of 2011 and 2012).

Most of the top companies (those that have made more than 100 declarations, except for CATT, InterDigital, and Panasonic) declared in 2012, and are expected to continue their declarations for the future.

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 the standards. The other is that the companies, by doing so, intend to show their strategic IPR power to the public.

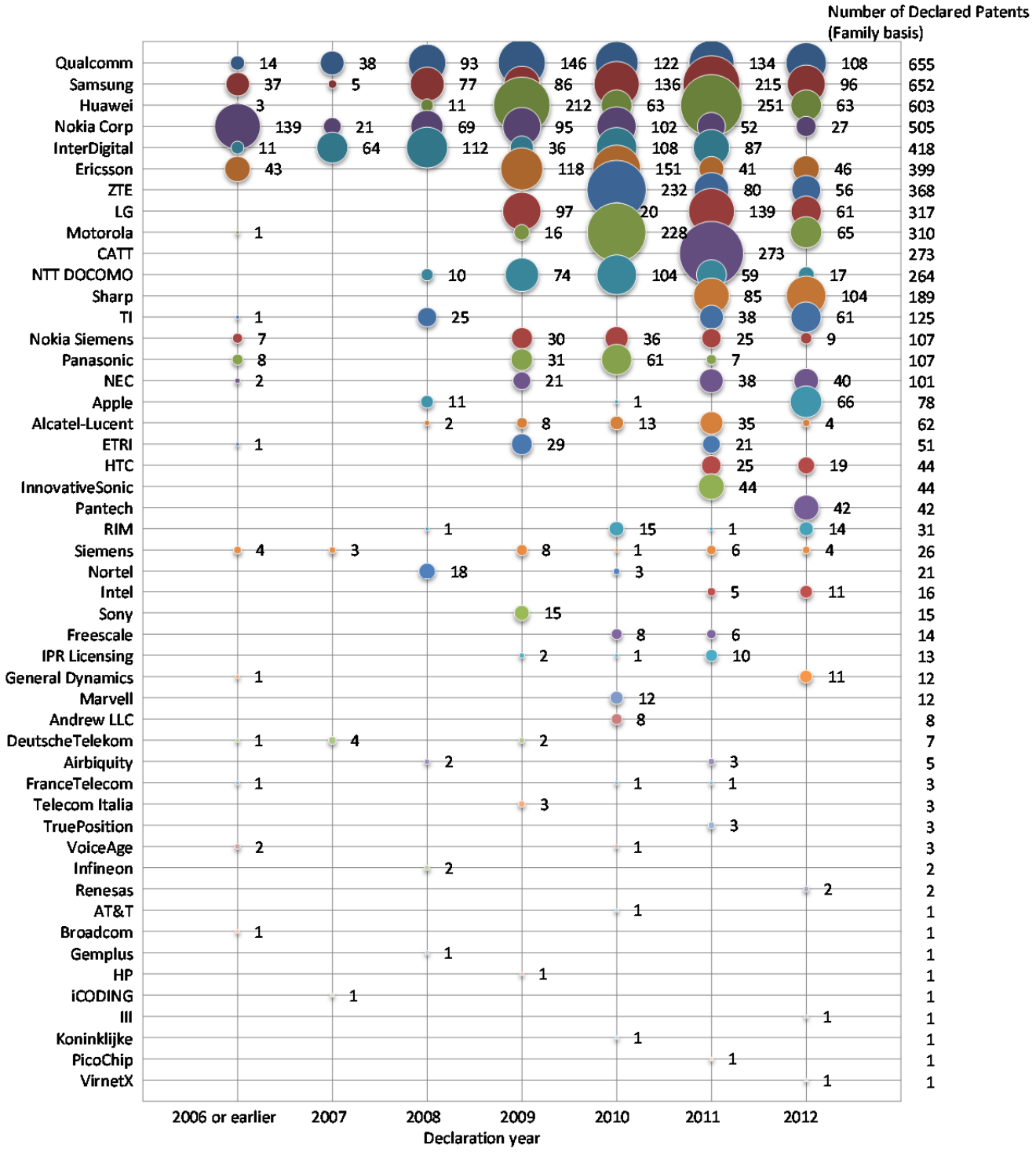


Figure 1 - Declared numbers of patents by company

Table 1 - Declaring companies

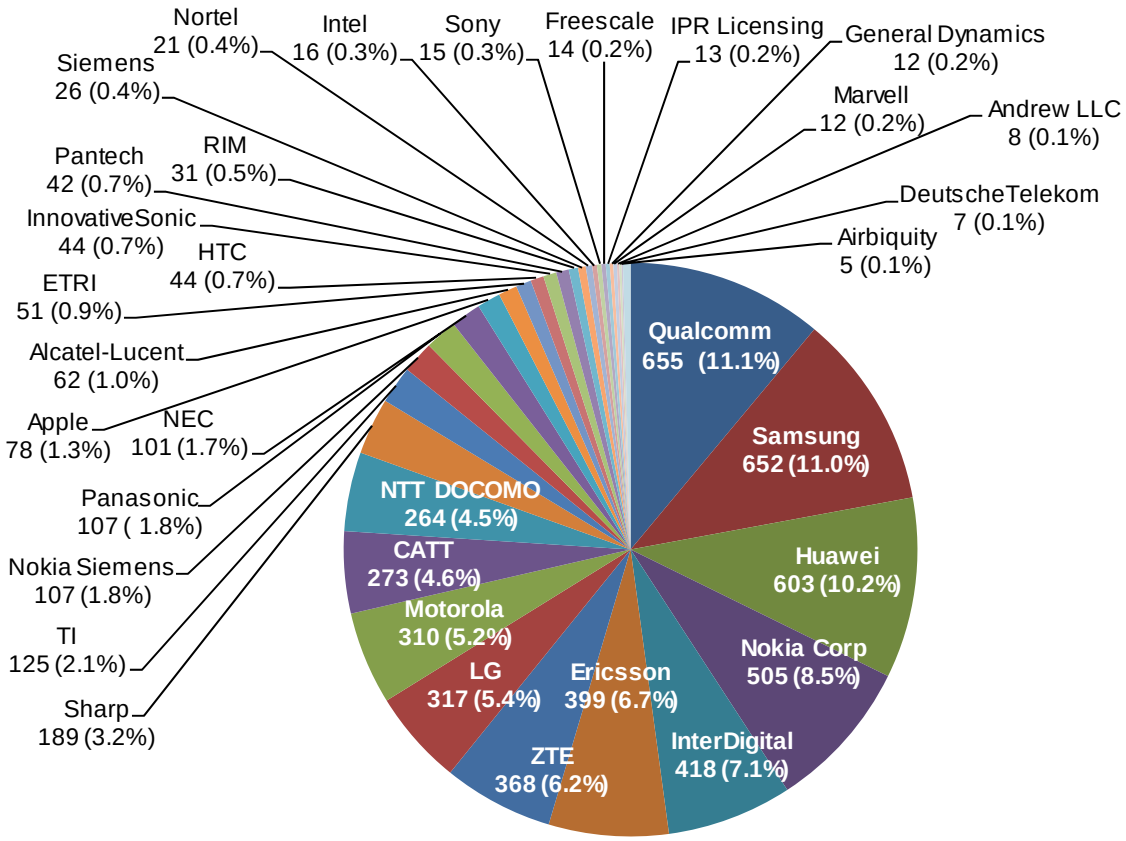
Effective Company Name	Name in "Declaring companies" column	Country Code[10]
Airbiquity	Airbiquity Incorporated	US
Alcatel-Lucent	ALCATEL-LUCENT	FR
	Alcatel-Lucent Shanghai Bell Co., Ltd	
	ALCATEL-LUCENT|Alcatel-Lucent Shanghai Bell Co., Ltd	
Andrew LLC	Andrew LLC	US
Apple	Apple Inc.	US
	Nortel Networks Ltd|Apple Inc.	
AT&T	AT&T	US
Broadcom	BROADCOM CORPORATION	US
CATT	China Academy of Telecommunications Technology (CATT)	CN
DeutscheTelekom	Deutsche Telekom AG	DE
	Telekom Deutschland GmbH	
	Telekom Deutschland GmbH|TIP Communications LLC|Research in Motion Limited	
Ericsson	Ericsson AB	SE
	Telefonaktiebolaget LM Ericsson	
	Telefonaktiebolaget LM Ericsson|Research in Motion Limited	
ETRI	ETRI	KR
FranceTelecom	France Telecom	FR
	France Telecom|TDF SAS	
Freescale	Freescale Semiconductor Inc.	US
Gemplus	Gemplus SA	FR
HP	Hewlett-Packard, Centre de Competences France	FR
HTC	HTC Corporation	TW
Huawei	Huawei Technologies Co., Ltd.	CN
iCODING	iCODING Technology Inc.	US
III	Institute for Information Industry	TW
Infineon	INFINEON TECHNOLOGIES	DE
InnovativeSonic	Innovative Sonic Corporation	TW
	Innovative Sonic Ltd.	
Intel	Intel Corporation	US
InterDigital	InterDigital Patent Holdings Inc.	US
	InterDigital Technology Corp.	
IPR Licensing	IPR Licensing Inc.	US
Koninklijke	Koninklijke KPN N.V.	NL
LG	LG Electronics Inc.	KR
	LG Electronics Inc.|Qualcomm Incorporated	

[10] Country names are the nationality of the location of corporate headquarters. Their abbreviations are shown below:
US: UNITED STATES OF AMERICA、FR: FRANCE、CN: CHINA、DE: GERMANY、
SE: SWEDEN、KR: KOREA、TW: TWIWAN、NL: NETHERLANDS、BM: BERMUDA、
FI: FINLAND、CA: CANADA、JP: JAPAN、UK: UNITED KINGDOM

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

Figure 2 shows the numbers and percentages of declared patents. The companies with no less than five declarations are shown.

Qualcomm has the largest percentage (about 11%) and is followed by Samsung, Huawei, and Nokia. The figure shows that the declarations are not just limited to a few particular companies but many companies, including Asian companies, have made fairly comparable numbers of declarations.



Total number of Declared Patents: 5,919
(Family basis)

Figure 2 - Numbers and Percentages of declared patents by company

(2) Breakdown by application year

Figure 3 shows the numbers of declared patents filed for each year. The horizontal axis shows the earliest priority year (i.e. the year when 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 declared patents (total of all companies' patents).

(a) A good proportion of declared patents were filed after 2005, the year when LTE standardization activities began. Especially, those that were filed between 2007 and 2009 are significant. It is remarkable that declarations have been made actively even after the first version of LTE standards was released in March, 2008. It is likely that these declared patents are to cover the technologies required with the subsequent revisions of the standards.
(b) The patent applications filed in 2011 have been declared. Because this survey studies only those patents that had been filed by May 2011, it is likely that the number of patens filed in 2010 and 2011 may increase in the future.

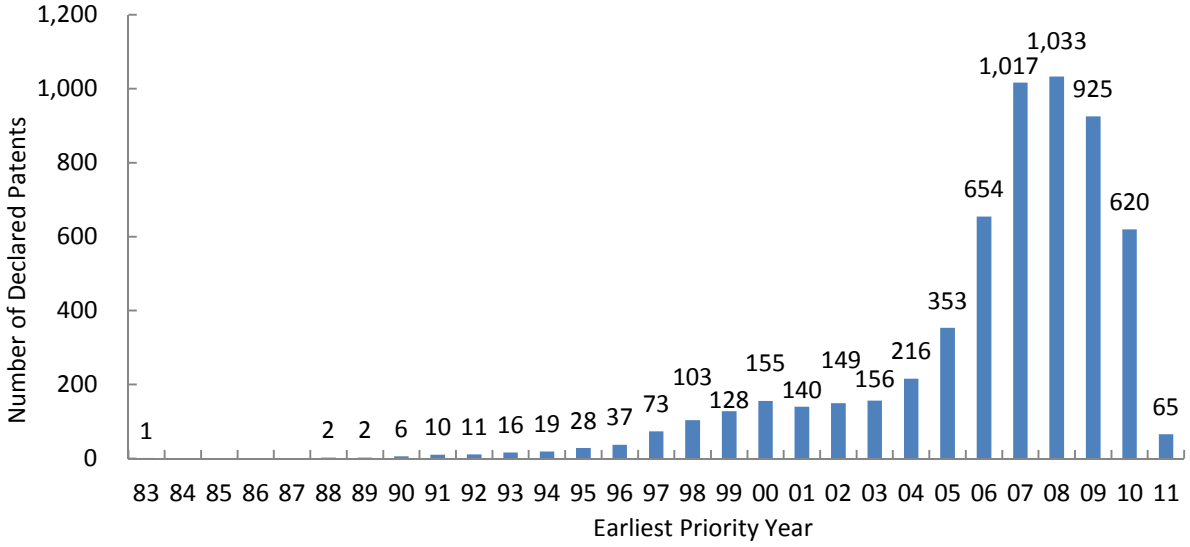


Figure 3 - The number of declared patents for each application year

(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. The vertical axis shows the names of the declaring companies, and the circle size is proportional to the number of declared patents.

The declaring companies can be roughly grouped into three categories:

(a) Companies that have declared patents that were filed over many years, from the middle of 1990's to the present: Qualcomm, Nokia, InterDigital, Ericsson, and Motorola.

(b) Companies that have declared patents that were filed mainly after 2005, the year when LTE standardization work began: Samsung, Huawei, ZTE, LG, CATT, NTT DOCOMO, Sharp, Alcatel-Lucent, HTC, InnovativeSonic, RIM, and Pantech.

(c) Companies that have declared patents whose applications were filed prior to 2005 but not afterwards: Siemens, Nortel, Sony, and IPR Licensing.

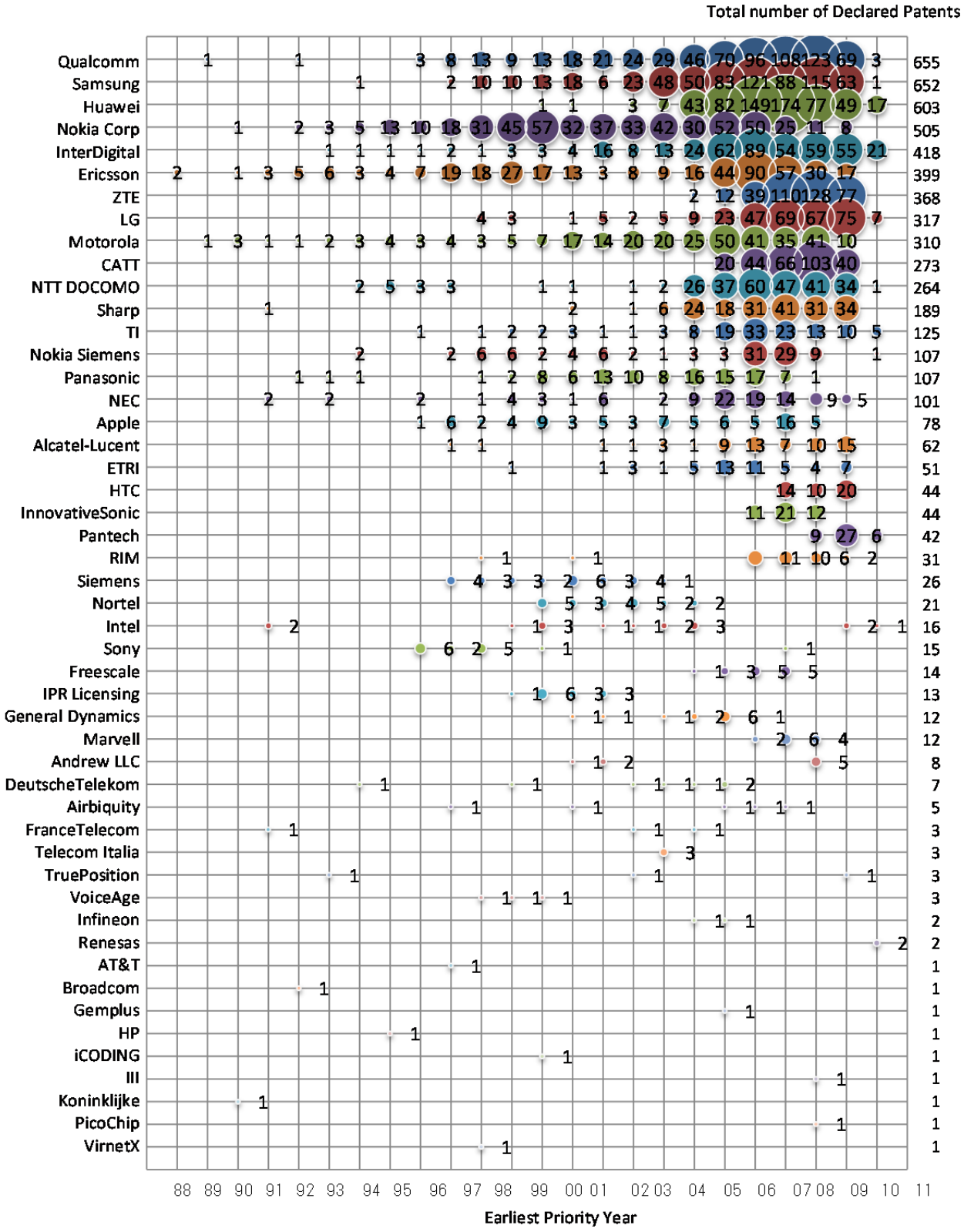


Figure 4 - Analysis of application by company and application year

(4) Breakdown by application country

Figure 5 shows the number of declared patents for application countries. In this analysis, we counted the number of patent applications for each application country by extracting all of patents included in each family[11]. The vertical axis shows the application country codes[12] and the horizontal axis shows the number of patents filed. The applications have been filed in 57 countries. Those countries that have less than ten patents filed are not shown in the figure.

The result shows that US scores the largest number, followed by Patent Cooperation Treaty (WO[13]), China (CN), European Patent Office (EP), Korea (KR), and Japan (JP). This indicates that the patents have been filed in countries and areas where major companies are located as well as where big mobile communication markets exist.

[11] Detailed steps to enumerate the relevant patents are as follows:
- To extract all the patents constituting each family
- To determine the application country by examining the first two characters of the application number, which signifies the country code

[12] In descending order of Figure 5, the corresponding country name and country abbreviations are as follows:
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、TW: TAIWAN、CA: CANADA、DE: GERMANY、MX: MEXICO、AT: AUSTRIA、
RU: RUSSIAN FEDERATION、BR: BRAZIL、ES: SPAIN、IL: ISRAEL、AR: ARGENTINA、HK: HONG KONG、GB: UNITED KINGDOM、FI: FINLAND、NO: NORWAY、ZA: SOUTH AFRICA、DK: DENMARK、
SG: SINGAPORE、PT: PORTUGAL、NZ: NEW ZEALAND、EA: EURASIAN PATENT OFFICE、
SE: SWEDEN、 ID: INDONESIA、FR: FRANCE、UA: UKRAINE、MA: MOROCCO、IT: ITALY、
MY: MALAYSIA、AP: AFRICAN REGIONAL INDUSTRIAL PROPERTY ORGANIZATION、PL: POLAND

[13] 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.

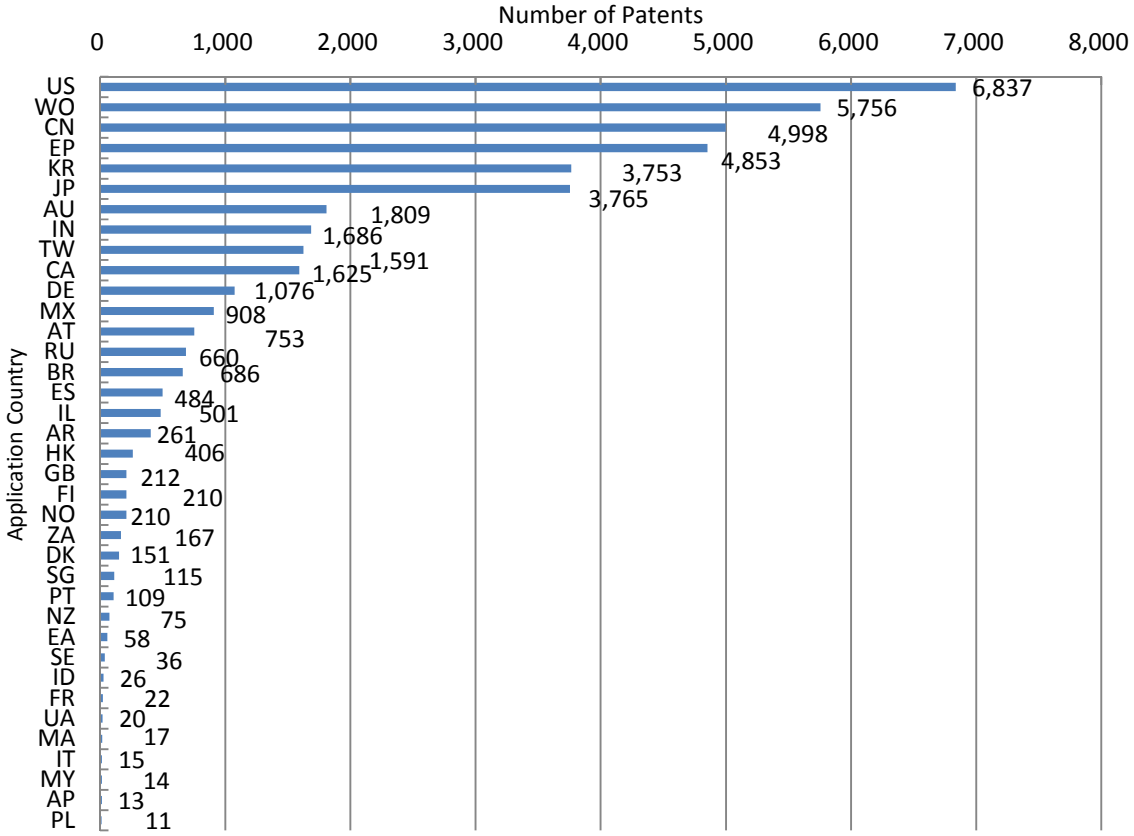


Figure 5- Number of Declared Patents for Application Countries

(5) Breakdown by company and application country

Figure 6 shows the breakdown by application country for major companies.
The following points are observed.

(a) Among the top ranking companies, U.S. and European companies, such as Qualcomm, Nokia, InterDigital, Ericsson, and Motorola, have been filing applications worldwide.

(b) Japanese and Korean companies' activities are not as strong as those seen in (a) but they have been filing applications to foreign countries in a balanced manner, including BRICs (BR, RU, IN, CN).

(c) VirnetX (USA) has only one application in terms of the family-basis, but it holds a relatively large number of member patents, in US, EP, and JP in particular, using divisional applications and continuation applications. Pantech (Korea) mainly files their applications to WO and KR, while there are some applications to US but not to JP.

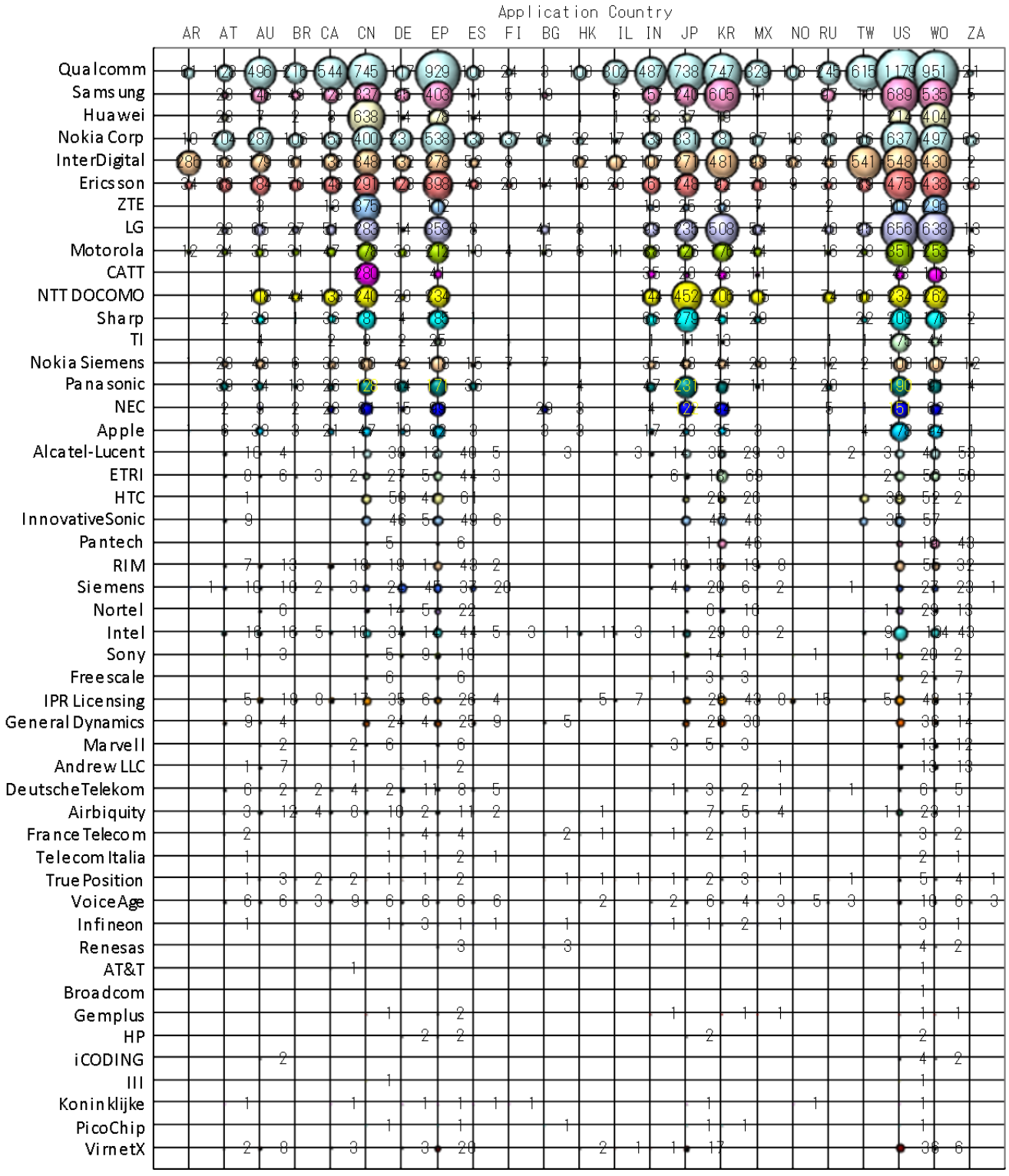


Figure 6 - Breakdown by application country and company

2.3 Evaluation of essentiality to standards

Because patent declarations to ETSI 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 are 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, ETSI does not evaluate the relevance of the declared patents to the standards. Due to these reasons, the numbers of declared 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 solve this difficulty, this survey evaluates the patents based on a common set of criteria to see their relevance to the standard specifications. By applying the objective analysis described below, we have derived the number of truly essential patents held by each company.

(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).
If the representative patent was a registered one, claims in the registered patent are evaluated. If it was still pending[14], 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[15].

(iii) If a patent has multiple claims, an independent claim that has the broadest scope was chosen.

(iv) 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.

(v) Regarding the versions of the standards for reference, in principle, Release 9 (released at the end of March, 2010) was used regardless of the version indicated in the "Essential to standards YES to ETSI FRAND license" column of the list. Additionally, Release 10 (released at the end of March 2011 and at the end of March 2012) was also used as a supplement.

[14] 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.

[15] For example in Japan, the "Review Document information Reference Menu" of Industrial Property Digital Library; http://www.ipdl.inpit.go.jp/Tokujitu/pfwj.ipdl?N0000=118

(vi) Essentiality was 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 (this category corresponds to essential patent).
B: The invention partially matches the standards.
C: The invention does not match the standards.

Since the number of declared patents was large, we resorted to a sample evaluation method to derive the number of essential patents. For each company, we selected sample patents for evaluation, derived the ratio of essential patents based on the samples, and then estimated the total number of essential patents by multiplying the total number of declared patents by the obtained ratio.

(2) Selection of patents for evaluation

The 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 a large number of declarations, around or more than 50 patents each are to be selected.
(c) Those patents whose specifications are written in Japanese or English are to be selected. If those are not available, patent specifications in other languages (e.g. Chinese) are used and evaluations are done based on their English abstracts.

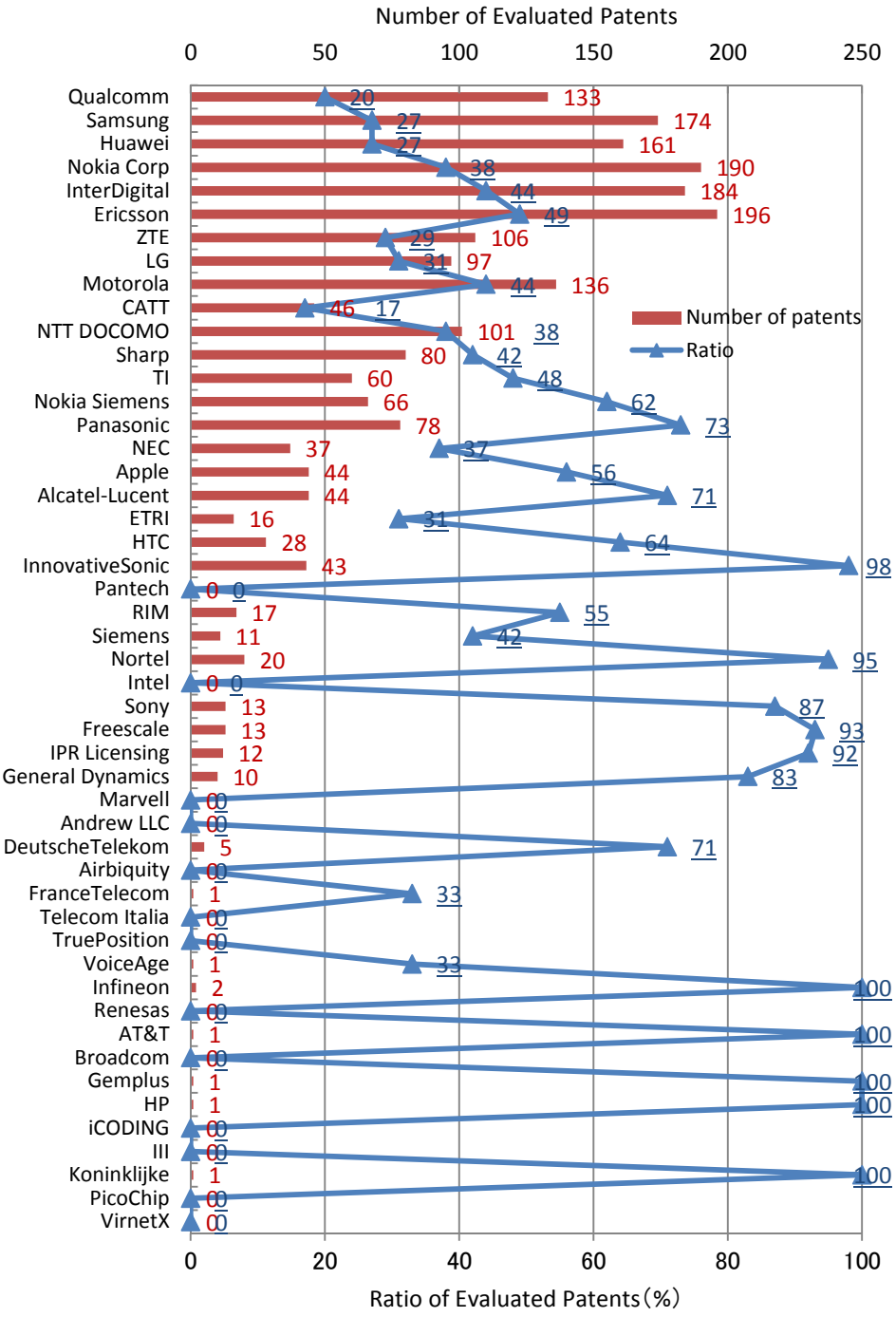


Figure 7 - Numbers and percentages of patents evaluated

In Figure 7, the bars show the numbers of patents selected for evaluation in the study, and the line shows the ratio of the number of selected patents to the number of declared patents for each company. The vertical axis shows company names, while the scale at the top shows the number of patents evaluated and the scale at the bottom shows the ratio in percentage. In the figure, underlined numbers show the percentages and those without underline show the number of patents evaluated.

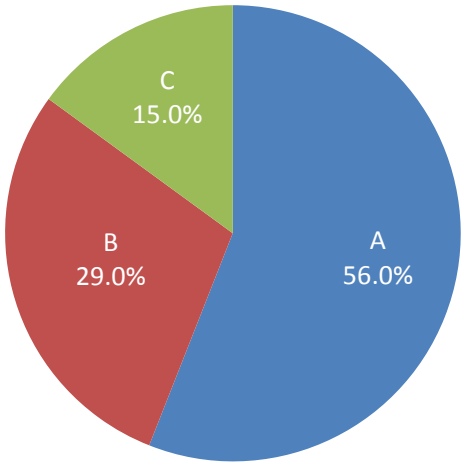
For most companies listed to the upper of Panasonic, the criterion (b) applies and around or more than 50 patents have been selected. With CATT, because the number of its English patents was less than 50, the evaluated patents were less than 50.

A total of 2,129 patents have been evaluated, which amounted to 36.0% of the total number of declared patents (5,919).

(3) Essentiality evaluation results

Figure 8 shows the essentiality evaluation results for all the evaluated patents. The percentage of those scored "A", i.e., truly essential for the standards, is 56.0%.

Although all patents studied have been declared to be essential by each company, 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. By observing the percentage of "A"-scored patents for each company, we should be able to see one aspect of the company's IPR strategy.



A: The invention contained in the patent matches the standards (i.e., essential patents).
B: The invention contained partially matches the standards.
C: The invention contained does not match the standards.

Figure 8 - Essentiality evaluation results

(4) Evaluation results for each company

Figure 9 shows the evaluation results for the 2,129 patents for each company. Most companies have more “A”s than “B”s or “C”s. In particular, LG, ZTE, CATT, NTT DOCOMO, NEC, HTC, InnovativeSonic, Siemens, and General Dynamics have relatively high “A” ratios and low “C” ratios. It is reasonable to see that these companies have declared patents based on their strict selection criteria.

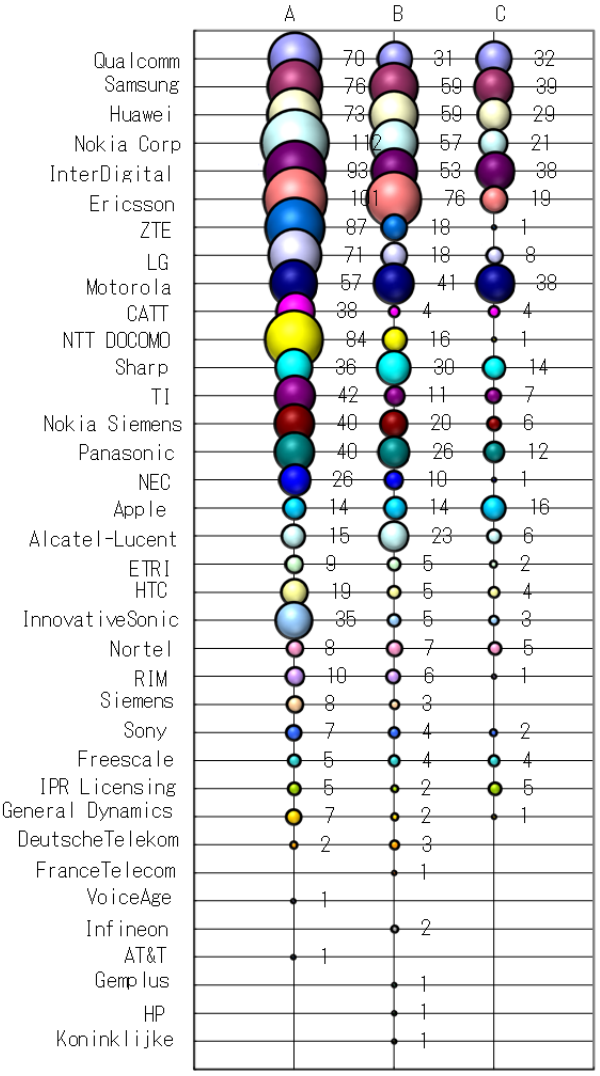


Figure 9 – Essentiality evaluation results by company

(5) Essentiality ratios based on all the evaluated patents

Figure 10 shows the essentiality ratios (defined as the ratio of declared patents evaluated as "A" to all the patents evaluated, called declaration-based essentiality ratio hereafter) for each company. The horizontal axis shows the essentiality ratio (%) and the vertical axis shows the company names. Companies with less than 10 declared patents are not shown.

Companies such as ZTE, LG, NTT DOCOMO, TI, NEC, InnovativeSonic, Siemens, and General Dynamic have higher ratios (over 70%). As shown in Figure 4, one of the reasons for this is that these companies, except General Dynamics, have declared relatively new patents, filed after the time LTE standardization began.

The companies, such as Apple, Alcatel-Lucent, Nortel, Freescale, show low ratios of 40% or less. With Apple, taking into consideration the fact that it has mainly declared the patents obtained from Nortel, and that Nortel's essentiality ratio indicates low level, it is likely that Apple has obtained many patens not matching with LTE standards.

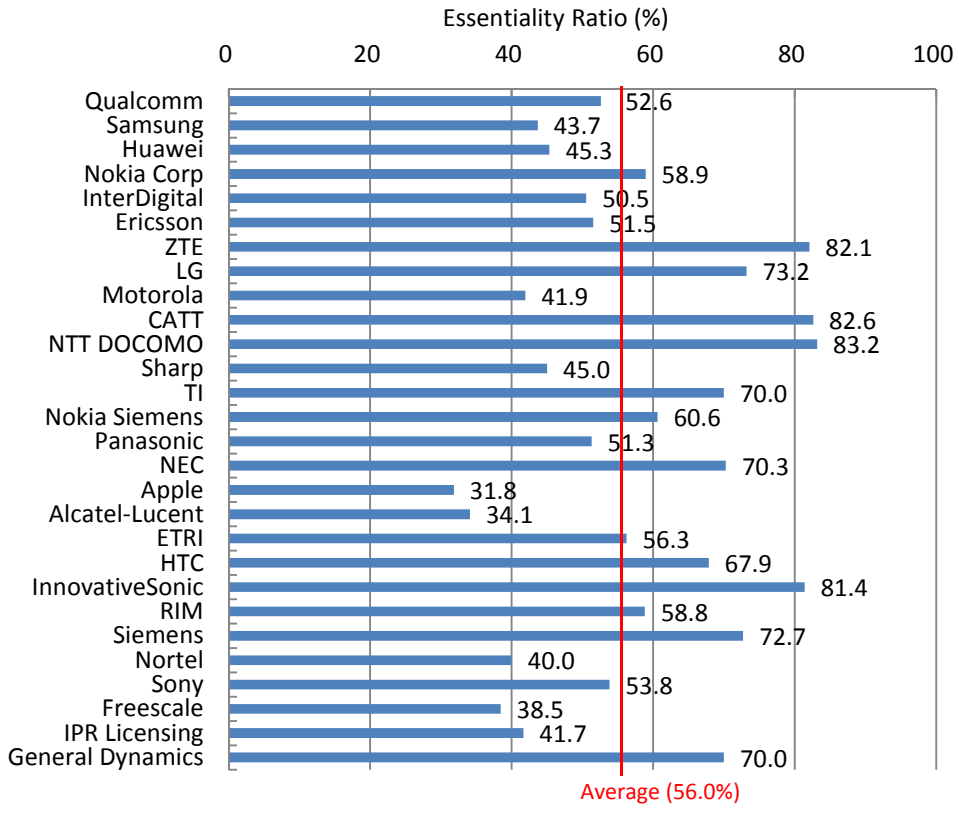


Figure 10 – Declaration-based essentiality ratio for each company

(6) Registration ratios of evaluated patents

In evaluating the essentiality of patents, it is important to take into account the examination status of the patents under study, to observe the effect of possible reductions in patent claims in the course of examination. Figure 11 shows the ratio of registered patents[16] 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.

Among patents evaluated (2,129), registered patents are 1,152 with registration ratio of 54.1%. With four companies, Siemens, Sony, IPR Licensing, and General Dynamics, all of the evaluated patents are registered ones.

Apple and Nortel's score are close to 100%. Sharp, Panasonic, NEC, and ETRI, each achieves the registration ratio higher than 80%. In contrast, ZTE and CATT resulted in very low ratios. Alcatel-Lucent and InnovativeSonic show a little lower score than the average (54.1%), due to the fact that the number of registered patents was small at the time of evaluation.

With companies whose registration ratios are high, the essentiality has been evaluated based mainly on registered patents and it is reasonable to assume that their essentiality ratios would not change largely; whereas with those whose registration ratios are low, their ratios may vary as their patents are examined in the future.

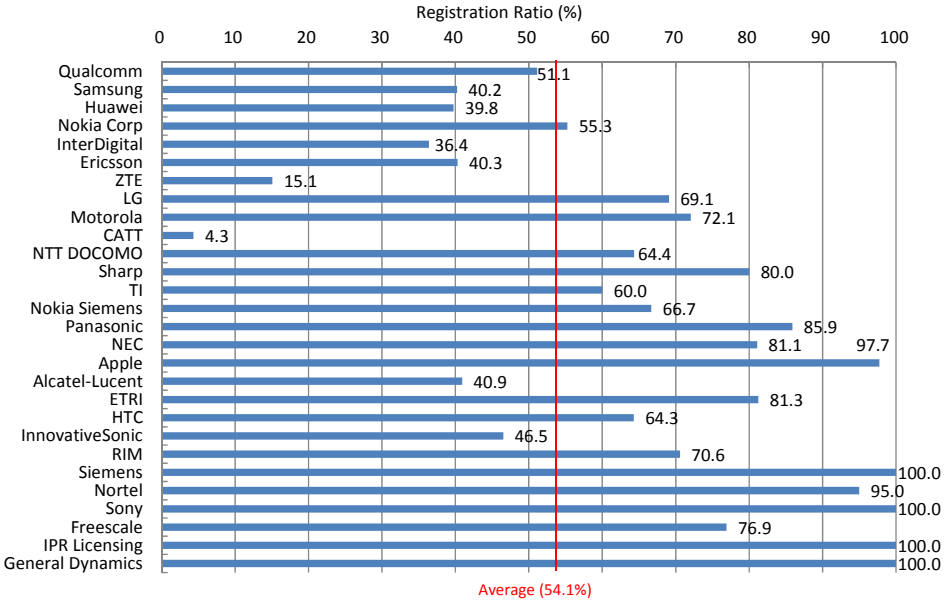


Figure 11 – Registration ratios

[16] The numbers of patents were determined by referring to the legal statuses of the evaluated patents in the respective application countries as of the survey period. Therefore, it should be noted that the result does not reflect the legal status as of present nor does it reflect the legal status of the very patents as declared to ETSI. 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 with 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.

(7) Essentiality ratios based on registered patents

Figure 12 shows, for each company, the number of registered patents evaluated and essentiality ratio (called registration-based essentiality ratio hereafter). Registration-based essentiality ratio pertains to the ratio of A-scored patents against the company's all registered patents evaluated. The line graph with scale on the bottom shows registration-based essentiality ratios (in %). The bar graph with scale on the top shows the number of patents and the vertical axis shows declaring company names.
The average essentiality ratio is 53.8%.

In the figure, pink bars show companies with higher essentiality ratio, and yellow bars show companies with lower essentiality ratio.

It is remarkable that LG, NTT DOCOMO, TI, and InnovativeSonic show high essentiality ratios while possessing a large number of registered patents evaluated. In contrast, Samsung, Motorola, and Apple have a large numbers of registered patents evaluated but their essentiality ratios are low.

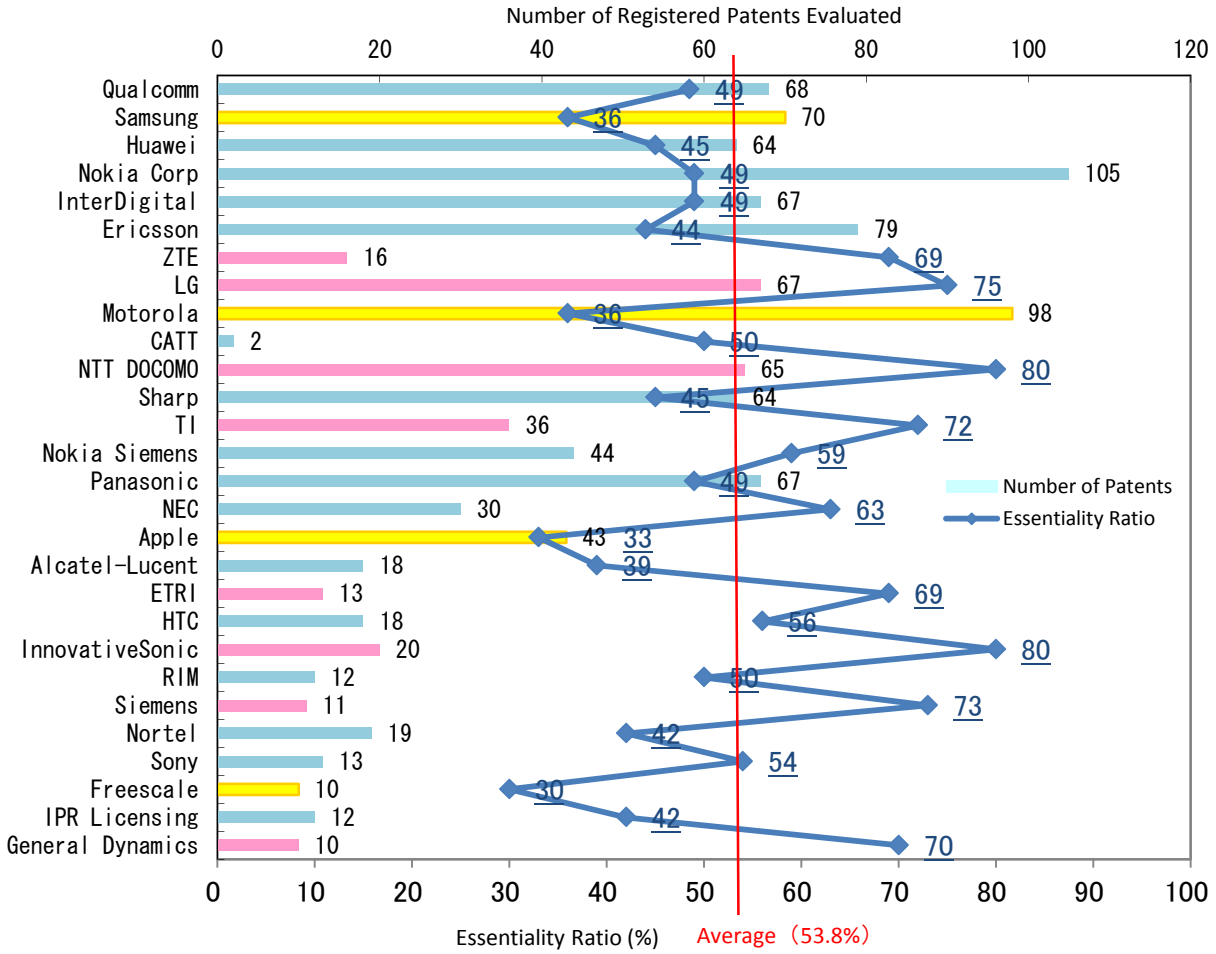


Figure 12 - Number of registered patents and registration-based essentiality ratios

Table 2 shows, for major companies, a comparison between declaration-based and registration-based essentiality ratios.

Among companies with a large number of registered patents evaluated, Nokia shows rather larger decrease of registration-based essentiality ratio as compared to the declaration-based one. The values for CATT and ZTE show much larger decline, but these should be taken only as a guide because the number of registered patents evaluated is small. In contrast, ETRI's registration-based essentiality ratio shows an increase, but it also should be taken only as a guide because the total number of evaluated patents is small.

LG and NTT DOCOMO are remarkable in the sense that, based on the evaluation of a sufficient number of patents (more than 50), their registration-based essentiality ratios are high, with marginal decline from the declaration-based essentiality ratios. TI, InnovativeSonic, and Siemens show similar characteristics, but these should be taken only as guides because they are based on the evaluation of a smaller number of patents.

Table 2 - Essentiality ratio of declaring companies

Declaring Company	Essentiality Ratio (%)		Declaring Company	Essentiality Ratio (%)	
	Declaration-based	Registration-based		Declaration-based	Registration-based
Qualcomm	52.6	48.5	Panasonic	51.3	49.3
Samsung	43.7	35.7	NEC	70.3	63.3
Huawei	45.3	45.3	Apple	31.8	32.6
Nokia Corp	58.9	48.6	Alcatel-Lucent	34.1	38.9
InterDigital	50.5	49.3	ETRI	56.3	69.2
Ericsson	51.5	44.3	HTC	67.9	55.6
ZTE	82.1	68.8	InnovativeSonic	81.4	80.0
LG	73.2	74.6	RIM	58.8	50.0
Motorola	41.9	35.7	Siemens	72.7	72.7
CATT	82.6	50.0	Nortel	40.0	42.1
NTT DOCOMO	83.2	80.0	Sony	53.8	53.8
Sharp	45.0	45.3	Freescale	38.5	30.0
TI	70.0	72.2	IPR Licensing	41.7	41.7
Nokia Siemens	60.6	59.1	General Dynamics	70.0	70.0

3 Estimation of the gross number 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 (shown in Figure 1) by the essentiality ratio (shown in Figure 12).

Figure 13 shows the result. For companies with less than 5 patents evaluated, the essentiality ratio of 53.8%, the average of ratios for all the other companies, is applied to avoid the estimation based on unreliable values.

Top three companies are Qualcomm, Huawei, and ZTE, which all have a large number of declared patents. When compared with the previous survey, ZTE moves up in the ranking from 6th position to 3rd, leveraging its large number of patents, and LG moves up from 9th position to 5th, leveraging its higher essentiality ratio.

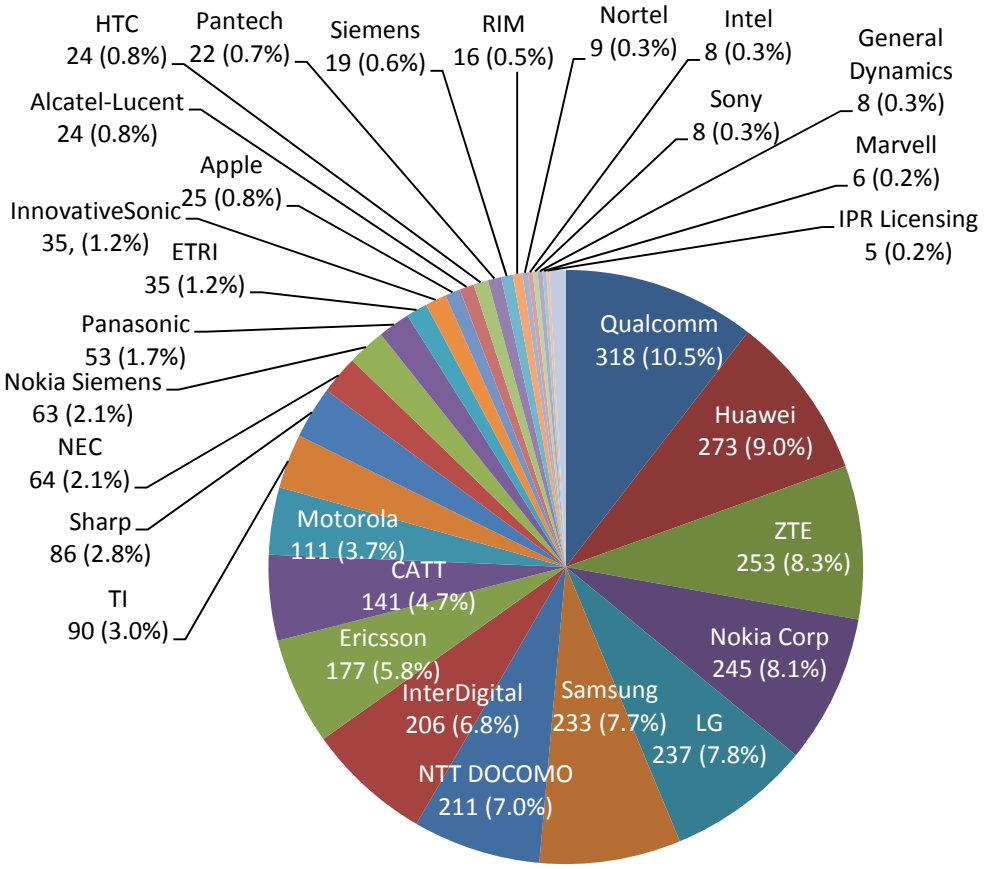


Figure 13 - Estimated number of essential patents

3. Estimation of the gross numbers of essential patents

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

(i) Qualcomm

Qualcomm has the largest number of declared patents. It has continuously made declarations from as early as 2007 up to 2012. The company's essentiality ratio stays around the average level. As a result, Qualcomm secures the 1st place in the essential patent ranking. This suggests that Qualcomm has been allocating significant resources for analyzing its own patents and actively declaring patents that exceeds reasonable criteria. It is foreseen that their declarations will further increase in the future. Keeping pace with the company's globalization efforts, Qualcomm is likely to hold a lot of essential patents in many countries.

(ii) Huawei

Huawei holds a large number of declared patents by declaring many patents in 2011 and with continued declarations in 2012. Its registration-based essentiality ratio is close to the average. Huawei assumes the 2nd place in the estimated number of essential patents. Observing that its registration-based essentiality ratio does not decline from the declaration-based one, the company is likely to hold high quality patents for the future.

(iii) ZTE

ZTE declared its patents, filed after 2006, in 2010, in a lump. The company has been declaring patents in 2011 and 2012, and is likely to continue its declarations. ZTE's characteristic point is that the company amends its patent claims in accordance to the standard specifications thus leading to successful registrations. As the result, its registration-based essentiality ratio is high. Therefore, the company assumes higher ranking (3rd place) in the estimated number of essential patents than its 7th place in the number of declarations. ZTE is one of the significant companies with strong IPR power.

(iv) Nokia

Nokia has continued its patent declarations from 2006 till 2011. Application dates rages 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 likely to hold a number of essential patents in many countries.

(v) LG

LG declared its patents, filed between 1998 and 2011, in 2009, 2011, and 2012. It has actively been declaring patents including relatively recently filed ones. Its high registration-based essentiality ratio suggests that they have made declarations based on relatively strict internal evaluations on their patents. LG is one of the companies with strong IPR power.

(vi) Samsung

Samsung started making its declarations after 2008 for patents filed mainly after 2005. The company declared many patents in 2011 that resulted in a very large number of declarations. It continued its declarations into 2012. Because its patents are new, its registration ratio is still low and its essentiality ratio is lower than the average. In spite of this fact, because the number of declared patents is large, the estimated number of essential patents is relatively large (6th place). Their policy of actively making declarations is evident but there is a chance that the sheer number of essential patents may not increase significantly, depending on the results of future patent examinations.

(vii) NTT DOCOMO

NTT DOCOMO made declarations in 2009 and 2010 for its patent applications filed after 2005. The company has continued its activity into 2011 and 2012. The ratio of registered patents is high despite their being newer applications, and its essentiality ratio is very high. As a result, NTT DOCOMO possesses a relatively high number of estimated essential patents (7th place) when compared with the ranking in the declaration number (11th place). It means that NTT DOCOMO is one of the companies with strong IPR power.

(viii) InterDigital

InterDigital shows a characteristic similar to Qualcomm. However, both registration ratio and essentiality ratio are lower than Qualcomm and there are cases that declared patents were rejected in examinations. Hence, the number of essential patent may not increase as can be seen with Qualcomm. Among the major companies, InterDigital is the only one company that did not made any declaration in 2012 despite the company had continuously made declarations until 2011. There is the possibility that its patent declarations are saturating.

(ix) Ericsson

Ericsson has continuously made declarations from 2009 till 2012. The registration ratio and essentiality ratio are both at the average level. Application years rage from around 1990 to the present time, but it is on a downward trend after its peak in 2007. There is unlikely that the number of declarations increases significantly in the future.

(x) CATT

CATT declared its patents, filed between 2006 and 2010, in 2011 in a lump, and none in 2012. Most patents were originally filed by Da Tang Mobile or SHANGHAI ULTIMATE POWER. Its declaration-based essentiality ratio is very high (over 80%), but those patents are mostly non-registered patents filed after LTE standardization. We should observe the effect of future examinations of those patents.

(xi) Motorola

Motorola declared its patents, filed between 1990 and 2007, in 2010 in a lump and none 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. It resumed its declarations in 2012, but the number of applications has been declining from its peak in 2009. Its number of declarations would not increase significantly for the future.

(xii) Apple

Apple has declared nearly 70 patents (1.1% of the total), filed between 1996 and 2009. Most of them are the patents that were obtained from Nortel. Some of them were originally declared by Nortel. Including the ones that were re-declared, Apple is deemed to have made its first declarations in 2012. Its declaration-based essentiality ratio is at the lowest level (31.8%). Apple's IPR power does not seem strong, at least at present.

(xiii) General Dynamics

General Dynamics made declarations for the first time in 2012. All patents had been obtained from IP Wireless. The number of patents is small, but its essentiality ratio is relatively high (70%). Comparing to Apple, it seems that General Dynamics has been declaring patents after sufficient internal examination. It seems that the company has considerable IPR power.

4 Summary

The main results of this survey are as follows:

i) The original list of patents declared to ETSI was obtained from the ETSI website. By sorting them based on patent families, a total of 5,919 patents have been identified as the subjects for this study. This is the effective number of declared patents. The number of companies that have made declarations is 49.

ii) The number of declared patens for each company are as follows:
Qualcomm has the largest number of declared patents (655, 11.1%) and is followed by Samsung (652, 11.0%), Huawei (603, 10.2%), Nokia (505, 8.5%), InterDigital (418, 7.1%), Ericsson (399, 6.7%), ZTE (368, 6.2%), and LG(317, 5.4%). 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 have been filed after 2005, when LTE standardization work began. In particular, the applications filed between 2006 and 2010 are dominant, and the declarations of the applications filed between 1999 and 2004 are also significant. Some companies have made declarations for the patents filed in 2011. (especially Huawei and InterDigital)

iv) Three types of companies have been identified, 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 began), and c) those who have declared patents filed earlier years, but not after 2005.

v) The countries, where the applications have been filed with, have been surveyed. Qualcomm, Nokia, InterDigital, Ericsson, and Motorola have been filing their applications with various countries in the world. Japanese and Korean companies have also been filing their applications evenly among BRICs and other countries.

vi) Sample patents have been extracted from the list for evaluation. Average essentiality ratios are identified to be 56.0% for declaration-based evaluation and 51.5% for registration-based evaluation. With regard to registration-based essentiality evaluation, LG, NTT DOCOMO, TI, and InnovativeSonic shows high essentiality ratios while possessing a large number of registered patents.

vii) Legal statuses of evaluated patents in respective application countries have been studied. The results show that Siemens, Sony, IPR Licensing, and General Dynamics show the highest registration ratio of 100%, and Apple and Nortel also show high ratios of over 95%. In contrast, CATT and ZTE show low ratios of around 10% and 15%, respectively, reflecting the fact that patent examinations have not progressed well.

viii) The gross numbers of essential patents have been estimated by multiplying the derived essentiality ratios by the entire number of declared patents. Qualcomm is estimated to have the largest number of essential patents (318), followed by Huawei (273), ZTE (253), Nokia (245), LG (237), Samsung (233), NTT DOCOMO (211), InterDigital (206), Ericsson (177), CATT (141), and Motorola (111).

References

1) List of essential, or potentially essential IPRs notified to ETSI
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