



## Empirical study on patenting and standardization activities at IEEE

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## 1. Introduction and Executive Summary

Technical standardization can involve the integration of hundreds, thousands or even tens of thousands of technologies, many of which are protected by patents. Such “standard essential patents” (SEPs) are subject to a variety of unique contract and competition law issues and considerations. To support access to and use of standards, and to restrict abuses, many standards-setting organizations (SSOs) require that participants submit binding declarations to offer licenses to their SEPs on “fair reasonable and non-discriminatory” (FRAND) terms.

This study evaluates standard essential patents (SEPs) publicly declared at IEEE, and evaluates activities at IEEE since March 2015, when the IEEE adopted certain updates to its Patent Policy. Based on the publicly available information regarding SEP declarations to IEEE, the IEEE’s standard document publications, and other information concerning IEEE’s standard setting activities we derived the following conclusions.

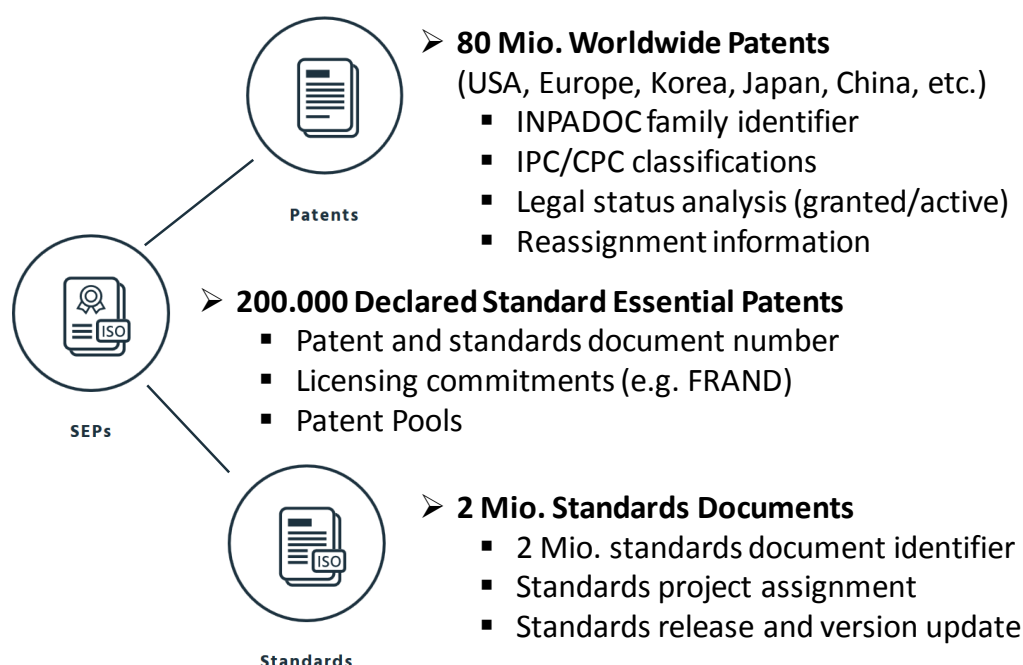
- Technical contributions to IEEE come from a wide variety of companies, the majority of whom utilize blanket declarations, making “patent counting” a particularly poor methodology of assessing IEEE technical contributions;
- IEEE’s receipt of patent declarations since March 2015 are largely in line with historical precedent, and indicate a particularly active declaration process shortly after completion of the Patent Policy updates (*i.e.*, there were a large number of declarations submitted subject to the terms of the new Patent Policy shortly after that policy was adopted);
- Standardization work at IEEE has continued to move forward in line with work levels prior to the IEEE IPR Policy updates; *and*
- New standardization work at IEEE has been at its highest levels ever since the IPR Policy updates were completed.

In short, and while we take no position in connection with the various substantive issues raised by the IEEE Patent Policy updates, the data indicates that contributions to IEEE standards, and technical work within IEEE working groups, continues apace.

## 2. Data Sources and Methodology

The data utilized in this study was derived primarily from the IPlytics Platform database, and was collected and analyzed by the IPlytics management and staff who created, maintain and manage that database.

The IPlytics Platform is a widely-used IP analysis tool helping companies making the right decisions by providing actionable and trustworthy insights on relevant IP assets. IPlytics integrates data on over 80 million worldwide patents, 2 million standards documents, 200k declared standard essential patents and over 20 data points of per-company information. The IPlytics Platform connects worldwide declared SEPs with worldwide patent and worldwide standards data as set forth in the following figure 1.



**Figure 1:** IPlytics Platform data match

To manage this extensive database and ensure that its information remains accurate, IPlytics cleans and standardizes the information provided in declaration statements submitted to SSOs.<sup>1</sup> The analysis performed by IPlytics for counting declared SEPs follows a sophisticated method that has been discussed and validated with some of the most prominent economists on the topic of patents and standards data. An article

<sup>1</sup> Neither IPlytics nor the underlying SSOs endeavor to verify the accuracy of the essentiality declaration itself; in other words, the patent owner's unilateral belief and statement that the relevant patent is essential has not been verified. Several studies indicate that only 20-28% of patent families declared essential to various SSOs were actually, upon independent examination, likely to be essential. In other words, the IPlytics database captures information about SEP licensing declarations, but it cannot be assumed that patents are essential based solely on the patent owner's submission of such a declaration.

describing in detail the matching methods used by IPlytics has already been presented, discussed, reviewed and validated at one of the most important conferences on patent and standards data: “Fourth Annual Research Roundtable on Technology Standards” Chicago, 2016.<sup>2</sup> In early 2017, this article on the data and matching methods will be published in a highly cited and well known peer reviewed journal called JEMS (Journal of Economics and Management Science).

The IPlytics Platform database uses the “extended” INPADOC patent family definition: “An ‘extended’ (INPADOC) patent family retrieves all the documents directly or indirectly linked to one specific priority document.” In the case shown below, documents D1 to D5 belong to the same patent family, P1. As a rule, national application numbers, international application numbers and domestic relations (e.g. divisional applications, continuations and continuations in part, etc.) are included in the family search. (Table 1).

Patent Document	Connected Priority Documents		
<b>Document D1</b>	Priority P1		
<b>Document D2</b>	Priority P1	Priority P2	
<b>Document D3</b>	Priority P1	Priority P2	
<b>Document D4</b>		Priority P2	Priority P3
<b>Document D5</b>			Priority P3

**Table 1.** INPADOC patent family identification

One challenge in building a reliable database is the need to harmonize company names, since some companies (e.g., Nokia) are using thousands of different applicant name variations, and furthermore applicant names are often subject to typos or misspellings (e.g. Nkia, Noika or Nokiaa). Public patent databases only provide original applicant names and do not offer any standardized or harmonized company name field. As such, simply searching for standardized company names, e.g., “NOKIA”, often will lead to incomplete information. This can be especially true for patent applications from Asian patent offices where translation issues may be particularly pronounced.<sup>3</sup> To address

<sup>2</sup> Baron, Justus, and Tim Pohlmann, “Mapping standards to patents using databases of declared standard-essential patents and systems of technological classification.” Searle Center on Law, Regulation and Economic Growth Working Paper (2015) (TP-015).

<sup>3</sup> de Rassenfosse, Gaétan, and Emilio Raiteri. “Technology Protectionism and the Patent System: Strategic Technologies in China.” Available at SSRN (2016).

these significant name harmonization problems, the IPlytics Platform database has been built upon multiple matching and merging methods, verified by scientific research.<sup>4</sup>

There are many additional aspects of the IPlytics Platform that make it unique and a key data source for information about standardization. Further information about the IPlytics Platform is available at <http://www.iplytics.com>.

### 3. Patent Counting, and the Limits of Counting Methodologies

Assessments of contributions to SSOs technical work can be performed using a variety of metrics. For example, researchers might look at the number of Chairmanships or other leadership positions held by company employees, or at technical contribution levels, or at participation levels in working groups. All such methodologies may provide some insight.

Another way to evaluate contribution levels can be to perform a so-called “patent count”. Theoretically, counting the number of declared standard-essential patents held by each participant might provide some insight into which companies are most active in supporting technical development.

But counting SEPs is not always straightforward. First of all, and as noted above, SSOs do *not* independently verify essentiality. A patent owner may have incentives to “over-declare” their patents, meaning that many non-SEPs may be included in SSO declarations. This concern seems to be borne out in practice, as – according to various studies – a large majority of declared SEPs are found to be non-essential when subjected to independent review.

Moreover, many SSOs permit (or even encourage) so-called “blanket” declarations that do not specify provisions concerning the updating of SEP declarations (table 2). In SSOs such as IEEE, parties who own patents subject to a particular standard may either file a specific declaration by disclosing a list of patent numbers relevant for a standard, or file these blanket declarations, whereby the party commits to FRAND licensing for any patents that it may own, rather than limiting its obligations to specific, enumerated patents. Blanket declarations have benefits in that they can capture *all* potentially-

<sup>4</sup> Thoma G., and S. Torrisi, 2007, “Creating Powerful Indicators for Innovation Studies with Approximate Matching Algorithms. A test based on PATSTAT and Amadeus databases,” Paper presented at the Conference on Patent Statistics for Policy Decision Making, October 2-3, 2007, Venice, Italy; Thoma G., S. Torrisi, A. Gambardella, D. Guellec, B. Hall, and D. Harhoff, 2010, “Harmonizing and Combining Large Datasets: An Application to Firm-level Patent and Accounting Data,” NBER Working Paper No. 15851.; Bessen J., 2009, “NBER PDP Project User Documentation: Matching Patent Data to Compustat Firms,” NBER Working Paper, <http://www.nber.org/~jbessen/matchdoc.pdf>.



essential patents that may be owned by a company, whereas declarations that recite specific patents that are known (or believed) by the patent owner to be essential only create obligations as to those specific patents. As such, blanket declarations can be preferable from the perspective of ensuring that as many patents as possible become subject to FRAND obligations.

On the other hand, because blanket declarations do not identify specific patents, they can lead to lower “transparency” around SEP ownership (*i.e.*, who owns which patents or how many) as well as limit information regarding SEP ownership distribution for a standard. In other words, while blanket declarations can provide broader FRAND assurances, they also can limit the accuracy and usefulness of patent-counting.

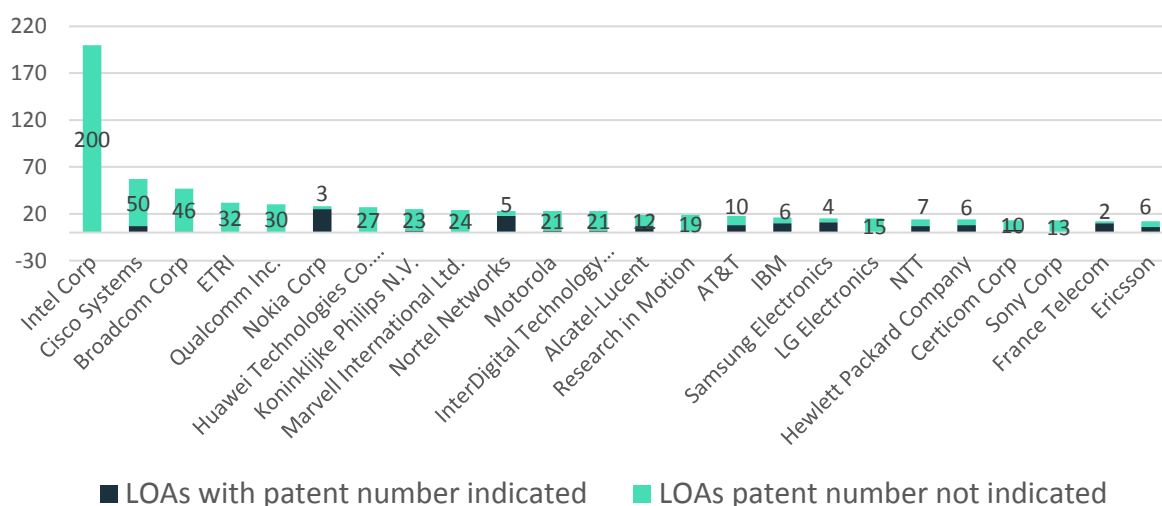
The US litigation case of Motorola (later Google) vs. Microsoft provides a helpful example regarding the challenge of determining SEP ownership for a standard. The court case dealt with the IEEE 802.11 standard. The district court identified ninety-two companies as patent holders for the 802.11 (“Wi-Fi”) wireless local access network standard. Fifty-nine of these companies had filed blanket declarations. To estimate the full scope of SEPs that would likely be essential to the 802.11 standard, the court needed to consider and rely upon expert testimony regarding the patent portfolios of the relevant companies that had submitted blanket declarations. Ultimately, the court found that there are likely thousands of patents declared essential to the 802.11 family of standards<sup>5</sup> and that this number was not fully reflected in IEEE’s data regarding specific patents that had been identified using non-blanket declarations.

#### **4. The IEEE’s Wide Distribution of Patent Contributors Is Not Reflected In “Specific Patent” Declarations**

In view of the above illustrated challenges of counting SEP declaration, this study considers various methodologies for counting SEP declarations to get a better understanding of the true SEP ownership distribution around IEEE standards. In a first step, we count all Letters of Assurance (LOAs) that have been declared at IEEE. As demonstrated in Figure 1, most of the companies with the highest activity at IEEE, such as Intel, Cisco and Broadcom, regularly submit blanket LOAs.

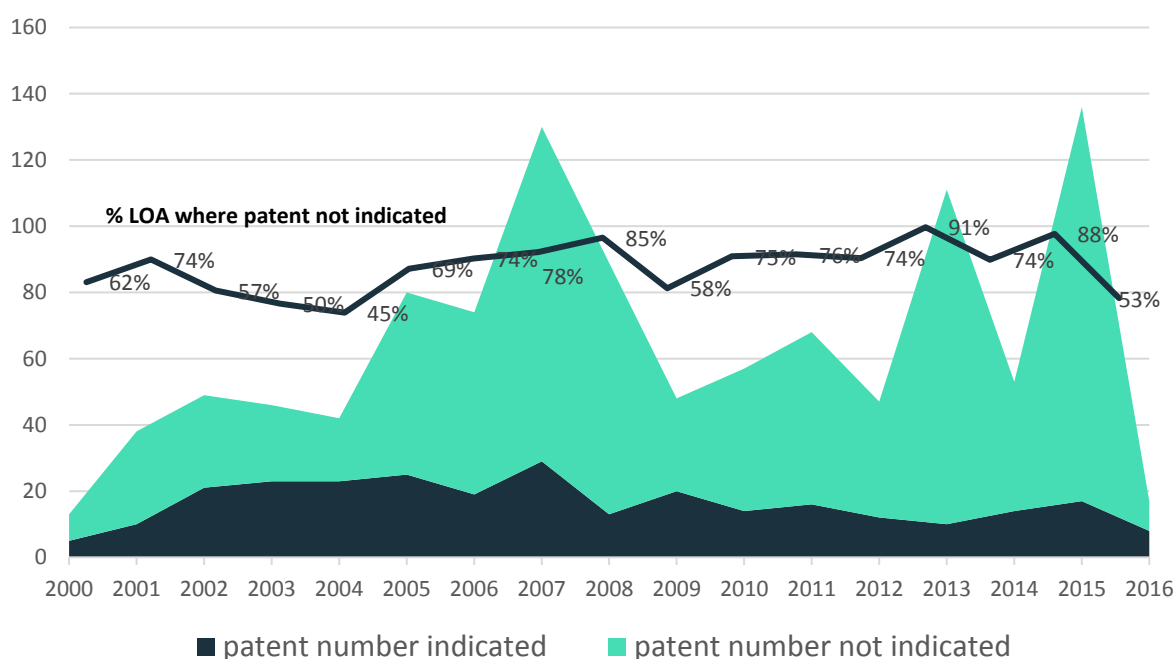
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<sup>5</sup> Microsoft Corp. v. Motorola, Inc., Findings of Fact and Conclusions of Law, 2013 U.S. Dist. LEXIS 60233 at paragraph 335 (W.D. Wash., Apr. 25, 2013).



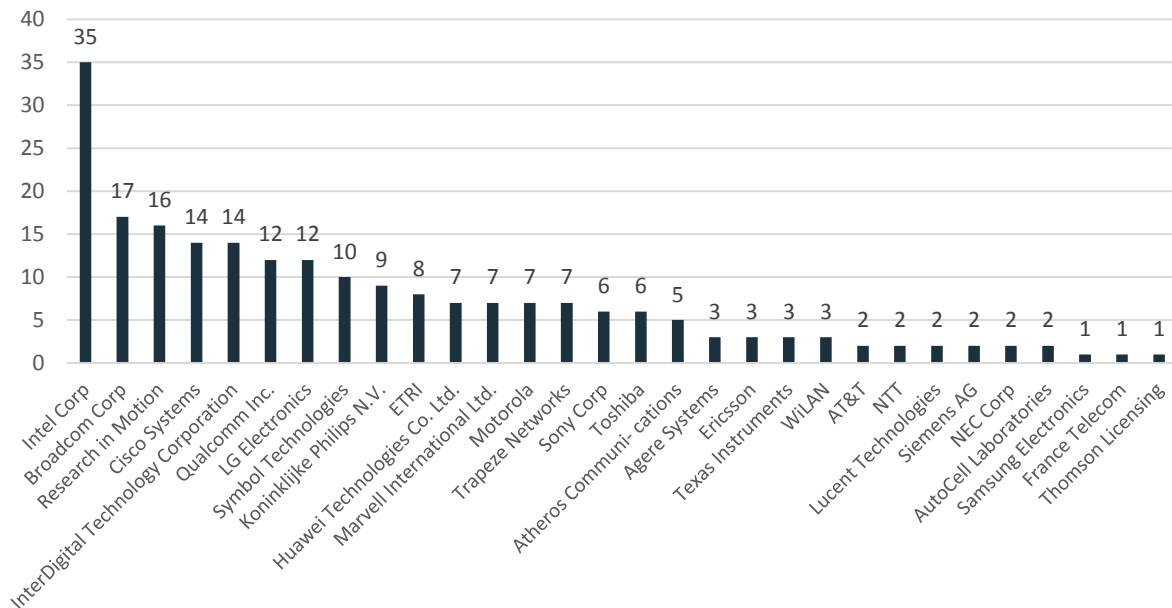
**Figure 2:** Number of blanket vs. specific LOAs submitted by all IEEE declaring companies for all IEEE standards (1992-2016)

This trend is indicative of the general practice at IEEE, whereby a significant majority of participants choose to use blanket declarations.



**Figure 3:** Number of specific and blanked LOAs submitted over time and share of blanked LOAs over time (2000-2016)

The practice of using blanket LOAs is particularly pronounced with the IEEE's 802.11 standard, where – again – most of the prominent contributors all utilize blanket LOAs.



**Figure 4:** Number of submitted blanket LOAs for the IEEE 802.11 (1992-2016)

Note that, for 802.11, there are multiple standards (*e.g.*, 802.11g, 802.11n, 802.11ac), such that companies often will submit separate blanket LOAs covering each successive amendment (*e.g.*, update or new generation) of the standard.

Significant problems will occur when the above realities regarding blanket declaration processes are not accounted for in analyzing SEP ownership distribution. For example, one recent study purports to analyze patent distribution for IEEE standards, based on information contained in our IPlytics database, but without taking into account patents held by companies that use blanket declarations.<sup>6</sup> In this analysis it is asserted that based on information in the IPlytics database, fourteen enumerated companies contributed 45% of all IEEE declared SEPs in 2007-2013. These numbers however do not take into account the widespread practice of utilizing blanket declarations and are thus incongruous with the realities of IEEE patent and technology contributions.

Such analyses are particularly problematic in view of the public information regarding the number of patents applicable to IEEE standards. For example, as noted above, the *Microsoft* court determined that there were thousands of essential patents applicable to the IEEE's 802.11 standard. Likewise, another US court held that there were at least 3,000 patents applicable to 802.11n – just one version of the many iterations of the 802.11 standard.<sup>7</sup> The IEEE has promulgated many hundreds of standards outside 802.11, including, for example, the ubiquitous Ethernet standard. We can probably

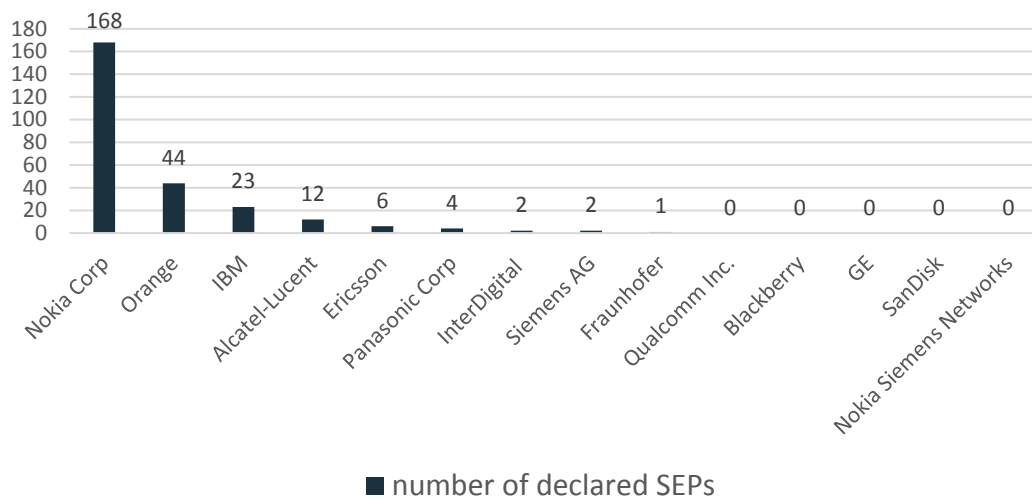
<sup>6</sup> Ron Katznelson, *The IEEE controversial policy on Standard Essential Patents – the empirical record since adoption*, presented at Symposium on Antitrust, Standard Essential Patents, and the Fallacy of the Anticommons Tragedy, Berkeley, CA. (2016).

<sup>7</sup> PUBLIC version of Judge Holderman's RAND determination in *Innovatio Wi-Fi SEP litigation*, By Essential Patent Blog on October 3, 2013



assume without too much risk that the thousands of SEPs relevant to 802.11 are simply a drop in the bucket, and that there are tens or even hundreds of thousands of additional SEPs committed under the IEEE FRAND policy when all of IEEE's various standards are taken into account.

But according to the IEEE's own records, the fourteen referenced companies<sup>8</sup> that allegedly own "45%" of all patents declared to all IEEE standards own – cumulatively – only 262 declared-essential patents.

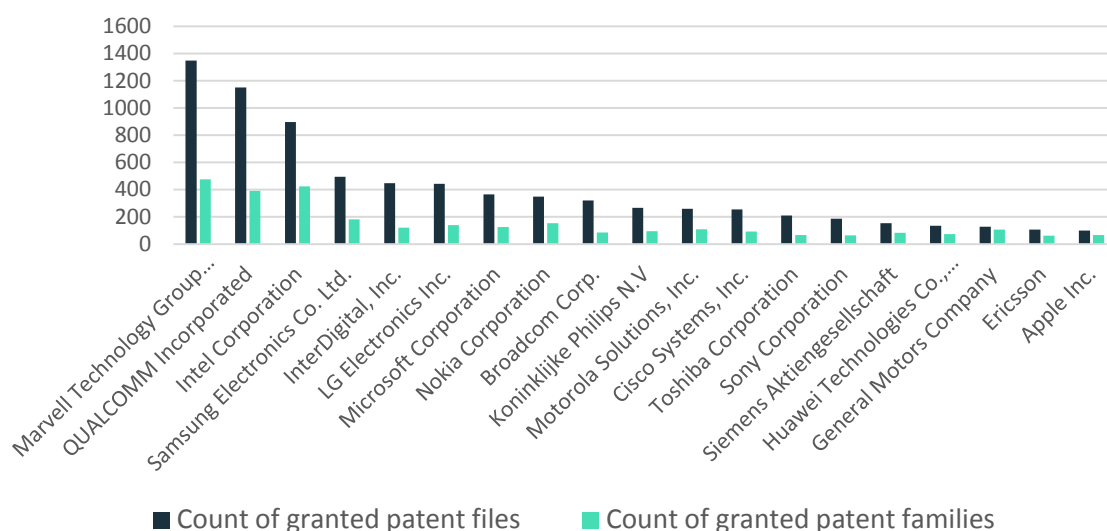


**Figure 5:** Number of specific SEPs declared to IEEE by fourteen referenced companies (1992-2016)

Even assuming that all of those declared standard-essential patents apply to just one IEEE standard – 802.11n – would mean those companies own, at most, a little over 8% of the SEPs relevant to 802.11n (using the assumption of 3000 applicable patents from the US court's findings). In view of these clear facts, suggesting that such companies own 45% of all patents applicable to all IEEE standards is simply incorrect, as it fails to account for a large portion of SEPs committed under applicable blanket declarations. In other words, assessing declared patent counts as representative of SEP ownership for IEEE standards would lead to significant inaccuracies.

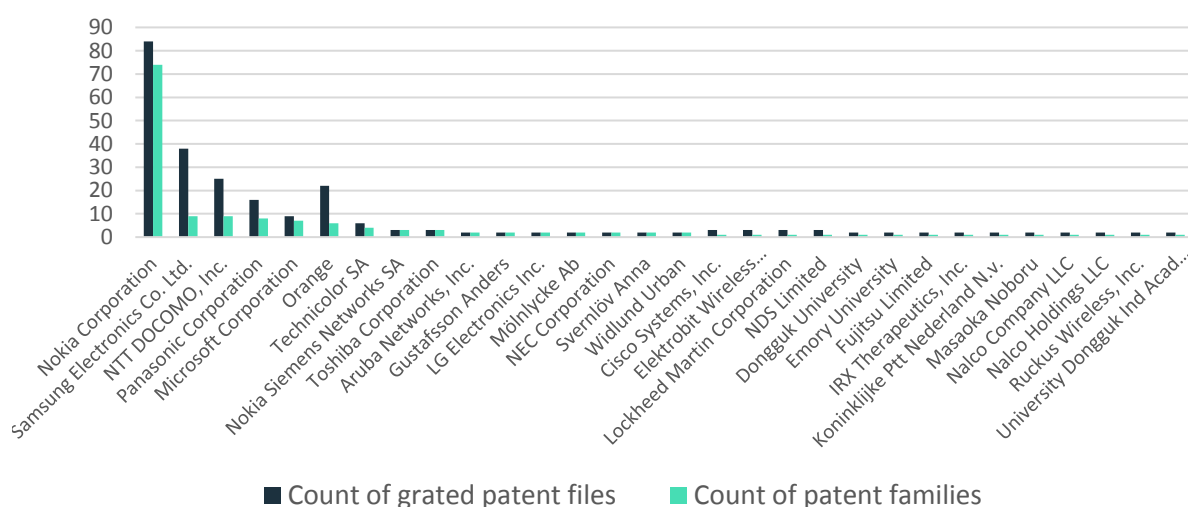
For example, while a patent is not necessarily a SEP merely because its text references a particular standard, an examination of published European patents referencing 802.11 indicates that a variety of companies active at the IEEE are patenting in this area. As Figure 6 indicates, the top 20 companies have filed about 3,000 patent families that reference the IEEE 802.11 standard.

<sup>8</sup> Katznelson, *supra*.



**Figure 6:** Number of EP patents and patent families that reference the IEEE 802.11 standard (1992-2016)

On the other hand, counting only the specifically declared patents (*i.e.*, excluding patents owned by companies that have made blanket declarations) at IEEE relating to 802.11 would tell a different, and inherently misleading, story. Figure 7, in comparison to Figure 6, shows the number of specific declared SEPs with regard to granted patents and patent families.



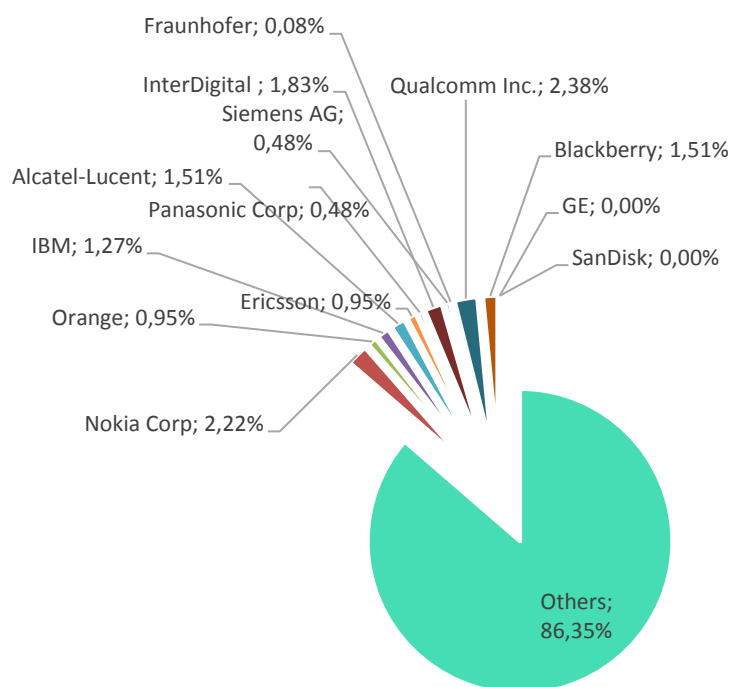
**Figure 7:** Number of specific declared SEPs and SEP families for the IEEE 802.11 standard (1992-2016)

In other words, as indicated in Figure 6, records from the European Patent Office demonstrate that there are thousands of patents that reference the 802.11 standard, and those patents are held by a variety of companies. On the other hand, as demonstrated in Figure 7, the IEEE's databases for specifically-declared patents for 802.11 (*i.e.*, excluding those patents subject to blanket declarations) includes only a few hundred specifically declared patents. Moreover, the top three patent owners for patents

referencing the 802.11 standard, as set forth in Figure 6, are not even listed in the IEEE database of specifically-declared patents, as indicated in Figure 7. Given these facts, suggestions that patent counts limited to patents specifically-identified in IEEE LOAs are somehow indicative of SEP ownership distribution are most likely incorrect, and are based on methodologically flawed approaches.

## 5. Submissions of LOAs to the IEEE Has Continued In-Line With Historical Averages

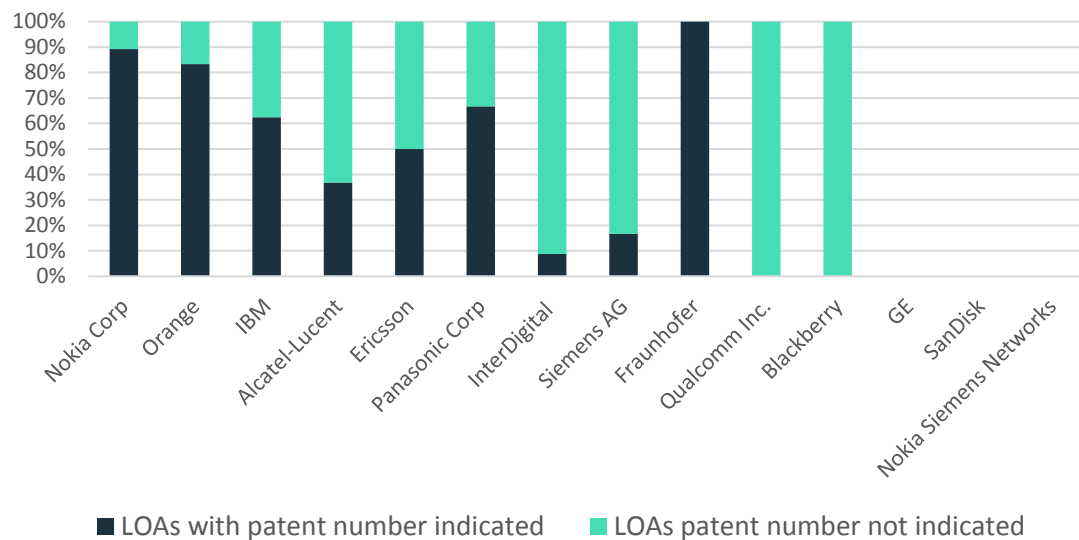
To assess whether there has been a recent decline in IEEE LOA filings, we start by recreating the analysis of the example report that has also used the IPlytics data and that references fourteen companies claiming to be responsible for 36% of all IEEE LOAs from 2007-2013. Figure 8 shows that the data used in the report has used a different counting or cleaning out of counting LOAs. (As noted above, because many IEEE participants use different LOAs for each successive amendment of a standard, casting such LOAs as “duplicate” is generally inaccurate.) Figure 8 reports the full picture of declared LOAs presenting a total share of the fourteen referenced companies of less than 14%.



**Figure 8:** Share of LOAs submitted by the referenced fourteen companies (2007-2013)

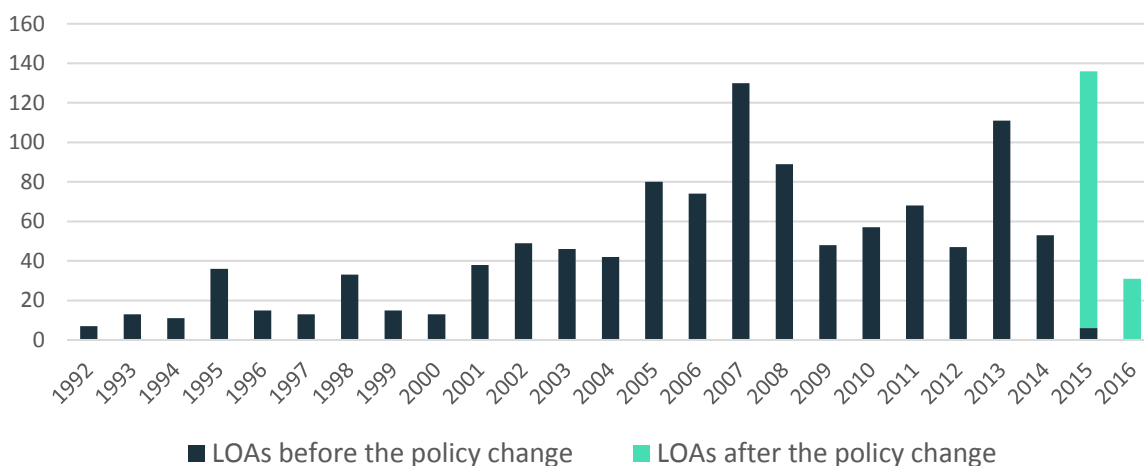
Moreover, as indicated in Figure 9, the companies referenced in the report tend to use specific patent declarations more commonly than do other IEEE participants. Because

specific declarations must be updated each time a new essential patent is identified even as to the same standard, whereas blanket declarations do not need such updating for the same standard or, in some cases, even for amendments thereto, it is not surprising that a preference for specific patent declarations could lead to an inflated LOA count.



**Figure 9:** Share of blanket vs. specific LOAs submitted to IEEE (1992-2016)

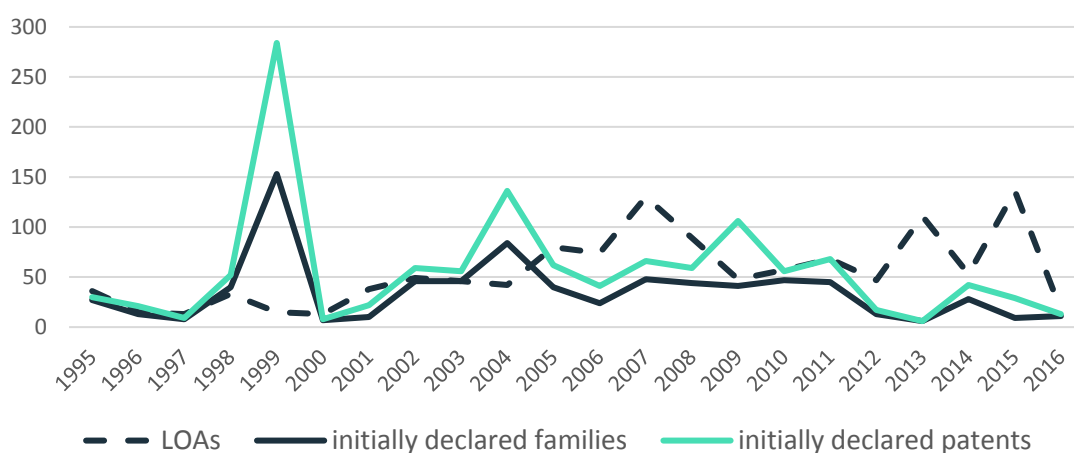
Finally, suggestions that LOAs are down at IEEE after March 2015 also seem to be without merit. More LOAs were submitted at IEEE in 2015 than in any prior year in IEEE's history (figure 10).



**Figure 10:** Number of submitted LOAs over time as of declared before and after the IEEE IP policy change (1992-2016)

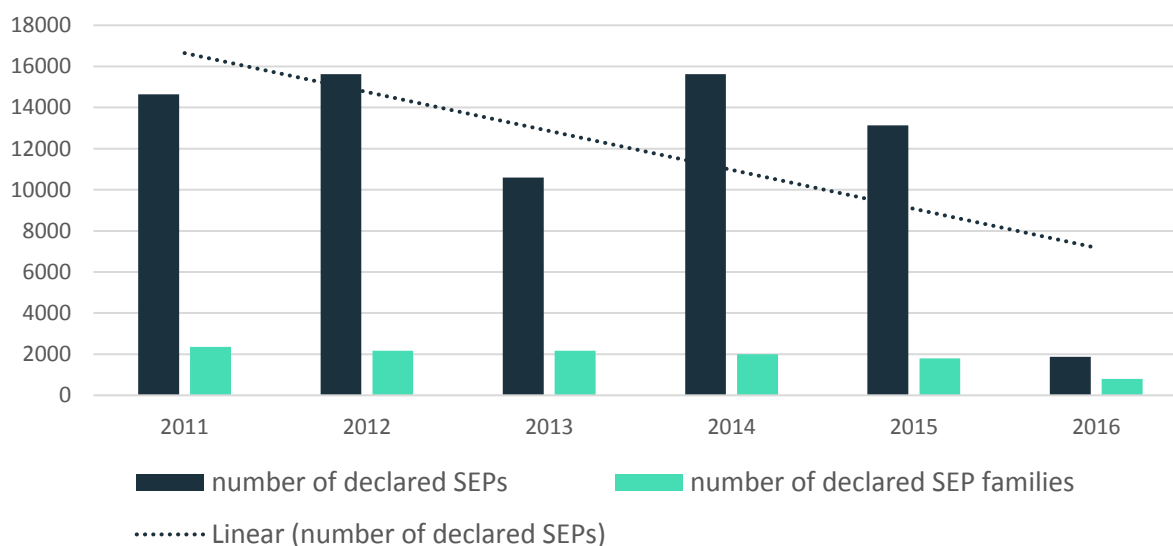
And while LOA submission in 2016 was, in fact, down compared to 2015, submissions were generally in line with historical fluctuations, particularly in view of the historically high number of submissions in 2015. More importantly though, as documented in Figure 11, the number of new patents and new patent families specifically declared in

2015 and 2016 was higher than in prior years, such as 2013, suggesting that any decline in LOAs in 2016 was more attributable to IEEE workflow issues than to any issues relating to the change in its patent policy.



**Figure 11:** Number of submitted LOAs, initially declared SEPs, and initially declared SEP families over time (1995-2016)<sup>9</sup>

Indeed, and even accepting that LOAs were down somewhat at IEEE in 2016, there are reasons to think that “LOA counting” is not a particularly meaningful methodology for evaluating the health of an SSO. For example, at ETSI – which has been cited as an example of a healthy and successful SSO – both IPR Declarations and the number of declared patent families were down significantly in 2015 and 2016 compared to each of the two prior years (figure 12).



**Figure 12:** Number of declared SEPs and SEP families at ETSI<sup>10</sup>

<sup>9</sup> Note that this chart does *not* include dozens of families that were identified and declared to the 802.11 standard in 2015, but which, due to certain corporate transactions, became subject to a blanket LOA previously filed by the organization having the right to grant licenses to the patents. See IEEE Doc. 802.11-15/1029r2; May 1, 2015 Rejected IEEE LOA (listing dozens of patents and patent families subject to LOA).  
<sup>10</sup> See EU study [2017]; [2014]

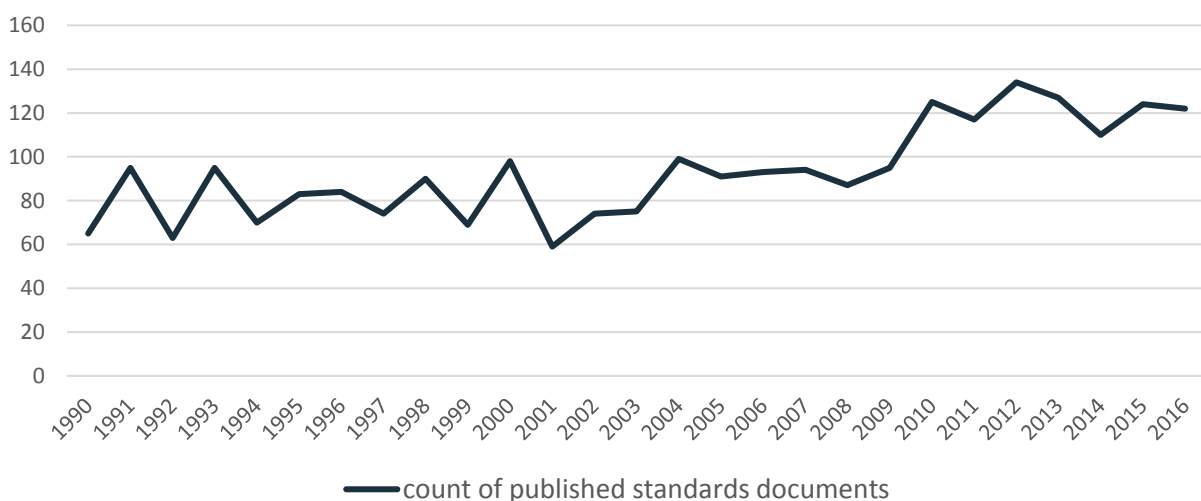
In short, suggestions, such as those in the recent study cited above, that IEEE LOAs have declined due to the IEEE's adoption of updates to its patent policy appear to be both incorrect and misleading.

## 6. Other Metrics Regarding the IEEE's Ongoing Work and Development

Of course, merely counting declared patents or LOAs is not necessarily indicative of the successes or failures of a standard setting organization. Other metrics, such as membership, workload and output, technical recognition and the like are all significant items that may bear on an SSO's health and growth.

In view of the various (and as shown above, incorrect) criticisms of the IEEE's patent and LOA situation, it is worthwhile to briefly consider other available metrics regarding the IEEE's recent work.

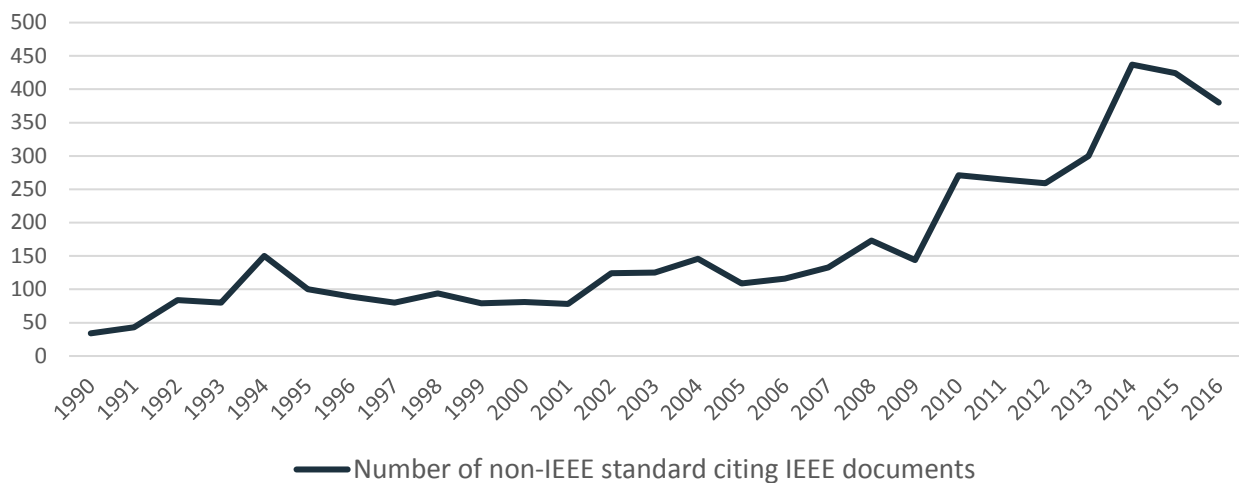
For example, we might consider the number of IEEE standards completed and published. As shown below in Figure 13, the IEEE expanded its output in 2015 and 2016 as compared to the prior year. Overall, IEEE's output has fluctuated a bit year-to-year, but has continued to grow steadily over the past two decades. In both 2015 and 2016, more standards were approved than in 2014, with 2016 representing the fourth highest total ever for approved standards at IEEE.<sup>11</sup>



**Figure 13:** Number of published IEEE standard documents over time (as to date of first version release)

<sup>11</sup> See IEEE-SA, February 2017 BoG - SASB Chair's report – Part 2.

Perhaps more significantly, and as diagramed in Figure 14, IEEE's technical influence has grown steadily over the years, with IEEE's standards regularly referenced by, and incorporated into, other SSOs standards.



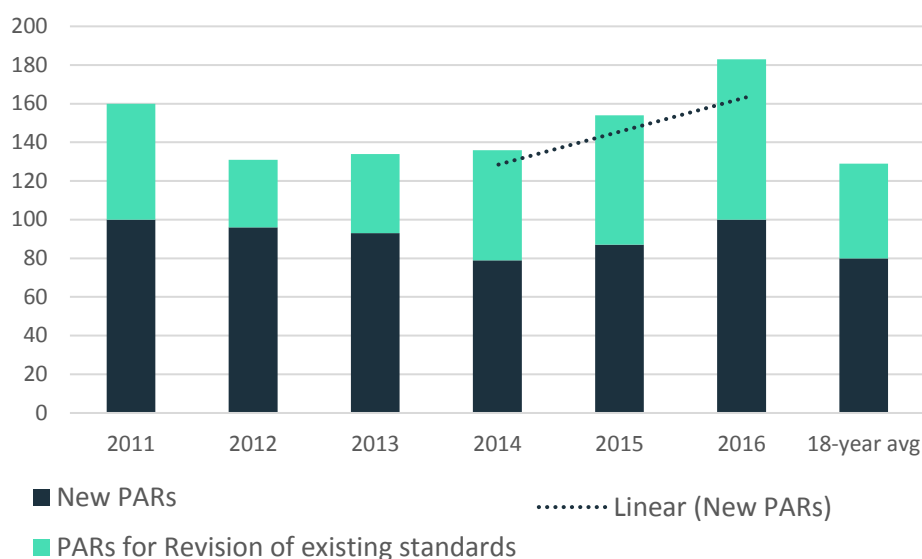
**Figure 14:** Number of non-IEEE standards documents citing IEEE standard documents over time

Membership in the IEEE-SA, which is the standardization arm of the organization, was up in both 2015 and 2016 as compared to 2014, and the IEEE remains the world's largest technical organization, with “more than 420,000 members in over 160 countries.”<sup>12</sup>

Most significant, work at IEEE has continued to increase. New Project Authorization Requests (“PARs”), the means by which new standards projects are initiated at IEEE and thus a key indicator of new activity and interest around IEEE standards, was at its highest level ever in 2016 (figure 15).<sup>13</sup>

<sup>12</sup> See, e.g., About IEEE, available at <https://www.ieee.org/about/index.html>.

<sup>13</sup> See IEEE-SA, February 2017 BoG - SASB Chair's report – Part 2.



**Figure 15.** Number of New Project Authorization Requests – PARs (2011-2016)

In sum, there are many ways to assess the health and significance of a given SSO. Based on our review of the available facts, and by many measures, IEEE remains as strong, or stronger, than it has ever been.

## 7. Professional Background and Expert Qualifications

IPlytics has been actively involved in preparing studies for the European Commission (2010, 2014, 2017), the World Intellectual Property Organization (2013), the German “Expertenkommission Forschung und Innovation” (2014), and the German Federal Government (2013) on the interplay of patents and standards, on patent licensing for complex technologies, on markets of patents, on technology standards in ICT, and on industry standards consortia. Further research on patents and standards has been published in expert journals such as the IAM Magazine, les nouvelles or GRUR as well as in peer-reviewed law and economic journals such as the Journal of Competition Law and Economic, International Journal of Industrial Organization, R&D Management or Research Policy. IPlytics thanks Intel Corporation for providing financial support to enable the research behind the data described in this research paper, but notes that we have retained full independence in preparing and publishing our findings and analysis.



## About IPlytics

IPlytics is a Berlin based company that maintains a data platform (IPlytics Platform) that augments the analysis of technology landscapes and a company's competitive position. IPlytics Platform is a browser based IP analysis tool that empowers its users to analyze a company's competitive position for patenting and standardization. IPlytics Platform integrates multiple data sources to provide a mapping of, for example, patents to technology standards, patent to company information, or patent to scientific articles. IPlytics Platform is a widely-used tool (especially in the telecommunication sector) to analyze trends, competition, and licensing issues in various departments. IPlytics Platform goes beyond patent data by linking and processing over 80 million patents to 2 million standards/SEPs, 60 million scientific articles and 3 million company information on one single platform. The tool helps users to perform analyses in the fields of patent valuation, landscaping, licensing, transfer or litigation. The intuitive graphical user interface allows to easily navigate, analyze and drill down into information, enabling in-depth technology analyses or a long-term monitoring of market segments. With just a few clicks IPlytics Platform provides answers to critical questions such as: Who is the technology leader in a market segment? Who holds the relevant IP and how valuable is it? How does competition develop?

In case you would like to test IPlytics Platform do not hesitate to contact us directly.

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