

Landscaping standard-essential patents

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Standard-essential patents are increasingly the subject of lively debate among market observers. Yet little is known about the overall number and occurrence of SEPs and whether they are worth all the fuss

Standardised technologies such as LTE, Wifi, radio frequency identification (RFID), near field communication (NFC) or high-efficiency video coding (HEVC) and are incorporated into many of today's pioneering products. Standards specify a common language that allows different systems or products to work together. Standardised technologies often describe an innovative solution – for example, enabling fast and efficient communication between a smartphone and a satellite. Patents that would necessarily be infringed by any implementation of the standard are known as 'standard essential'. Many standards that are subject to standard-essential patents (SEPs) are implemented by entire industries, which means that licensing them results in lucrative royalty income for rights holders.

While most debates around SEPs focus on the amount of royalties, the definition of licensing terms or the outcome of infringement cases, until now no study has quantified and analysed the existence of SEPs themselves. This article uses data on over 200,000 patents declared as standard essential by the following major standard-setting organisations (SSOs):

- the Advanced Television Systems Committee;
- the Alliance for Telecommunications Industry Solutions;
- the American National Standards Institute;
- the BluRay Disc Association;
- the Broadband Forum;
- the DVD Forum;
- the European Committee for Standardisation;
- the European Telecommunications Standards Institute;
- the International Electrotechnical Commission;
- the Institute of Electrical and Electronics Engineers;
- the Internet Engineering Taskforce;
- the International Organisation for Standardisation;
- the ITU Radiocommunication Standardisation Sector;
- the ITU Telecommunication Standardisation Sector;
- the Open Mobile Alliance;
- the Organisation for the Advancement of Structured Information Standards;
- the Society of Motion Picture and Television Engineers;
- the Telecommunications Industry Association; and

- the Worldwide Web Consortium.

All of these SSOs have a formal IP policy and are required to publicly disclose SEPs. They also hold lists of patent declaration letters, which set out information on the patent being claimed as essential for a particular standard, the licensing terms and conditions, information on the declaring company and the date of declaration. This article connects this data to bibliographic information on patents and standards documents, as well as to information on litigation or licensing agreements, to illustrate trends across time, technology and litigation, as well as on licensing terms, ownership distributions and patent bibliographic characteristics. In the course of the analysis, applied data on patents and standards was cleaned and harmonised (source: iplytics.com). However, the empirical investigation makes no attempt to verify the accuracy of the declaration in a legal sense – a declaration that a patent is essential is based on the assessment of the declaring rights holders only. All companies that contribute to standard-setting activities are obliged to declare whether they own patents that are potentially standard essential. By declaring that a patent is standard essential, the rights holders commits to license it under particular terms (eg, fair, reasonable and non-discriminatory (FRAND) terms).

The article investigates several statistics and characteristics of declared SEPs. First, it analyses recent trends with regard to the declaration of SEPs. It then compares patent characteristics, such as the average frequency of patent lapse, the frequency of reassignments and the frequency of litigation; as well as bibliographic statistics such as the number of forward citations, backward citations, patent family size, patent claim count, inventor count and distribution of SEPs in international patent classifications (IPCs). In the course of the analysis, it uses a control group of comparable patents (patents published in the same year, in the same IPC class and in the same country) to benchmark the results. It further illustrates the occurrence of declared SEPs licensing terms, conditions and contracts. Finally, it looks at owners of SEPs by comparing portfolio sizes, as well as portfolio characteristics, patent forward citations, family size, standard relevance and litigation frequency. In evaluating a portfolio's relevance for a standard, it uses indicators such as the average number of prior art citations of standards documents and the number of citations that a declared SEPs receives from other declared SEPs. The article concludes by discussing the results and by identifying an action plan for IP professionals at patent-owning companies where standardised technologies matter.

Ensuring the interoperability of different products or systems can often unlock the potential of innovative applications

Two decades of SEPs

Due to the increasing interconnection not only of devices such as notebooks, smartphones and smart watches, but also of manufacturing machines, cars and households, standardised technologies have increased dramatically in importance. Ensuring the interoperability of different products or systems can often unlock the potential of innovative applications. Although the need for interoperability is not a recent requirement, the last two decades have seen standard setting evolve from the mere coordination of common specifications to the joint development of complex technology platforms. Many of today's standards describe state-of-the-art innovations which are constantly updated and renewed. Having patents incorporated into a standard is a practice which can recoup a company's investments in standard-setting activities. Standardised technologies are increasingly subject to patents that claim an invention which would necessarily be infringed by any company producing products complying with the standard. Figure 1 illustrates the number of declared SEPs, as well as the

number of lawsuits subject to declared SEPs over time. From the early 1990s until the early 2000s the number of SEP declarations has been steadily increasing. During that time most standards being declared essential were in the field of audiovisual technologies (eg, MP3, DVB, DVD or AVC). In the late 2000s, the number of SEPs rose sharply due to patent-dense standard projects such as Wifi, Worldwide Interoperability for Microwave Access (WiMax), NFC, RFID and Universal Mobile Telecommunications System (UMTS). Peaks in 2009 and 2014 corresponded to the release of new generations of digital telecommunication technologies such as LTE and LTE-advance (4G). The success of these new standard generations implemented in worldwide devices also had a noticeable effect on the number of disputes. Since the mid-2000s the amount of litigation relating to SEPs has increased dramatically. Widely debated cases such as *Motorola v Microsoft* and *Apple v Samsung* demonstrate not only that cases involving SEPs are more frequent, but also that the length and size of the disputes have increased. The fact that two parties are willing to fight in court for several years reflects the growing financial impact of declared SEPs.

Figure 1. Number of declared and litigated SEPs by date of public declaration

Figure 2 shows the number of declared SEPs against the office of patent applications. In the early 1990s most declared SEPs were filed in the United States, Europe and Japan. However, since the early 2000s the Chinese, Korean and Taiwanese markets have been increasing in size and activity, while the number of declared SEPs in Germany, Japan and the United States has been falling. This development reflects the increasing importance of the Asian markets for recently standardised technologies. China has opened up its markets by accepting international standards, while Chinese rights holders increasingly contribute to the international standardisation scene (eg, Huawei Technology, ZTE Corp and Datang Mobile Communications).

Figure 2. Number of declared SEPs by patent office

[Standards-essential patents] can be extremely lucrative in terms of royalty income, but also in terms of being strong bargaining chips in cross-licensing negotiations

Are SEPs different?

SEPs can be extremely lucrative in terms of royalty income, but also in terms of being strong bargaining chips in cross-licensing negotiations. SEPs are by definition essential for an often widely accepted standardised technology and thus may be infringed by entire industries. However, rights holders are obliged to commit to licensing declared SEPs under FRAND conditions, which caps royalty rates. Are declared SEPs thus more or less valuable than other patents? To test characteristics of declared SEPs, I created control groups of patents that have not been declared standard essential, but which were filed at the same patent office in the same publication year and which were categorised in the same main IPC classes as each declared SEP. I calculated mean values for several SEP characteristics and compared these to those of the control group.

Figure 3 shows that declared SEPs have on average lapsed in about 67% of cases, whereas patents in the control group have lapsed in over 76% of the cases. Dropping a patent indicates that the rights holder no longer perceives any value in the patented technology. The analysis confirms that patent holders keep declared SEPs alive more frequently and are more likely to keep paying expensive maintenance fees.

Figure 3. Comparing characteristics of SEPs with a control group

The market for patents has been increasing over the last few years as new internet companies such as Google, Twitter and Facebook have actively acquired SEPs. More than 12% of all SEPs have been transferred at least once; for the control group, this is the case for only about 9% of patents. Buying SEPs may be a way to enter new markets (eg, Google bought the Motorola Mobility portfolio in order to enter the smartphone sector).

The results of the litigation analysis confirm that declared SEPs are subject to litigation much more frequently than the control group. Almost 2% of all declared SEPs have been litigated at least once, while patents in the control group have been litigated in only 0.45% of cases. The results not only suggest that SEPs may constitute a good bargaining chip in litigation, but also indicate sectors in which SEP matters are highly competitive (eg, the smartphone market).

I further compared the patent bibliographic characteristics (eg, the number of citations, families, claims or inventors) of declared SEPs with the control group. Declared SEPs receive on average almost four citations by other patents, not counting self-citations. Patents in the same year, country and IPC control group receive only about three forward citations on average. Patent citations are reviewed and verified by objective and qualified patent examiners. Statistical studies have proved that receiving frequent citations of prior art is an indicator of patent value. In this regard, declared SEPs appear more relevant compared to other patents.

Backward citations are those that a patent must cite as prior art. The more prior art patents cited, the more technologies use that invention. Backward citations may thus reflect how radical an invention is. Following this interpretation, declared SEPs are on average more radical than other patents.

The family size – counted by a patent's International Patent Documentation family ID – reflects the number of patents that can be associated with the same priority invention. The more families, the more markets are protected for the invention and the wider its legal strength. Since patent examination fees and maintenance fees result in considerable costs for the applicant at each patent office, counting the family size may reflect not only legal market coverage, but also the value that the rights holder places on a particular patent. The family size of declared SEPs is almost twice as large as that for patents in the control group. The results confirm that declared SEPs have a wider market coverage and thus a higher perceived market value.

The average number of claims reveals the legal breadth of a patent, which is on average higher for declared SEPs compared to the control group. As for the average number of inventors, assignees or distinct IPC classes, the average values are closely related and differences are negligible.

Overall, declared SEPs appear to be more valuable and relevant than other patents. However, this analysis is limited to the extent that the results do not differentiate an intrinsic or induced value of declared SEPs. In other words, it is uncertain whether declared SEPs are more valuable and therefore declared essential for a standard, or whether these patents become more valuable only after being declared standard essential.

Table 1. Comparing bibliographic characteristics of SEPs with a control group

	Declared SEPs	Control group
Average forward citations	3.93	2.88
Average backward citations	6.12	7.76
Average family size	27.93	16.11
Average number of claims	20.89	17.79
Average number of inventors	2.70	2.50
Average number of assignees	1.19	1.25
Average number of distinct IPC sub-classes	1.21	1.22

Rights holders commit to license SEPs under certain conditions. Each SSO has a different IP policy and in some cases the declarant chooses between different licensing options. Rights holders may also create patent pools to license all patents that are essential for a particular standard under a single contract. These one-stop shops allow licensees to contact a single entity for a licence contract. While many economists suggest that licensing through patent pools is more efficient in terms of transaction costs and double marginalisation effects, 91% of declared SEPs are licensed individually rather than through a patent pool. Rights holders that include their patents in a patent pool commit to license these patents under a maximum price. While the rights holder has an opt-out possibility if the offered royalty is lower than the pool price, higher pricing outside the pool is prohibited. This is one reason why rights holders shy away from pools – they fear losing leverage when negotiating cross-licensing agreements for other technologies. Another reason why many patent pool initiatives have failed in the past is that a pool licence must integrate the business interests of multiple players (eg, upstream and downstream manufacturers, as well as telecommunications network providers, universities, research organisations, non-practising entities and privateers). Securing the agreement of all of these players to one single contract is extremely difficult, which could be one reason why only 9% of declared SEPs are pooled.

The most common framework under which SEPs are licensed is FRAND. Licensing terms under FRAND must be fair – no bundling and no grant-backs – reasonable and non-discriminatory. In particular, the term ‘reasonable’ has been subject to many disputes and even litigation. Despite this, most market observers still see FRAND as the best basis on which to set royalty rates and 68% of all declared SEPs are licensed under FRAND.

In some SSOs the rights holder can state that it is not prepared to license essential patents, provided that it did not commit to license and thus did not participate in the standard-setting process. This was the case for only 11% of declared SEPs.

Reciprocity rules describe the possibility of cross-licensing SEPs for a particular standard. Sixty-five percent of the declared SEPs agree to such reciprocity rules, allowing for the cross-licensing of patents which are relevant for the same standard.

Figure 4. SEP licensing terms, conditions and policies

Main holders of SEPs

In the following analysis, I counted the number of declared SEPs by rights holder and compared value indicators for each portfolio using the IPlytics Platform tool. Many market observers have claimed that the number of overall declared SEPs is too high, or at least higher than the actual number of patents that are truly essential. SSOs maintain databases of declared SEPs without investigating further whether the patents claim an invention essential for the particular standard. Further, the SSOs do not verify whether the patent has been granted by the patent office or is active, lapsed or expired. Thus, I created several value measures to estimate the declared SEP portfolio of each rights holder. First I calculated the age of the portfolio, as well as the share of active patents that have not yet expired or have not lapsed (eg, for failure to pay maintenance fees).

The portfolio age illustrates which companies have patented standardised technologies more recently and which companies have been active for several years. The portfolios of companies such as Philips, Siemens, Hitachi and NTT are comparatively old, while companies such as Datang Mobile Communications, ZTE and Huawei own patents that have been filed quite recently. The analysis reflects a shift from US, Japanese and European rights holders to Chinese, Korean and Taiwanese rights holders. The share of active patents is surprisingly high for most of the top rights holders and negatively correlates to the portfolio's age.

Table 2. Top 30 holders of declared SEPs

In order to measure the value of the patent portfolios, I used IPlytics Platform to calculate bibliographic valuation indicators. First I measured a patent's market coverage by calculating the normalised number of patent family counterparts for worldwide patent offices. The market coverage indicator helps to benchmark a patent portfolio in terms of geographical coverage and perceived patent value. Most of the declared SEP portfolios have a market coverage value above one, which is above the average for patents in the same IPC, same publication year and same country. While most portfolios have a similar score, the strongest portfolios in terms of market coverage are owned by LG, Huawei, Panasonic and Sharp. I further measured the technical relevance value of the patent portfolio by calculating the normalised number of patent forward citations. A higher value reflects a higher relevance within a technology space. Again, values above one are above the industry, year and country average. As to this indicator, the strongest portfolios are owned by the Rockstar Consortium, Datang Mobile Communications, ZTE and Texas Instruments.

In order to quantify the relation of declared SEP portfolios to standardised technologies, I used IPlytics Platform to calculate three measures. The first of these is standard related non-patent literature citations, which count if a declared SEP cites at least one standard document as prior art. I only counted citations of standards that relate to the declaration. This is the case where a patent that has been declared as standard essential either cites former versions of the same standard as prior art or cites documents that can be assigned to the same standards project. This citation count measures the relation of the declared SEP to the standardised technology. Overall, the share of declared SEPs citing standard documents is high, with the portfolios of Innovative Sonic, Google and Sharp having the highest shares of citing relevant standards documents. However, this measure is not normalised by patent office or publication year and thus may also be subject to different practices of prior art search. For example, the European Patent Office (EPO) introduced a new policy in 2009 whereby examiners gained access to documents such as standard drafts, standard documents and standard-setting meeting

minutes to better search for prior art publications. Patents filed after 2009 at the EPO may thus more likely cite standards documents.

The second measure counts the number of citations received by declared SEPs, while discounting self-citations. This measure reflects whether other owners of declared SEPs have cited the declared portfolio. The more citations a portfolio receives, the more relevant it appears to other standard-setting companies. Companies owning patent portfolios with the highest declared SEP citation shares include Qualcomm, Nokia, Interdigital and Samsung. However, patent documents which cite a patent are usually at least 12 months newer than the cited patent itself – this is due to a lag in publishing filed applications. Thus, patents that are filed around the same time will rarely cite one another. The measure may reflect the technical relevance of a patent portfolio for later generations (eg, patents that were relevant for UMTS are nowadays cited as being relevant for LTE). In fact, the top four companies mentioned above have contributed to early standard-setting activities for the Global System for Mobile Communications and UMTS, while other rights holders joined the standard-setting process only in later generations (eg, LTE) of standard-setting activities.

The third measure counts the number of declared SEPs that have been subject to litigation. Interdigital, Qualcomm, Nokia and Samsung have the highest litigation frequency of declared SEPs. A company that publicly declares a patent to be standard essential and then asserts it in court may be confident of its essentiality. However, this count also reflects a company's enforcement strategy and may thus be biased by differences in business models.

Declared [standards-essential patents] are cited more often, are subject to larger patent families, are transferred more often and are litigated more frequently

Interplay of patents and standards

The overall results of the declared SEP landscaping analysis shows that the significance of the interplay between patents and standards is still rising. Declared SEPs are cited more often, are subject to larger patent families, are transferred more often and are litigated more frequently. The number of SEP declarations – as well as the number of lawsuits that are subject to declared SEPs – has been steadily increasing. The analysis further confirms that declared SEP portfolios are by and large still active and valid. Most of the declared SEPs either cite the relevant standards projects as prior art or are cited by other declared SEPs. Both measures confirm that declared SEPs have a close technical relationship with the respective standardised technology. However, it is not yet possible to verify whether this relationship constitutes standard essentiality.

Figure 5. Patents referencing standard documents as prior art over time

While SEPs constitute a specific case, the number of patents relevant for standards is far higher. In order to quantify the number of patents relating to standards, I therefore counted all patents that cite standards documents as prior art. Figure 5 charts the number of standards citing patents by publication date over time. The number of patents that reference at least one standard document has been constantly increasing since the early 1990s and has reached a level of around 42,000 patent publications per year, an apt illustration of the urgency of reaching a better understanding of this landscape.

Action plan

The interplay between patents and standards is higher on the agenda than ever before. Senior managers and directors at patent-owning businesses which are active in fields where standards matter, or will matter in the future, should bear some key considerations in mind:

- Future technologies such as Internet of Things, smart cars, smart home and smart energy will increasingly rely on patented technology standards such as LTE, Wifi, NFC, RFID and Bluetooth.
- The number of declared SEPs is constantly increasing. IP directors should consider royalty costs for products that comply with technology standards.
- Not only has the number of declared SEPs been increasing, but so too have the number and diversity of rights holders. This is reflected in the increasing geographical variety of rights holders, as well as the increasing variety of business models. IP directors should conduct foresight screenings on the existence of relevant SEPs to identify possible licensing costs or legal problems at an early stage. The risk potential for the launch of new technologies or products can thus be quantified and valued during the early stages.
- While litigation around declared SEPs is rising, the market for declared SEPs has evolved in recent years. Senior managers should bear in mind that buying SEPs may be a way to enter new markets. SEPs may be good bargaining chips in licensing negotiations, which could avoid costly court disputes.
- The results of the analysis suggest that companies should pursue a common strategy for patenting and standardisation in order to ensure that they are aware of the existence of SEPs and are exploiting patented inventions in technology fields where standards matter.

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