



Empirical Assessment of Potential Challenges in SEP Licensing

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1. INTRODUCTION

1.1. Background

This study was commissioned by the European Commission (GROW/2021/MVP/0010). The contract for the study was awarded to iplytics GmbH after a call for proposals, based upon a proposal by a consortium consisting of lead researcher Dr. Justus Baron (Northwestern University), Dr. Tim Pohlmann (iplytics and TU Berlin), Dr. Pere Arque-Castells (University of Groningen), Dr. Amandine Leonard (University of Edinburgh), and Dr. Eric Sergheraert (University of Lille).

The consortium has constituted a group of advisors; including Cyrille Amar, Prof. Knut Blind, Dr. Fabian Gaessler, Yorck Hernandez, Fabian Hoffmann, Friedhelm Rodermund, Dr. Bertrand Sautier, and Dr. Nikolaus Thumm. We have consulted different individual experts on different individual aspects and findings of our study. We also provided all our advisors with a draft version of the completed study, and received both specific and general comments and suggestions. We thank our advisors for their time and for their insights. None of the advisors may be held responsible for the content of this study.

The European Commission has long taken an active interest in Standard-Essential Patents (SEP). In its “Communication on Standard Essential Patents” of November 2017, the Commission called for a balanced approach to SEP licensing, and emphasized the importance of greater transparency. The Communication also called for the creation of an Expert Group on Standard-Essential Patents (‘SEP Expert Group’), and a pilot project to assess the feasibility of generalized essentiality checks for declared SEPs.

The SEP Expert Group delivered its contribution in 2021, featuring numerous proposals of potential policy measures aiming to improve the SEP licensing framework. The essentiality pilot project has resulted in a report (Bekkers et al., 2020) concluding that generalized essentiality checks for declared SEPs would be feasible and have the potential to produce significant benefits.

In its “Intellectual Property Action Plan” of November 2020, the European Commission noted that it sees continued need for reforms to the SEP licensing framework, and discussed possible policy initiatives; such as support for industry-led initiatives and regulation.

In this context, since January 2022, the European Commission has conducted an Impact Assessment of different policy options regarding SEP Licensing. The present study provides an empirical assessment of potential challenges in SEP licensing (‘Problem Assessment Study’). This study is one input to the Commission’s Impact Assessment. The consortium has further developed an impact assessment of potential policy options with respect to one specific policy issue, namely transparency regarding the actual essentiality of patents declared to be potentially standard-essential (declared SEPs) (‘Impact Assessment Study’). Both studies are published simultaneously with the Commission’s Impact Assessment.

The present study was written by the five consortium members, based upon regular exchanges with the Commission. The consortium determined the scope and methodology of the study based on the Technical Specifications for the contract with the European Commission, as well as further elaborations on the objectives of the study the Commission.

Based on the potential problems identified by the Commission, the Commission and the consortium jointly selected the topics for the ‘Problem Assessment Study’. The topics are divided in ‘Complexities in SEP Licensing’, i.e. specific features of SEP licensing that may contribute to its complexity; and ‘Potential Problems in SEP Licensing’, i.e. problems arising in the context of SEP Licensing, at least partly as a consequence of the aforementioned complexities.

The selected topics are:

- I. Complexities in SEP Licensing
 1. Multiple patents, multiple implementations
(there are potentially large numbers of SEPs for which implementers need licenses, and some SEP portfolios are implemented in large numbers of different products)
 2. Uncertainty regarding essentiality and validity
(it may be difficult to ascertain which and how many patents are really essential and valid)
 3. Uncertainty regarding FRAND
(there may be uncertainty regarding the meaning of the FRAND concept, uncertainty regarding the terms on which SEP licenses are being offered, and disagreements between negotiating parties regarding the FRAND rate of a license)
 4. Complex dispute resolution
(it may be difficult to resolve SEP licensing disputes, in particular because of the often global nature of SEP licensing negotiations and the national scope of court decisions)

- II. Potential Problems in SEP Licensing
 5. Inefficient licensing
(SEP licensing negotiations may be costly and lengthy. Licensing disputes may significantly amplify the costs and the delays associated with concluding SEP licenses)
 6. Under-licensing
(SEP licenses may fail to be concluded, and implementations of technology standards including technology subject to SEPs may remain unlicensed. Under-licensing may result from SEP holders’ failure to make SEP licenses available, or implementers’ failure to enter into a SEP license, or a combination of both)
 7. Opt-out
(Complexities and costs associated with SEP licensing may discourage participation in the development of new standards and/or investment in implementing standards subject to SEPs)

Other factors may significantly affect the efficiency of SEP Licensing. We have not made an effort to identify all or the most important factors affecting SEP Licensing. The topics were not selected in view of an exhaustive economic analysis of SEP Licensing, but to

produce empirical evidence regarding certain topics identified together with DG GROW as potentially relevant to possible regulatory actions by the Commission.

Our assessment largely focuses on an economic analysis of the complexities and potential problems that may arise in SEP licensing. We hereby focus on the overall efficiency of SEP Licensing, i.e. the effect of SEP licensing conditions on overall social welfare. We recognize that SEP licensing conditions may have important redistributive implications, e.g. affect the distribution of economic surplus between SEP owners (licensors) and implementers (licensees). We have not attempted to assess the proper redistribution of profits based on notions of fairness or other equitable or political considerations.

1.2. Empirical Methodology

The empirical analyses conducted for this study are largely based on data that is publicly available, with certain noteworthy exceptions:

- We had early access to the responses to the European Commission's public consultation. While the Commission has produced a comprehensive summary of these responses, which is published independently of this study, we selectively used information from the responses (or from the Commission's summary thereof) to support our analyses. We have relied more extensively on information provided by stakeholders through the public consultation with respect to empirical aspects of SEP licensing that are particularly difficult to observe; while we have otherwise given preference to publicly available documentary evidence.
- We have relied extensively on two commercial databases: we used Iplytics for information on declared SEPs, implementations of standards subject to SEPs; and we used Darts-ip for information on assertion of declared SEPs and other patents in litigation, as well as post-grant proceedings at patent offices. Both databases are offered to the public against a fee, and are widely used by practitioners in the relevant industries.
- We have consulted a small number of practitioners with personal experience with specific aspects of SEP licensing. In particular, we have conducted a small survey of 10 individual experts with experience producing essentiality assessments, and we have conducted a small number of interviews with individuals with personal experience with SEP licensing negotiations and SEP litigation. We have used the information provided by these individuals to cross-check our estimates based on the existing literature, publicly available documentary evidence, and comprehensive datasets.

For the remainder, we have relied on publicly available information. In particular, we have used the following sources:

- Existing empirical studies on SEP licensing; including a larger number of studies commissioned by the European Commission. Several existing studies provide evidence based on surveys of stakeholders and practitioners, which we have cited to produce estimates of empirical magnitudes that are not observable from publicly available documentary evidence (in particular estimates of the costs of different activities related to SEP licensing). We also cite existing studies analyzing data that

is also available to us, such as studies of SEP litigation records, analyses of the information disclosed through court decisions on SEP licensing disputes, and studies on the number of declared SEPs. In these cases, we use estimates from the existing literature for cross-checks or to complement our own findings.

- Court decisions: a small share of SEP licensing negotiations involve litigation. In those cases in which litigation results in a judgment on the merits, a written decision is often publicly available. Such court decisions may offer valuable information on the negotiation conduct prior to and during litigation, the terms of comparable licenses, and the negotiation and licensing conduct that judges considered (based on expert testimony and parties' arguments) to be generally accepted in the industry. We thus often rely on such court decisions in individual cases to shed light on more general SEP licensing practices.
- Licensing programs on standard terms and conditions: some licensors of potential SEPs (including many patent pools) publish information on their licensing programs, often including the names of licensees (and, in the case of pools, participating licensors), lists of patents covered by the license, and certain standard terms and conditions. We collected this information from licensor websites; in many cases also using Internet Archives to retrieve historical information. We understand that in some cases the terms of individual SEP licenses may deviate from the information available on licensor websites.
- Company announcements of (intended) licensing terms: some owners of declared SEPs have published individual or joint declarations regarding the terms on which they make or plan to make licenses to their patents available to standard implementers. We have compiled information from a limited number of declarations, and relied on existing compilations from the literature for a larger number of observations. In some cases, we were able to compare company's announced licensing intentions with the terms of actual SEP licenses (e.g. where such terms were discussed in court decisions as part of a comparable license analysis).
- Mandatory disclosures to the SEC: companies sometimes provide information on their SEP or other patent licensing activities as part of their mandatory disclosures to regulatory authorities, in particular the Security Exchange Commission (SEC) in the US. This data has been used by an increasing number of empirical studies of patent licensing. We cite and discuss selected statements from individual firms' disclosures, and rely on existing compilations of firm disclosures for estimations of the aggregate royalty proceeds from SEP licensing.
- Data on product release dates and features: we use information from GSM Arena, WiFi Alliance, DLNA, and other publicly available sources to compile information on the standardized features and release dates of different products.
- A variety of sources for general statistical information, such as overall sales volumes in different industries etc.

Notwithstanding our efforts to combine a large number of diverse sources of empirical information that is potentially relevant to an analysis of SEP licensing, we had to contend with significant limitations in the data and evidence that we could rely on.

- Some aspects of SEP licensing are more easily observable than others – for instance, while the vast majority of bilateral SEP licensing negotiations are conducted in secrecy, providing researchers with little information on the process of negotiations and the agreed-upon terms; SEP litigation produces publicly observable records, and

some pool licensing programs are relatively transparent. We thus have much better information on some forms of SEP licensing than on others, determining to some extent the focus of our analysis. In particular, we often use SEP litigation and pool licensing programs as windows into the broader process of SEP licensing, which may result in a biased representation of the prevalence and importance of different forms of SEP licensing.

- Some aspects, such as the costs of different activities related to the conduct of bilateral SEP licensing negotiations and SEP litigation, is difficult to observe. We have invested significant efforts in producing transparent and defensible estimates of some of the most relevant costs arising in some of the most relevant forms of SEP licensing; nevertheless, we recognize that our estimates are subject to significant uncertainty, and that there are other forms of SEP licensing, and other types of costs, which we have not considered.
- Our analyses are predominantly based on licensing practices in fields in which there is a relatively long history of SEP licensing. The Commission’s primary focus is on fields that have emerged more recently, such as the Internet of Things (IoT). Nevertheless, we have limited empirical data from court decisions, company announcements, litigation records and other sources that is specific to these recent fields. We recognize that there is some uncertainty regarding the extent to which our assessments are relevant to the IoT and other fields that have emerged too recently to produce a significant record of publicly observable data.
- The Commission has asked us to offer specific numbers to quantify our best possible estimations of certain empirical magnitudes. While the specific numbers may convey an illusion of precision, many of our estimates are subject to significant uncertainty. We believe that our assessments provide defensible “best possible estimates” of these magnitudes, based on the public record alone. At the same time, it is important to recall that many of the most important aspects of SEP licensing are inherently unobservable to researchers and other members of the public.

1.3. Specific methodological aspects:

1.3.1. Declared SEPs:

We use the Iplytics platform to identify *potential* SEP families. We identify a SEP family as an inpadoc extended patent family with at least one member that is a declared SEP in the Iplytics Platform database.¹ Declared SEPs in this database include patents that were specifically disclosed as potential SEPs to an SDO, as well as patents listed as being included in a patent pool that is reserved to SEPs. For reasons that are extensively discussed in this study, these two groups of patents are an imperfect representation of the actual population of SEPs. As we use this data to study e.g. the prevalence of SEP litigation, it is important to recall that not all potential SEPs are included in the Iplytics database, that not all potential SEPs in this database are actual SEPs, and that the group of patents included in the database are unlikely to be representative of the population of actual SEPs. With these caveats in mind, we believe that datasets of declared potential SEPs offer valuable insights on SEPs,

¹ When assessing repeat litigation within an SEP family, we count litigation involving the members of a simple family (docdb, those patents that share exactly the same priority documents as the SEP). Similarly, when counting SEP litigations per jurisdiction, we count litigations involving patents that are members of a simple family that has at least one member that was declared as SEP.

and our use of data of declared SEPs is broadly in line with a significant existing empirical literature on SEPs.

1.3.2. SEP Litigation:

We use data from Clarivate - Darts-ip to study SEP litigation. While we produce counts of litigations involving declared SEPs involving a larger number of jurisdictions, most analyses and graphs are based on searches for litigation activity in the following countries: China, France, Germany, Italy, The Netherlands, United Kingdom, United States.

Our search criteria within the Darts-ip platform furthermore include limits on specific types of actions. Broadly speaking, we include infringement and various post-grant challenges to validity. In particular, we focus on the following types of actions: Infringement Action, Opposition Action, Invalidity Action, and Inter Partes Review (IPR). We do not include IP office first instance decisions, i.e. examiner's rejections and appeals against these decisions.

When comparing declared SEPs to other patents, we study cases involving patent(s) classified in the following technical areas: telecommunications, digital communication, audio-visual technology, and computer technology. We identify these areas using specific IPC subclasses. Focusing on these four technical fields alone allows the Non-SEP set to be technologically similar to the SEP set.

1.3.3. Type of actors

When analysing patterns in different forms or segments of SEP licensing, we differentiate between broad categories of parties; e.g. “major net licensors”, Non-Practicing Entities (“NPEs”) and Patent Assertion Entities (“PAEs”), as well as patent pools. Our assessments of licensing patterns and costs that are typical for SEP licensing negotiations in which these actors participate are based on individual case studies. We do not purport that these individual cases are statistically representative of broader classes of economic actors, or that any licensor of SEPs falls within one of these categories. We also recognize that there may be overlaps and fuzzy boundaries between the categories. Our assessments of SEP licensing costs in these segments are therefore highly stylized. Nevertheless, given the significant heterogeneities in SEP licensing practices between different actors, and in the absence of any population level data on SEP licenses and licensing negotiations, we have opted for an assessment of costs within these three stylized forms of SEP licensing as the best possible current estimation of overall licensing activities and costs.

I. Complexities

Because of the specificities of SEP licensing, there are several complexities that may affect the efficiency of different forms of SEP licensing. We will focus on four principal aspects: SEP licensing usually involves multiple SEP portfolios and multiple implementations (“many-to-many”); there is uncertainty regarding the actual essentiality (and validity) of declared (potential) SEPs; there is disagreement regarding the meaning and implementation of FRAND; and the resolution of global SEP licensing disputes through national court systems is complex.

2. MULTIPLE PATENTS, MULTIPLE IMPLEMENTATIONS

Some standards are subject to large numbers of potential SEPs, and some patents are potentially essential to standards implemented in large numbers of products. We will focus on four principal aspects: Potentially large numbers of SEPs for which implementers need licenses; multiple implementations per company; multiple implementations per standard and different standards subject to different IPR policies,

- *Increasing number of patent declarations:* The number of declared patent families has increased significantly in recent years. Overall, we identify a cumulative number of over 74,000 patent families including patents that were declared by 2021 to be potentially essential to a standard. Compared to 2011, the number of such patent families has increased by factor 5x.
- *Increasing number of owners of potential SEPs:* The number of companies declaring to own potential SEPs has also increased significantly in recent years. Overall, we identify over 261 unique patent owners that have made declarations with respect to at least 10 patent families by the year 2021. Compared to 2011 the number of such declaring companies has increased by factor 2,6x.
- *Multiple implementations per company:* We analyzed data on the 25 companies with the largest number of products that are compliant to cellular standards (e.g. UMTS, LTE, 5G), wireless standards (Wi-Fi, NFC, Bluetooth) as well as hardware standards such as USB. In the past ten years, each of these companies released 170 different standard-compliant products, on average.
- *Potentially large number of implementers:* Some standards are implemented by large numbers of different companies. Wi-Fi alliance e.g. currently lists 67,663 different implementations of different generations of WiFi standards, from 602 different manufacturers. One licensing administrator of a SEP licensing program for Wi-Fi claims to have notified more than 2.000 different companies that they need a license to the SEPs included in the pool. Some pool licensors list more than 2.000 companies as being licensed to a pool of SEPs related to a single standard.
- *Different standards and SDOs per product:* Of 251 technical interoperability standards implemented in a modern laptop computer 44% were developed by

standards consortia, 36% by formal standards development organizations, and 20% by single companies.

- *Different IPR policies:* an analysis of IPR policies associated with 197 standards shows that 75% of these standards were developed under “FRAND” terms, 22% under “royalty free” terms, and only 3% are related to a patent pool.

One important driver of the complexities in SEP licensing is the fact that many products implement large numbers of standards, and many standards are implemented by large numbers of users. This makes it difficult for implementers – the developers and producers of complex networked end products and their components – to assess the extent of their SEP exposure. It also makes it difficult for the owners of SEPs to monitor use of their patented technology, and ensure comprehensive and non-discriminatory SEP licensing and enforcement.

2.1. Potentially large numbers of SEPs for which implementers need licenses

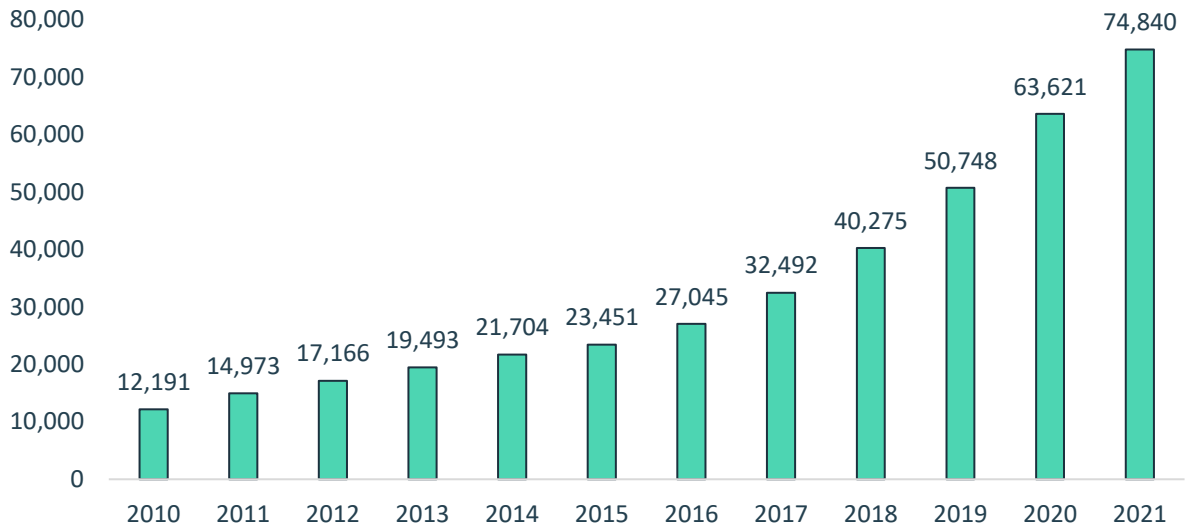
From the point of view of implementers, SEP licensing in some key industries is characterized by a large number of potential SEPs, owned by a large number of different firms, that are potentially essential to one or several of the many technology standards used by the implementer’s products. SEP licensing is thus potentially cumbersome for implementers, as implementers may need to monitor a large number of portfolios of potential SEPs, and some implementers need to negotiate licenses with a large number of SEP owners. Furthermore, SEP licensing can be costly, as the cost of each additional SEP license adds to the cumulative, aggregate royalty burden on implementers.

2.1.1. Potentially large numbers of declared SEPs per standard

Standards such as UMTS, LTE, 5G or Wi-Fi are subject to tens of thousands of declared SEPs². The invention and standardization of complex communication technologies continues to generate significant numbers of SEPs. According to IPLYtics data, the cumulative number of self-declared SEP families has surpassed 74,000 in 2021, indicating a five-fold increase in just 10 years (**Figure 4**).

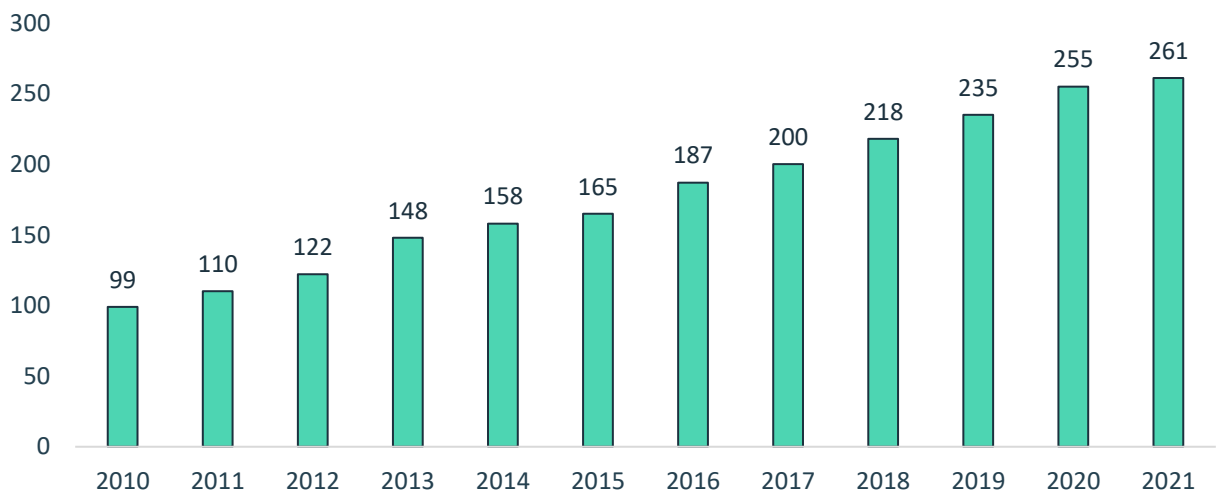
Figure 4: Cumulative number of declared patents and patent families over time (IPLYtics Platform)

² Who leads the 5G patent race November 2021?, link: <https://www.iplytics.com/report/5g-patent-race-november-2021/>; Who’s ahead in the Wi-Fi 6 patent race? link: <https://www.iplytics.com/report/whos-ahead-wi-fi-6-patent-race/>



The number of SEP holders that have self-declared at least 10 patent families over the past 10 years (has risen from 99 in 2010 to 261 in 2021 (by factor 2.6x; this is the number of *unique* companies, i.e. considering only the highest parent of corporate groups; **Figure 5**). The uptick in the number of new SEP holders is largely driven by market entrants from China, Taiwan and South Korea, which develop smartphones, network devices, computer chips, semiconductors and audio and video technology.

Figure 5: Number of declaring companies with at least 10 declared patent families (IPlytics Platform 2022)

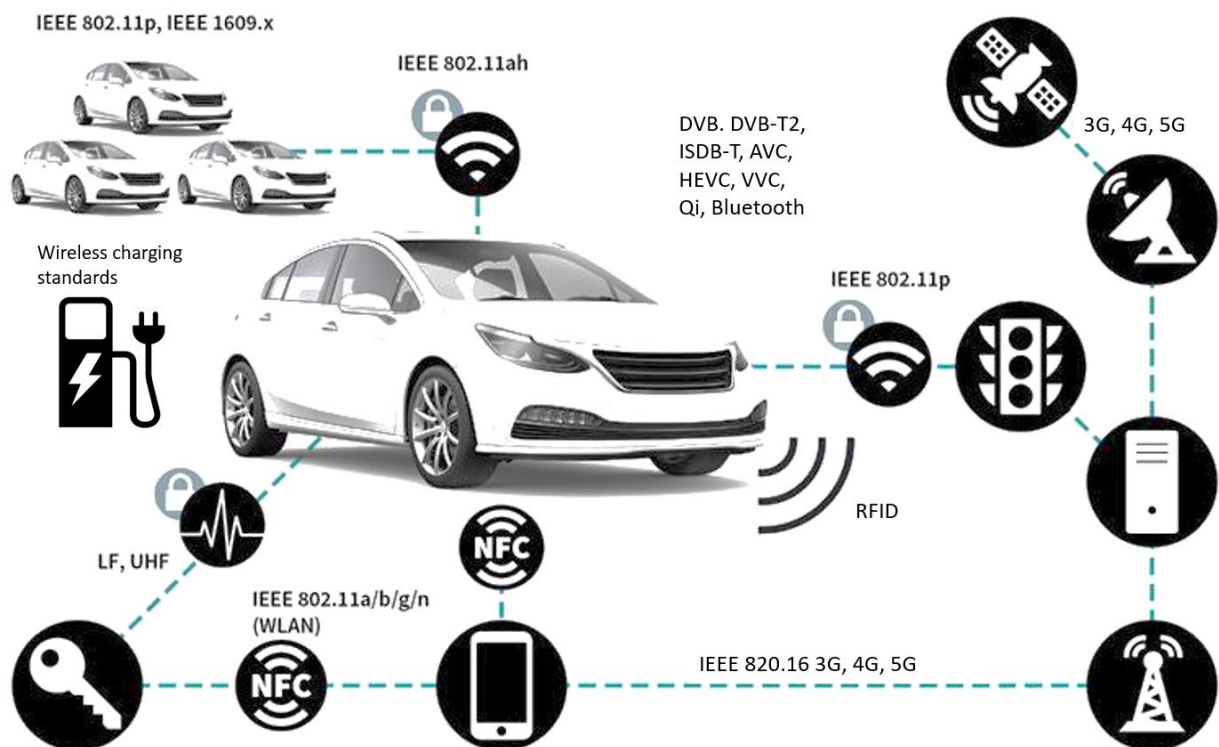


2.1.2. Multiple standards per product

An empirical study (Biddle et al., 2010) identified 251 technical interoperability standards implemented in a modern laptop computer. Of the identified standards, the authors find that 44% were developed by standards consortia, 36% by formal standards development organizations, and 20% by single companies. The intellectual property rights policies associated with 197 of the standards were assessed. The results show that 75% were developed under “FRAND” terms, 22% under “royalty free” terms, and 3% utilize a patent pool.

The implementation of potentially large numbers of SEP-encumbered standards in a single product is no longer limited to traditional ICT industries. The auto industry is one of the first sectors to rely on Internet of Things (IoT) technologies, which connect devices, machines, buildings and other items with electronics, software or sensors. Interconnectivity across multiple vehicle parts and units relies on the specification of technology standards such as 4G or 5G, Wi-Fi, video compression (HEVC/VVC), Digital Video Broadcasting (DVB) and Near Field Communication (NFC) or the wireless charging Qi, standard to name a few (Figure 6).

Figure 6: Connectivity standards implemented in vehicles



Source: Pohlmann (2017-1)

The already significant number of ICT standards implemented in vehicles is bound to increase. Most market experts predict dramatic changes in the auto industry because of shifting consumer preferences, new business models and emerging markets. The sector is also poised to be affected by new upcoming regulations on sustainability, environmental

impact, and security issues. These forces may further exacerbate disruptive technology trends, such as driverless vehicles, electrification and interconnectivity. As a consequence, the share of connected vehicles among new car sales is rapidly increasing, and new cars increasingly implement a wider range of connectivity features.³

Standard implementers thus potentially need licenses to SEPs that are essential to many different standards. An additional source of complexity is that these standards are developed by different SSOs, which have often very different patent policies. The illustrative list of standards in Figure 5 alone includes standards developed by 3GPP, IEEE-SA, ISO, ISO/IEC JTC1, as well as consortia such as DVB, Bluetooth SIG, and NFC Forum, among others. This means that the database of declared SEPs of any individual SSO does not provide comprehensive information on all the potential SEPs that producers of complex standard-compliant products may need to take into consideration. Furthermore, each of these organizations is governed by different patent policies, which may e.g. provide for different levels of disclosure, and stipulate different licensing requirements.

2.1.3. Multiple implementations by company

Smartphones, laptops, tablets, smart watches and soon thousands of networked devices rely on technology standards to allow connectivity among devices and the Internet of Things (IoT). An empirical analysis making use of the IPlytics Platform product database (**Table 1**) shows the top 25 companies as to the number of products they released to the market in the past 10 years that are compliant to standard generations of cellular standards (e.g. UMTS, LTE, 5G), wireless standards (Wi-Fi, NFC, Bluetooth) as well as hardware standards such as USB.⁴

Table 1: Number of products per company and compliance with standards

Company/ Brand	Number Products	UMTS	LTE	5G	NFC	GPS	Bluetooth	USB	Wi-Fi 3 (802.11g)	Wi-Fi 4 (802.11n)	Wi-Fi 5 (802.11ac)
Samsung	740	14	268	4	206	510	686	679	516	480	131
Nokia	441	51	46	0	42	139	346	337	158	100	15
LG	325	4	137	1	106	229	308	305	245	217	45
Sony	277	26	81	0	98	159	259	259	159	134	42
Motorola	244	7	83	0	48	166	220	219	160	143	26
Huawei	225	2	143	2	67	216	225	217	218	215	57
HTC	216	2	101	0	74	207	216	216	212	175	41
Lenovo	173	0	98	1	14	162	173	173	170	169	42

³ <https://www.statista.com/statistics/1276018/share-of-connected-cars-in-total-new-car-sales-worldwide/>

⁴ Patents are declared to technology standards. Currently IPlytics identifies about 30 SSOs that have patent declaration databases. All of these SSOs develop technology standards in the field of cellular or wireless communication, audio or video compression as well as broadcasting or other communication transmission protocols.

BLU	166	0	64	0	2	159	166	166	160	158	5
Alcatel	156	0	64	0	24	124	143	151	132	128	5
ZTE	156	1	113	1	30	154	156	154	155	146	42
Asus	149	0	83	0	28	139	147	144	146	139	40
Micromax	134	1	35	0	0	105	131	132	122	117	1
Xiaomi	103	0	92	1	25	100	103	103	103	103	65
Vivo	99	0	92	0	9	99	99	99	99	99	44
Oppo	92	2	74	1	16	92	92	92	92	91	33
Blackberry	72	1	22	0	24	62	72	71	60	47	10
Allview	70	0	42	0	2	66	70	68	68	68	6
Apple	67	0	39	0	36	53	67	48	67	64	25
Acer	62	0	16	0	3	56	62	62	62	58	5
Honor	61	0	51	0	21	61	61	61	61	61	26
Wiko	55	0	33	0	5	55	55	55	55	55	2
Gionee	54	0	41	0	5	54	54	54	54	54	4
Meizu	54	0	50	0	8	54	54	53	54	54	22
Panasonic	50	0	36	0	3	44	46	46	44	44	2

Many large companies thus launch hundreds of different standard-compliant products. Each of these products may implement a large number of different standards subject to SEPs.

Table 1 only lists the latest generations of standards and only a fraction of the overall number of standards that handsets, tablets or personal computers implement.

2.1.4. *Different standards, different IPR policies*

An empirical research study by Bekkers and Updegrave (2012) of the major SSOs IP policies shows the complexity and differences with regards to provisions of on disclosure, licensing, and enforcement of potential SEPs.⁵ For illustration, Table 2 summarizes the SSO's IP policy differences with regards to the SEP essentiality definition.

⁵ R. Bekkers, A. Updegrave, A Study of IPR Policies and Practices of a Representative Group of Setting Organizations Worldwide (2012). Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2333445

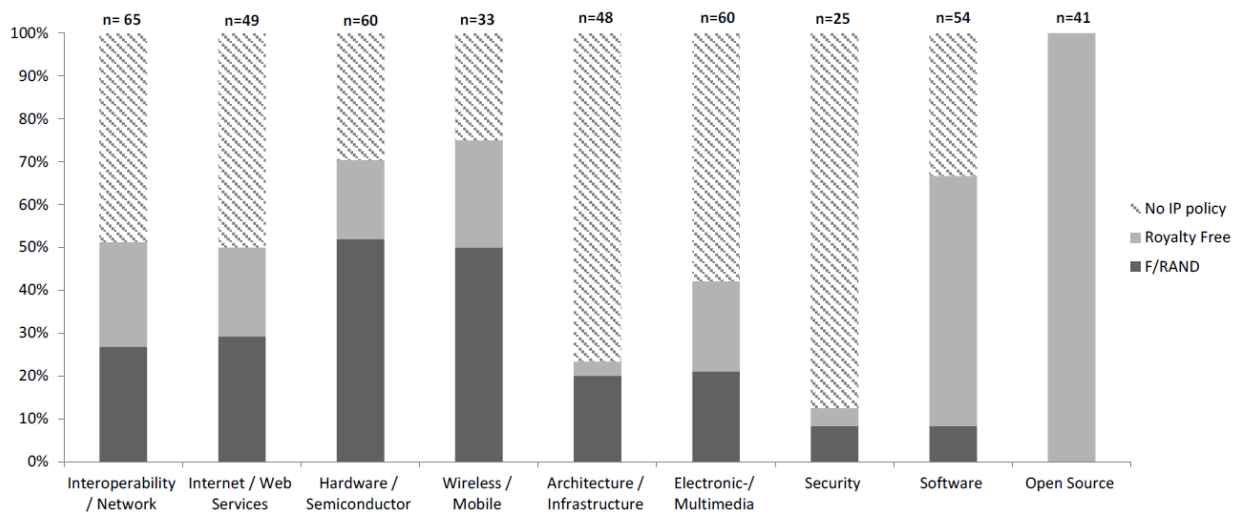
Table 2: SSO IP policy differences⁶

	ITU/ISO/IEC	IEEE	ETSI	ANSI	IETF	OASIS	VITA	W3C	HDMI Forum	NFC Forum
Includes copyrights essential to implementation (§ A4.1.1) (C14, G2)	ITU Only (1)	No	Yes	Yes	Yes (18)	No (2)	No	No	Yes	Yes
Specific policy for non-essential copyrights for implementation (§ A4.1.1) (C14, G2)	ITU Only (1)	No	Yes	(14)	(18)	No	No	(10)	No	No
Includes other IPR than patents or copyrights (§ A4.1.2) (C14)	No (12)	No	Yes (specified)	No (16)	Yes (specified)	No	No	No	Yes (any by law)	No
Includes commercial essentiality (§ A4.1.3) (C9)	[No]	Yes	No (15)	[No]	[No]	[No]	Yes	[No]	[No]	[No]
Includes optional normative portions (§ A4.1.4) (C11)	{No} (11)	Yes	Yes	Not defined	Not defined (4)	Yes	Not defined	Yes	Yes	Yes
IPR on other, externally developed standards that are normatively referenced (§ A4.1.5) (G3)	Not defined	Not defined	Not defined	Not defined	Not defined	Not defined	Not defined	Excluded	Not defined (5)	Included (9)
Specifically excludes enabling technologies (§ A4.1.6) (C9)	No	Yes	No	No	No	No	No	Yes	Yes	Yes
Defines timing of essentiality test (§ 0) (C9)	No	Yes	Yes	No	No	Yes	No	Yes	No	No
Excludes non-essential claims in same patent (§ A4.1.8) (C9)	Yes	Yes	[No/yes] (15)	[Yes]	[Yes]	Yes	[Yes]	Yes	Yes	Yes
Includes pending applications (§ A4.1.9) (C14, C9)	Yes	Yes	Yes	Left to accredited SSO (7)	Yes (also unpublished)	Yes (also unpublished)	Yes	Yes, also unpublished (8)	Yes	Yes
Excludes expired patents, withdrawn applications, and patents held invalid by court (§ A4.1.10) (C9)	Not Specified	Not Specified	Not Specified	Not Specified	Yes	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified
Essentiality determined with reference to final standard (§ A4.1.11) (D10)	{Yes} (17)	[Yes]	Yes	Not defined	[Yes]	Yes	Yes	Yes	n/a	Yes (10)
IPR is also essential if all alternatives are patented (§ A4.1.12) (C9)	[No]	Not defined (6)	Yes	Not defined	[No]	No	[No]	Not defined (6)	Not defined (6)	Not defined (6)

Table 2 compares SSO IP policies of the major organizations. These SSOs set standards such as 4G/5G, Wi-Fi or HEVC/VVC, which are subject to larger numbers of SEPs. In addition, there are hundreds of other SSOs that develop standards. A SSOs comparison study that looked at over 400 standard organizations in the information and communication technology (ICT) surveyed **differences with regards to the IP policy of the SSOs and the industry the standards are set for** (Figure 7). Here hardware and wireless standards organizations have mostly F/RAND based IP policies while software and open source SSOs have mostly royalty free IP policies. Some SSOs do not even have IP policies yet. This comparison shows the **wide-ranging complexity** of standards development across industries as policies and practices on how to handle patents may differ significantly.

⁶ Ibid.

Figure 7: SDO IPR policy by industry



While compliance with multiple standards is inevitable to ensure connectivity, standards implementers are thus faced with the ever-growing challenge to not only identify patents that are reading on the implemented standards but also to consider the rules under which these patents must be licensed across the different bylaws and IP policies of the various SSOs.

2.2. Multiple implementations per SEP portfolio

2.2.1. Multiple implementations per standard

While increasingly complex end products conform to a large number of technology standards subject to (declared) SEPs, individual standards are implemented in a very large number of products in diverse industries.

The WiFi (IEEE 802.11) series of standards for example has been implemented in a very large number of different products. Considering only those products that it has certified to be compliant with one or multiple WiFi standards (likely to be a subset of an even larger universe of WiFi-compliant products), the WiFi alliance currently lists 67,663 different WiFi implementations from 602 different manufacturers.⁷

⁷ The data from the Wi-Fi Alliance “Product finder” (<https://www.wi-fi.org/product-finder>) was retrieved on January 17, 2022.

Table 3: Wi-Fi compliant products

CATEGORY	PRODUCTS	BRANDS
Phones	21.507	111
Routers	14.941	297
Televisions & Set Top Boxes	11.941	83
Computers & Accessories	7.652	148
Other	6.757	262
Tablets, Ereaders & Cameras	2.697	86
Gaming, Media & Music	1.636	124
Smart Home	529	89
Building	3	1

Depending on where in the value chain SEPs are licensed, not all these end product manufacturers necessarily need a license to patents essential to the WiFi standards they implement. Conversely, the 602 listed end product manufacturers may not constitute all companies that need a license to these SEPs, as at least some of the SEP owners may choose to license at a different level in the value chain. Furthermore, there are potentially large numbers of additional manufacturers of WiFi-compliant products who have chosen not to submit their product for certification by the WiFi-Alliance. One licensing administrator of a SEP licensing program for WiFi claims to have notified more than 2,000 different companies that they need a license to the SEPs included in the pool.

While several licensors currently license SEPs for WiFi standards to hundreds of licensees, other patent pools reach even larger numbers of licensees. Many of the SEP licensing programs with the largest number of licensees are in the field of Audio/Video Coding.

Table 4: Pool administrator and number of licensees for audio/video coding pools

POOL	ADMINISTRATOR	NUMBER OF CURRENTLY LISTED LICENSEES
AVC/H264	MPEGLA	1,575
MPEG Audio	Sisvel	1,154
Advanced Audio Coding	Via Licensing	891
MPEG2	MPEGLA	822

The large numbers of implementers and (potential) licensees of SEP licensing programs represents a significant challenge for SEP licensors.

The combination of the large number of companies declaring (potential) SEPs for some standards, and the large number of implementers of some of these standards, results in a very large number of hypothetically necessary SEP licenses. Standards such as AVC and WiFi, which have both large numbers of (potential) SEP owners and large numbers of implementers, could *hypothetically* give rise to hundreds of thousands of bilateral licensing relationships.⁸

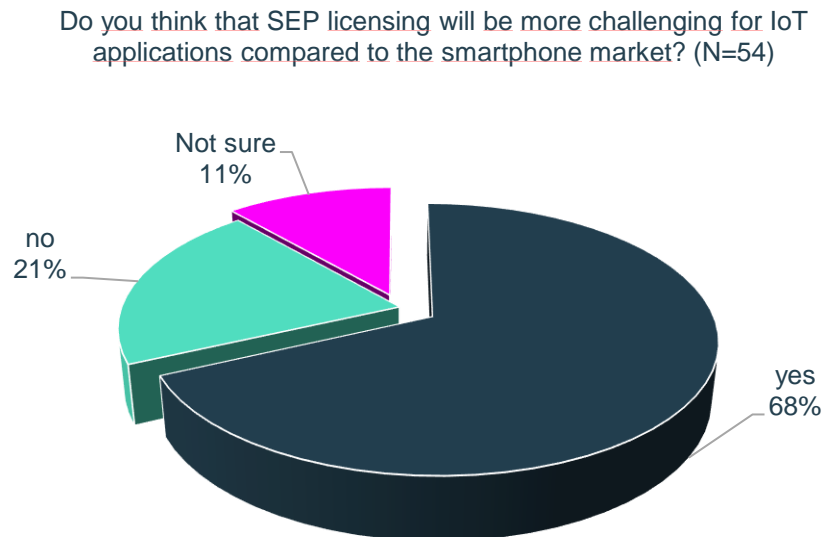
⁸ In practice, many of these potential bilateral licenses are replaced by a single pool license, and the per unit value of many other hypothetical licenses is low, and enforcement is likely to be very unsystematic. The largest known bilateral SEP licensors have concluded licenses with between 100 and 300 licensees, each.

2.2.2. Diversity of licensing practices in different industries

Another challenge is the diversity of licensing practices in the different industries in which a single standard may be implemented.

The application of 4G and 5G in vehicles for example will differ greatly from implementation in smart phones, tablets and smart watches. Thus, a uniform licensing model will not work. Instead, the SEP royalties for use cases (ie, smart home, smart factory, smart energy and smart vehicles) will likely need to be different than those for smartphones. Indeed, the results of a recent survey among SEP experts confirms that the licensing of SEPs for IoT applications is expected to be more challenging (**Figure 8**).⁹

Figure 8: Practitioner Survey on challenges of SEP licensing in IoT compared to smartphone market



Although flexibility is vital, the industry must also find mechanisms that allow companies to aggregate and package the licensing of SEPs to avoid licensing inefficiencies that yield lengthy negotiations or patent litigation. Here, the industry must acknowledge that not all SEPs will be relevant e.g. for each 5G use case. Classifying how technical standards specifications relate to different use cases is an important starting point to get a much more accurate picture about which standards and patents subject to these standards are relevant.

⁹ Results of a Survey conducted with SEP industry experts by the Technical University of Berlin in October 2020

3. UNCERTAINTY REGARDING ESSENTIALITY AND VALIDITY

There may be considerable uncertainty regarding which valid patents exist that are essential to a standard. We will focus on the following principal aspects: Multiple databases to identify declared patents; complexity in mapping standards specifications to technology generations; blanket declarations without patent numbers; cost and complexity of essentiality assessments. We discuss the implications of this lack of transparency for SEP Licensing.

- *Multiple databases and different formats:* Over 25 standards organizations provide lists and statements for over 350,000 declared patents.
- *Increasing number of SEP owners:* Patents are declared to on average to more than 6,84 standard specifications. For the 240,000 ETSI declared patents alone this results in 1.778.440 combinations of patents and standards specifications (TS).
- *Over-declaration:* It is estimated that only about 20-30% of the declared patents are essential; where there appears to be a tendency essentiality rates are even lower for more recent generations (with estimated essentiality rates for 5G as low as 10-20%).
- *Blanket declarations:* Estimates show that only about 10-20% of all Wi-Fi SEPs are specifically declared at IEEE and only approximately 20-30% of all HEVC SEPs are specifically declared at ITU-T. Most patents that are potentially essential to these standards are not specifically disclosed.
- *Cost of essentiality assessments:* We estimate the median costs of creating rigorous claim charts at 3,670€ per patent.
- *Time needed for essentiality assessments:* The median time needed for a rigorousness claim chart was 600 minutes per patent.
- *Complexity of essentiality assessments:* Not all implementations of standards equally incorporate the same number of SEPs. An LTE-based machine-to-machine communication implementation may incorporate only a fraction of LTE SEPs.
- *Uncertainty regarding the essentiality of individual patents* has a larger effect on the licensing of smaller portfolios. We analyze the plausible extent of uncertainty regarding the likelihood that a portfolio does not contain any patents that are both valid and essential; as well as the plausible extent of uncertainty regarding the share of patents in a portfolio that are both valid and essential. Both types of uncertainty decrease in portfolio size.

3.1. The role of information on patents' essentiality and validity

The exact type and amount of information that is used in licensing negotiations is empirically very difficult to observe, and likely to significantly vary case by case. We can however make general observations about the type of data commonly required in FRAND licensing negotiations.

As a general matter, participants in SEP licensing negotiations typically need information to formulate a position with respect to two fundamental questions:

- a. Does the producer of a certain device (ie. an implementer) **need a license** from the owner of a portfolio of alleged SEPs (ie. a SEP holder)? and if so,

b. What is an **appropriate (FRAND) price** for that license?

As a practical matter, practitioners report that SEP licensing negotiations often entail a “**technical phase**” and a “**commercial phase**”. During the **technical phase**, parties discuss the characteristics of the patent portfolio. SEP holders generally seek to persuade the implementer that a license is required. Implementers generally require a license from a SEP holder if one of their products implements a standard, and at least one patent of the SEP holder is valid and essential to that standard.¹⁰ Some SEP holders **provide claim charts**, i.e., a mapping between patent claims and features of the accused infringing products, and/or sections of a standard specification that is implemented by the accused infringing product.¹¹ Implementers may dispute the essentiality of these selected patents (and the appurtenant claim charts), and/or challenge the validity of these patents.

Based on the outcome of the public consultation, we estimate that there is significant heterogeneity in firms’ practices during the technical phase of SEP licensing negotiations, in particular regarding the number of patents being discussed. Nevertheless, the majority of respondents support the suggestion that detailed technical discussions typically involve in-depth analyses of a small number (<20) of selected patents.¹²

During the **commercial phase**, the negotiating parties discuss the value of the license. There is a large number of considerations that may be taken into consideration to define the value of a license. Potentially relevant factors include the value that the technology adds to the implementer’s products, the share of the value of the technology attributable to the patented technology, and the price level for comparable licenses in the market. Each of these factors are difficult to observe and assess.

As part of negotiations about the value of a license, there may be discussions about **how many patents are valid and essential**, or how that number of valid and essential patents compares to the number of valid and essential patents in other portfolios. In addition, these discussions may extend to the (relative) quality of these patents.

Parties to SEP licensing negotiations may thus require information on the number of declared SEPs, their essentiality, and their validity – in most cases, the need to assess whether at least some patents in the portfolio are both valid and essential; sometimes, they may also seek to assess how many valid and essential patents there are in the portfolio, and how that number

¹⁰ There may be exceptions, e.g. if there is exhaustion of the patent through a license at a different level in the value chain, or if the patent is unenforceable against the implementer (e.g. because the patent holder has failed to comply with a disclosure obligation).

¹¹ While SEP holders must provide notice to the implementer that it is infringing a patent (under the Huawei/ZTE negotiation framework), courts in EU Member States have repeatedly clarified that such notice obligations do not entail an obligation to provide claim charts. The notice must merely be sufficient to allow the implementer to make its own assessment whether it is infringing the patent, if necessary, using external expert opinions. See in particular the decision of the German High Court (Bundesgerichtshof) in *Sisvel v Haier* (KZR 36/17, decision of 5 May 2020), at 85.

¹² A majority of respondents to the European Commission’s public consultation (32 out of 53 respondents who have provided a quantitative estimate) report that technical discussions in licensing negotiations between an implementer and a SEP holder with a large portfolio are usually limited to less than 20 patents. 11 respondents indicated that in their experience, such negotiations would typically involve technical discussion of 20-50 patents. Only two respondents indicated that these discussions would cover more than 400 patents, and one of these two respondents added comments clarifying that more detailed technical discussions normally take place on the basis of so-called “proud lists” of less than 20 patents with claim charts. A smaller number of respondents indicated that practices vary widely and that it is not possible to provide an estimate of a typical number of patents. While there is thus a significant number of respondents disagreeing with the majority view that technical discussions cover less than 20 patents, more than 83% of the respondents agree that detailed discussions are generally limited to no more than 50 patents.

compares to the overall number of valid SEPs for a standard. This information is not readily available, contributing to the cost and complexity of SEP licensing negotiations.

3.2. Sources of lack of transparency on the number of valid and essential patents

There are three main reasons for the lack of transparency on the number of valid and essential patents for different standards, all related to the fact that firms' declarations of potential SEPs often provide the only generally available indication of potential SEPs: First, while some SDOs require declaring firms to identify specific patents that are potentially essential, these declarations are complex, and lack relevant complementary information, which needs to be retrieved from additional data sources. This complexity of SEP declarations makes it cumbersome to work directly with SDOs' declaration databases. More readily usable data is available from commercial providers; for a charge. Second, many SDOs do not provide comprehensive data on self-declared potential SEPs, as they allow for *blanket disclosures*. Firms may simply declare that they own potential SEPs, which they are prepared to license on terms compliant with the SDO's patent policy, without specifically identifying any potential SEPs. Third, firms' declarations of potential SEPs do not provide reliable information on actual SEPs, as SEP declarations are subject to both over- and under-declaration. Reliable estimates of the number of actual SEPs thus typically require some kind of expert assessment. The cost of assessing individual patents is significant, and thorough assessments of large numbers of potential SEPs are thus often prohibitively expensive.

3.2.1. *The complexity of SEP declarations*

Retrieving information from SDOs' declaration databases is challenging, because the structure of declarations is not harmonized, application and patent numbers have different formats, and some patents as well as standards numbers are subject to typos and mistakes. Company representatives typically submit a declaration form or declaration letter, which in some cases may be even handwritten. The declaration information is hosted on different SDOs' websites, is gathered in spreadsheets and is in some cases published as a PDF scans.

Patent declarations usually include information on the company and the license commitment, a patent publication or application number, as well as a **standard specification number** ("Technical Specification (TS)") and/or information on the standard project.¹³

A user wishing to use this data to identify (and/or count) potential SEPs for a specific standard owned by different firms may need to (1) standardize the declared patent numbers, and match these patent numbers to third-party databases to retrieve additional information, such as expiration status, grant status (if the patent is already granted or still a pending application), and current assignees (changes of patent ownership); and (2) standardize declared standard specifications numbers or project identifiers, and regroup declarations relevant to a particular use (e.g. identify the specifications that are relevant to a particular implementation of 5G).

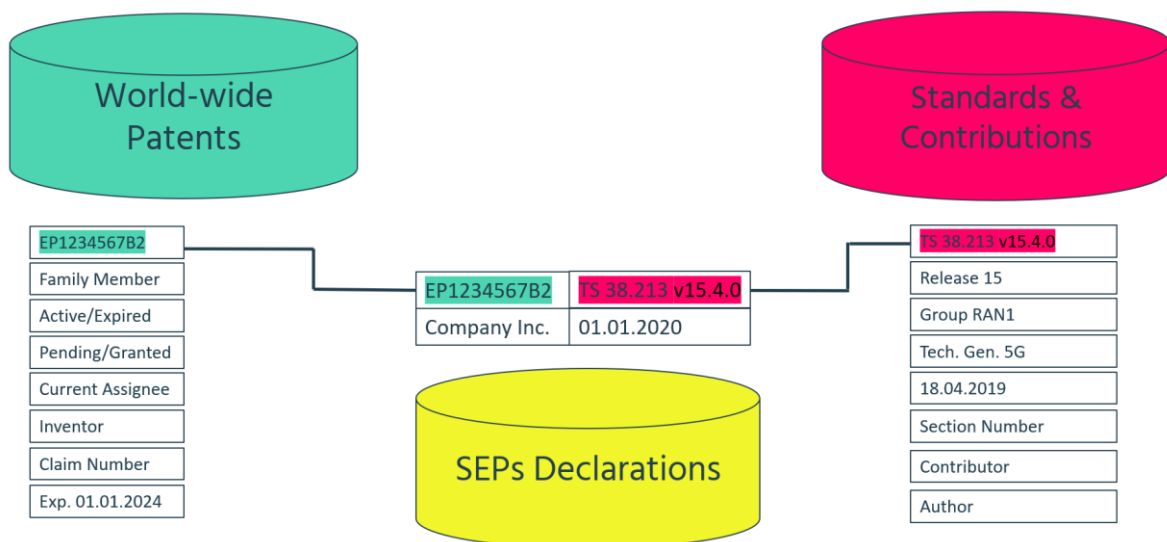
¹³ Find examples of patent declarations and associated licensing agreements here: <https://www.iplytics.com/general/back-to-basics-part1-seps/>

To count the patent declarations declared for a certain standard generation that are active and enforceable in a certain jurisdiction and assigned to a current patent owner, one thus needs access to at least three different databases to get an accurate result:

- a. A world-wide or local patent database such as e.g. Espacenet, WIPO or USPTO,
- b. A database with information on standard documents (and potentially contributions) of relevant SDOs, such as e.g. 3GPP, ETSI, IEEE or ITUT
- c. A patent declaration database with harmonized patent publication and standards document numbers from declarations to multiple SDOs.

Figure 9 provides an example of how patent, standards and SEP declaration databases are harmonized and connected in the IPlytics Platform database¹⁴. A combination of the three databases allows counting and understanding patent declaration portfolios e.g. for a standard generation such as 5G. While the manual lookup of single patents in publicly available patent databases as well as the lookup of single patents in a declaration database is possible, a large-scale analysis of e.g. a whole patent portfolio of 100+ declared patents needs a much more sophisticated approach that will take weeks or even months if conducted manually.

Figure 9: SEP declarations and their matching with patents and standards database (IPlytics)



¹⁴ <https://www.iplytics.com/>

3.2.1.1. Processing information on declared patents

Harmonizing patent numbers

Matching firms' SDO declarations with patents databases providing necessary complementary information (e.g. on legal status, patent families, and assignees) requires harmonization of the declared patent numbers. Patent declarations may provide ambiguous or even wrong patent numbers, as SDOs do not verify the declared patent numbers.

A frequent occurrence of ambiguous patent numbers is relating to missing patent *kind codes*.¹⁵ In some jurisdictions, especially China, Korea or Japan, different patents (pertaining to different patent families) may share the exact same patent number except for different kind codes. A patent number with missing kind code is thus ambiguous (may relate to different patents). As an example, if a declared Chinese patent publication number without a kind code matches more than one patent publication number relating to more than one patent family, an exact patent number match creates at least one wrong match.¹⁶

A second common reason why a patent may be wrongly matched is that the declaring company has submitted the wrong patent number. For instance, a typo or an incorrectly transposed patent number (bad quality pdf scan) would likely result in a match of the declared SEP to the wrong patent family.

An automatic matching algorithm may not detect which of the matches is a true match. Therefore, the cleaning and normalization of declared patent numbers needs support of a semi-manual identification process. IPlytics – one of the patent declaration database providers – has developed filters as well as manual lookups that identify and correct such wrong matches; using e.g. information on the declaring firm and the applicant/assignee of the patent (if the declaring firm matches an assignee of the patent, the likelihood of a wrong match is lower); the patent's classification in the International Patent Classification/Cooperative Patent Classification (together the "IPC/CPC classifications") to detect patents that are very likely unrelated to the standardized technology; and manual inspection by subject matter experts. An illustration of this process is provided in Appendix 2.

Patent family extension

Once a match with a patent database has been established, it may be necessary to extend the dataset of declared potential SEPs to other members of the declared patents' *families*. Patent families consist of different patents that share one or several priority applications. A firm may e.g. have declared a US patent application as potentially essential to an SDO; and subsequently filed an application with the EPO using the US application as priority

¹⁵ The kind code of a patent document is a code (consisting of a letter and a number) that is part of the patent number, and identifies the kind (or type) of document; e.g. for EP patent documents, the kind code A1 identifies European patent applications published with European search report.

¹⁶ Hong, Wei, and Yu-Sung Su. "The effect of institutional proximity in non-local university–industry collaborations: An analysis based on Chinese patent data." *Research Policy* 42.2 (2013): 454-464.

application. A family extension would identify the EP patent application as potentially subject to the firm's SDO declaration.

The ETSI IPR policy e.g. stipulates that firms participating in ETSI standards development must disclose patents that are potentially essential for an ETSI standard, and indicate whether they are willing to license this patent on FRAND or royalty-free terms. Under ETSI's policy, this licensing commitment applies not only to the specifically disclosed so-called "basis patents", but also to additional patents that are members of the same patent family, using a definition of patent family that is specific to ETSI. In other words, ETSI's IPR policy only requires the declaring company to declare at least one patent family member (ETSI family definition),¹⁷ assuming all other family members are covered by the declaration and appurtenant licensing commitment.

3.2.1.2. Mapping standards specifications to technologies (standards or generations)

Firms declaring potential SEPs to an SDO usually identify the standard to which they believe their patents are potentially essential. This standard designation can be very specific (e.g. a specific section of a specific version of a TS), or highly general (e.g. broadly labelled as "3GPP"). Both highly specific and overly general standard designations can make it difficult for many users of the declaration database to determine which declared patents are potentially relevant to a standard that they wish to use.

Comparisons of different firms' portfolios often compare portfolios of patents essential to different generations of standards, e.g. for mobile communication technology 2G (e.g. GSM), 3G (e.g. UMTS), 4G (LTE), or 5G. Implementers may require more specific information, e.g. the patents that are potentially essential to a specific version of LTE, such as LTE Category 6 (LTE-Advanced).

In the case of declarations to ETSI of patents potentially essential to 3GPP, declarations may designate projects, which can be related to different standards and generation, e.g.:

- 2G: GSM/GPRS Standard - including GSM, HSCSD, GPRS, EDGE, and updates and other evolutions promulgated by ETSI/3GPP
- 3G: UMTS Standard - including UMTS, HSDPA and HSUPA (together known as "HSPA"), and updates and other evolutions promulgated by ETSI/3GPP
- 4G: LTE Standard – E-UTRA; LTE (including SAE), and updates and other evolutions promulgated by ETSI/3GPP
- 5G: New Radio

Many declarations identify the numbers of TS, along with a version number (or a release number). In combination with a version or release number, TS numbers can usually be related to a technology generation.

One TS number (even within a particular release) may however be associated with multiple generations, e.g. 4G and 5G at the same time. This means that some TS numbers are relevant across standard generations. Therefore, a patent declared potentially essential to one of the

¹⁷ For further information on the ETSI patent family definition, see Bekkers et al. (2020-1), page 14 onwards.

TS that are relevant to multiple generations (e.g. 4G and 5G) would directly constitute a declaration to multiple standards (**Table 5**).

Table 5: Examples of TS number that are relevant for both 4G and 5G

TS	Title	Group	Release	Technology Generation
TS 38.213	NR; Physical layer procedures for control	R1	Rel-15	5G
TS 38.212	NR; Multiplexing and channel coding	R1	Rel-15	5G
TS 38.300	NR; Overall description; Stage-2	R2	Rel-15	5G
TS 37.470	W1 general aspects and principles	R3	Rel-15	5G,LTE
TS 37.471	W1 layer 1	R3	Rel-15	5G,LTE
TS 37.472	W1 signalling transport	R3	Rel-15	5G,LTE
TS 37.473	W1 Application Protocol (E1AP)	R3	Rel-15	5G,LTE

Overall, 3GPP hosts almost 4,000 TS. Manually mapping these specification numbers to generations is cumbersome and time consuming. Commercial databases that offer automated mappings facilitate access to this information.

3.2.1.3. Commercial patent databases

Open and freely available patent databases such as WIPO patent scope¹⁸, Worldwide Espacenet¹⁹ or the applicable patent office’s websites,²⁰ allow the lookup of single patent documents. Also, SDOs’ declaration databases are open and freely available to look up single patent declarations.

However, to analyse and compare larger patent portfolios, patent professionals such as patent portfolio manager, licensing executives, patent attorneys, legal counsel or R&D manager, need professional software solutions that allow the analysis of patent portfolios with daily updated legal status information about patent expiration, grant status, current ownership or patent family counterparts. Providers of such commercial solutions include companies such as LexisNexis Patentsight, Clarivate Derwent Innovation, Questel Orbit, Patsnap, Minesoft Patbase and many others. Recently such companies have integrated SEP declaration information in their databases; i.e. patent datasets include a flag whether or not a patent has been declared. Some solution providers such as IPlytics, PatentCloud Inquartik, Patently or

¹⁸ <https://patentscope.wipo.int>

¹⁹ <https://worldwide.espacenet.com/>

²⁰ e.g. the USPTO patent search website <https://www.uspto.gov> › patents › search

Unified Patents have created designated patent declaration analytics solutions that allow searching across the full text of patent and standard documents.

All above-described patent software solutions are available to any user for subscription fees ranging between **5,000 and 25,000 EUR per year**. Professional software solutions provide a fast and easy access to SEP declaration data, allowing to break down patent counts of self-declared patent families by current patent owner, standards generation, even release or working group within a few minutes or hours.

While these commercial solutions significantly reduce the complexity of SEP declaration data, and access to such information is available to anyone on similar terms, the cost of subscribing to such datasets constitutes a (moderate) fixed cost for companies seeking access to information on SEPs. This fixed cost contributes to the general fixed cost of operating a SEP licensing program, or of implementing technology standards potentially subject to royalty-bearing SEPs.

3.2.2. *Blanket disclosures*

While the SEP declaration databases of some SDOs, most prominently ETSI, offer detailed (and complex) information on specific patents that are potentially essential, other SDOs, such as the Institute of Electrical and Electronics Engineers (IEEE), which specifies Wi-Fi, and the International Telecommunications Union (ITU), which specifies HEVC/VVC, **allow patent owners to submit so-called blanket disclosures**, and declaring companies are not required to declare specific patent numbers. These SDOs' databases thus contain a mix of specific declarations with patent numbers, and blanket disclosures, which may cover just a single SEP or several thousand SEPs. Our estimates show that only about 10-20% of all Wi-Fi SEPs are specifically declared at IEEE,²¹ and approximately 20-30% of all HEVC SEPs are specifically declared at ITU-T²² - hence, the large majority of potential SEPs are not specifically declared at either SDO. These SDOs' databases thus provide no useful information about the numbers of potential SEPs owned and declared by different companies.

Table 6 from research by Bekkers and Updegrave (2012) shows the **different declaration practices across SSOs**, comparing blanket and specific declarations. Declaration practices differ across SSOs that allow for blanket disclosures, but also within SDOs: while some firms predominantly make specific disclosures, other firms predominantly make blanket disclosures, and a majority of firms are hybrid (make both blanket and specific disclosures).

Table 6: Comparison of disclosure practices in different SDOs²³

²¹ Estimations in Microsoft Corp. v. Motorola, Inc. 2013 U.S. Dist. LEXIS 60233.

²² Based on comparing ITU-T declaration data with patent lists of MPEGLA's and Access Advance's HEVC patent pools.

²³ Rudi Bekkers and Andy Updegrave (2012): A Study of IPR Policies and Practices of a Representative Group of Setting Organizations Worldwide, link: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2333445

SSO	Firms that predominantly make specific disclosures		Firms that predominantly make blanket disclosures		Hybrid firms		Total
	Freq.	%	Freq.	%	Freq.	%	Total
ATIS	7	11.3%	14	22.6%	41	66.1%	62
IEC	14	14.4%	28	28.9%	55	56.7%	97
IEC-JTC1	27	16.1%	53	31.5%	88	52.4%	168
IEEE	23	4.9%	139	29.6%	307	65.5%	469
IETF	20	10.4%	18	9.3%	155	80.3%	193
ISO	10	20.4%	17	34.7%	22	44.9%	49
ISO-JTC1	32	14.2%	64	28.3%	130	57.5%	226
ITU	48	5.5%	212	24.5%	606	70.0%	866
TIA	0	0.0%	78	34.2%	150	65.8%	228
Total	181	7.7%	623	26.4%	1,554	65.9%	2,358

Firms that seek information on patents potentially essential to standards subject to blanket disclosures (including standards with significant SEP licensing, such as different versions of WiFi, or audio/video compression technologies standardized by ISO/IEC and ITU-T) thus need complementary information. Different commercial providers offer different data solutions. Patent landscaping approaches may provide indications of potential SEPs.²⁴ These approaches may use patents' CPC classification (using the CPC classes of specifically declared potential SEPs, and/or expert assessments of which CPC classes are relevant), citation data (e.g. citations to and from specifically declared SEPs, or patent citations to the standard itself), and/or semantic analyses (searching for keywords, or semantic comparisons of patents' text with the text of standard specifications or the text of specifically declared SEPs) to identify potential SEPs subject to blanket disclosures.²⁵

These studies make numerous research choices, which may be to the benefit or detriment of individual patent portfolios. Studies available free-of-charge have often been financed by individual stakeholders. High-quality analyses by unaffiliated experts are generally not publicly available free-of-charge.

3.2.3. Assessing essentiality

Accessing harmonized and processed information on declared potential SEPs (or potential SEPs subject to blanket disclosures) is only a first step for companies seeking information on the patents that are actually essential to a standard they use. It is well understood that declarations of potential SEPs (and, a fortiori, patents potentially subject to blanket disclosures) include numerous patents that are not actually essential. To assess from which patent holders standard implementers need a license, and to estimate how many SEPs these firms own (and, relatedly, what share of the total number of SEPs for a standard they own),

²⁴ Similar to datasets of specifically declared potential SEPs, these approaches certainly do not produce accurate information on numbers of actual SEPs; but they may provide an indicative starting point.

²⁵ See e.g. <https://www.managingip.com/article/2a5d08lcu0fnaw1v6eh34/data-analysis-essentiality-report-on-wi-fi-6-patents-2021> for an example for WiFi6

users of SEP declaration data also require an estimate of the essentiality share in different portfolios of declared SEPs. The cost of assessing individual patents' essentiality is substantial, and even rigorous expert assessments never provide full certainty regarding the actual essentiality of a patent. SEP licensing thus necessarily involves a probabilistic element – companies negotiate licenses for a portfolio of patents whose essentiality can never be fully known.

3.2.3.1. Share of declared potential SEPs that are actually essential

While a few declaring companies conduct claim charts before declaring patents, most declare potential patents with no in-depth analysis. In addition, companies often submit declarations when patents applications are still pending, and the standard is still evolving. Thus, patent claims as well as standards specifications are subject to change after the declaration. As a result of this practice, some of the declared patents end up being non-essential. However, publicly self-declaring all potentially essential patents for a given standard is an important part of firms' obligation under SDOs' IPR policies, and allows ensuring that all potential SEPs are subject to a FRAND commitment.

Still, such patent declarations must not be confused with verified SEPs. Additionally, self-declarations of SEPs however may not provide reliable information on whether a license is required. Several studies indicate that only a fraction of the declared patent families is essential.²⁶

For example, **Table 7**, taken from a report by Bekkers et al. (2020), indicates that only between 20% and 47% of all ETSI declared 2G, 3G and 4G patents were assessed to be essential by parties' experts and judges in two SEP litigation cases (*Unwired Planet v Huawei* and *TCL v Ericsson*).

Table 7: Essentiality rates derived from *Unwired Planet v Huawei* and *TCL v Ericsson*.

²⁶ See Goodman and Myers (2005), as well as several reports published by Fairfield Resources Intl.: "Analysis of Patents Declared as Essential to GSM as of June 6, 2007" (2007); "Review of Patents Declared as Essential to WDCMA Through December, 2008" (2008); "Review of Patents Declared as Essential to LTE and SAE (4G Wireless Standards) Through June 30, 2009" (2010)

Case	Analysis or data by	Standards in question	Total standard or portfolio of a specific party?	Essentiality rate	Numerator
Unwired Planet	Experts for Huawei ('HPA') ²³	2G/GSM	Total standard	41.2% for all 20.5% for RAN 23.7% for UE	ETSI disclosures plus filter ("Identified disclosed families with at least one issued and non-expired patent and an English or Chinese language member"
		3G/UMTS	Total standard	31.8% for all 18.2% for RAN 22.4% for UE	
		4G/LTE	Total standard	35.8% for all 22.4% for RAN 26.3% for UE	
	Experts for Unwired Planet ('MNPA') ²⁴	4G/LTE	Total standard	13.9%	ETSI disclosures plus filter
		4G/LTE	Portfolio of major patent owner A	9.4% 'at most'	
		4G/LTE	Portfolio of major patent owner B	15.9% 'at most'	
Judge Birss ²⁵	4G/LTE	Total Standard	26.2%	n/a (*)	
TCL	Experts for TCL ²⁶	2G/3G/4G	Total of all three standards	47.9%	ETSI disclosures plus filter
		2G/3G/4G	Total U.S. patents of all three standards	44.5%	
	Judge Selna ²⁷	2G/3G/4G	Total U.S. patents of all three standards	39.4%	n/a (*)

Some experts claim the essentiality rate to be even lower. A recently published 5G patent study²⁷ uses a sample of 2,000 randomly selected 5G self-declared patents (EP or US granted) to identify the share of “fully mappable” patents, that is, patents where all claim elements were found in the 5G standard specification, and a claim chart was made to justify that the patent is essential. Results of this study confirm that patent essentiality differs strongly across the self-declared 5G patent portfolios, as the share of “fully mappable” patents in portfolios of declared 5G SEPs ranges from only 6% to 30%.

Overall, the **determination of standard essentiality is not always a clear-cut case**. Patents that are yet pending have claims that are still subject to change, also standards are continuously updated in versions and releases. That is also why **SEP determination may change**. A patent may not be essential to a certain standard version today, while the next version of that standard may include newly added technologies on which the patent’s claims read. Essentiality determination is only accurate for the version of the standard it was charted against. Claim charts provide evidence whether or not a patent is verified essential. The claim charting results can be categorized in three types of result outcomes. Fully mappable patents, where all claim elements can be mapped to the standard, partially mappable patents, where only some claim elements can be found in the final standard, as well as not mappable patents where none of the claim elements can be mapped to the standard. As to a recent random sample study, only 9.32% of the declared 5G patents that were tested were found fully mappable.²⁸ These numbers confirm that the declaration databases such as the ETSI’s IPR database²⁹ include large numbers of non-essential patents, and further analysis of declared SEPs would be required to identify actual SEPs.

²⁷ “Who leads the 5G patent race November 2021?”, link: <https://www.iptytics.com/report/5g-patent-race-november-2021/>

²⁸ “Who leads the 5G patent race November 2021?”, link: <https://www.iptytics.com/report/5g-patent-race-november-2021/>

²⁹ IPR declaration - ETSI <https://ipr.etsi.org>

3.2.3.2. Cost and complexity of essentiality assessments

Assessing the essentiality of declared potential SEPs is complex and costly. The complexity of the standardized technology (sometimes consisting in thousands of TS with numerous sections) makes it difficult to identify the sections to which a patent could potentially be essential. This problem is exacerbated by the fact that most declarations fail to specify specific sections of a TS to which a patent could potentially be essential. Furthermore, the expertise that is necessary for an informative essentiality assessment is expensive.

The complexity of standards subject to SEPs

One reason why **human SEP determination is both costly and time consuming is the complexity of the standardized technology**. Standards such as e.g. 5G consist of over a thousand TS. These TS may have up to 600 pages and hundreds of so-called sections. Individual declared SEPs very often relate to multiple TS – on average, those SEPs for which declaring firms designate specific TS to which they believe these patents to be essential, have been declared essential to 6.84 different TS.

Based on IPlytics data, there were approx. 260.000 patents that had been declared potentially essential to ETSI – considering the average of 6.84, this would result in an estimated 1.778.440 combinations of patents and TS. How many of these combinations would need to be checked would depend on the structure of the essentiality checks (**Figure 10**).³⁰

Figure 10: Combinations of declared SEPs and TS (ETSI SEP database example):



³⁰ As discussed later, checks are often carried out for only one member of a patent family. Nevertheless, using ETSI's family definition, there are still 72,686 declared patent families in the ETSI database (as of 13.7.2022), resulting in an estimated number of 497,172 combinations to be checked.

Under-specificity of SEP declarations

Declarations, while overly complex for many users seeking quick access to information on patents potentially essential to a technology they wish to use, are often insufficiently specific to support the work of technical experts tasked with verifying whether patents are actually essential. To *check* the actual essentiality of a patent, one would need the number and version of the relevant specifications, and the specific sections thereof to which the patent most specifically relates. Ideally, the expert would also need the numbers of the specific claims of the patent which are believed to be potentially essential.

A recent study shows that only 7.2% of the patent declarations specify a section number.³¹ If that section number is not declared, to identify if a declared patent relates to a standard, experts may need to study and understand much larger numbers of patent claims and standards sections to identify the potentially relevant claims and sections. At least three studies have established that technical experts are more likely to corroborate the essentiality of declared potential SEPs if the disclosure indicates a specific standard section (Stitzing et al., 2017; Brachtendorf et al., 2020; Baron and Pohlmann, 2021). This may indicate that SEP declarants are more likely to indicate standard sections for patents that have a higher likelihood of being essential; or that experts find it easier to corroborate SEP declarations that point to specific sections of a TS.

More specific (i.e. more informative) SEP declarations, which indicate not only patent and TS numbers, but identify specific claims and TS sections, may thus facilitate the task of technical experts charged with assessing the essentiality of declared potential SEPs. In addition, experts' assessments may be supported by automated approaches that identify potentially relevant claim-section combinations, and allow experts to focus on the most relevant sections and claims.

The unit cost of essentiality and validity assessments

While producing objective information on patents' likelihood to be found valid and essential may improve parties' negotiation positions, such expertise is often very expensive. In order to assess the general cost range for these assessments, we conducted standardized interviews with 10 subject matter experts, including both inhouse experts working for SEP owners as well as external experts representing SEP owners as well as SEP licensees.

Experts generally concurred that **validity analyses** (in particular analyses of the prior art) are usually **more complex and costly than essentiality assessments**. Put differently there is almost no limit on spending budgets to find prior art. Experts also concurrently reported that essentiality analyses are usually undertaken first, i.e. usually only the prior art for patents considered likely to be essential is assessed.

Subject matter experts that are qualified to provide an **assessment of essentiality** require **extensive experience in the SSO working groups** where the particular standards were developed to really understand the complex technology standards. **Experts without such experience must read and study the specification first before they can even start the claim charting**. As to IPlytics data 5G is currently subject to over 1,200 standards

³¹ Baron and Pohlmann (2021); Table 2

specification documents that on average have between 98-671 pages and 80-350 different sections. Subject matter experts must read through all this to conduct claim charts.

It is not only difficult to find the right experts for claim charting, but the **hourly rates** can be as high as 500€ outside of litigation (technical expert witnesses often request even higher rates during litigation) and on average vary between 200€-500€.

The identified experts provided average estimates of the time needed for claim charting as well as the cost of claim charting. Identifying if individual patents are essential may require hours or even days of work (sometimes weeks). Before large budgets are spent on rigorous claim charting, some companies may also employ experts to do a first “light” SEP determination. For such first “light” evaluations, experts may only have on average 30 minutes to determine if a patent’s claims are potentially mappable to a standards section. In the interviews with the experts, we defined different rigorousness levels of claim charting to provide the average minutes spent as well as the associated costs for each rigorousness level applying an average hourly rate of 367€ (based on the hourly rate average of the 10 experts). **Table 8** compares the average minutes spent, the mean minutes spent as well as the minimum and maximum minutes spent as to the different rigorousness levels.

Table 8: SEP evaluation rigorousness level description

	SEP evaluation rigorousness level description	Average minutes	Median minutes	Min minutes	Max minutes
A	Light SEP evaluation: Rough determination whether any TS could be relevant for given patent at all	58	30	5	210
B	Quick SEP evaluation: Rough determination, which TS could be relevant for which claim features of the given patent	129	60	15	450
C	Specific SEP evaluation: Determination of specific standard sections for each claim feature of the given patent	243	120	120	600
D	Claim chart: Specific SEP evaluation plus arguments on mapping, i.e., specific correspondence	680	600	120	1,440
E	Claim chart as to d) covering 2 different standards (e.g. 4G/5G)	1,000	1,020	720	1,440
F	Claim chart as to d) with potential objections on essentiality	1,160	1,260	480	1,440
G	Claim chart as to d) with potential objections on novelty, inventive step, and/or added subject-matter	1,285	1,395	960	1,440
	SEP evaluation rigorousness level description	Average costs in €	Median costs in €	Min. costs in €	Max costs in €
A	Light SEP evaluation: Rough determination whether any TS could be relevant for given patent at all	355 €	184 €	31 €	1,285 €
B	Quick SEP evaluation: Rough determination, which TS could be relevant for which claim features of the given patent	789 €	367 €	92 €	2,753 €

C	Specific SEP evaluation: Determination of specific standard sections for each claim feature of the given patent	1,486 €	734 €	734 €	3,670 €
D	Claim chart: Specific SEP evaluation plus arguments on mapping, i.e., specific correspondence	4,159 €	3,670 €	734 €	8,808 €
E	Claim chart as to d) covering 2 different standards (e.g. 4G/5G)	6,117 €	6,239 €	4,404 €	8,808 €
F	Claim chart as to d) with potential objections on essentiality	7,095 €	7,707 €	2,936 €	8,808 €
G	Claim chart as to d) with potential objections on novelty, inventive step, and/or added subject-matter	7,860 €	8,533 €	5,872 €	8,808 €

For the lightest type of SEP evaluation, the individual experts' estimates of time requirements varied significantly, from 5 minutes at the lower end to 210 minutes at the higher end, with a median value at 30 minutes and average value as high as 58 minutes. The median and average minutes spent were much closer for the more rigorous levels D, E, F and G, where individual experts' opinions were more aligned. The interviewed experts all agreed that a rigorousness level of category D is required for an actual claim chart, which experts estimated to require a minimum of 120 minutes and a maximum of 1,440 minutes of work. The median for rigorousness level D was 600 minutes, with an average of 680 minutes. When applying the average hourly rate of 367€; such a claim chart costs 3,670€ (as to the median value of category D).

When larger patent portfolios are evaluated, subject matter experts stated to discount their hourly rates by 20-30%. Nevertheless, even with a discount of on average 25% per claim chart, average costs per patent at that level of rigorousness would still be 2,750€. **Figure 12** illustrates that the **claim charting costs for patent portfolios of 200 patents can thus exceed half a million Euros.**

The costs averages for claim charting listed above are in line with earlier EU studies and subject matter expert interviews.³² Experts interviewed for the 2016 EU study reported that to provide assistance to licensors/licensees to help with commercial negotiations or litigation subject matter experts would charge approximately 5,000€ to 10,000€ per patent to develop claims charts and validity checks. **Table 10** is based on claim charting costs only, but the 10 interviewed experts indeed reported that **with providing potential objections on novelty, inventive step, and/or added subject-matter the costs go up to 5,872€-8,808€ per patent** (see category G).

In a recently published study (Bekkers et al., 2020), findings on technical feasibility were based on a pilot experiment with a total of 205 essentiality assessments. The experiment conducted in the study confirmed that essentiality assessments on a larger scale, where each assessment takes on average approximately 7 hours (420 minutes), are technically feasible. Here, the most consistent results were achieved by patent examiners who work in a patent office. For the experiment patent examiners had to claim chart patents that were before charted by patents pools. The examinations reached a consistency rate of 84%. The 420 minutes spent are however as to the category of the 10 experts interviewed in this study not yet enough to conduct real claim charts as to category D with on average 600 minutes spent.

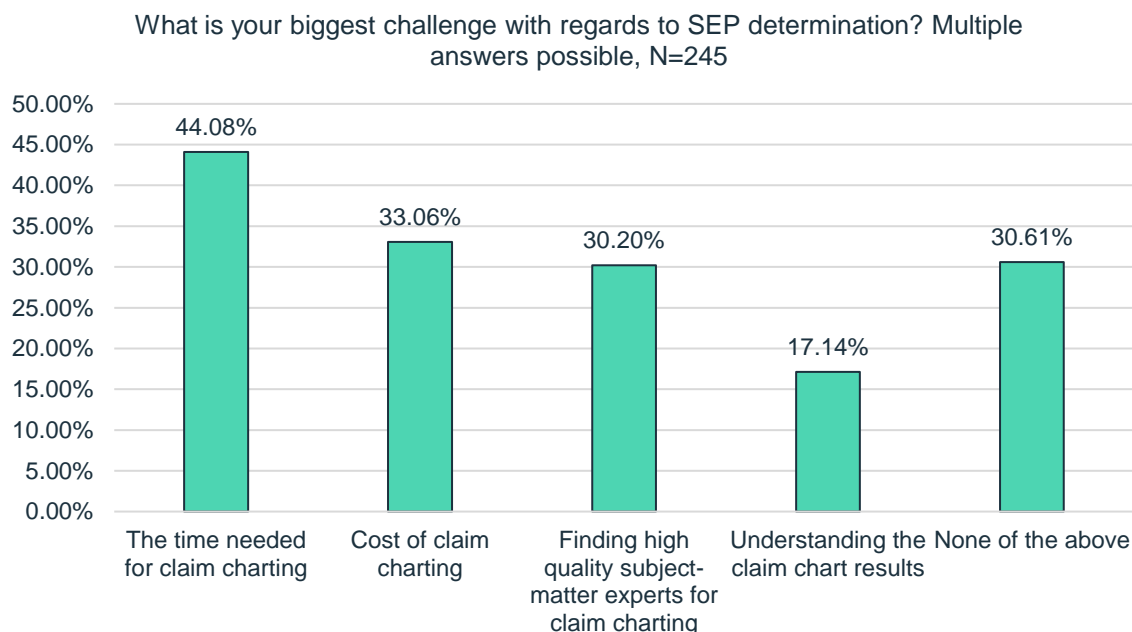
The 10 experts that we interviewed stressed that the times indicated in the rigorousness levels in **table 10** only consider claim charting comparing the patent's claims and the standards

³² Pohlmann and Blind (2016), Pages 50- 51. Link: <https://ec.europa.eu/docsroom/documents/20741/attachments/1/translations/en/renditions/native>

section. This **patent essentiality check differs from patent infringement analysis because patent infringement depends on the specific implementation of a standard in a device.** Here, not every device category needs to incorporate all the elements of a standard. It depends on whether the patent in question is only essential to an optional or a normative feature which may or may not have been implemented in the device. One expert provided the example that in LTE the mobile's device-to-device communication features are specifically aimed at public safety applications, hence irrelevant to a smartphone. Another example is that Machine Type Communication devices cannot use high end 5G features and thus will not need such patented technology in a 5G implementation. Also, SEPs essential to base stations may or may not be used in a smartphone. As the 5G standard will have an increasing number of application layers compared to LTE, the essentiality check of patents will depend very much on how the 5G technology specifications are implemented (for example in a vehicle compared to a smart phone or smart meter). Various subject matter experts stated that with an increasing number of 5G implementations for different use cases, claim charting must consider these use cases and thus the different implementations of a standard.

A recent industry survey conducted by IPlytics in 2022 shows that claim charting challenges are not only about the budgets (**Figure 11**). The experts surveyed were both working for SEP holder as well as SEP implementers. Over 44% of the surveyed experts reported that **the time needed for claim charting is the most challenging part when charting patents.** Indeed, as to the time estimations in table 10 a subject matter experts may need more than one day just to conduct one claim chart. If that expert works alone, claim charting a portfolio of 200 patents may need almost a whole year. While maybe larger teams of claim charting experts provide faster result, more than 30% of the surveyed experts reported to have difficulties with finding such experts. 33% of the surveyed experts claimed that limited budgets to be spent on claim charting also creates challenges.

Figure 11: Practitioner survey about claim charting challenges (IPlytics, 2022)



In licensing negotiations there are **costs of charting for licensor in building the charts and costs for licensee in reviewing the charts.** Some licensees have argued that negotiation level claim charts provided by licensors are in some cases not fit for purpose and leave the licensee with too much work to do. Licensors argue that this represents a level of “risk” in

the negotiation that should be seen as normal business risk. At least in Germany, courts have repeatedly clarified that implementers can be expected to seek the necessary technical assistance (and thus make appurtenant investments) to form their own opinion on the technical information provided by SEP holders.

3.3. Licensing probabilistic patents

As discussed, firms' declarations to SDOs are often the only generally available source of information on potential SEPs. These declarations however, in addition to their complexity and general difficulty to use, include numerous patents that are not actually essential. Assessing the essentiality of all declared potential SEPs is complex and costly. In this section, we analyze how the absence of affordable information on patents' essentiality affects SEP licensing; first, we describe what the absence of information on the essentiality of individual patents entails for the probability of needing a license, and the size and quality of the portfolio for which a license is potentially needed. Second, we assess how these factors affect the behavior of parties, and in particular the extent to which they actually choose to incur the expense of assessing patents' essentiality.

3.3.1. Probabilistic SEP portfolios

As stated in Section 0., parties may require information about the technical characteristics of potential SEPs (most notably their essentiality and validity) in order to form an assessment of two crucial magnitudes: the probability that an implementer requires a license for a certain portfolio, and a FRAND value of a license to that portfolio.

3.3.1.1. Probability that a license is needed

In general, an implementer requires a license to a portfolio if the portfolio includes at least one valid patent that is essential to a standard that the implementer is using. In addition to including patents that are potentially non-essential, **SEP declaration data include patents that would potentially be found invalid if challenged**. According to Darts-ip data, when challenged, 29% of declared SEPs are fully upheld, and 29% are fully revoked, while 42% are partially upheld (with the scope of protection being reduced). There is no significant difference between declared SEPs and comparable patents in the rates at which patents are found valid, partially valid, or invalid. For the US, Lemley and Simcoe (2018) find a SEP validity win rate of 83.7% (asserted patents only). They also show that declared SEPs are statistically significantly more likely to be upheld than comparable patents.³³

Patents whose validity was challenged are not representative of the general patent population, and there are no studies of patent validity rates based on randomly selected

³³ It is likely that cases "won" by the patent owner according to Lemley and Simcoe (2018) include cases in which patents are partially upheld. In which case the observed rates are comparable.

samples. Academic studies have inferred validity rates in the patent population using a combination of diverse methodologies, yielding vastly different estimates.³⁴ We are not aware of studies estimating validity rates in the population of declared SEPs, or estimating how validity rates vary between firm portfolios. Given that all firms’ patents are subject to the same examination process at patent offices, we believe that **it is plausible that there is less variation in validity rates between firm portfolios than essentiality rates. In that case, the effect of uncertainty regarding patent validity on overall licensing uncertainty would be limited.**

To **illustrate** the implications of essentiality and validity uncertainty for SEP licensing, we can compute the likelihood that a license is needed for a particular portfolio, depending on the size and average essentiality rate of the portfolio, and different assumptions regarding validity rates. To simplify, we focus on three different essentiality rates, a low (10%), medium (25%), and high (50%) rate. For validity, we apply an optimistic (80% valid) and a pessimistic (30% valid) assumption. We assume that essentiality and validity are independently distributed (a patent’s likelihood to be valid is independent of its likelihood to be essential).³⁵

Table 9: Validity and essentiality

validity	pessimistic (30% valid)			optimistic (80% valid)		
	low (10%)	medium (25%)	high (50%)	low (10%)	medium (25%)	high (50%)
essentiality						
Portfolio size						
5	0.1413	0.3228	0.5563	0.3409	0.6723	0.9222
10	0.2626	0.5414	0.8031	0.5656	0.8926	0.9940
25	0.5330	0.8576	0.9828	0.8756	0.9962	1.0000
50	0.7819	0.9797	0.9997	0.9845	1.0000	1.0000
100	0.9524	0.9996	1.0000	0.9998	1.0000	1.0000
250	0.9995	1.0000	1.0000	1.0000	1.0000	1.0000

Table 9 illustrates the likelihood that a license is needed for a portfolio of a given number of potential SEPs, depending on the underlying validity and essentiality rates. As an example, consider a medium size portfolio of 100 potential SEPs, which is known to be of low “quality”, i.e. the likelihood for each individual patent in this portfolio to be essential is

³⁴ de Rassenfosse et al. (2021) use correlations between different patent offices’ examination outcomes, and derive a validity rate above 90%. Henkel and Zischka (2019) use evidence on invalidation in court, addressing various selection effects, and estimate that only 23% of granted German patents are fully valid.

³⁵ The likelihood that a portfolio of n patents includes at least one patent that is both valid and essential, given individual patents’ probability to be essential p_e , and probability to be valid p_v , is $1 - (1 - p_v p_e)^n$

low (10%). Even if one is pessimistic about the actual validity of patents granted by European patent offices (e.g. estimate that only 30% of such patents would be found valid if challenged), there would still be a 95% chance that this portfolio includes at least one valid and essential patent (on expectation, assuming that validity and essentiality probabilities are independently distributed). From these calculations, it is clear that the **validity and essentiality rates of individual patents are really relevant for the question of whether a license is needed only in the case of smaller portfolios.**

On one hand, larger portfolios, are highly unlikely not to include a single valid and essential patent. The vast majority of declared SEPs form part of such larger portfolios; i.e. uncertainty regarding the essentiality and validity of these patents has a limited impact on the most decisive form of licensing uncertainty (uncertainty whether a license is needed). On the other hand, there is a large number of companies owning portfolios of smaller numbers of declared SEPs for particular standards. Depending on the average strength (validity and essentiality rate) of the patents, there is a significant likelihood that an implementer does not need a license to such a portfolio. This uncertainty may contribute to the difficulty of licensing smaller portfolios of potential SEPs, and may be a significant driver of the subset of SEP litigations involving smaller SEP portfolios.

3.3.1.2. Probabilistic size of portfolios

While larger portfolios of potential SEPs are unlikely not to include a single valid and essential patent, there can be significant uncertainty regarding the actual size of such portfolios, i.e. the number of valid and essential patents therein.

The absolute number of patents in a portfolio is usually less relevant to the assessment of whether specific licensing terms are FRAND than the *relative* number of patents: parties may seek information on the portfolio's *share in the total number of valid SEPs* for a standard, in order to apportion a reasonable aggregate royalty, or to cross-check whether an otherwise derived royalty rate for this specific portfolio is consistent with a reasonable aggregate royalty burden. Furthermore, when comparing licensing terms between different licenses, it may be necessary to produce estimates of *relative portfolio strengths*, including comparisons of the number of valid SEPs in the different portfolios.

The focus on relative numbers may attenuate the impact of certain uncertainties regarding patents' characteristics. As discussed, estimates of the actual validity of granted patents vary substantially. Some authors find that only approx. 20% of granted patents are fully valid (Henkel and Zischka, 2019), whereas others find that more than 90% of granted patents are actually valid (de Rassenfosse et al., 2021). This huge variation between different estimates is certainly larger than plausible variations in validity rates between different firms' portfolios. All patents undergo the same examination process. While there can be significant scholarly debate regarding the *accuracy* of patent offices' examination outcomes, it does not seem plausible that patent examination is subject to significant and systematic *bias*.

Following this argument, we believe that aggregate patent validity rates are highly uncertain, but the probability for granted patents to have been erroneously granted is unlikely to vary

significantly between firms; i.e the probabilities of patent invalidity conditional upon a positive examination outcome are similar across firms. If this is true, validity rates play a minor role in determining the *relative* number of patents in different *large* portfolios – validity rates are unlikely to differ dramatically from one large portfolio to the other. We assess that for larger portfolios of 150 patents or more, uncertainty resulting from potential invalidity of individual patents in the portfolio is unlikely to lead to over- or under-assessments of relative portfolio strengths by a factor greater than 1.2. For specific calculations, see Appendix 3.

Essentiality rates in different firms' portfolios of declared SEPs can however vary more substantially, reflecting e.g. different firms' different disclosure strategies. Brachtendorf et al. (2020) e.g. find that the share of presumably true SEPs in different firms' (larger) portfolios varies from 22.9% to 43.3%. Baron and Pohlmann (2021) find a similar distribution of predicted essentiality rates across portfolios. Using these estimates, we can state that uncertainty about essentiality rates in different firms' larger portfolios may lead to divergences in relative portfolio strength estimates of up to a factor of 4 (e.g. a portfolio containing twice as many declared SEPs as another portfolio may plausibly contain about one to four times as many actual SEPs as that other portfolio).³⁶ The uncertainty regarding the share of a portfolio in the total number of SEPs for a standard is lower (as variations between other firms' portfolios cancel each other out) – a firm whose portfolio accounts for 20% of the potential SEPs for a large standard may plausibly hold about 13 to 27% of the actual SEPs for that standard.³⁷

From these calculations, it is clear that uncertainty regarding the number of actual SEPs may contribute to uncertainty regarding the FRAND value of a license. The role of uncertainty regarding the number of actual SEPs is larger in the context of a comparable license analysis comparing licenses to different portfolios, as the uncertainty regarding the number of actual SEPs in the focal portfolio and the comparison portfolio compound each other, whereas it is more moderate in the context of a top down analysis.

Plausible divergences in the estimated relative portfolio strengths are larger for smaller portfolios. For empirically observable larger SEP portfolios, different opinions regarding the number of actual SEPs in a portfolio may explain divergences between parties' view of a FRAND rate up to a factor of 2 (up to a factor of 4 in the context of a comparable licenses analysis across different portfolios). This is an estimate of the maximum role that this uncertainty can play, based on a scenario in which the FRAND rate is strictly numerically proportional to the number of actual SEPs. In practice, the estimated number of actual SEPs is however only one among many relevant factors; the dependency of the FRAND rate on the estimated number of actual SEPs is therefore likely to be lower. Nevertheless, even this maximum estimate cannot adequately explain empirically observable divergencies between parties' FRAND offers – it is thus clear that disagreements regarding the relative number of actual SEPs in a portfolio are only one among many factors in SEP licensing disputes. Quantitatively, divergent estimates of relative portfolio sizes may be a significant or even decisive factor in disputes over the terms of licenses to smaller portfolios, whereas disputes over licensing terms for larger portfolios would be more significantly driven by other commercial and economic considerations.

³⁶ Assume portfolio A includes 100 declared SEPs and portfolio B includes 50 declared SEPs. If firm A's essentiality rate is very low (22%) and firm B's rate is very high (44%), both firms have 22 SEPs; if firm A's essentiality rate is very high (44%) and firm B's rate is very low (22%), firm A has 44, and firm B has 11 SEPs.

³⁷ If firm A's 100 declared SEPs have a low (22%) essentiality rate, and the total 500 SEPs have an average essentiality rate of 33%, firm A's 22 SEPs account for 13.3% of the total; if firm A has a high essentiality rate, its 44 SEPs account for 26.7% of the total (assuming that the essentiality rate of the total number of potential SEPs is average)

3.3.2. *Parties' expenses on technical assessments of potential SEPs*

Based on the analysis of the licensing uncertainty arising from the probabilistic nature³⁸ of patents' validity and essentiality, and the estimated unit cost of expert assessments of individual patents, we can analyse parties' endogenous decisions to spend resources on such technical assessments.

3.3.2.1. SEP holders' assessments of their own portfolio

SEP holders must make some kind of technical assessment of their portfolio before seeking to license their portfolio to standard implementers. Based on practitioner reports, it appears that SEP holders' practices in this regard vary significantly. On one end of the spectrum, some SEP holders reportedly provide claim charts for every SEP included in their licensing offer.³⁹ On the other end, some SEP holders do not provide claim charts at all during negotiations.

While an implementer may require a license if at least one patent in the entire portfolio is both valid and essential, several practitioners reported that it is economically not feasible to produce claim charts for every patent in a larger portfolio.⁴⁰ SEP holders may provide claim charts for a sample of the licensed patent portfolio. Technical discussions between the parties of SEP licensing negotiations will usually focus on the characteristics of the patents in that sample (often called a "proud list").

SEP holders actively engaging in licensing negotiations, particularly when seeking to resolve a licensing dispute through litigation, thus usually need to make a selection among their declared SEPs, and identify the patents they choose to put forward and/or assert. Furthermore, at least if they pursue injunctive relief, and at least for the asserted patents, they must have provided sufficient notice of infringement before filing a lawsuit, which may entail an explanation of how the patent relates to the standard and/or accused infringing product⁴¹. The required level of detail of that explanation is likely to vary depending on the circumstances of the case, but is generally below the level of an actual claim chart.

³⁸ "The probabilistic nature of patents' validity and essentiality" refers to the fact that validity and essentiality can always be challenged. This, despite the existence of a presumption of validity which accompanies a patent granted by a patent office. The probabilistic nature of essentiality is also connected to the developments supra on declarations.

³⁹ Presumably one patent for each family of declared SEPs. Subject matter experts confirmed that for most FRAND negotiations they were involved in, the patents charted were either EP or US patents. As technical standards specifications are most often in English language it is straight forward to chart English original language patents from the EPO or USPTO. However, also Chinese expert translated patents have been charted in some cases which however creates another level of costs and also technical complexity, due to the interpretation that happens during the translation of claims

⁴⁰ The burden and costs to claim chart patents is however also relevant to licensees, because even when enough claim charts are available, the licensee must usually verify the charts with their own experts.

⁴¹ As established under the negotiation framework developed by the CJEU in Huawei/ZTE. See infra, on complex dispute resolution.

In any event, SEP holders engaging in licensing would thus generally make some assessment of individual declared SEPs in their portfolio to identify patents with a sufficient prima facie likelihood of effectively being essential. Depending on the circumstances, the company's strategy, and the size of the portfolio, the SEP holder may carry out further assessments of increasing stringency (e.g. proceeding from categories B to G in Table 10) on all or some of the patents with sufficient prima facie likelihood of being essential.⁴² These internal analyses will support the company in formulating a licensing offer. The company may also make a selection of patents that it will explain to prospective licensees in the course of negotiations (e.g. by sharing expert assessments of individual patents of varying degrees of rigorosity). These analyses will also support the company's decision which patents to assert in litigation (if applicable, these are usually the ones that were discussed during the technical phase of the negotiations).

In its analyses, the SEP holder can often rely on existing internal resources. While some SEP holders hold significant portfolios of declared SEPs that they have acquired from other companies, many SEP holders have produced their SEP portfolios by participating intensively in standards development; they thus possess significant tacit knowledge regarding the standard and the underlying technology. Note also that assessing its own portfolio is a fixed cost for a SEP holder – the information thus produced can be used in negotiations with a variety of implementers.

3.3.2.2. Implementers' assessments of SEP holders' portfolios

Implementers using standards subject to potential SEPs may also need to carry out some technical assessment of these SEPs. We believe that there are at least two circumstances in which implementers currently regularly undertake some kind of assessment of the SEPs that they potentially use.

First, when determining whether to implement a certain standard, implementers may need to form an opinion of the provisional licensing cost related to that standard, e.g. to include a plausible expectation of this cost in their bill of materials. These assessments may require an approximate estimate of the number of SEPs and SEP portfolios to which they need to be licensed.

Second, implementers may need to carry out more extensive analysis of individual SEP portfolios in support of licensing negotiations, usually upon receipt of a notice that they are allegedly infringing on SEP holders' patent rights.⁴³ At least in Germany, courts have consistently found that while patent holders' notice of infringement must enable implementers to evaluate the allegation of infringement, implementers can be expected to carry out their own assessment of these patents (at their own cost) in order to understand whether they need a license to this SEP.⁴⁴ If an implementer concludes that a license is needed, they may need to form an opinion on the size and technical quality of the SEP portfolio covered by the SEP holder's licensing offer, in order to assess whether the offer

⁴² A company owning a large portfolio may thus carry out light-touch assessments of all patents to identify a (large) subset of potentially suitable patents, carry out further assessments on this subset to identify a narrower set of candidates, and focus more detailed assessment efforts on this narrower set.

⁴³ Theoretically, implementers could pro-actively approach (potential) SEP holders and request a license. Empirically, this appears not to be a common practice (see our analysis of the usual sequence of FRAND disputes in Germany in Section 6.3.2.2.)

⁴⁴ See in particular the BGH decision of 5 May 2020 in *Sisvel v Haier*, KZR 36/17, at 85.

that they have received is actually FRAND. An estimate of the number of valid and essential patents included in this portfolio may be one relevant aspect of this evaluation.

In practice, the extent to which implementers engage in these technical assessments varies significantly from one situation to the other. In the public consultation, responding firms were invited to report the costs they incur for estimating their SEPs exposure per product that they want to bring on the market. There is significant heterogeneity in survey responses, and only 19 quantitative responses, while nine respondents indicated that it is impossible to provide a general quantitative estimate.⁴⁵ The 19 quantitative responses are indicative of a bimodal distribution. Eleven respondents reported costs below 50,000 Euro (seven below 10,000 Euro, and four 10,000-50,000 Euro), whereas six respondents reported costs above 500,000 Euro,⁴⁶ and only two respondents selected intermediate ranges (one respondent each reported “50,000-100,000” and “100,000-250,000”).

Economically, this pattern makes sense: Many implementers may lack the capabilities to assess the essentiality or validity of SEP claims for licensing.⁴⁷ This means that obtaining technical assessments of potential SEPs may be particularly costly for such firms. Investments of less than 500,000 Euro may not be sufficient for implementers to formulate an informed own position on the relative size and quality of different SEP portfolios for major standards (including patent landscaping, sampling, essentiality checks, analyses of relative patent quality etc.).⁴⁸ Most implementers may thus rely on publicly available information, or commercial solutions available for less than 50,000 Euro.

Note that none of the 19 respondents who have provided a quantitative estimate purported to represent an SME. Qualitative comments indicated that even a cost of 10,000 Euro (consistent with the cost of available commercial solutions) would be prohibitive for SMEs. This is in line with qualitative responses from SEP holders, who reported that in their view a majority of implementers does not incur any significant expenses in assessing their SEP exposure.

The expected value of the license needed by small implementers (such as SMEs) may regularly not justify the cost of any meaningful technical assessments. In some cases, implementers may have access to reliable public information (e.g. court cases) on the validity and essentiality of individual patents. More commonly, implementers may rely on information that significant numbers of other, similarly situated implementers have taken a license to the same portfolio (e.g. publicly available lists of licensees in good standing) to conclude that they also need a license. In many cases, SEP holders furthermore rely on comparable licenses to justify their offered licensing terms, and comparable licenses are often accepted by courts as a criterion to establish that a licensing offer is FRAND. In such situations, implementers are less likely to invest significant resources into forming their own technical assessments of whether a license is needed, or to form an opinion on the technical merit of the portfolio.

⁴⁵ Some respondents also reported to have no knowledge of these costs, as these costs are typically borne by their suppliers or customers.

⁴⁶ Five respondents chose the option “>500.000 Euro”. We added one respondent who chose the option “100.000-250.000 Euro”, but added a comment clarifying that this is the estimated cost per license, not per product.

⁴⁷ This is especially true for automotive OEM, where the integration of cellular technology comes from off-the-shelf connectivity modules provided by suppliers, and OEMs do not participate significantly in the development of the standardized technology embedded in such connectivity models.

⁴⁸ Several respondents who reported that they do not incur such expenses pointed out that given the number of potential SEPs and the cost per patent of such assessments, the cost of such in-depth analysis would generally exceed 500,000 Euro.

Only large implementers have incentives to hire internal experts or external counsel to conduct their own in-depth analyses of potential SEP portfolios for in-licensing purposes. Large implementers are most likely to invest significant resources into technical assessments of SEP portfolios for various reasons: first, the value of the licenses they may need is more likely to justify significant expenses in technical assessments. Second, large implementers are more likely to be able to negotiate individual rates in bilateral licensing, rather than standard rates accepted by many other similarly situated firms. Third, even when small and large implementers are offered the same standard licensing terms, implementers' challenges to these licensing terms are subject to a *collective action problem* – if one implementer's acceptance of certain licensing terms is observable to other implementers (e.g. because a SEP owner makes confidential information on comparable licenses available during negotiations), acceptance of these terms by a larger implementer may induce smaller implementers to accept the same offer; as smaller implementers may rely on the greater incentives of larger implementers to assess the portfolio and form an opinion on whether the offered terms are FRAND.

3.3.3. *SEP licensing under imperfect and asymmetric information*

Based on these considerations, we can analyze the impact of uncertainty regarding the technical characteristics of potential SEPs (in particular the validity and essentiality of these patents) on the form and the efficiency of SEP licensing. We can distinguish between large and small portfolios, and large and small implementers:

Small portfolios of potential SEPs may be subject to significant uncertainty whether a given portfolio contains any patent that is both valid and essential. In addition, there is significant uncertainty regarding the number of valid and essential patents in such portfolios, potentially contributing to significant uncertainty regarding the value of a license to this portfolio. This uncertainty can be resolved through litigation, and may diminish over time, if sufficient numbers of licensees join the licensing program.

Large portfolios of potential SEPs are usually highly likely to include at least one valid and essential patent; but there can be substantial uncertainty regarding the size of the portfolio. Nevertheless, plausible estimates of validity and essentiality rates vary less than in the case of smaller portfolios. The remaining uncertainty regarding validity and essentiality however is very expensive to resolve.

Small implementers may often lack the means to carry out detailed technical assessments of potential SEPs, and because they do not sell in big volumes, the total amount of the royalty they potentially need to pay may often not justify the considerable expense of acquiring external expertise. These implementers may request SEP holders to provide information on licensing terms accepted by similarly situated licensees for an alternative indication of the FRAND value of the license.

Large implementers are more likely to have the means to carry out or acquire technical assessments of potential SEPs. The larger per unit value of the licenses they may require regularly justifies considerable expenses in such assessments; and such implementers more commonly find it advantageous to negotiate bilateral licenses on idiosyncratic terms. Even when being offered licenses on standard terms accepted by other implementers, large implementers may need to carry out detailed assessments of these licenses and underlying portfolios in order to uphold a reasonable check on SEP owners' licensing offers.

There are thus cases in which there is a significant probability that a portfolio does not include any patent that is both valid and essential. In such cases, parties may agree to a license on terms that reflect the probabilistic nature of the necessity for a license. Alternatively, parties may resolve their disagreement on the necessity for a license through litigation.⁴⁹ There are also cases in which implementers challenge the validity and essentiality of patents asserted by the owners of large portfolios of declared SEPs (such as numerous challenges from Daimler to the validity of individual patents asserted by Nokia). Such challenges are highly unlikely to eliminate the need for a license; but they can be used strategically to increase the SEP holder's willingness to make concessions.⁵⁰

Overall, the validity and essentiality of individual declared (potential) SEPs are often unknown and costly to assess. In SEP licensing negotiations, this uncertainty has the *potential* to cause significant transaction costs. The level of these costs is likely to vary substantially. Depending on the circumstances, costs created by this uncertainty may also take different forms: some parties have incentives to invest significant resources into resolving uncertainty regarding patent validity and essentiality, significantly contributing to the direct costs of licensing negotiations and litigation. In other cases, parties choose to negotiate licenses based on limited information and probabilistic beliefs about patents' validity and essentiality. Depending on the distribution of information and parties' bargaining power, deliberately agnostic licensing of probabilistic SEPs can be individually rational and socially efficient; nevertheless, licensing under incomplete and often asymmetric information may also contribute to under-licensing, licensing delays, as well as licensing on economically inefficient licensing terms. Relative to potential revenue, the costs related to uncertainty regarding patents' essentiality and validity are likely to be largest for smaller portfolios. On the implementer side, while large implementers are likely to incur the largest share of observable expenses related to the resolution of this uncertainty, smaller implementers are likely to be particularly affected by indirect costs (such as necessity to accept licensing terms that may be unreasonable, or delays in the availability of SEP licenses).

⁴⁹ This is illustrated by SEP litigations such as Core Wireless/Conversant vs LG Electronics at the TGI Paris; in which each of the asserted patents was found either invalid or non-essential.

⁵⁰ From a welfare perspective, the effect of this type of litigation is ambiguous. On one hand, litigation on the validity and essentiality of individual patents from large portfolios uses significant resources, creates significant licensing delays, and produces limited information on the value of a portfolio. Given that the few patents that are asserted and challenged are non-randomly selected, the small number of patents that are assessed provide no meaningful information on the average quality of the larger portfolio from which they are drawn. On the other hand, the availability of endogenous challenges to patent validity through courts may contribute to the overall screening of patent validity, reduce the private value of invalid patents, and thus result in lower rates at which invalid patents are filed and granted (Schankerman and Schuett, 2021).

4. UNCERTAINTY REGARDING FRAND

There is significant disagreement regarding the meaning of FRAND. Standard implementers may face significant uncertainty regarding the rates at which they may be able to obtain SEP licenses. Furthermore, SEP holders and implementers may disagree on what terms are FRAND. We assess the prevalence of each of these issues. First, we review available sources of guidance on the concept of FRAND and discuss possible limitations. Next, we review the sources of information on SEP licensing terms available to implementers and discuss whether they are sufficient to eliminate uncertainty. Finally, we assess the prevalence of disagreements over FRAND from SEP licensing disputes.

- *SDOs' patent policy and uncertainty regarding the meaning of the FRAND concept:* most of the relevant SDOs do not define or describe licensing terms that would fulfil the patent holder's commitment to offer licenses on FRAND terms.
- *Ex-ante announcements of SEP licensing terms through SDO processes:* There have only been few voluntary ex-ante announcements of licensing terms by SEP owners, and their informative content is limited. SDO policies requiring binding ex-ante disclosures of most restrictive licensing terms remain very rare.
- *Unilateral ex-ante announcements of SEP licensing terms by individual SEP owners:* the rates that companies declare individually are a high ceiling to the actual licensing terms agreed upon between SEP holders and licensees.
- *Joint announcements of a reasonable maximum aggregate royalty stack* by groups of SEP owners suggest a reasonable maximum aggregate royalty level that is considerably lower than aggregate royalty stacks from combining individual ex-ante announcements.
- *Standard licensing offers:* There is some evidence that the licenses concluded by at least some patent pools stick to the announced rates without major departures.
- *Publicly available information about (comparable) licenses:* Available information on licensing terms of bilateral SEP licenses is limited. Information from data sources such as company disclosures to SEC is of limited scope, and lacks sufficient detail.
- *Disclosure of information through bilateral negotiations and court decisions:* an implementer who demonstrates its willingness to accept a license on FRAND terms can expect to be provided with sufficient information on relevant comparable licenses during the course of SEP licensing negotiations. However, the level of information that is voluntarily disclosed by SEP holders through bilateral negotiations varies.
- *Incidence of litigation involving FRAND in SEP licensing disputes:* the frequency of citations to "FRAND" in global patent litigation exhibits significant yearly fluctuations but lacks a distinct pattern over time.
- *Extent of disagreement over FRAND rates:* the divergence of opinions between parties involved in SEP litigations regarding FRAND rates can be substantial. There is some indication that the extent of disagreement has winnowed in more recent disputes.
- *Court determinations:* In various cases, the determinations made by courts regarding FRAND royalties have differed significantly from the perspectives of both implementers and licensors regarding what constitutes a FRAND rate.

- *Sources of disagreement:* In litigated cases, parties’ diverging views of the number of truly essential patents in a portfolio only rarely account for a significant portion of parties’ disagreements over the FRAND rate.

In addition to uncertainty regarding the validity and essentiality of potential SEPs, there may be significant uncertainty regarding FRAND licensing terms for SEP licenses. There is significant disagreement in the industry and among individual experts regarding the meaning of FRAND (4.1.). Partly as a consequence of this controversy, standard implementers have limited information on the terms and conditions at which a SEP license will be offered to them; or such information will only become available late in the process (4.2.). Furthermore, parties of SEP licensing negotiations may disagree on what are FRAND terms and conditions for a specific SEP license (4.3.).

4.1. Uncertainty regarding the meaning of the FRAND concept

There is considerable disagreement among policy makers, industry practitioners, academic scholars, and other experts regarding the concept of ‘FRAND’.⁵¹ This includes **disagreement about what constitutes ‘FRAND terms and conditions’ of a SEP license** (or licensing offer); as well as disagreement about the **nature, scope, and implications of FRAND licensing obligations**.

Significant controversies exist in particular regarding the circumstances in which a SEP holder who has made a FRAND licensing commitment may seek an injunction against unlicensed standard implementers; the extent to which FRAND licensing commitments entail an obligation to make licenses available at a specific level of the value chain; and the specific requirements for parties’ conduct during FRAND licensing negotiations.

Several **sources of guidance on the concept of FRAND** exist:

- **First**, FRAND licensing commitments given by a patent holder to a particular SDO are subject to that **SDO’s patent policy**. With few exceptions, most SDO policies’ provisions on FRAND licensing commitments are very general (Section 4.1.1.)
- **Second**, policy makers such as the European Commission and foreign national government authorities have produced **guidance documents**. This guidance is generally non-binding. While most guidance from government authorities is also quiet general, some guidance documents provide more specific indications and interpretations. Nevertheless, there is inconsistency across different sources of

⁵¹ Different SDOs’ policies refer to terms that are “reasonable and non-discriminatory”, “fair, reasonable, and non-discriminatory”, “reasonable and free of unfair discrimination”, etc. Policy makers and observers variably refer to RAND or FRAND terms. While there is some debate whether there are substantive differences between these different formulations, in our judgment, these formulations are usually understood to be synonymous. We use “RAND”, “FRAND”, or “(F)RAND” without intending a variation in meaning.

guidance, and even among the same authorities' guidance over time. (Section 4.1.2.)

- **Third**, a large number of **court decisions** in numerous FRAND disputes interpret FRAND licensing commitments and more generally different parties' FRAND obligations. In some countries (e.g. Germany, UK, US), a larger number of detailed court decisions on FRAND, including at the highest instance, provide direction to the parties of FRAND licensing disputes. Nevertheless, heterogeneity in the approaches of different countries' courts leads to forum shopping and venue conflicts. At European level, the existing guidance mostly consists in one CJEU decision in *Huawei v ZTE*; and significant heterogeneity exists in courts' implementation of this general framework. (Section 4.1.3.)
- **Fourth**, an impressive amount of **scholarship** has analysed or interpreted the FRAND concept, or suggested specific implementations. This scholarship is characterized by persistent differences of opinion on key aspects of the FRAND concept. (Section 4.1.4.)

4.1.1. *SDO's patent policy*

SDOs require firms that participate in standard setting to **disclose patents** which are potentially essential to one of the SDO's standard, and to **indicate whether they are willing to license those patents that are effectively essential on FRAND terms** to implementers of the standard. Therefore, the assessment of what constitutes FRAND licensing terms has to be guided by the specific language of the applicable SDO policy.⁵² Nevertheless, most **SDO policies are highly general**.⁵³

For example, in ETSI, this process is based on its Directives, which include Rules of Procedure and a Guide to IPRs with a clear IPR policy.⁵⁴ Once a patent has been declared by its owner to ETSI to be potentially essential to an ETSI standard, the owner is requested, under Article 6.1 of the ETSI IPR Policy, to give "*an irrevocable undertaking in writing that [the owner] is prepared to grant irrevocable licences on fair, reasonable and non-discriminatory ("FRAND") terms and conditions under such IPR to at least the following extent:*

- *MANUFACTURE, including the right to make or have made customized components and sub-systems to the licensee's own design for use in MANUFACTURE;*

⁵² In the US, the Court of Appeal of the Federal Circuit (CAFC)'s decision in *Ericsson v DLink* e.g. highlights the need to analyze language of the specific licensing commitment, rather than defining a generic (F)RAND obligation: "The district court should have turned to the actual RAND commitment at issue to determine how to instruct the jury. In this case, Ericsson promised that it would "grant a license under reasonable rates to an unrestricted number of applicants on a worldwide basis with reasonable terms and conditions that are demonstrably free of unfair discrimination." J.A. 17253. Rather than instruct the jury to consider "Ericsson's obligation to license its technology on RAND terms," J.A. 226, the trial court should have instructed the jury about Ericsson's actual RAND promises. "RAND terms" vary from case to case."

⁵³ There is heterogeneity in the process in which SDOs make decisions. SDOs can reach decisions on policy matters by formal or rough consensus, vote (simple majority or supermajority), or special procedures (see Baron, Contreras, Husovec, Larouche and Thumm 2019).

⁵⁴ see <https://www.etsi.org/images/files/IPR/etsi-ipr-policy.pdf>.

- sell, lease, or otherwise dispose of EQUIPMENT so MANUFACTURED;
- repair, use, or operate EQUIPMENT; and
- use METHODS.

The above undertaking may be made subject to the condition that those who seek licences agree to reciprocate.”⁵⁵ Further policy provisions in ETSI’s IPR Policy clarify that such commitments “shall be interpreted as encumbrances that bind all successors-in-interest” (Art. 6.1bis ETSI IPR Policy); and “shall apply to all existing and future ESSENTIAL IPRs of that PATENT FAMILY unless there is an explicit written exclusion of specified IPRs at the time the undertaking” (Art. 6.2 ETSI IPR Policy).⁵⁶

As another example, the CEN-CENELEC IPR Guide 8 succinctly defines FRAND as “Fair, Reasonable And Non-Discriminatory conditions”.⁵⁷ Licensing assurances given to CEN-CENELEC indicate that: “The patent (or other IPR) holder is prepared to grant an irrevocable licence to an unrestricted number of applicants on a worldwide, non-discriminatory basis and on fair, reasonable terms and conditions to make, use and sell implementations of the above document. Negotiations are left to the parties concerned and are performed outside CEN or CENELEC.”⁵⁸

Finally, the ‘Common Patent Policy for ITU-T/ITU-R/ISO/IEC’ describes the (F)RAND licensing commitment that a patent holder may provide to the SDO in the following terms: “The patent holder is willing to negotiate licences with other parties on a non-discriminatory basis on reasonable terms and conditions. Such negotiations are left to the parties concerned and are performed outside ITU-T/ITU-R/ISO/IEC.”⁵⁹

Overall, most of the relevant SDOs, including ETSI (and other SDOs participating in 3GPP), IETF, ISO, IEC, ITU, and CENELEC, **do not define or describe licensing terms that would fulfil the patent holder’s commitment to offer licenses on FRAND terms.**

The only notable example of **an SDO that provides a more specific definition of “reasonable” licensing terms**, and other aspects of FRAND licensing obligations, is IEEE-SA. IEEE’s Patent Policy defines “reasonable rates”⁶⁰, and lists specific indicators that should be considered in the determination of such a reasonable rate. Nevertheless, significant numbers of companies have indicated that they are not prepared to commit to make licenses

⁵⁵ ETSI Rules of Procedure, Annex 6: ETSI Intellectual Property Rights Policy, 30 March 2022; Article 6.1.

⁵⁶ Ibid.

⁵⁷ CEN-CENELEC Guidelines for Implementation of the Common Policy on Patents (and other statutory intellectual property rights based on inventions) Edition 2, 2019-05 <https://www.cencenelec.eu/media/Guides/CEN-CLC/cenclcguide8.pdf>

⁵⁸ Ibid. Annex 2: “Statement and Licensing Declaration for CEN and CENELEC Deliverable” at 14

⁵⁹ Common Patent Policy for ITU-T/ITU-R/ISO/IEC; <https://www.itu.int/en/ITU-T/ipr/Pages/policy.aspx>

⁶⁰ “Reasonable Rate” shall mean appropriate compensation to the patent holder for the practice of an Essential Patent Claim excluding the value, if any, resulting from the inclusion of that Essential Patent Claim’s technology in the IEEE Standard. In addition, determination of such Reasonable Rates should include, but need not be limited to, the consideration of:

- The value that the functionality of the claimed invention or inventive feature within the Essential Patent Claim contributes to the value of the relevant functionality of the smallest saleable Compliant Implementation that practices the Essential Patent Claim.
- The value that the Essential Patent Claim contributes to the smallest saleable Compliant Implementation that practices that claim, in light of the value contributed by all Essential Patent Claims for the same IEEE Standard practiced in that Compliant Implementation.
- Existing licenses covering use of the Essential Patent Claim, where such licenses were not obtained under the explicit or implicit threat of a Prohibitive Order, and where the circumstances and resulting licenses are otherwise sufficiently comparable to the circumstances of the contemplated license.”. <https://standards.ieee.org/about/policies/bylaws/sect6-7/>

available on terms that comply with this definition.⁶¹ In addition, the policy restricts the circumstances in which a patent holder who has given a licensing assurance pursuant to the IEEE patent policy may seek an injunction (or other “prohibitive order”, such as an ITC exclusion order) against an implementer of an IEEE standard.⁶²

On 30 September 2022, the IEEE announced further changes to its patent policy, which reduce the extent to which the policy defines FRAND licensing obligations.⁶³ In particular, the revised patent policy no longer requires consideration of the listed indicators of what constitutes reasonable rates, but merely offers these indicators as “some optional considerations”. The suggested “optional considerations” of what constitutes reasonable rates also are less restrictive (less specific) than the currently listed indicators, and the announced new policy’s restrictions against injunctions are somewhat softened with respect to the current patent policy.

The effect of the additional definitions of FRAND obligations in IEEE’s current patent policy on the actual determination of reasonable licensing terms is empirically unclear – in particular, we are not aware of a judicial (F)RAND determination involving a patent subject to an affirmative LoA under the policy, a court adjudication of a request for injunctive relief against an infringer of a patent subject to such an affirmative LoA, or a case in which a company that has provided such an affirmative LoA has been accused of offering licenses on terms that are not compliant with that commitment. Therefore, we have no empirical observations of how assessments of licensing terms under IEEE’s 2015 patent policy differ from assessments of licensing terms under its previous or other SDOs’ patent policies.

4.1.2. *Policy statements*

Over the last three decades, **governmental authorities and policy makers** have issued numerous documents that indicate policy positions and provide potential **guidance on the meaning of FRAND**.

4.1.2.1. EU Policy statements

⁶¹ For the working group 802.11 alone, at least 34 “negative LoAs” have been submitted since 2015 (i.e. statements from companies declaring to own potential essential patent claims that indicate that the company is not willing to make licenses available on the terms defined by IEEE’s patent policy). At least some of the affirmative LoAs submitted after 2015 have used a “custom LoA form”, providing licensing assurance in accordance with the IEEE patent policy that was in effect on 14 March 2015 (prior to the policy change resulting in the addition of a definition of “reasonable rate”). <https://mentor.ieee.org/myproject/Public/mytools/mob/loa-13June2019limited-statement.pdf> Another set of companies have not submitted any licensing assurances since 2015, and continue to contribute to standards development activities at IEEE-SA under a blanket licensing assurance provided prior to the policy change.

⁶² <https://standards.ieee.org/about/policies/bylaws/sect6-7/>

⁶³ <https://standards.ieee.org/news/archive-2022/ieee-announces-decision-on-its-standards-related-patent-policy/>

One of the earliest of these policy documents was the **Communication from the Commission** on “Intellectual Property Rights and Standardization” of 1992; in which the Commission states its position on FRAND terms for SEPs:

“If there are proprietary Intellectual property rights underlying the technology on which a standard is to be based and that fact is known to the standard makers, then the agreement of the rightholder must be sought if the work on the standard is to continue.” [...] “If agreement is reached between the rightholder and the standard-making body, the terms for licences must be fair, reasonable and non-discriminatory. It is not feasible or appropriate to be more specific as to what constitutes “fairness” or “reasonableness” since these are subjective factors determined by the circumstances surrounding the negotiation. If the rightholder is to be satisfied that his investment in research and development can be adequately recovered, he would expect the royalty rate to relate in some way to the normal freely negotiated commercial rate, allowing for the greatly increased market for his technology which standardization will bring.”⁶⁴

In its 2017 Communication on Standard-Essential Patents, the Commission chose to provide significantly expanded elements of interpretation of the meaning of FRAND:

“Licensing terms have to bear a clear relationship to the economic value of the patented technology. That value primarily needs to focus on the technology itself and in principle should not include any element resulting from the decision to include the technology in the standard. In cases where the technology is developed mainly for the standard and has little market value outside the standard, alternative evaluation methods, such as the relative importance of the technology in the standard compared to other contributions in the standard, should be considered. • Determining a FRAND value should require taking into account the present value added of the patented technology. That value should be irrespective of the market success of the product which is unrelated to the patented technology. • FRAND valuation should ensure continued incentives for SEP holders to contribute their best available technology to standards. • Finally, to avoid royalty stacking, in defining a FRAND value, an individual SEP cannot be considered in isolation. Parties need to take into account a reasonable aggregate rate for the standard, assessing the overall added value of the technology³⁰. The implementation of measures on SEP transparency can already support this objective. It can be addressed further, within the scope of EU competition law, by the creation of industry licensing platforms and patent pools, or based on indications by standardisation participants on the maximum cumulative rate that could be reasonably envisaged or expected.”⁶⁵

4.1.2.2. Policy statements by foreign government authorities

Foreign government authorities have similarly taken a significant interest in the interpretation of the (F)RAND concept. Over the past ten years, **US government officials**,

⁶⁴ White Paper 4.3.1. and 4.3.3.; at 16

⁶⁵ (Communication of 2017; at 6-7)

and in particular the Department of Justice (DoJ) antitrust division, have made numerous statements and speeches providing views on the proper meaning and implications of (F)RAND commitments. The DoJ, in conjunction with other government agencies, has also issued more formal policy statements on specific aspects of FRAND, and in particular regarding the appropriateness of granting injunctive relief against unlicensed standard implementers to SEP holders who have given FRAND licensing commitments.

In a joint statement of the DoJ and the USPTO of 2013, the agencies state that: *“A patent owner’s voluntary F/RAND commitments may also affect the appropriate choice of remedy for infringement of a valid and enforceable standard essential patent. In some circumstances, the remedy of an injunction or exclusion order may be inconsistent with the public interest.”*

The statement also recognizes that an *“exclusion order may still be an appropriate remedy in some circumstances, such as where the putative licensee is unable or refuses to take a F/RAND license and is acting outside the scope of the patent holder’s commitment to license on F/RAND terms.”*

In 2019, the DoJ, the USPTO, and the National Institute of Standards and Technology (NIST) withdrew the 2013 policy statement, lamenting that the statement *“has been misinterpreted to suggest that a unique set of legal rules should be applied in disputes concerning patents subject to a F/RAND commitment that are essential to standards (as distinct from patents that are not essential), and that injunctions and other exclusionary remedies should not be available in actions for infringement of standards-essential patents.”* The agencies issued a new statement *“to clarify that, in their view, a patent owner’s F/RAND commitment is a relevant factor in determining appropriate remedies, but need not act as a bar to any particular remedy.”* In December 2021, the three agencies issued a “Draft Policy Statement”, stating the agencies’ view on the availability of injunctions for SEPs subject to FRAND commitments; noting in particular that: *“Where a SEP holder has made a voluntary F/RAND commitment, the eBay factors, including the irreparable harm analysis, balance of harms, and the public interest generally militate against an injunction.”*

These three statements have widely been perceived as striking significantly different balances between the rights of patent holders and implementers. In particular, the 2019 statement takes a significantly less restrictive position than the other two statements on the circumstances under which exclusive orders such as injunctive relief should be available to SEP owners who have made a FRAND licensing commitment. While each of these statements discusses circumstances under which exclusion orders against unlicensed uses of FRAND-encumbered SEPs would or would not be appropriate, the grant of such exclusion orders is incumbent upon courts and the International Trade Commission (ITC), who are not bound by these executive agencies’ policy statements.⁶⁶

After receiving a significant number of comments from the public, in June 2022, the three agencies (DoJ, USPTO, and NIST) decided to withdraw the 2019 policy statement, without adopting the Draft Policy Statement of December 2021 or reinstating the 2013 policy statement. After approximately ten years of debate and three different policy statements

⁶⁶ ITC exclusion orders may however be subject to veto by the U.S. Trade Representative; as was the case of an exclusion order that the ITC had granted to Samsung against Apple for infringement of several SEPs.

regarding SEPs, the US government thus has (for now) concluded that the best course of action is not to offer any policy statement.

The **Japanese Patent Office** (JPO) in 2018 offered a non-binding “Guide to Licensing Negotiations Involving Standard-Essential Patents”; in which it observed that “*there are two aspects to FRAND: (1) the negotiation process itself and (2) the terms of the resulting license.*” The statement observes that “*when implementers intend to obtain a license on FRAND terms in good faith, however, court decisions around the world are consistent in imposing limitations on granting injunctive relief to owners of FRAND-encumbered SEPs.*” For the determination of what constitutes good faith in this regard, the JPO refers to the CJEU decision in *Huawei v ZTE*, which it considers “*to be a useful approach in terms of encouraging good faith negotiations,*” and offers further suggested interpretations of the different steps of the general process described by the CJEU decision.

With respect to the implications of the FRAND concept for the terms of a SEP license, the JPO offers extensive discussions of diverse aspects of the valuation of patent licenses, such as the choice of a royalty base; and different methodologies for the valuation of a SEP license following the bottom-up and/or top-down approach.

More recently, in March 2022, the Japanese Ministry of Economy, Trade and Industry released “Good Faith Negotiation Guidelines for Standard Essential Patent Licenses”.⁶⁷ The Guidelines detail the government’s view on the steps that licensors and licensees should take in the course of SEP licensing negotiations. For example, the SEP holder should open the negotiations with a “Licensing offer”, including a list of patent numbers, claim charts mapping the patents (or a sample thereof) to the standard, and information relative to the FRAND licensing commitments that the SEP owner has made. The Guidelines state that “when the SEP holder provides the claim charts mapping patent claims to standards element by element, it is desirable that the SEP holder does not include them in the scope of a non-disclosure agreement (hereinafter referred to as “NDA”) if requested by the implementer.”; but clarify that this shall not apply when the claim charts include non-public information. The Guidelines also emphasize that these steps reflect the Japanese government’s view on the “norms of good faith negotiations”; hence, the guidelines “are not legally binding and do not guarantee that, even if followed, negotiations can be judged to be in good faith in each individual case as there are no clear global rules for SEP licensing negotiations.”

In 2016, the **Korean Fair Trade Commission** (KFTC) released “Review Guidelines on Unfair Exercise of Intellectual Property Rights”, which include several sections on SEPs. In particular, the Guidelines state that “[...] *an act of filing an injunction against willing licensees by an SEP holder who promised to license its SEP on FRAND terms can be determined as a behavior that restricts competition in the relevant market as it exceeds the reasonable extent of exercise of patent right.*” The Review Guidelines offer limited guidance on what constitutes FRAND terms. Nevertheless, “[a]n act of imposing royalty of which the amount is considerably unreasonable comparing with usual trade practices”, as well as offering different licensing terms to licensees that do and do not use the licensors’ products (chips), are listed as examples of conduct that is highly likely to be considered abusive.

⁶⁷ https://www.meti.go.jp/policy/economy/chizai/sep_license/good-faith-negotiation-guidelines-for-SEPllicenses-en.pdf

4.1.3. Court cases

As most SDOs' policies only define FRAND licensing obligations in highly general terms, and government authorities' policy statements lack binding force, the most significant source of more specific guidance regarding the meaning of FRAND are court decisions.

In some countries, a large body of publicly available court decisions provides guidance to the parties of SEP licensing negotiations. In particular in Germany, the US, China, and the UK, courts have issued larger numbers of decisions on different aspects of FRAND. In Germany and the UK, there are also Supreme Court decisions on specific aspects of FRAND, potentially offering increased legal certainty. Finally, in the UK, the US, and China, courts' determinations of FRAND licensing terms in individual disputes offer a variety of methodologies that parties may apply to their own circumstances.

Nevertheless, the decisions of the national courts of different countries may apply very different standards, leading to forum shopping and parallel litigation, and diminishing the value of the existing case law for increased predictability and transparency. Furthermore, in many other countries, including most EU Member States, there has so far only been a very limited number of SEP litigations, and most of these litigations have been decided on grounds other than FRAND-related aspects (e.g. validity or non-infringement).

At European level, the most significant decision has been the CJEU's ruling in *Huawei v ZTE*. In this decision, the CJEU provides a framework to assess under what circumstances a SEP holder would violate EU competition law by seeking injunctive relief against a standard implementer after having committed to make licenses available to those SEPs on FRAND terms. The *Huawei v ZTE* framework has been implemented in a large number of decisions by national courts in EU Member States, in particular Germany. Nevertheless, different courts have taken different approaches to individual aspects of the *Huawei v ZTE* framework, and important and contentious debates regarding the scope and content of FRAND obligations remain unresolved by this framework.

One such debate concerns the level of licensing in the value chain, and more specifically the question whether SEP holders that have made a FRAND licensing commitment must offer SEP licenses to any willing licensee (*license to all*), or may fulfill their FRAND obligations by offering SEP licenses to implementers at one level of the value chain of their choice (e.g. end product makers), while abstaining from asserting their SEPs against implementers at other levels of the value chain (*access to all*). This controversy has played a significant role in litigation, most notoriously disputes between SEP licensors on one side and automotive end product makers and their suppliers on the other side. In one such dispute (*Nokia v Daimler*)⁶⁸, the German Cartel office (Bundeskartellamt) urged several German courts to submit a new set of questions on SEP licensing disputes to the CJEU to expand on the existing guidance; nevertheless, the parties of this dispute settled before the CJEU took a position.

Another debate focuses on whether courts must always assess whether a SEP holder has made a licensing offer on terms that are objectively FRAND prior to granting injunctive relief against an implementer who has expressed a willingness to license on FRAND terms;

⁶⁸ <https://caselaw.4ipcouncil.com/german-court-decisions/olg-karlsruhe/nokia-v-daimler>.

or whether such an assessment may become unnecessary if the implementer has failed to show through its conduct during bilateral negotiations that it would indeed be willing to accept any licensing offer that is FRAND. While different German courts have taken diverging positions in this debate, the German High Court in *Sisvel v Haier* espoused the latter view.⁶⁹ Following this view, the implementation of the *Huawei v ZTE* framework by German courts routinely focuses on parties' conduct during bilateral negotiations, instead of a substantive determination of what would be FRAND terms for a particular SEP license.

In many other EU Member States, there currently is only a limited number of decisions under the *Huawei v ZTE* framework, or no such decisions at all. In light of the controversies and diverging court approaches observed in Germany, it may be difficult for parties of SEP licensing negotiations to predict how the courts of these EU Member States would decide.

See Pentheroudakis and Baron (2016) for an earlier, more extensive review of the existing large body of case law on FRAND.

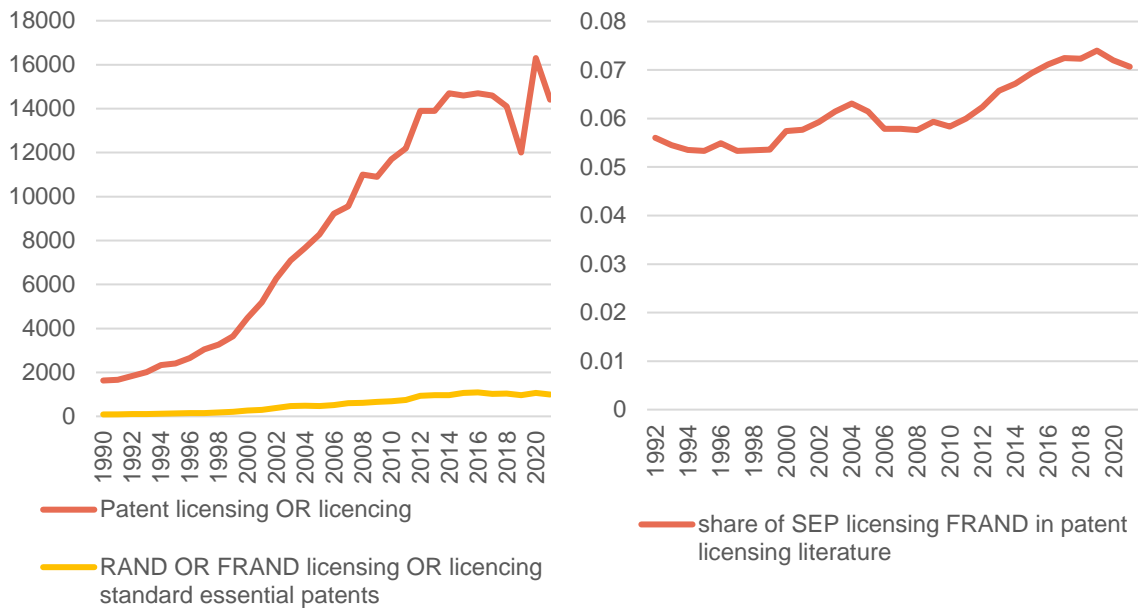
4.1.4. *Research on FRAND*

In addition to SDO policies, ex-ante announcements, government guidance, and court decisions, there is a **large and heterogeneous body of literature on the FRAND concept**, including scholarly literature in law and/or economics, studies commissioned by policy makers such as the European Commission, and position papers by different stakeholders and their associations, lawyers, and consultants.

A search on “google scholar” of publications on (F)RAND, licensing, and standard-essential patents reveals that on average about 1,000 new publications on these topics have been published every year since 2014 (**Figure 12**). There is a significant growth in the number of publications on these topics per year over time, which mostly tracks the growth of the broader literature on patent licensing. Within the literature on patent licensing, the share of publications on (F)RAND and standard-essential patents has increased more incrementally, from about 5% in the 1990s to about 7% in more recent years.

Figure 12: Publications on (F)RAND licensing of SEPs in the broader literature on patent licensing

⁶⁹ *Sisvel v Haier*, Bundesgerichtshof KZR 36/17, at 81. Cited from English translation provided by Arnold Ruess.



These findings indicate a **healthy and sustained scholarly interest in the concept of FRAND** in the context of SEPs. There is thus significant “supply” of analyses and interpretations of FRAND. At the same time, authoritative definitions of FRAND remain mostly limited to the highly general language of SDO policies, which (with the exception of IEEE) have not significantly changed in recent decades; and the case-law of national courts.

4.2. Lack of information on terms and conditions for SEP licenses

Because of the limitations of existing guidance, significant uncertainty may remain regarding what constitutes FRAND rates for an individual SEP license. As a consequence, standard implementers may lack information on the terms of the SEP licenses that may be offered to them, or such information may become available only late in the process, after implementers have incurred significant fixed costs related to standard implementation.

Depending on the circumstances, implementers may have access to the following sources of information on SEP licensing terms.

First, the initial licensing commitment to the SDO may provide some information on the terms at which the SEP owner commits to make SEP licenses available.

Second, leading SEP holders on occasions make **ex-ante announcements** with information on their intended licensing terms. These announcements aim to provide implementers with some indication of potential future licensing costs, and to contribute to more predictable and more transparent royalty rates.

Third, some SEP licensors offer ‘Standard licensing terms’, which they disclose on their websites.

Fourth, in the absence of a licensing program with informative standard licensing terms, implementers may rely on **(limited) publicly available information** as indication of (FRAND) licensing terms that they are likely to be offered.

Fifth, implementers can expect to receive a licensing offer at the beginning of SEP licensing negotiations, in which SEP holders describe proposed licensing terms, and explain why these terms are FRAND.

Usually, these different sources of information become available sequentially, and the information that is available to implementers becomes more specific and reliable over time. Therefore, uncertainty regarding SEP licensing terms is greatest early in the process.

4.2.1. *Licensing commitments to SDOs*

The first piece of information that potential licensees have about FRAND licensing terms are the licensing commitments that patent holders make to the SDO along with the disclosure of their patent as potentially standard-essential. As we have noted above (see Section 4.1.1.), most SDOs allow for licensing commitments that are highly general; and merely require owners of potential SEPs to indicate that they are prepared to make licenses available to any SEPs on FRAND terms, without defining what constitutes FRAND terms, or requiring SEP owners to offer a more specific indication of the terms on which they intend to offer SEP licenses. These FRAND commitments provide only limited information to implementers on the specific terms they can expect to be offered.

Many SDOs (including ISO/IEC/ITU, IETF, IEEE) offer patent holders **a menu of licensing commitments**, including an option to commit to make licenses available on **(F)RAND terms, on royalty-free and (F)RAND terms, or not to assert their SEPs against implementers of the standard**. Commitments to RF or NA provide specific information on the price (zero) that implementers can expect to be charged for the specific SEPs subject to these commitments. The Percentage of RF vs FRAND commitments varies among SDOs. Bekkers et al. (2017) compiled licensing declarations to various SDOs; finding that at IETF, 37% of the licensing commitments are on royalty-free terms; as opposed to 57% on FRAND terms. In other major SDOs offering the explicit option to commit to make licenses available on royalty-free terms, **the vast majority of licensing commitments are on FRAND terms** – at IEC, IEEE, ISO, and ITU, the percentage of licensing commitments on royalty-free terms ranges from 2 to 6%.⁷⁰ At ETSI, the SDO with the largest number of declared SEPs (many of which concerning 3GPP standards), 100% of the licensing commitments are on FRAND terms. ETSI offers declarants the option to make their licensing commitment conditional on reciprocity.

Another optional feature is the option to condition SEP licensing commitments on reciprocity. Based on an analysis of licensing commitments applicable to 5G standards,

⁷⁰ Bekkers et al. (2017), p. 41. Link: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3005009

91.4% of the declarants choose to condition their licensing commitment on reciprocity.⁷¹ This variation among patent holders provides implementers with some (limited) information on future licensing terms (or at least the process of future licensing negotiations); nevertheless, this information is relevant only to potential licensees who themselves seek to license SEPs to the respective SEP holders.

At least one SDO (Vita) provides for disclosure of specific royalty-bearing “most restrictive licensing terms”.⁷² Nevertheless, the number of companies that have submitted ex-ante declarations of most restrictive licensing terms subject to this policy is limited – at our most recent visit, the SDO website currently lists 14 disclosures.⁷³

Overall, **the information about SEP licensing terms that is available from SEP disclosures and licensing commitments is thus limited.** For the vast majority of SEPs, the information is generic (usually indicating that the SEP owner is prepared to make licenses available to standard implementers on (F)RAND terms). Only a very limited number of licensing commitments provide more specific information.

4.2.2. *Ex-ante announcements before the actual licensing program starts*

To mitigate uncertainty, leading SEP holders on occasions make ex-ante announcements with information on their intended licensing terms. These announcements aim to provide implementers with some indication of potential future licensing costs, and to contribute to more predictable and more transparent royalty rates. There are **three types of announcements**: ex-ante announcements of licensing terms following a process defined by SDO policies (3.2.2.1.); unilateral individual announcements of SEP holders (3.2.2.2.), and joint announcements by groups of industry participants (3.2.2.3.).

4.2.2.1. Ex-ante announcements of SEP licensing terms through SDO processes

In addition to aforementioned Vita, which adopted a policy requiring owners of potential SEPs to make ex-ante disclosures of most restrictive licensing terms, at least two SDOs adopted patent policy provisions allowing companies to make general ex ante announcements on a voluntary basis, and make information about these announcements publicly available.

Clause 4.1. of ETSI’s IPR Policy e.g. provides that “ETSI may act as a depository, where IPR owners (licensors) can make available information on how and where to access such disclosed licensing terms, and provide links to URLs of IPR owners, which contain the

⁷¹ Considering only declarations disclosing at least one EP patent as potentially essential to a 5G TS, we identified 1.234 declarations (covering 10.645 EP patents). 1.128 of these declarations provided a licensing commitment that is conditional on reciprocity.

⁷² For an empirical analysis of the effects of this policy, see Contreras (2013).

⁷³ <https://www.vita.com/Essential-Patents>, last consulted on 16.09.2022

details of licensing terms and conditions, so that information about the availability of licenses can be disseminated to all users of ETSI standards.”

ETSI’s policy however also clearly states that there is no obligation for holders of potential SEPs to make such ex-ante announcements. At our most recent visit, ETSI’s website hosts links to three company websites with announcements regarding SEP licensing terms.⁷⁴ All announcements are related to 5G, and are dated from 2017 or 2018, thus prior to the commercial availability of 5G-compatible end user devices. While these statements only describe the licensing intentions of three SEP owners, and a much larger number of companies has declared to own patents that are potentially essential to 5G and other 3GPP standards, these three companies are the largest known SEP licensors (in terms of volume of patent licensing royalty income, pursuant to data from Galetovic et al., 2018). **While certainly incomplete, the information that is available from these announcements is thus not necessarily insignificant.**

Ex-ante licensing announcements that can be accessed through ETSI’s website however are not only limited in number, but also in the extent of information that they provide. Clause 4.1. of ETSI’s IPR Policy specifically prohibits ETSI to make “detailed licensing terms” available. The three currently available announcements are formulated as a description of the companies’ expectations regarding future licensing conditions, rather than binding commitments.⁷⁵ Furthermore, some of the announcements explicitly provide caps, rather than specific royalty rates that individual implementers can expect to be offered.

In 2007, IEEE-SA also has introduced a policy provision allowing for the voluntary ex-ante disclosure of licensing terms related to patents that are potentially essential to IEEE standards. This policy change has been favourably reviewed by antitrust authorities, e.g. DoJ.⁷⁶ Nevertheless, it is unclear to what extent patent holders have made or currently make use of this provision. We were not able to identify ex-ante announcements of SEP licensing terms on IEEE’s website.

To summarize, while welcomed by policy makers (at least at the time of their adoption), SDO policies allowing for **voluntary ex-ante announcements** of licensing terms by SEP owners have resulted in **relatively few declarations**, whose **informative content is limited**. SDO policies requiring **binding ex-ante disclosures** of most restrictive licensing terms remain **very rare**.

4.2.2.2. Unilateral ex-ante announcements of SEP licensing terms by individual SEP owners

⁷⁴ <https://www.etsi.org/intellectual-property-rights/46-ipr/580-ex-ante-list-of-disclosures>, last consulted on 26.01.2022

⁷⁵ E.g. “These statements are based on management's best assumptions and beliefs in light of the information currently available to it. Because they involve risks and uncertainties, actual results may differ materially from the results that we currently expect.” <https://www.nokia.com/about-us/news/releases/2018/08/21/nokia-licensing-rate-expectations-for-5gnr-mobile-phones/> “All statements made or incorporated by reference in this release, other than statements or characterization of historical facts, are forward-looking statements. These forward-looking statements are based on our current expectations, estimates and projections about our industry, management’s beliefs and certain assumptions made by us.” <https://www.ericsson.com/assets/local/patents/doc/frand-licensing-terms-for-5g-nr-in-3gpp-release-15.pdf>

⁷⁶ DoJ Business Review Letter, April 30, 2007. <https://www.justice.gov/atr/response-institute-electrical-and-electronics-engineers-incs-request-business-review-letter>

In addition to the ex-ante announcements that can be accessed through SDO websites, a number of SEP owners have made unilateral announcements of licensing terms. Information on these announcements has been collected and analysed e.g. by Stasik (2010), Armstrong et al. (2014), and Stasik and Cohen (2020).

The royalty stack of individual ex-ante announcements reported by Stasik (2010) is 14.80%. Similar values are reported in Armstrong et al (2014). This stack only includes announcements by approximately 60% of LTE SEPs declared essential to ETSI so that the implied total royalty stack is likely to be even higher.

It is important to note that the ex-ante royalty rate resulting from individual announcements may be significantly different than the actual royalty rate resulting from bilateral negotiation. Ex-post estimations of actual royalty payments by Galetovic et al (2018) suggest an average ex-post royalty stack of 3.4% of the average selling price, way below the royalty stack implied from individual announcements. This discrepancy suggests that the rates that companies declare individually are a high ceiling to the actual licensing terms agreed upon between SEP holders and licensees.

Nevertheless, comparing announced licensing terms to observations of the implied average royalty stack is potentially misleading. Cross-licensing provisions may substantially lower royalty payments between parties of individual SEP licenses, thus leading to lower aggregate licensing payments. Furthermore, as the total volume of product sales in downstream industries includes products sold by unlicensed implementers, the estimated average royalty payments by *licensed* users is larger than the estimated average royalty stack in the industry.

There is a limited number of cases in which it is possible to compare individual SEP holders' licensing expectations with royalty rates agreed upon in subsequent SEP licensing negotiations. We use Tables 3 and 4 from Love and Helmers (2022) for the comparison, focusing only on those cases where there is an announcement followed by a licensing agreement, for the same licensor and same technology, where both the announcement and the agreement provide information on royalty rates (as opposed to lump sum, per unit, or other price information).

- Ericsson in 2009 announced a royalty rate for 4G of “around 1.5 percent for handsets”.⁷⁷ The redacted version of the judgment of the District Court of the E.D. Tex. in *HTC v Ericsson* (2019) lists a number of comparable licenses, including four licenses with 4G-only royalty rates agreed upon between Ericsson and undisclosed licensees. The royalty rates range from 1.0% to 1.4% of the handset price (but each of these licenses also includes diverging provisions on floors and caps). In *TCL v Ericsson*, the District Court of the Central District of California derived the 4G royalty rates of licenses between Ericsson and four large handset makers (Apple, HTC, LG, Samsung); with estimated rates ranging from 0.314% to 0.662% (depending on the license and the unpacking methodology).
- Qualcomm in 2008 announced royalty rates of “approximately 3.25 percent of the wholesale selling price” for 4G only licenses, and not greater than 5% for 4G Multimode licenses. The decision in *FTC v. Qualcomm* of the District Court of the Northern District of California discloses information on royalty rates in licenses between Qualcomm and Huawei (of 2014) and Qualcomm and Sony (of 2012). In both licenses, licensees agreed to royalty rates of 3.5% for 4G, and 5% for 4G

⁷⁷ All numbers in this paragraph are from Love and Helmers (2022)

Multimode. Nevertheless, at least the license with Huawei includes a provision on an undisclosed royalty cap.

These very limited comparisons between announced and effective royalty rates suggest that announced royalty rates may (at least in some cases) provide a good indication of *nominal* royalty rates in actual SEP licenses. Nevertheless, to determine the effective royalty rate paid by different licensees, one also needs to incorporate lump sum payments, royalty caps, royalty floors, etc. At least in some cases, “unpacking” the effective royalty rate from different licenses’ complex price provisions yields royalty estimates that are significantly below the nominal and announced royalty rates. Nevertheless, these “unpacked” royalty rate estimates are also subject to greater methodological uncertainty.

4.2.2.3. Joint announcements of a reasonable maximum aggregate royalty stack⁷⁸

In addition to unilateral statements by individual SEP holders, at various points in time there have been **joint announcements by a number of industry players**; e.g. related to (see Stasik, 2010):

- LTE (GSM standards) - April 2008 joint press release by Ericsson, Alcatel-Lucent, NEC, NextWave Wireless, Nokia, Nokia Siemens Networks and Sony Ericsson: the companies support that a reasonable maximum aggregate royalty level for LTE essential IPR in handsets is a **single digit percentage** of the sales price.⁷⁹
- 3G (UMTS/W-CDMA) - May 2002 joint press release by NTT DoCoMo, Ericsson, Nokia and Siemens and Japanese manufacturers: enable the cumulative royalty rate for W-CDMA to be at a modest **single digit level**.⁸⁰

Note that announced aggregate royalty rates can provide information on individual rates through the “**top-down approach**”. The top-down approach starts from an estimate of the reasonable aggregate royalty rate that any firm should pay for licensing the standard. Then it apportions individual royalty rates to licensors, based e.g. on the share of SEPs that they own out of the total number of SEPs in the standard.

Compared to unilateral announcements by individual SEP holders, the total aggregate royalty announced in joint press releases has sometimes been considered more informative. This is because SEP holders face a countervailing pressure to keep the aggregate estimate (as opposed to individual disclosures) low enough to encourage investment and adoption of LTE over the alternatives and become the dominant standard. At least one court found aggregate royalty rates from joint releases more reliable, as evidenced by the decision in the

⁷⁸ On “stack” and patent counts see *infra* 3.3.4.2.

⁷⁹ Ericsson Press Release, (April 14, 2008) Wireless Industry Leaders commit to framework for LTE technology IPR licensing, undersigned by Ericsson, Alcatel-Lucent, NEC Corporation, NextWave Wireless, Nokia, Nokia Siemens Networks, and Sony Ericsson. Available on Oct. 13, 2008 at URL <http://www.ericsson.com/ericsson/press/releases/20080414-1209031.shtml>

⁸⁰ NTT DoCoMo Press Release (Sept. 1, 2002) Industry leaders NTT DoCoMo, Ericsson, Nokia and Siemens, and Japanese Manufacturers reach a mutual understanding to support modest royalty rates for the W-CDMA technology worldwide. Available on Oct. 16, 2009 at URL: <http://www.nttdocomo.com/pr/2002/000901.html>.

case *TCL v. Ericsson*⁸¹. By contrast, in *Unwired Planet v. Huawei*, the UK High Court has considered these statements of reasonable aggregate royalties to be self-serving, internally inconsistent, and unreliable⁸².

4.2.3. *Standard licensing terms*

After SEP owners begin licensing their SEPs, they may offer additional information on licensing terms. In particular, some SEP licensors offer ‘Standard licensing terms’, which they disclose on their websites. There are **two types of standard licensing offers** (a) **individual** (bilateral) standard licensing offers, and (b) **patent pool** licensing programs.

Individual SEP licensors may provide information on ‘standard licensing terms’ on their website.⁸³ Transparency on their standard licensing terms may assist patent holders with demonstrating non-discrimination, and facilitate the conclusion of licensing agreements. Nevertheless, patent holders offering a standard licensing contract may negotiate amendments to these standard terms in bilateral negotiations with individual implementers; or conclude individual licenses on terms that differ from the publicly disclosed standard licensing terms. **The extent to which SEP owners’ publicly disclosed standard licensing terms are descriptive of actual licensing terms in SEP licenses concluded with a larger number of implementers is empirically unclear.**

Patent **pools** are a special case of SEP licensors. Most pools publicly disclose standard licensing terms for a license under the patents included in the pool, and many pools publish lists of licensees that have entered into a license with the pool.⁸⁴ Regarding the royalty rates announced by patent pools, **there is some evidence that the licensors that adhere to the licensing terms of the pool tend to respect the rates stated in the announcements without major departures.** For example, in *Tagivan v. Huawei*, the claimant Tagivan II LLC sued the defendant Huawei for infringing a patent found to be essential to the AVC/H.264 standard. Such SEP was subject to FRAND and licensed via a pool administered by MPEG LA, comprising more than 5,000 patents. The claimant presented evidence that more than 2,000 license agreements reached through the pool were substantially identical to the standard license document of the pool that was sent to the defendant (see paragraphs para 453-481 of the court decision).⁸⁵ Such evidence suggests that at least some pools offer

⁸¹ *TCL v. Ericsson*, SACV 14-341 NS, U.S. District Court Central District of California, Memorandum of Findings of Fact and Conclusions of Law, p.24.

⁸² “In my judgment the statements set out above have little value in arriving at a benchmark rate today for a number of reasons. The claims are obviously self-serving. The statements about aggregate royalties in particular are statements about other people’s money on the footing that the person making the statement says at the same time that the cake is quite small but they are entitled to a large piece of it.”; *Unwired Planet v Huawei*, [2017] EWHC 711 (Pat), at 269.

⁸³ For an example from a large Europe-based SEP holder, see <https://www.philips.com/a-w/about/innovation/ips/ip-licensing/mobile-devices.html>

⁸⁴ Annex 10 of the “Contribution to the Debate” of the European Commission’s SEP Expert Group provides an overview of the type of information that six different pool licensing administrators make publicly available. All licensors publicly disclose royalties per program for some pools, and four out of six licensors disclose royalties rates for all their pools. Four pool licensing administrators also disclose the full licence agreements per program, either generally or upon request. Five licensing administrators publicly disclose lists of licensees for at least some of their pools.

⁸⁵ LG Dusseldorf, 4a O 17/17 (09.11.2018). Available in German:

https://www.justiz.nrw.de/nrwe/lgs/duesseldorf/lg_duesseldorf/i2018/4a_O_17_17_Urteil_20181109.html

worldwide uniform license fees, and that the royalty rates announced by pools provide a reliable indication of the actual price that implementers pay for a license from the pool.

Nevertheless, pool licensing administrators may also negotiate “side agreements” with individual licensees.⁸⁶ Practitioners with experience with both bilateral and pool licensing of SEPs reported that the licensing terms of the pool are agreed upon between licensing administrators and pool members. While licensing administrators are generally expected to offer licenses on these terms, there are common situations warranting side agreements; e.g. in order to account for SEPs included in the pool to which a potential licensee is already licensed through other means.

4.2.4. *Publicly available information about (comparable) licenses*

In the absence of a licensing program with informative standard licensing terms, **implementers may need to rely on (limited) publicly available information on comparable licenses** as the most relevant indication of licensing terms that they are likely to be offered. Publicly available data on licensing deals are **scarce and incomplete** due to strategic considerations.⁸⁷

Information on royalty rates for SEPs can be obtained from **compulsory disclosures**, e.g. annual (10K) and quarterly (10Q) earnings reports to the Securities Exchange Commission (SEC). Public companies are required to disclose material transactions in their filings. A material event is any significant event that affects the company’s financial standing. Some licensing deals qualify as material events and must be disclosed. There are several vendors that have specialized in extracting and curating meaningful information in such licensing contracts and make them available for a fee (e.g. ktMINE, Royalty Source or Deloitte’s RecapIP). Such databases include a few thousands of licensing deals, some of which provide detail on the structure of royalty payments and other contractual arrangements of interest.

An important caveat of **such datasets** is that they **are limited to a selected subset of the whole population of licensing deals**. The licensing deals covered in compulsory disclosures to the SEC are in the upper tail in terms of economic significance. Also, SEC disclosures by definition offer a broader coverage of deals in which at least one the parties in the agreement (and often all of them) are publicly traded firms.

An English summary of the decision is available here:

<https://caselaw.4ipcouncil.com/german-court-decisions/lg-dusseldorf/tagivan-mpeg-la-v-huawei-district-court-landgericht-dusseldo>.

⁸⁶ In a decision of the District Court of Dusseldorf in *Dolby v MAS Electronics*, the court mentioned a larger number of side agreements concluded between the administrator of the HEVC pool and individual licensees. “Der Standardlizenzvertrag neu sei bereits mit 138 Lizenznehmern abgeschlossen worden. Nebenabreden seien in entsprechenden Sidelettern festgehalten worden, die der Beklagten zugänglich gemacht worden seien. Dementsprechend hätten alle neuen Lizenznehmer an den HEVC-Poolpatenten gemäß dem Standardlizenzvertrag neu eine Lizenz genommen.” LG Dusseldorf, 4c O4 44/18 (07.05.2020) at 49. Available in German:

https://www.justiz.nrw.de/nrwe/lgs/duesseldorf/lg_duesseldorf/j2020/4c_O_44_18_Urteil_20200507.html

⁸⁷ Generally, it is neither in the licensor nor the licensee’s best interest to disclose information on licensing deals. Licensors may want to preserve their bargaining position in subsequent negotiations (within FRAND boundaries). Licensees may want to avoid revealing information to competitors, and potentially preserve a competitive advantage.

Another **limitation** is that the licensing deals reported to the SEC are often originally **redacted** by virtue of a Confidential Treatment Request (CTR) and can only be accessed through Freedom of Information Act (FOIA) requests ten years after the original filing upon the expiration of the CTR. Redacted contracts mean that information on royalty rates for relevant comparable licenses become available with a substantial delay with respect to the first waves of adoption and licensing.

Finally, our own experience with merging datasets on SEPs with patent information extracted from the SEC resulted in a handful of satisfactory matches. This suggests that **the information that can be potentially retrieved from the SEC disclosures on licensing terms of individual SEP licenses is of limited scope.**

Even when the financial disclosures of publicly listed companies do not disclose relevant terms of individual licenses, in some (rare) cases, analysts are able to infer terms such as royalty payments of particularly significant SEP licenses from licensors' aggregate earnings reports.⁸⁸ For very large SEP licenses between publicly listed companies, analyst reports using such information on likely licensing terms are generally available to investors and industry participants alike; and may provide relatively reliable indications of at least some major characteristics of the license. For major SEP licenses, licensors and licensees may also issue press releases disclosing some (usually very general) characteristics of the license.

For the (very small number of) SEP licenses whose terms were determined by a court, these terms are generally publicly available (see *infra*). Determinations of FRAND licensing terms by a court may also reveal (limited) information on the terms of other licenses, that were used or suggested for use as comparable licenses. In the public version of the decision, many important characteristics of potentially comparable licenses are often redacted; including the royalty rates and other relevant terms, and/or the identity of one or both parties of the license.

As already mentioned, some licensors publish standard licensing terms, and – at least in the case of patent pools – these published standard licensing terms may often provide reliable information about the actual licensing terms of licenses between the pool and a (publicly available) list of licensees. In some cases, these publicly available terms may constitute **comparable licenses**, and thus provide potential licensees with an indication of licensing terms available outside of the pool.

Love and Helmers (2022) compiled publicly available information on SEP licensing terms from different sources. The authors conclude that available price points are “few and far between”. Furthermore, the authors point out that comparisons between different licensing terms, let alone aggregations, are extremely challenging due to largely unobservable heterogeneity in the terms and scope of the underlying agreements.

Overall, publicly available information on the licensing terms of existing SEP licenses is uneven. For a relatively small number of licenses, such as those whose terms were determined by courts, or licenses concluded through a pool, terms may be publicly available; but these licenses are often not representative of other licenses; and therefore, may not provide reliable information on FRAND terms for these other licenses. For a larger number of licenses, some information may be available from a variety of sources, such as financial disclosures, analyst reports, press releases, or legal decisions; nevertheless, this **information is patchy, disaggregated, and of inconsistent quality.** As a general matter, the terms of particularly large and valuable SEP licenses are more likely to be publicly known; at the same time, these licenses are often subject to many idiosyncrasies that make it difficult to

⁸⁸ <https://9to5mac.com/2022/01/25/apple-patent-license-fees-ericsson/>

use the (limited) publicly available information on the terms of these licenses to infer the likely or appropriate licensing terms available for a different license.

4.2.5. *Disclosure of information through bilateral negotiations and court decisions*

In light of the significant limitations of publicly available information, participants in the SEP licensing market may have limited access to information on SEP licensing terms before the actual beginning of negotiations.

Licensees can obtain significant information on comparable licenses from licensors upon engaging in **bilateral negotiations with licensors**. A good faith negotiation between parties involves several steps; and requires both parties to exchange relevant information.⁸⁹ **Under the framework developed by the European Court of Justice in *Huawei v ZTE***, in a first step, the rights holder notifies the implementer of the infringement, and indicates its willingness to offer licenses on FRAND terms. In a second stage, the implementer expresses its willingness to obtain a license. In a third stage, the rights holder sends a specific licensing offer on FRAND terms.

At this stage, the SEP holder should provide specific grounds explaining why the offer is on FRAND terms. This may include either an explanation of how the rights holder calculates the royalties or a list of comparable licenses and their terms. Courts in the EU (primarily in Germany) have taken different positions on the exact scope of the SEP holder's obligations to disclose existing comparable licenses. This entails two aspects: first, under what conditions disclosure of existing comparable licenses suffices to fulfil the SEP holder's obligation to justify its FRAND licensing offer; and second, to what extent disclosure of existing comparable licenses is a requirement, even if the SEP holder justifies its FRAND offer through different means (in particular to allow the implementer to assess the non-discriminatory character of the offer).

In at least two decisions, the District Court of Dusseldorf has ruled that (to the extent possible) it is required and generally sufficient to demonstrate the market acceptance of a FRAND licensing offer by disclosing already concluded comparable licenses.⁹⁰ Hereby, the court takes the view that it is required to provide information on *all* concluded comparable licenses, in order to rule out the risk of selective disclosure, and to permit an assessment of the non-discriminatory character of the offer.⁹¹ Nevertheless, in a different decision, the court ruled that it is not generally required to disclose all terms and conditions of all existing licenses (regardless of the characteristics of the licensed product). The court hereby takes the view that a full disclosure of all existing comparable licenses for a SEP portfolio is not required to enable good faith negotiations, and not customary in the industry.⁹² The court

⁸⁹ Also see the Japan Patent Office (JPO) Guide to Licensing Negotiations Involving Standard Essential Patents. June 5, 2015. Japan Patent Office. <https://www.meti.go.jp/press/2018/06/20180605003/20180605003-2.pdf>

⁹⁰ LG Dusseldorf, 4a O 154/15 Rn. 391 "Sofern dies im konkreten Fall möglich ist, ist es erforderlich und regelmäßig hinreichend, die Akzeptanz der verlangten (Standard-) Lizenzsätze am Markt über bereits abgeschlossene Lizenzverträge darzulegen (Kammer, Urteil vom 31.03.2016 – 4a O 126/14 – Rn. 253 bei Juris)."

⁹¹ 4a O 154/15 Rn. 393

⁹² LG Dusseldorf, 4c O 44/18 "Das aus dem FRAND-Kriterium ableitbare Mindestmaß an Transparenz des Lizenzangebots durch Erläuterung und Information dient dazu, FRAND-Lizenzverhandlungen in gutem Glauben zu gewährleisten. Dafür ist die vollständige Offenlegung aller vorhandener Drittlizenzverträge nicht erforderlich und in der Verhandlungspraxis von FRAND-Lizenzverträgen schon nicht allgemein üblich."

hereby references a decision of the Düsseldorf Court of Appeals, which requires the disclosure of all *relevant comparable* licenses (as opposed to all existing licenses for the same portfolio).

Other courts have taken a less categorical approach. The District Court of Mannheim e.g. noted that the scope of the required disclosure of comparable licenses depends on the specific circumstances of the case.⁹³ The German Supreme Court in *Sisvel v. Haier* similarly noted that “[t]o what extent, at what level of detail and at what time the information to be requested from the patentee is required is a question of the individual case and depends in particular on the respective reaction of the infringer.”⁹⁴

Overall, it is clear that an implementer who demonstrates its willingness to accept a license on FRAND terms can expect to be provided with sufficient information on relevant comparable licenses during the course of SEP licensing negotiations. A SEP holder failing to provide an appropriate level of disclosure risks undermining the FRAND-compliance of its licensing offer.

Nevertheless, there may be situations in which individual implementers have insufficient information to assess whether the SEP holder is withholding information on relevant comparable licenses. While implementers actively participating in SEP licensing negotiations thus are likely to have access to information that significantly exceeds the level of information that is in the public domain, **the level of information that is voluntarily disclosed through bilateral negotiations may often fall short of the level of disclosure on comparable licenses that potential licensees may achieve through FRAND litigation in a judicial system with pre-trial discovery** (such as the US or UK).⁹⁵

To summarize, the information that is available to (potential) standard implementers about SEP licensing terms is uneven. It generally improves over time; and many implementers may learn on what terms SEP licenses are available to them only during SEP licensing negotiations. The information that is available at the time when standard implementation decisions are made is often not reliable.

4.3. Disagreements and controversies on FRAND terms and conditions

In addition to uncertainty regarding the licensing terms and conditions that standard implementers will be offered, there can be **conflicts and disagreements between parties whether these terms are FRAND**. That is, implementers may not only find it difficult to

⁹³ LG Mannheim, 7 O 28/16 “Der Umfang der gebotenen Darlegungen im Einzelfall wird dabei von der konkreten Lizenzierungssituation abhängen.”

⁹⁴ *Sisvel v Haier* at 79

⁹⁵ As an example of the scope of comparable licenses information available during a FRAND trial in the US, the Court of Appeal of the Federal Circuit rejected the District Court’s decision to unseal the financial terms of 109 licenses between Uniloc and third parties, which were disclosed to the parties during litigation opposing Uniloc and Apple.

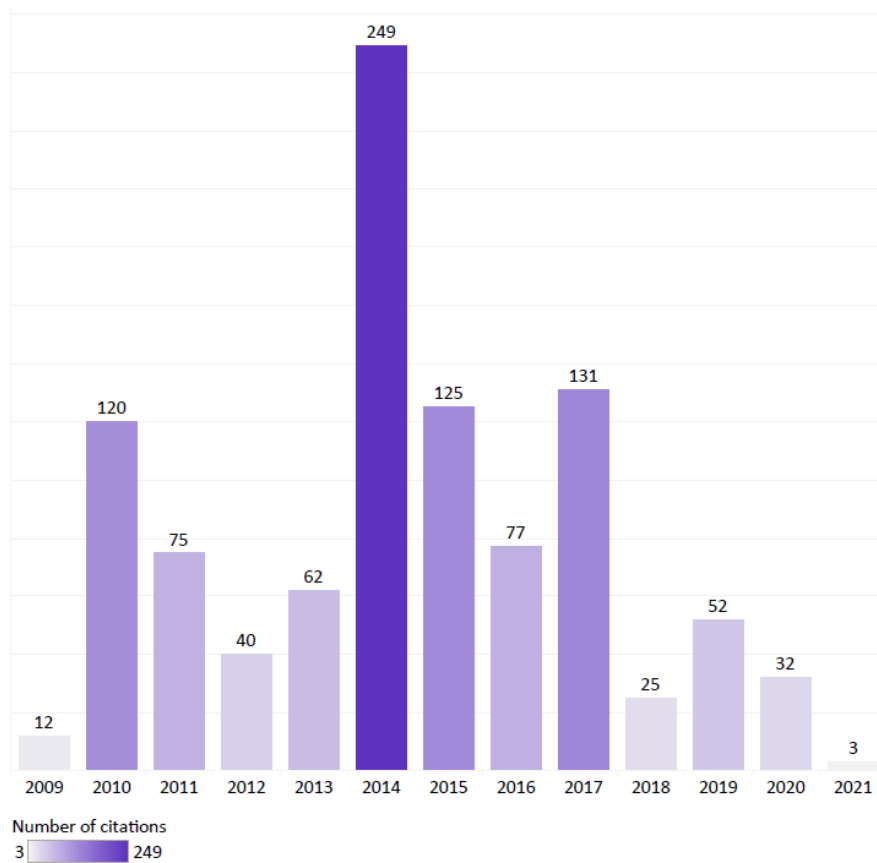
predict the licensing terms they will be offered, but they may also find it difficult to assess whether the terms they are being offered are acceptable.

Disputes regarding FRAND obligations are common in SEP litigations; particularly in Europe (largely driven by litigation in Germany). In most of these cases, these disputes focus on FRAND obligations regarding parties' conduct during SEP licensing negotiations. Parties' diverging interpretations of the concept of FRAND may also contribute to significant discrepancies between licensors' and licensees' expectations regarding the FRAND licensing terms of individual SEP licenses. Different opinions regarding the appropriate royalty base, relevant comparable licenses, and apportionment methods have sometimes led to large differences between total royalty amounts in the licensing offers of licensors and licensees. Nevertheless, from the limited number of observations of FRAND determinations by courts, there is some indication that these discrepancies have winnowed (see Section 4.3.3.).

4.3.1. Incidence of litigation involving FRAND in SEP licensing disputes

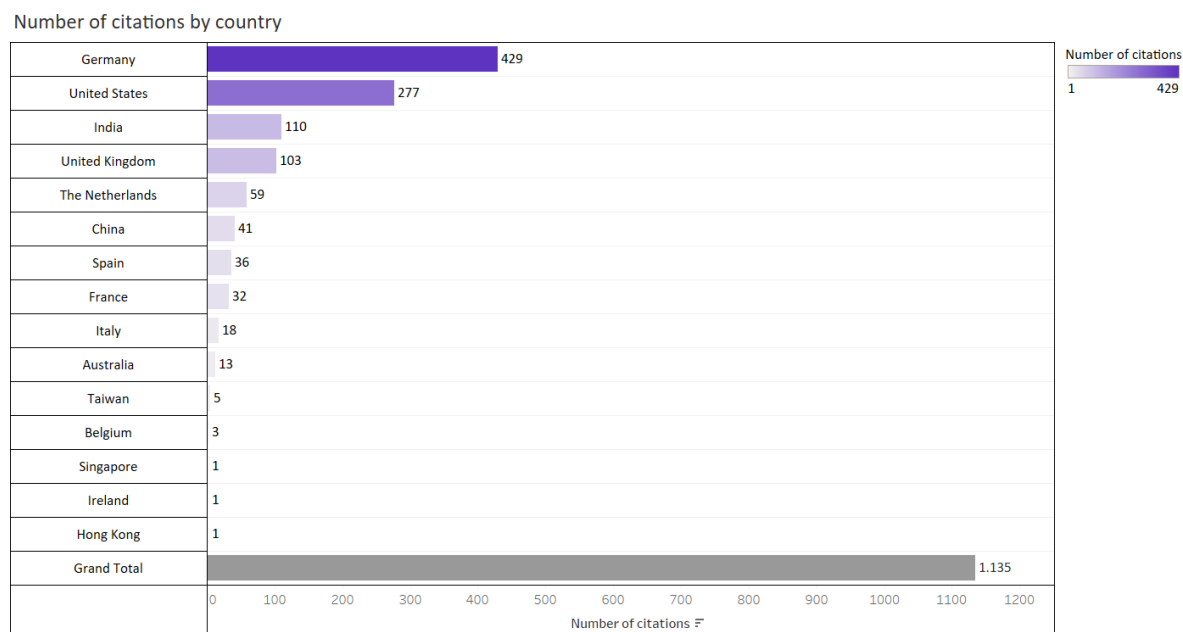
Based on Darts-ip data, we can offer several high-level quantitative observations, which provide an indication of the incidence of different types of FRAND disputes. Counting citations of "FRAND"⁹⁶ in court decisions provides a rough indication of time trends in FRAND disputes over time. Over the past 12 years, there is no clear trend, but significant year-to-year variation in the number of "FRAND" citations in patent litigation (see **Figure 13**). A peak was reached in 2014, with 249 citations. Observations for the most recent years in the analysis are likely affected by data attrition.

⁹⁶ And common variations of the term, such as "RAND" or "fair, reasonable, and non-discriminatory".

Figure 13: Number of citations of “FRAND” in worldwide patent litigations, by year

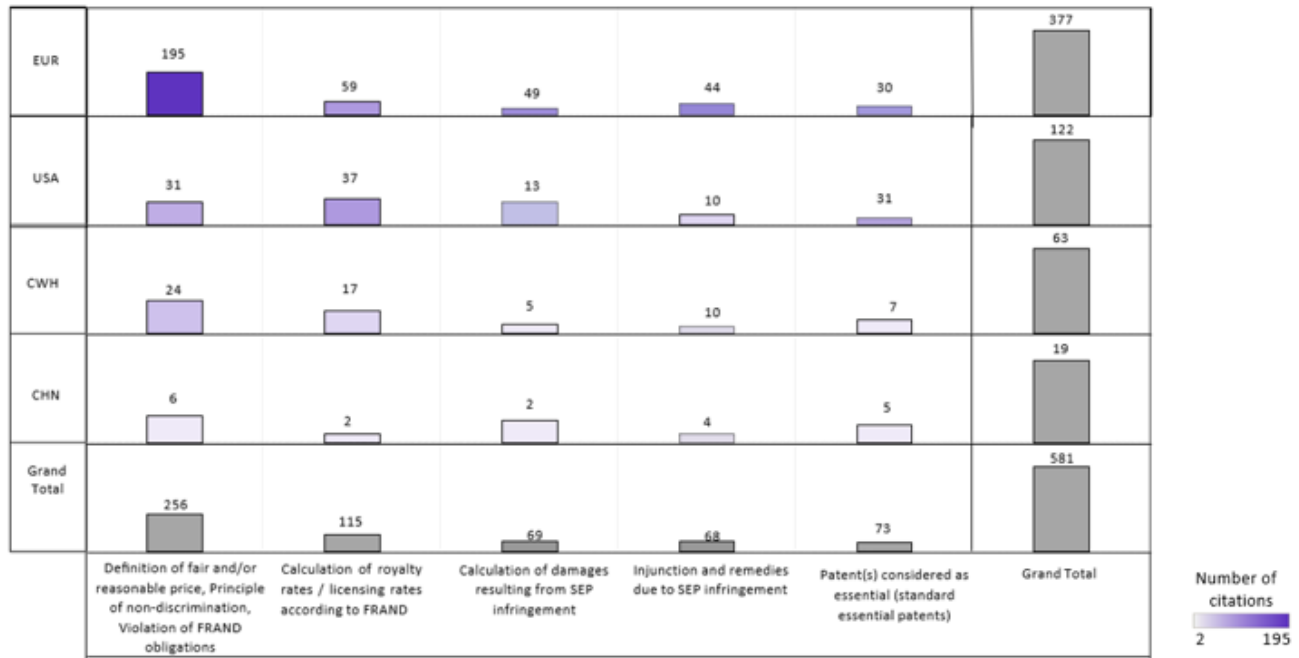
In terms of geographical distribution, the Darts-ip data suggests that **FRAND citations in court decisions are particularly frequent in Germany, followed by the United States, India, and the UK** (see **Figure 14**). Other EU Member States with a certain number of FRAND citations are the Netherlands, France, Italy, and Spain. Nevertheless, **Germany** alone represents more than four times more FRAND citations than all other EU Member States combined. This preponderant share of German courts in the “FRAND” discussions in the jurisprudence of EU Member States is comparable to the outsized role of German courts in litigation counts involving declared SEPs.

Figure 14: Number of FRAND citations by jurisdiction



Furthermore, we can observe the number of FRAND citations by “region” (EU, USA, Commonwealth, China) and point-of-law (**Figure 15**). While FRAND citations are most common in the EU (accounting for 377 out of 581 citations), a lower share of these citations are related to calculations of royalty/licensing rates according to FRAND in the EU (15.6%, or 59 out of 377 citations) than in the Rest of the World (27.4%, or 56 out of 204 citations). Discussions of FRAND in the immediate context of injunctions seem to represent similar shares of courts’ FRAND citations in the EU (11.7%, or 44 out of 377 citations) and the Rest of the World (11.8% or 24 out 204 citations).

Figure 15: Number of FRAND citations by group of points-of-law (POL)



4.3.2. *Nature of disagreements on FRAND rates*

In some cases, **parties’ different interpretations of the FRAND concept may contribute to divergent views on what constitutes a FRAND royalty rate for a particular license.** This risk is highlighted e.g. by the European Commission in its 2017 Communication on SEPs, where it states that *“Currently, licensing is hampered by unclear and diverging interpretations of the meaning of FRAND. The debate is particularly heated when it comes to valuation principles.”*⁹⁷

In addition to fundamentally different views on the nature of the FRAND concept, and more commonly, parties’ positions may differ on other, idiosyncratic and license-specific issues, such as e.g. **different views on which licenses are or are not comparable.** As recognized e.g. by the European Commission’s Expert Group on Standard-Essential Patent, *“whether the terms and conditions of a SEP licence are FR may be a determination made based on the totality of the provisions of the licence agreement, considering the specific circumstances of the parties to the agreement.”*⁹⁸

Courts have similarly recognized that determining a FRAND rate for a particular SEP license requires a fact-intensive appreciation of the circumstances of the license.

For example, in *HTC v. Ericsson*, in the context of a FRAND contractual dispute, the Fifth Circuit rejected HTC’s challenge to the district court’s jury instruction that *“whether or not a license is FRAND will depend upon the totality of the particular facts and circumstances*

⁹⁷ European Commission, Communication on Standard-essential patents, p. 6

⁹⁸ SEP Expert Group, “Contribution to the Debate” (at 96) <https://ec.europa.eu/docsroom/documents/45217>

existing during the negotiations and leading up to the license. . . . [T]here is no fixed or required methodology for setting or calculating the terms of a FRAND license rate.”⁹⁹

Similarly, the Bundesgerichtshof recognized in *Sisvel v Haier* that “*what constitutes reasonable and non-discriminatory terms and conditions of a licence agreement in a particular case usually depends on a variety of circumstances.*”¹⁰⁰ The Court further opines that “*appropriate conditions for a contractual relationship, in particular an appropriate price, are regularly not objectively determined, but can only be determined as the result of (possibly similar) negotiated market processes*”.¹⁰¹

When parties disagree on FRAND rates for a particular SEP license, this may thus be due to parties’ fundamentally different interpretations of the (abstract) FRAND concept (e.g. some parties have argued that a FRAND rate needs to be derived from the SEP portfolio’s *ex ante* value with respect to standardization, whereas other parties dispute the applicability of such an *ex ante* comparison). More often, parties disagree on purely factual issues (e.g. parties have different opinions on the number of SEPs owned by different firms). In many cases, disagreements involve combinations of abstract and factual considerations (e.g. disagreements on whether an existing license may be used as comparable may hinge on different views on the factual characteristics of the different licenses, as well as different opinions on what (if any) specific criteria are applicable to the choice of comparable licenses for the purpose of determining FRAND terms and conditions).

It is thus not straightforward to relate abstract considerations on the meaning of FRAND to empirical observations of parties’ disputes on the FRAND value of individual SEP licenses. On one hand, parties may have pronouncedly different views on what terms and conditions are FRAND for a specific license without disagreeing on the fundamental concept of FRAND; on the other hand, fundamentally different views on FRAND need not result in vastly different terms and conditions for individual licenses.

4.3.3. *Extent of disagreement on FRAND rates*

Like other aspects of FRAND licensing negotiations, parties’ views on what constitutes a FRAND rate are generally unobservable. Litigation is a rare window into this important aspect of SEP licensing, but **SEP licensing negotiations resulting in litigation are not representative of SEP licensing negotiations more generally.** In particular, disagreement between parties’ FRAND offers must be sufficiently large to justify the costs of litigation. While there is a larger number of SEP litigations, adjudications of FRAND disputes are rare, and particularly expensive.¹⁰² Therefore, **litigation only provides information on parties’ views on FRAND rates in a very small number of SEP licensing negotiations, where the unit value of the license is very large, and/or discrepancies between parties’ FRAND offers are particularly pronounced.**

⁹⁹ HTC Corporation v. Telefonaktiebolaget LM Ericsson, -- F.3d – (5th Cir. Aug. 31, 2021) (“HTC 1”), Slip. op. at 6.

¹⁰⁰ *Sisvel v Haier*, Bundesgerichtshof KZR 36/17, at 81. Cited from English translation provided by Arnold Ruess

¹⁰¹ *Ibid.*

¹⁰² Outside China and India, there is a number of determination of FRAND rates by courts in the UK and the US, where patent litigation costs in general are high. At least in the UK, there is evidence that FRAND litigation is particularly expensive. In Western countries with lower litigation costs (mostly in continental Europe), SEP litigation usually focuses on questions of validity, essentiality, and availability of injunctive relief.

In **Table 10**, we summarize the views of the parties of FRAND litigation cases on what constitutes a FRAND rate for the license under dispute. Rates can only be compared if applied to the same base. Nevertheless, parties usually apply different bases and structures to their FRAND licensing offers. In some cases, courts have transposed these offers to a common base to make them comparable, in others, we have used blogposts and press reports that offer a transparent methodology for transposing licensing offers to a common base.¹⁰³

Table 10: Parties’ and courts’ views of the FRAND value of a SEP license in SEP litigation

<i>Case</i>	<i>Standard</i>	<i>Licensor Demand</i>	<i>Implementer offer</i>	<i>Court Award</i>	<i>Base</i>
INDIA					
Ericsson v Micromax	2G	1.25% - 2%	?	0.8% - 1.3%	end product price
	3G	2%	?	1.30%	end product price
UK					
Unwired Planet v Huawei	2G	0.28%	0.05%	0.06%	end product price (Handset)
	3G	0.28%	0.05%	0.03%	
	4G	0.55%	0.06%	0.05%	
	2G	0.21%	0.05%	0.06%	RAN infrastructure revenue
	3G	0.21%	0.05%	0.02%	
	4G	0.42%	0.06%	0.05%	
US					
Microsoft v Motorola	H.264	\$4.5	\$0.00065 - 0.00204	\$0.00555	per unit
	802.11	\$4.5	\$0.03 - 0.065	\$0.03471	per unit
Hynix v Rambus	JEDEC	2.50%	?	0.8% - 0.85%	total US sales
Ericsson v DLink	802.11	\$0.5	?	\$0.15	per unit
Innovatio IP Ventures	802.11	\$3.39 - \$36.90 per end product	\$0.0072 - 0.0309 per Wi-Fi chip	\$0.0956 per Wi-Fi chip	per unit (≠ products)
Realtek v LSI	802.11	0.29%	0.034%	0.19%	end product price
CISCO v CSIRO	802.11	1.35% - 2.25%	0.03% - 0.37%	\$0,65 - \$1,90	end product price
TCL v Ericsson	2G	0.8% - 1.0%	0.21%	0.09% - 0.164%	end product price
	3G	1.20%	0.21%	0.224% - 0.3%	
	4G	1.50%	0.16%	0.314% - 0.45%	
HTC v Ericsson	4G	\$2.5	\$0.1	\$2.5	per unit

The most complete picture is available from the US, where we have been able to compare parties’ offers with each other, as well as with court determinations of FRAND rates, in 8 cases.¹⁰⁴ Most of these cases are complex multi-product disputes, often involving different standard generations. There are thus multiple rates per case to compare. FRAND determinations by US courts are a recent phenomenon, with Judge Robart’s decision in *Microsoft v. Motorola* in 2013 representing the first such decision. In this and another early

¹⁰³ A more detailed table, which provides the intermediate steps of our methodology, is available in Appendix 4.

¹⁰⁴ We only focus on one instance/ruling per case; and include rulings that were partially or fully vacated on appeal. The table thus does not offer a comparison of parties’ offers with the “true” FRAND rate; but rather a descriptive overview of the extent of discrepancies between parties’ and individual judges’ views on what constitutes a FRAND rate.

decision, *In re Innovatio IP Ventures* (also initiated prior to the first FRAND determination by a US court), discrepancies between parties' views on a FRAND rate for the license under dispute are extremely large (approx. three orders of magnitude). No similar level of disagreement is observable in any of the four more recent decisions that we analysed; where parties' offers still diverge significantly, but are more often of the same order of magnitude.

Across this small sample of cases, courts have sometimes fully accepted the licensing offer of one side, or determined a FRAND rate that is much closer to one party's offer than to the other's; and sometimes determined FRAND rates somewhere in the middle between the parties' positions. Licensors and implementers were equally likely to "prevail" (i.e. courts' rates are more similar to licensors' offers in three cases, and more similar to implementers' offers in three cases).¹⁰⁵

Outside the US, there is less consistent information on FRAND determinations by courts.¹⁰⁶ This is particularly true for EU Member States – while German courts have frequently assessed the compliance of parties' conduct during SEP licensing negotiations with their FRAND obligations, there has so far not been a determination of a FRAND rate by a court in the EU.

Overall, we conclude that disagreements on FRAND rates between parties of SEP litigations can be very substantial. There is some indication that the extent of disagreement has winnowed in more recent disputes. In different disputes, courts' FRAND royalty determinations have differed significantly from both implementers' and licensors' views of what constitutes a FRAND rate.

4.3.4. *Substantive aspects of controversies over FRAND rates*

While parties' disagreements on FRAND rates may be caused by a large number of idiosyncratic aspects of SEP licenses, as well as different opinions on complex legal issues, there are certain empirically observable disagreements that arise in a larger number of litigations, and which often account for a large part of the decision (presumably reflecting the fact that discussion of these points was a significant component of litigation, and perhaps also negotiations).

¹⁰⁵ Note that our comparison of offers is based on divisions (Rate1/Courtrate <> Courtrate/Rate2); but the finding would be unchanged if we compared the difference in terms of subtraction (Rate1-Courtrate <> Courtrate-Rate2).

¹⁰⁶ We have not included FRAND determinations from China in our analysis, principally because of language issues.

4.3.4.1. Comparable licenses

All decisions in our sample involved analyses of comparable licenses (see Appendix 5). Many relevant aspects of comparable licenses discussed in court, including rates and other terms and conditions, the identity of the parties, and the scope of the license, are routinely redacted in the public version of the decision. Nevertheless, the comparative overview reveals that **discussions of comparable licenses are extensive in FRAND litigation**, and allows making several observations on this important aspect of SEP licensing disputes.

To the extent that the **identity of the parties** of comparable licenses are observable, the majority of potential comparable licenses discussed in court are licenses between the patent holder and other implementers (or licenses between the previous owner of the portfolio at issue, such as in the case *Unwired Planet v Huawei*, where most comparable licenses are Ericsson's). This observation is significant, as implementers may often have no access to information on the patent holder's other licenses unless they engage in litigation.

Another noteworthy observation is that the majority of potentially comparable licenses discussed in the decisions was **ultimately not considered comparable**. This underlines the importance for parties of SEP licensing negotiations to be provided with comprehensive information on SEP licenses, as individual licenses may yield an inconsistent (and ultimately incorrect) representation of the FRAND rate.

Finally, it is observable that **comparable licenses** (including those ultimately relied upon in the decision) often **differ in payment structure, the existence of cross-licensing provisions, and date**. Parties therefore routinely require not only access to information on the terms comparable licenses, but also complementary information and expertise allowing them to “unpack” comparable licenses in view of deriving a truly comparable rate that can be used for comparison (see also Helmers and Love (2022), who further develop this argument).

On the other hand, we do not observe significant variation in discussed licenses' **geographical scope**. To the extent observable, all potentially comparable licenses discussed in our sample decisions had **worldwide** scope. While this information is based on a limited number of observations, it also is consistent with more general (and unredacted) statements by courts, which highlight the prevalence of worldwide SEP licenses. We also do not observe significant numbers of non-SEP licenses; SEP licenses concluded prior to standardization; or SEP licenses deemed non-FRAND because they were concluded under a threat of injunction. This observation suggests that these potential aspects of comparable licenses, which receive a significant amount of academic attention, do not (currently) play a significant role in the discussion of comparable licenses in SEP litigation practice.

4.3.4.2. Patent counts

Another substantive aspect that may potentially contribute to disagreements over FRAND rates are diverging views over patent counts. In particular, **parties may hold different views on the share that a portfolio of SEPs represents in the total “stack” of patents that are essential to the same standard**.

In a **top-down approach**, this may provide information on the FRAND rate for a license to this particular portfolio. In a **comparable licenses** analysis involving comparisons between licenses to different portfolios, parties may have diverging views on the relative portfolio sizes and strengths. To reflect these divergences, we express parties' positions on two different patent counts: the "**numerator**", reflecting the number of essential and valid patents in the portfolio under dispute; and the "**denominator**", reflecting the overall number of valid patents that are essential to the same standard. Licensors and implementers may disagree on the numerator (where licensors typically believe that they own a larger number of essential patents) and/or the denominator (where licensees typically argue that the total number of essential patents is large). Divergences of views on the numerator and denominator combine to create diverging views on the share of the portfolio in the total.

Explicit analyses of patent counts are rare, in particular with respect to the denominator. In our sample (see Appendix 6), there are only four cases in which a court adjudicated a dispute over the total number of essential patents for a standard. Only in two of these cases (Innovatio and TCL v Ericsson), the court derived a FRAND rate using a top-down approach based on these patent counts. Furthermore, in only two cases (TCL v Ericsson and Unwired Planet v Huawei), the count of essential patents involved expert assessments of the essentiality of (a sample of) declared SEPs in the denominator.

Based on the very small number of cases in which divergent views on SEP counts were adjudicated, we can make some tentative observations. First, **divergences over the numerator are relatively small** – presumably reflecting the fact that patents in the portfolio under dispute have been analyzed in previous stages of the dispute, reducing the potential scope of disagreement during the FRAND trial.

As for the **denominator, disagreements can be substantial:**

- In Unwired Planet v Huawei, the implementer's proposed total SEP counts were approximately three to five times larger than the patent holder's proposed total SEP counts. Combined with the parties' different views on the numerator, these differences amount to divergences that almost fully account for the differences between parties' views on a FRAND rate. This is, however, the only case in which parties' different views on SEPs in the denominator could be considered a main driver of their disagreement on the FRAND rate.
- In Innovatio, the patent owner's and implementer's views on the total SEP count differed by a factor of six, whereas parties' views on the FRAND rate differed by factors ranging from 200 to 2,000.
- In Microsoft v Motorola, while the court used a total SEP count in its FRAND determination, the three-order-of-magnitude discrepancies between parties' views on the FRAND rate could not plausibly be explained by differing views on the number of SEPs in the denominator.
- In TCL v Ericsson, SEP counts in the denominator played a significant role in the trial and decision. Nevertheless, diverging views on the number of SEPs in the denominator do not seem to have had a large impact on the outcome. While the licensor's methodology did not involve a count of SEPs in the denominator, we can compare the implementer's proposed counts, and the counts used by the court in the judgment. The court found the number of patents in the denominator to be about 15% to 20% smaller than proposed by TCL. For comparison, the court's FRAND rates for 4G were two to three times higher than TCL's. Diverging views on the number of

SEPs in the denominator thus can only account for a small share of the discrepancies between the licensee's and the court's view on what constitutes a FRAND rate for this license. The much larger discrepancies between the licensee's and the licensor's views on a FRAND rate could not plausibly be explained by different opinions on the number of SEPs in the denominator.

Overall, the analysis suggests that **parties' diverging views on the number of SEPs in the denominator are very rarely the main factor in driving FRAND litigation**. There is only a small number of decisions in which the court has adjudicated disputes over the number of SEPs in the denominator. Even among these cases, there is only one case in which diverging views on the number of SEPs in the denominator can account for a large share of the discrepancies between parties' views on the FRAND rate for this license.

This does not, however, indicate that parties' differing views on the total number of SEPs do not play a significant role in generating disagreements on FRAND rates. FRAND trials involving expert assessments of the number of SEPs in the denominator are likely to be particularly complex and costly. At the same time, unlike e.g. differing views on the appropriate royalty base, parties' views on the total number of SEPs for a standard cannot plausibly vary by several orders of magnitude (and even divergences by a factor of five or six such as in the observed cases appear unusually large, and unlikely to be repeated for the same set of standards). From the point of view of the parties, diverging views on the number of SEPs in the denominator thus can only justify the substantial expense of this type of trials if the expected FRAND value of the license is very large. While suggesting, on one hand, that lack of transparency on the number of actual SEPs in the population does not play a large role in driving SEP litigation, it also suggests that most disagreements between parties on the true number of SEPs are not observable through litigation.

5. COMPLEX DISPUTE RESOLUTION

SEP licenses may have a large geographic scope due to the fact that the standard is patented and implemented in a large number of countries. However, patent litigation generally occurs on a ‘country-by-country’ basis. This situation leads to complexities and potential inefficiencies. We focus on four complexities considered most problematic in SEP disputes:

- *Courts determination of global FRAND rates*: Courts in the US, China and the UK have shown willingness to set global FRAND rates. On the other hand, courts in EU Member States have not (yet) engaged in such a determination. We analyzed 8 instances in which a request for global FRAND determination was made, out of which only 5 led to a court’s setting of global FRAND rates. In these instances, three elements have been considered by courts before setting these rates: the industry norms, the parties’ intentions and/or interests and specific legal rules (ie. the issue of comity and proper nexus).
- *Parallel litigation*: In the context of SEPs, there is an increased likelihood of parallel litigation because of the global nature of standards and licensing practices. We found that SEP families are most often litigated in only one jurisdiction, but are more often litigated in two (or more) jurisdictions than other patent families. We studied 23 pairs of repeat litigants and found that, on average, they have engaged in SEP-related disputes in 3.2 jurisdictions. A particular issue in identifying parallel litigation in SEP disputes is the possibility of fragmentation of litigation between questions of patent, competition and contract law.
- *Forum shopping*: We found that the majority of SEP disputes take place in China, the US and Europe (in particular UK and Germany). These are common fora for patent litigation (SEP or non-SEP). SEP disputes only differ slightly from non-SEP disputes, in the sense that SEP litigation is more likely to take place in China.
- *Anti-suit injunctions (ASI)*: Courts in China and the US have issued orders in the context of SEP disputes to prevent the parties from initiating or continuing parallel litigation in another jurisdiction. The use of ASI within the EU is limited by Brussels I Regulation and CJEU decisions. In SEP disputes, Member States courts (eg. in Germany and France) have issued anti-anti-suit injunction (AASI) in response to orders from China and the US, thereby trying to restore their jurisdiction. Over a period of ten years between 2011 and 2021, we found 53 requests for ASI or AASI. The incidence of such requests has increased over time since 2018. Out of these 53 requests, 25 have taken place in SEPs disputes (15 ASIs and 10 AASIs).

As we have seen in section 4.3., parties of SEP licensing negotiations may have strongly diverging views on what constitutes a FRAND rate for a SEP license. These divergences may result from disputes over both factual and legal questions. Resolving these disputes through litigation may be complex: the majority of SEP licenses have a large geographic scope, i.e. the technology is both patented and implemented in a larger number of countries. Nevertheless, courts’ jurisdiction generally extends to only one country. This situation results in a larger number of complexities and potential inefficiencies.

5.1.Introduction

Principle of territoriality – Patents are granted for inventions that meet patentability requirements: novelty, inventive step and industrial applicability. In Europe, patents are either granted by a national patent office¹⁰⁷ or the European Patent Office (EPO). In the US, patents are granted by the US Patent and Trademark Office (USPTO) and in China by the National Intellectual Property Administration (CNIPA).

The same invention can be protected by different patents granted by different patent offices. Patent applicants may therefore apply to different offices in order to obtain multiple patents covering different territories.¹⁰⁸ When this is the case, the different patents granted by different patent offices form what is called an International Patent Family (IPF). A patent family is therefore a set of patents obtained at different patent offices but which cover the same invention.

Despite the existence of patent families, and according to the principle of territoriality, **a patent is only effective in the territory of the country where it has been granted**. For example, the EPO grants European Patents (EPs). However, and maybe counterintuitively, these patents are not automatically effective in all the countries members of the European Patent Organisation.¹⁰⁹ EPs form a “bundle” of national patents which must be validated (in the sense of registered) at the national patent offices of the countries part of the EP Organisation and which have been selected by the applicant, in order to be effective.¹¹⁰

National conflict resolution – Once granted, patents become effective and their owner can then use them to put an end to any act of infringement by a third party. This can be done by starting infringement proceedings before a national court. Additionally, third parties may also try to invalidate a patent (either before a patent office or a national court) after its grant. Infringement actions and challenges to validity are the most common patent disputes.

There is currently no European court or multi-national forum in which patent litigation may take place. This may change in a short future with the adoption of the Unified Patent Court (UPC). However, **patent litigation is currently characterized by fragmentation rather than harmonization**. This, despite the existence of the Enforcement Directive of Intellectual Property Rights (IPRED) which provides for a minimum harmonization of IP enforcement rules.

In light of the principle of territoriality, any challenge related to the validity¹¹¹ of a patent will have to take place in the country where that patent has been validated. The decision of validity or invalidity resulting from a national procedure will not affect the validity of other patents which are part of the same patent family and which have been validated in other

¹⁰⁷ For example: The DPMA (*Deutsches Patent- und Markenamt* – the German Patent and Trade Mark Office) in Germany, the INPI (*Institut National de la Propriété Industrielle* – the National Institute of Industrial Property) in France or the UKIPO (the UK Intellectual Property Office).

¹⁰⁸ According to the Paris Convention and the mechanism of “priority right”, anyone who files a patent application in one country, can file an identical application in another country part of the Convention without being exposed to the risk that the first application will be considered as novelty-destroying for subsequent applications. The decision to file in multiple country is generally driven by the market activities of the applicant.

¹⁰⁹ The European Patent Organization counts 38 member states. See: <https://www.epo.org/about-us/foundation/member-states.html>

¹¹⁰ This will partially change with the creation of European Patents with Unitary Effect (EPUE or Unitary Patent). These patents will be granted by the EPO and (upon request from applicants) will be effective in the territory of the EU member states which are parties to the Unitary Patent Package. Unitary Patents will be available from June 01, 2023. See: https://ec.europa.eu/growth/industry/strategy/intellectual-property/patent-protection-eu/unitary-patent_en

¹¹¹ Once the 9 months opposition period at the EPO has expired.

jurisdictions. A similar scenario applies to question of infringement. A right holder may only initiate infringement proceedings before a court in a jurisdiction which has competence to determine if there are some acts of infringement in that specific jurisdiction. Overall, **patents can only be litigated before the courts of a jurisdiction where it produces legal effects and the decisions of these courts can only have effects in their own jurisdiction.**

SEPs and SEPs-related disputes – With regard to SEPs, it is quite common that right holders apply for multiple patents at different offices in order to obtain the largest geographical coverage of protection. This goes hand in hand with the market globalization which characterises SEPs. There are therefore a large number of IPFs when it comes to SEPs. The same underlying invention is protected by patents granted by the EPO, the USPTO, the CNIPA and other national offices. These patents form a patent family.

However, **SEPs do not escape the principle of territoriality.** Therefore, **disputes related to SEPs have to be dealt with on a “country by country” basis.** This includes patent litigation and the determination of validity and infringement. Since SEPs are validated in many countries, if third parties want to invalidate these patents, they have to start revocation or invalidity proceedings in many jurisdictions. Similarly, SEPs can be infringed in many different places as the technology is implemented across the globe. **Right holders may therefore have to litigate multiple times in multiple jurisdictions and obtain diverse injunctions in order to put an end to acts of infringement.** Additionally, there is no international or regional organisation or authority which can determine the essentiality of a patent for a particular standard. These patents are declared essential to SSOs or SDOs by right holders but this is on a voluntary basis. Finally, even if SEP holders promise to license their technology under FRAND terms to SSOs or SDOs, the actual meaning of FRAND is not determined by these organisations. The terms of such licensing contracts remain in the hands of the parties. Under the principle of freedom of contract, the parties are free to determine the terms of this agreement (ie. the territorial scope, length, royalty rates...). If the parties cannot reach an agreement or if the meaning of FRAND is disputed, they can turn to traditional conflict resolution fora (ie. national courts). When this is the case, the principle of territoriality comes back and technically prevents a regional or worldwide conflict resolution.

Overall and in principle, the questions of validity, infringement, essentiality and FRAND determination (when there is no agreement between the parties) must respect the principle of territoriality. The fact that disputes have to be resolved at the national level, on a country-by-country basis, may be particularly burdensome for the parties involved. This **country-by-country approach also means that the parties will have to decide in which jurisdiction to litigate.** They may decide to start multiple proceedings in different jurisdictions more or less at the same time and therefore engage in **parallel litigation.** Both SEP holders and implementers have different options as to where to start proceedings. This is what is generally known as a situation of **forum shopping.** Parallel litigation in SEPs-related disputes led to the issuance of **Anti-Suit Injunctions (ASIs).** These injunctions are orders issued by one jurisdiction to prevent the parties from initiating or continuing parallel litigation in another jurisdiction. They can be understood as means to reduce parallel litigation and divergent outcomes.

5.2. Injunctive relief and FRAND licences

In case of litigation, different outcomes may take place. If the dispute reaches a decision on the merit, a national court may decide that an asserted patent is valid and infringed, valid

and non-infringed or invalid and therefore non-infringed. If a patent is found to be infringed, national courts may grant an injunction putting a stop to any acts of infringement.¹¹²

This **injunction can only have effect within the jurisdiction of the deciding court**. This means that **a right holder may have to obtain multiple injunctions in different jurisdictions in order to put an end to different acts of infringement**. At any point in time during litigation, the parties may also decide to settle the case and, in most instances in the context of SEPs, enter into a licensing agreement. If this is the case, the parties are free to determine the terms of this agreement (ie. the territorial scope, length, royalty rates...).

Injunctive relief is a very powerful tool in the hands of right holders. In case of SEPs, a permanent injunction may be very detrimental to implementers as there may not be any non-infringing alternative to the standard protected by the SEPs. Implementers would therefore have to leave that market or renounce to implement the standard technology in their products.

It is in light of this specific situation that **some national courts have tailored the rules of injunctive relief**. In particular, courts in the UK, the US and China have considered that instead of having to suffer the consequences of an injunction, implementers could agree to take a FRAND licence.¹¹³ If the parties cannot agree on the terms of such licence (eg. territorial scope, length or royalty rates) courts in these jurisdictions have also considered that they can engage with such determination. Moreover, these courts have also argued that a worldwide licence could be FRAND. This would be in line with the practice of the parties to enter into worldwide licensing agreements when they are not engaged in litigation. In these jurisdictions the parties face two possible outcomes to findings of infringement: **injunctive relief or a FRAND licensing agreement**.¹¹⁴ The courts' intervention in the determination of licensing terms agreement is debatable.

On the other hand, **EU Member State courts tend to shy away from the determination of FRAND licensing royalties**. It may be possible for a national court to determine FRAND licensing terms that would be applicable to its territory¹¹⁵ but to engage in global FRAND determination has currently not taken place in the EU. Moreover, there is currently little to no alternative to injunctive relief. EU courts will either grant, deny, or temporarily stay the enforcement of an injunction, but will not try to elaborate alternative remedies. Therefore, the alternative between a national injunction and a global FRAND determination is currently unavailable before EU courts.¹¹⁶

The core issue with this development lies with the fact that there is a **discrepancy between the limited territorial effects of an injunction and the extraterritorial effects of a global**

¹¹² Before litigation on the merits, right holders may also petition for preliminary injunctions. If successful, these injunctions can put a temporary stop on infringement or prevent acts of infringement. The requirements to obtain such an order vary between jurisdictions.

¹¹³ For global rate: UK *Unwired Planet*, US C.D. Cal *TCL v Ericsson* (but with consent of both parties). Chinese decision – *Oppo/Sharp*.

¹¹⁴ See in *Unwired Planet* [2020] UKSC 37, at 88: "SSOs such as ETSI have crafted a contractual arrangement which enables the courts to determine a FRAND licence which, if accepted by the implementer, may prevent a SEP owner from obtaining a prohibitory injunction to exclude the implementer's products from a particular jurisdiction. The implementer has the choice whether to exclude the risk of injunction by accepting a FRAND licence".

¹¹⁵ Similar to the determination of royalties that may be due as damages for past infringement and which are established in light of the harm cause in the jurisdiction of the court seized.

¹¹⁶ Art 12 of the Enforcement Directive provides for alternative remedies to an injunction. In particular, for the grant of a pecuniary compensation in lieu of injunctive relief. This presents similarities with the position adopted by UK, US and Chinese courts since an injunction is replaced by a FRAND licensing agreement. The SEP holder will therefore obtain pecuniary compensation (ie. in the form of royalty payment) instead of an injunction. However, Art 12 has no direct effect and has not been implemented in the national patent laws of Member States. In Germany, it has been implemented in the field of copyright but not patent law. See: P. Blok, A harmonized approach to prohibitory injunctions: reconsidering Article 12 of the Enforcement Directive, 11(1) *JIPLP*, 56 (2016).

FRAND licence. In light of the principle of territoriality, an injunction can only have effect within the jurisdiction of the deciding court. However, when courts engage with the determination of a worldwide FRAND licensing agreement, this agreement has extraterritorial effects, beyond the borders of the jurisdiction in charge of determining validity and infringement.

In other words, in these jurisdictions where an injunction is considered as an alternative to a licensing agreement, there is a possibility to rely on a remedy to infringement which has limited territorial effect (ie. the injunction) to obtain a different type of remedy to infringement (ie. the licensing agreement as a substitute to the injunction) which has extraterritorial effect. Both SEP holders and implementers can exploit the fact that the threat of an injunction in one jurisdiction can be used to acquire, via the licensing agreement, rights in other jurisdictions. Depending on the circumstances of each case, this may be more or less advantageous to one or the other party.

5.2.1. *The practice of courts*

To reconcile this potentially conflictual situation, courts, in particular in the UK and the US, have analysed licensing agreements (including FRAND licensing agreements) within the framework of contract law.¹¹⁷

Because SEP holders make a promise to SSOs or SDOs to license their technology under FRAND terms, it is recognised by these national courts that, in determining a FRAND licence, they are actually being asked to enforce a contractual obligation. In the case of ETSI for example, the promise to license under FRAND terms that is made to ETSI is legally binding under French law and considered under the guides of third-party beneficiary contract (*stipulation pour autrui*). This means that, even if the promise to license FRAND is made to the SSO and not directly to implementers, they can rely on this promise to obtain a FRAND licence. This is a **contractual obligation that SEP holders must respect and which can be enforced before a court**.

On the other hand, courts in Germany have been more reluctant to engage with contract law and prefer to **analyse the question of FRAND under the umbrella of competition law**. In particular, German courts consider that the promise to license under FRAND terms does not invest third parties with a right to obtain a license (as would be the case under a contract law interpretation) but rather merely an invitation to make offers. In Germany, Art 102 TFEU

¹¹⁷ Contreras, 2021 [at...]: “Even though a national court typically lacks authority to adjudicate damages with respect to the infringement of foreign patents, the fact that FRAND disputes are essentially contractual disputes gives a national court the jurisdictional authority to determine a global rate for the portfolio licensed under the agreement in question (as opposed to infringement damages for patents in other jurisdictions).” See also: in the UK, *Unwired Planet* [2020] UKSC 37, at 3: “In English law, once a patent owner has established that a patent is valid and has been infringed, it is prima facie entitled to prevent further infringement of its property rights by injunction. [] This prima facie entitlement and the patent owner’s entitlement in other jurisdictions to obtain similar prohibitory remedies **form part of the backdrop to the contractual arrangements** which lie at the centre of these appeals” (emphasis added). At 58: “It is the **contractual arrangement** which ETSI has created in its IPR Policy **which gives the court jurisdiction to determine a FRAND licence** and which lies at the heart of these appeals” (emphasis added). In the US, *Microsoft Corp v Motorola Inc* 696 F 3d 872 (9th Cir 2012) p 10: “When that contract is enforced by a US court, the US court is not enforcing German patent law but, rather, the private law of the contract between the parties. Although patents themselves are not extraterritorial, there is no reason a party may not freely agree to reservations or limitations on rights that it would have under foreign patent law (or any other rights that it may have under foreign law) in a contract enforceable in US courts.”

remains the basis of a FRAND defence (discussed under 5.4.2) and this necessarily affects the interpretation to be given to the promise to license under FRAND terms.¹¹⁸

National courts are regularly asked to engage with this type of FRAND related questions within the confine of a patent dispute. Therefore, answering questions of contract law, competition law and patent law. However, the rules of contract law do not answer to the same limitations as those of patent law when it comes to the principle of territoriality. If this approach of separating questions of contract law from questions of substantive patent law helps in answering the question of the competence of the courts to determine global rates while only being competent for the determination of validity and infringement of national patents, the point made regarding the threat of injunction remains.¹¹⁹

Table 11 includes decisions in which a national court has considered a request by one of the parties to litigation to determine a worldwide rate for FRAND licensing. This list is not exhaustive and included decisions which have been discussed in the literature. As we can see from the table there are, to our knowledge at the time of research, only few instances in which these requests have taken place and have been considered by the court. All these instances are coming from the UK, the US or China and none has taken place in the EU. From those, only 5 (1 in the UK, 1 in the US and 3 in China) have led to the determination by a court of global FRAND rates.

Table 11: Global FRAND rate determined by a court

JURISDICTION	INSTANCE	GLOBAL FRAND?
UK	Vringo v ZTE [2015] EWHC 214 (Pat)	NO
	Unwired Planet Intl. Ltd. v Huawei Techs. Co. Ltd. [2020] UKSC 37	YES
US	TCL Communication Technology Holdings Ltd. v Ericsson US No. 2:15-cv-02370 CV 15-2370 JVS(DFMx) SACV 14-341 JVS(DFMx) (C.D. Cal Dec. 21, 2017)	YES
	Optis Wireless Tech., LLC, v. Huawei Device Co. Ltd., No. 2:17-cv-123-JRG-RSP, 2018 WL 476054 (E.D. Tex. Jan. 18, 2018)	NO
China	Xiaomi Communication Technology Co Ltd v InterDigital Inc [2020] Wuhan Intermediate People’s Court, Case E 01 Zhi Min Chu No 169.	YES
	Samsung v Ericsson [2020] Wuhan Intermediate People’s Court, Case E 01 Zhi Min Chu No 743.	YES
	OPPO v Sharp, Supreme People’s Court (19.08.21). (2020) Zui Gao Fa Zhi Min Xia Zhong No. 517	YES

¹¹⁸ T. Cotter, Like Ships That Pass in the Night: U.S. and German Approaches to FRAND Disputes (July 11, 2022). Forthcoming in FRAND: German Case Law and Global Perspectives (Peter George Picht, Erik Habich & Thomas F. Cotter eds., Edward Elgar Publishing Ltd. 2023)., Minnesota Legal Studies Research Paper No. 22-10, Available at SSRN: <https://ssrn.com/abstract=4160170>, p. 18 and references at footnote 100.

¹¹⁹ Point made by Mr. Justice Birss in Vringo v ZTE [2015] EWHC (Pat) 214 at [108]-[109]: “if Vringo had offered ZTE a FRAND license for the UK patent alone, and ZTE rejected that license, Vringo might indeed be entitled to an injunction. However, as Vringo had only offered ZTE a global license, even if that global license were FRAND, the court could not find ZTE to be an unwilling licensee. Doing so, in fact, would facilitate a form of “international coercion” in which the threat of an injunction in the UK could be used to force a licensee to acquire — i.e., pay for — undesired rights in other jurisdictions”. Reversed by Unwired Planet [2020] UKSC.

	Oppo v Nokia Intermediate Court of Chongqing [2021] Docket: (2021)渝01民初1232号	No information available
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Table 11 lists instances in which a national court has been asked to determine a global FRAND rate. In each of these instances, courts have considered 3 key elements before deciding to engage with a global FRAND determination (see also the Table with parallel litigations in Appendix 7).

These 3 key elements are:

1. **Industry norm:** Courts have enquired about the licensing practice in the specific industry at stake in the case. Essentially asking: Is it “the norm” in this specific industry to have worldwide licenses or is it more common to have a ‘country-by-country’ approach?
2. **Parties’ intentions and/or interests:** In some instances, courts have engaged with whether the parties in the dispute (and not the industry in general) showed a particular interest in obtaining a worldwide license. In the US instance, both parties explicitly agreed that the court determine a worldwide license. However, in the UK decision in *Unwired Planet* as well as in the Chinese decision in *Oppo/Sharp*, courts have considered that it was not necessary to have the agreement of the parties to grant a worldwide license.¹²⁰ In the UK decision, the request for a global determination emanated from the SEP holders (ie. *Unwired Planet* and *Conversants*). *A contrario*, in the Chinese decision, the request came from the implementers (ie. *OPPO*).
3. **Legal rules:** The last element which courts have considered is the point mentioned in the previous section on how to reconcile the global nature of licensing with the national approach to patent litigation. It is vis-à-vis this third element that courts have approached the question of FRAND licensing as being essentially a question of contract law, while leaving the question of validity/infringement as a question of national patent law. Two other points have also been considered by courts under this general heading: (a) **the issue of comity** and (b) **the proper nexus** justifying the competence of the court (infra).

It should also be mentioned that the **risk of using injunctive relief as an instrument of international coercion** (as mentioned supra) was initially raised by the UK High Court in *Vringo v. ZTE* (2015)¹²¹. However, this approach was reversed by the UK Supreme Court in *Unwired Planet* (2020). In this instance the Supreme Court concluded that: “a recognition that the determination of a FRAND licence by one national court does not prevent an

¹²⁰ Eg in *Unwired Planet* [2020] UKSC 37, at 49 et seq.: “Issue 1: Whether the English courts have jurisdiction and may properly exercise a power **without the agreement of both parties** (a) to grant an injunction restraining the infringement of a UK SEP unless the defendant enters into a global licence on FRAND terms of a multinational patent portfolio and (b) **to determine royalty rates** and other disputed items for a settled global licence and to declare that such terms are FRAND” (emphasis added).

¹²¹ At 106: “I am bound to say I am sceptical about Vringo's argument. **Even if the portfolio global licence is FRAND** and it is not an abuse of a dominant position to make the offer, **it is not obvious to me why that means that the only options to ZTE in this case are being enjoined** under EP 1,212,919 (UK), **a territorial patent** covering only the UK and only covering one aspect of the standard, or signing up to a **global portfolio licence**, in effect on all patents (within some relevant class) and for all countries, **which ZTE does not want.**” At 107: “I suspect the fallacy in the reasoning of Vringo at this stage may be that just because it may be so that the global portfolio offer is a FRAND offer, it does not follow that the global portfolio licence on offer is the only set of terms which could be FRAND.” At 109: “In that sort of case, unlike the one based on the global portfolio licence, the threat of the injunction, which is after all a territorial remedy, **would not be being used to create some sort of international coercion or coercion about other patent rights.**” [Emphasis added].

*implementer from challenging foreign patents on the grounds of invalidity or non-infringement in other relevant national courts*¹²² and that it was justified for a national court to grant injunctive relief against the infringement of SEPs if the implementer has refused to take a FRAND licensing offer. Since the court considered that a *worldwide* licensing offer could be FRAND, the refusal to take such a license can lead to the grant of a *national* injunction.

On (a) *the issue of comity*: According to the **principle of comity**, national courts recognize and enforce each others' legal decisions as a matter of courtesy, or based on the need for reciprocity, but not necessarily as a matter of law. It is arguable that, if a national court decides to determine worldwide licensing rates on the basis of findings of infringement of a patent, this may affect the competence of other courts to decide on these same questions. It may be questioned to what extent courts seized after the first court should recognise the terms of the licensing agreement which may affect their territory but also the validity and infringement of the underlying patent. In instances where the issue of comity has been raised, courts have essentially considered that the principle of comity had not been breached. They have argued that courts in other jurisdiction seized after the first court could also decide on worldwide licensing terms. Additionally, since patents are national, it remains for the national court to decide on validity and infringement and they are not bound by the first seized court's decision on these points. There is therefore no breach of comity as courts are not overstepping the territorial patent boundaries. In practice, none of the disputes for which a court has determined worldwide licensing rates has been re-litigated before a different national court. It is unclear if a court seized after a court's determination of a worldwide licensing contract would engage with such determination.

On (b) *the proper nexus*: In some instances (and in particular in the Chinese decision in *Oppo v Sharp* [2020]) courts have justified the worldwide determination of the licensing rates in light of the closeness between the licensing practices of the parties and the territory of the court seized. For example, in the Chinese decision opposing Oppo to Sharp, the court looked into the “main places of implementation”, “business operation” and “source of revenue of implementers” and found that these were all closely connected to China. Thereby justifying the competence of the Chinese courts to solve this dispute.

5.2.2. *Quid of determination of essentiality?*

Although this has not yet been discussed by courts, the approach of distinguishing between FRAND licensing and pure questions of patent law could also apply to the question of the determination of essentiality. Whether a patent is actually essential to a standard is a technical question. It is not a legal determination coming from patent law.

Some legal consequences have been derived from findings of essentiality. Mostly, if a patent is truly essential to a standard, any compliance with the standard will infringe on the patent. There is therefore a sort of presumption of infringement connected to the essentiality of a patent. However, this is a rebuttable presumption. Beyond this point, essentiality could be determined by a court and have worldwide consequences if courts in other jurisdictions give some deference to that determination, provided that the wording of the claims is sufficiently similar between the different members of a single patent family. However, this is a hypothetical scenario and has not taken place yet.

¹²² Unwired Planet [2020] UKSC 37, at 84.

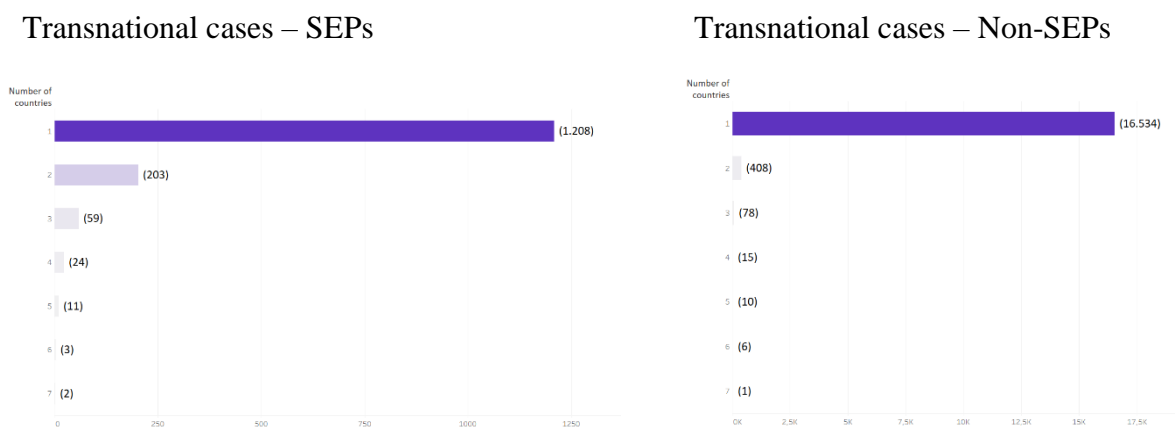
5.3.Parallel litigation

As previously mentioned, the principle of territoriality means that questions of validity, infringement, essentiality or FRAND determination can only be litigated before the courts of a jurisdiction where right holders can claim patent protection (ie. designated states where patents have been validated). If patents are validated in multiple countries, **right holders may have to litigate multiple times before different courts**. For example, as mentioned supra, under the EPO system, even if a European Patent (EP) is delivered by the EPO, this EP will consist of a bundle of national patents, or national tiers. If different national members of the same patent family are litigated at the same time between the same parties but before different courts in different jurisdiction this constitute a situation of “**parallel litigation**”.

The issues with parallel litigation are essentially twofold: (1) to engage in multiple litigation may be particularly costly as well as time consuming and (2) there is a risk of divergent outcomes. For example, it may be found in one jurisdiction that a patent is valid and infringed while in another jurisdiction the same patent may be found invalid and non-infringed. There can be some variation of these combinations of validity/infringement. Additionally, when it comes to SEPs-related disputes, it may also be found by one court that a potential SEP is truly essential while another court in another jurisdiction will find that its counterpart (member of the same family) is not. As for the question of FRAND determination, the meaning and interpretation of FRAND may also vary from one court to the other.

According to literature, there is a considerable number of patents that are litigated across multiple jurisdictions.¹²³ Studies on **patent litigation in Europe** show that patents are regularly litigated in two jurisdictions and that these jurisdictions are, most often, Germany and France. The question is to what extent SEP/FRAND litigation diverge from more traditional patent disputes.

Figure 16: Parallel litigation: transnational cases involving SEPs and non-SEPs



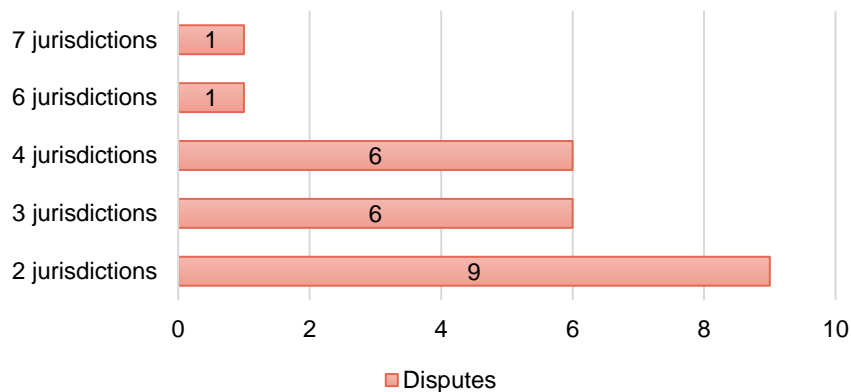
¹²³ S. Graham, N. Van Zeebroeck, Comparing patent litigation across Europe: a first look, 17(2) Stan. Tech. L. Rev. 655 (2014). K. Cremers et al. Patent litigation in Europe, Eur J Law Econ (2017) 44:1-44 (2000-2008 period).

Using Data from Darts-ip, we find that cases involving **non-SEPs** are generally litigated in **one jurisdiction (Figure 16)**. This result slightly contradicts previous findings in literature but may be explained by the differences in the geographical coverage (Europe v Worldwide) and time frame (2000-2008 for the literature reviewed and 2012-2021 in this case) used for each study. While also declared **SEPs** are most often litigated in only **one jurisdiction**, we do see that these patents are nonetheless **more often litigated in two (or more) jurisdictions than non-SEPs**.

Parallel litigation involving members of the same patent families may severely under-represent the broader phenomenon of parallel litigation between parties of one global SEP licensing dispute, because patents-in-suit often only represent a small fraction of a larger portfolio concerned by the dispute. Court cases in different countries involving different patent families (i.e. different patents-in-suit) may thus still revolve around the same SEP licensing dispute.

We therefore extend our analysis through a further analysis of **23 pairs of litigants** identified as repetitive litigants (**Figure 17**).¹²⁴ This analysis is not limited to repeat litigation over the same patent family. Similar to the findings of previous studies, it appears that **all 23 pairs of litigants have litigated in at least 2 jurisdictions**. A maximum of 7 jurisdictions were involved in the dispute between *Vringo* and *ZTE*. On average, the 23 pairs of litigants studied have engaged in SEP-related disputes in 3.2 jurisdictions.

Figure 17: Disputes related to declared SEPs – number of jurisdictions per dispute



The most common fora are: Germany (15 out of 23 pairs) and the US (15 out of 23 pairs) closely followed by China (13 out of 23 pairs) and the UK (11 out of 23 pairs). In terms of

¹²⁴ This analysis of parallel litigation of SEPs is based on the **parties** which have been identified as particularly active in SEP/FRAND litigation. Moreover, it is limited to patents **declared as SEPs** under the Darts-IP functionality “Search by Standard Disclosures”. Therefore, this does not necessarily mean that the parties are litigating the “same” patent(s) before different courts. It only tells us that they are repetitive litigants and are litigating declared SEPs in different countries. It should be noted that, despite the fact that the parties may not be litigating the same patent (or patents from the same family), by limiting the search to declared SEPs, it cannot be excluded that multiple litigation between the same parties actually led to an agreement regarding SEPs and FRAND. This, particularly in light of the fact that licensing agreements do not necessarily cover *one patent* but are more generally concern with licensing patent portfolios. Some instances did not appear in the search conducted. For example, regarding the dispute between *IPCom* and *Lenovo*, by limiting the search criteria to *declared SEPs*, the French and English disputes did not appear. The French dispute focusing more on question of anti-suit injunctions (see *infra*) than validity and/or infringement of patent. The same goes for the dispute between *Xiaomi* and *Interdigital*, only the German dispute appeared in the search despite litigation having taken place in China and India. Some of these instances have been identified in the literature and therefore added to the list of parallel litigation. Potentially this means that there might be more parallel litigation than identified in the search.

combination of these different jurisdictions, we found that the combination of Germany and China is the most common combination of jurisdictions (9 out of 23 pairs).

These findings do not necessarily indicate parallel litigation, but disputes between the same combination of litigants. It is possible that some disputes involving a pair of litigants have taken place, for example, in 2003 and then again in 2010 in other jurisdiction. Not all litigations between the same set of litigants are therefore necessarily related to the same dispute. Additionally, since we have selected pairs of repeat litigants, this sample is not representative of the total population of participants in SEP litigation (we are more likely to find multiple disputes in different jurisdictions within a sample of repeat litigants). It is therefore **difficult to extrapolate from these 23 pairs of litigants that parallel litigation is particularly prevalent in SEP litigation.**

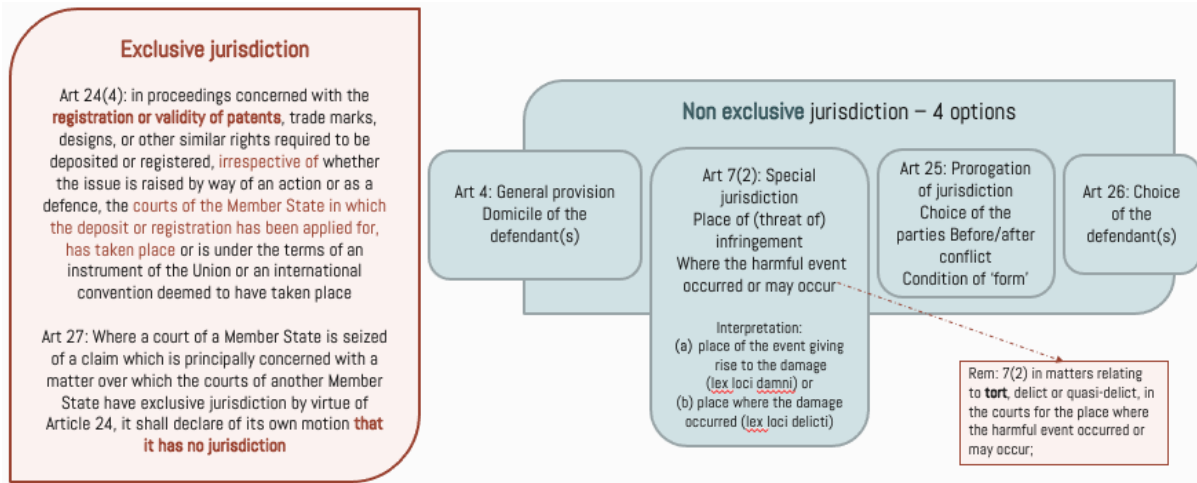
A particular **issue in identifying parallel litigation** in SEP disputes is coming from the possibility of **fragmentation of litigation** between questions of patent law (ie. validity and infringement), competition law (ie. abuse of dominance or anti-competitive agreement) as well as contract law (ie. FRAND licensing). In some instances, all these questions can be dealt with in front of the same court in one jurisdiction. However, it is also possible that the same parties would initiate litigation on one point in one jurisdiction while litigating another point in another jurisdiction. There have been instances in which validity and infringement were discussed before one court while FRAND licensing and contract-related questions were discussed before another court. To some extent, even if the same patent is connecting these two cases, their object is very different and it may therefore be considered that, from a legal point of view¹²⁵, these two instances are not constitutive of a true scenario of parallel litigation. Once again, this is due to the possibility of fragmentation or atomization of SEP disputes which is more common than in other patent-related disputes.

5.4. Forum shopping

Different characteristics of national litigation systems offer opportunities for litigants to “pick and choose” where they want to take their disputes, i.e to engage in **forum shopping**. Arguably, the principle of territoriality limits this opportunity as a national patent can only be litigated before the courts of a jurisdiction where it produces legal effects. However, it is possible that the choice to litigate in a couple of jurisdictions only, leads to a global settlement between the parties. Therefore, where litigation takes place is particularly important. The impact that a few decisions may have on the parties’ relationship alleviates some of the costs related to parallel litigation. If the parties do not have to litigate in all jurisdictions where a patent is valid and potentially infringed, and can rely on a few decisions to reach an agreement, this will save time and costs.

Figure 18: Forum choice and patent litigation – Brussels I Regulation (1215/2012) [Recast]

¹²⁵ For example, in the *Oppo/Sharp* (2021) decision, the Chinese Supreme Court considered that there was no issue of parallel litigation or risks of contradictory outcomes if a Chinese court was to decide on FRAND patent licensing terms while a court of another jurisdiction were to decide on the amount of damages for patent infringement. The court considered that the determination of damages is a question of pure patent litigation stemming from findings of infringement while FRAND licensing falls within the scope of contract law. This is a bigger issue when entering into a FRAND licensing agreement is considered as an alternative to injunctive relief. Then, the lines between patent law and contract law are more blurred. If different courts were to engage with these questions, this could lead to contradictory outcomes.



In Europe, the Brussels I Regulation (1215/2012) [recast] provides two rules in order to determine if the courts of a MS have the competence to engage with patent litigation (**Figure 18**). On the one hand, there is a rule of **exclusive competence for questions of validity**. Only those courts of the MS where the patent has been validated can decide on questions of validity. On the other hand, there is a rule of **non-exclusive competence for questions of infringement**. There, litigants have, overall, four options (or opportunity to forum shop) as to where to initiate litigation. Competence can be established for the courts of a MS in light of:

1. The domicile of defendant(s);
2. The place of infringement/threat of infringement, ie. where the harmful event occurred or may occur;
3. A choice of forum by the parties;
4. The choice of the defendant(s)

In combination with these options, litigants also pay particular attention to **different characteristics of national litigation systems**. Each system holds particular characteristics making it more or less attractive to litigants.¹²⁶ The key characteristics, or main differences between jurisdictions, which can influence the forum choice of litigants, usually consist of:

- IP (or patent) specialised or non-specialised jurisdiction as well as bifurcated or non-bifurcated systems;
- Ease of obtaining an injunction and room for flexibility;
- The costs of litigation and in particular, the rules on fee-shifting.

5.4.1. Specialised/non-specialised jurisdiction and bifurcated systems

France – In France, since 2009, it is the ordinary civil court of the ‘Tribunal de Grande Instance de Paris’ (Paris District Court), and on appeal the ‘Cour d’appel de Paris’ (Paris Court of Appeal), which have exclusive jurisdiction over patent cases. Since 2020, the Tribunal de Grande Instance has been replaced by the ‘Tribunal Judiciaire de Paris’. These

¹²⁶ For a general overview of the differences in the way patent litigation systems are designed across jurisdictions, see: C. Helmers, The economic analysis of patent litigation data, Economic Research Working Paper No. 48. WIPO. Available at: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_econstat_wp_48.pdf

French courts are not an IP specialised court however, four District Court chambers and two Court of Appeal chambers are specialised in intellectual property matters. Decisions of the Paris Court of Appeal may be further appealed before the highest civil court in France, i.e. the ‘Cour de Cassation’. The ‘Cour de Cassation’ will only examine issues of law and not issues of fact. The system is not-bifurcated. Therefore, issues of validity and infringement are heard and examined together in the same action.

United Kingdom – In the UK, courts are specialised IP/patent courts. In particular, the Patents Court¹²⁷ and the IP Enterprise Court (IPEC) have exclusive jurisdiction over patent cases. The IPEC is a streamlined and more cost-effective forum to hear lower-value and less complex IP claims. There is a cap of £500.000 on damages and a cap of £50.000 for the legal costs that a successful party can claim. If the value of the dispute exceeds these caps, the case will be decided by the Patents Court. On appeal, the panel of the Court of Appeal of England and Wales (EWCA) is composed of 3 judges. Decisions may ultimately be appealed before the Supreme Court of the United Kingdom (UKSC). Similar to the French system, litigation is not-bifurcated. Issues of validity and infringement are heard and examined together in the same action.

Germany – The most distinctive characteristic of patent litigation in Germany is the bifurcation system. Bifurcation means that some courts will be in charge of questions of infringement, while others will review questions of validity. At the level of first instance proceedings, the competence for infringement cases is shared between 12 ‘Landgerichten’ (regional courts). These are not specialised IP/patent courts. Decisions of the regional courts are reviewed on appeal by ‘Oberlandesgerichten’ (Higher Regional Courts) and ultimately the ‘Bundesgerichtshof’ (Federal Court of Justice – ‘BGH’). On the other hand, the ‘Bundespatentgericht’ (Federal Patent Court – ‘BPatG’) has exclusive jurisdiction for questions of invalidity.

Due to the bifurcated system, many litigants request that regional courts deciding on infringement stay their proceedings until a decision on validity by the Federal Patent Court is taken. In theory, a stay would permit to avoid a situation in which a patent is found infringed but later found invalid. However, it is argued that courts do not often stay infringement proceedings on the merits pending validity challenges.¹²⁸ On the other hand, studies have shown that patents challenged in invalidity proceedings are regularly (at least partially) invalidated.¹²⁹ This situation of “invalid but infringed”¹³⁰ is generally possible due to the fact that decisions from the Federal Patent Court on validity take more time to be issued than decisions on infringement. The bifurcated system also leads to the potential for an injunction gap, i.e. when infringement is solved before the decision on validity and leads to the grant of injunctive relief although the patent is later invalidated.

In 2021 new amendments have been adopted in the German Patents Act. One of these amendments is an attempt at closing this injunction gap by improving the synchronization of nullity in infringement proceedings. In a few words, a preliminary opinion from the Federal Patent Court on the validity of patents also disputed in infringement proceedings

¹²⁷ A specialist court within the Chancery Division of the High Court of Justice of England and Wales (EWHC).

¹²⁸ For example, in a 2020 study on German patent litigation, it was found that between 2009 and 2011, the Dusseldorf Regional Court stayed about 10% of the infringement proceedings on the merits pending validity challenges. TaylorWessing, German Patent Cases: Statistics (2020).

¹²⁹ J Henkel and H Zischka, ‘How many patents are truly valid? Extent, causes, and remedies for latent patent invalidity’ [2019] Eur J Law Econ 195; P Hess, T Müller-Stoy and M Wintermeier, ‘Sind Patente nur “Papiertiger”?’ (2014) Mitt. 439; T Müller-Stoy, A Giedke and J Große-Ophoff, ‘Aktuelle Vernichtungsquoten im deutschen Patentnichtigkeitsverfahren’ (2022) GRUR 142, 152.

¹³⁰ K. Cremers et al., “Invalid but infringed? An analysis of Germany’s bifurcated patent litigation system”, 31 J. Econ. Behav. Organ., Part A, 218-242 (2016).

should be made available within 6 months of service of the nullity complaint. This report should inform the first instance infringement court before deciding on a stay.

United States – In first instance the 94 Federal District Courts of the US have exclusive jurisdiction over patent litigation. These are, however, non-specialised IP/patent courts. On appeal, it is the Court of Appeal of the Federal Circuit (CAFC) which has jurisdiction. This Court of Appeal is a specialised court. Finally, decisions of the CAFC can be reviewed on points of law by the Supreme Court of the United States (SCOTUS).

The system of litigation is not bifurcated. Questions of validity and infringement are considered together by the same court. However, since the creation of the Patent Trial and Appeal Board (PTAB) at the US Patent and Trademark Office (USPTO), third parties can challenge the validity of US patents before this specialised board. The relationship between district courts and PTAB is not always straightforward as district courts have wide discretion to stay their proceedings until a decision on validity is issued. The absence of a mandatory stay can, de facto, lead to a situation of “invalid but infringed” as well as an “injunction gap” as mentioned supra regarding Germany.

Next to District Courts, litigants can also initiate proceedings before the International Trade Commission (ITC). The ITC is a federal agency which investigates unfair trade practices. It can issue exclusion order on imports (an order which presents similarities with an injunction) as well as cease and desist orders for US sales relating to an infringed patent. Since litigants can file in both venues (district courts and the ITC) there is potential for parallel litigation and duplicative disputes.¹³¹

China – The litigation system in China has gone through recent changes. In particular, since 2019, more specialised IP courts have come to life. The Chinese system is largely inspired by the German and US systems. There is a form of bifurcation but contrary to the German system, it is not automatic. For infringement, in first instance, it is the IP tribunals of Intermediate People’s Courts which have exclusive jurisdiction. These are located in Beijing, Shanghai and Guangzhou. Decisions of these intermediate courts can be appealed before the IP Chamber of the Supreme People’s Court. For validity, it is the Patent Review and Adjudication Board of the National IP Administration of China (ie. the patent office) which has jurisdiction. The decisions of the board can be appealed before the IP Chamber of the Supreme People’s Court. At this stage, questions of validity and infringement will be considered together.

5.4.2. *Injunctive relief*

Patent holders benefit from a relatively large portfolio of enforcement tools. One of the most powerful tools at their disposal is the possibility to obtain a court ordered injunction upon findings of validity and infringement (or infringement only in case of bifurcation). **For many jurisdictions across the world (and in particular in the EU), an injunction will be automatically granted if it is found that a patent is valid and infringed.** The injunction aiming at putting an end to future acts of infringement. However, in recent years, there has been a growing debate around injunctive relief and the role of proportionality. It is essentially argued that injunctions should not be granted automatically but that courts should consider

¹³¹ For a review of the ITC and patent litigation see: C. Chien, “Patently protectionist? An Empirical Analysis of Patent Cases at the International Trade Commission” (2008). Available at: <http://digitalcommons.law.scu.edu/facpubs/67>. Last accessed: March 15th 2022.

whether an injunction is actually a proportionate remedy before granting it. In other words, there is a **call for more flexibility** when it comes to injunctive relief.

In the EU, it is essentially vis-à-vis the practice of German courts that this criticism has been formulated. Nevertheless, it should be noted that French courts as well as other continental courts also grant injunctive relief on an automatic basis. The main point of contention lies in the fact that, in Germany, the process of litigation is bifurcated and the point made previously on the risks related to an injunction gap. Under the current interpretation of Section 139 of the German Patents Act, there is no room for consideration of proportionality in the *grant* of an injunction. Eventually, when it comes to the *enforcement* of the injunction, some consideration of proportionality can take place. However, instances in which German courts have found that the enforcement of an injunction would be disproportionate are fairly limited. Moreover, the burden of proof to show that the enforcement would be disproportionate is particularly heavy. In particular, it is required to demonstrate that such enforcement would be contrary to ‘good faith’.

In 2021, the test used by the German Federal Supreme Court (BGH)¹³² to determine if the enforcement of an injunction would be disproportionate, has been codified. Some have seen this codification as a positive change in the sense that it opens the door to proportionality in injunctive relief. However, for others, since the new provision only codifies the practice of the courts, this remains a rather limited opportunity for proportionality in injunctive relief. It remains to be seen in the coming years if this will lead to more flexibility.

Overall, in the EU, **without exceptional circumstances (such as violation of competition law or abuse of rights) injunctive relief will be automatically granted**. However, it has been considered that the **particular context of SEPs litigation** and promises to license FRAND generates exceptional circumstances under which the rules of injunctive relief may be considered with more flexibility and that a “**FRAND defence**” may be available to implementers.

In particular, since the seminal decision of the Court of Justice of the European Union (CJEU) in *Huawei/ZTE* (C-170/13, 2015) national courts benefit from a procedural framework in order to determine if a SEP holder who initiate infringement proceedings against an implementer with the objective of obtaining an injunction is not doing so in breach of Art 102 TFEU. In this instance, the CJEU clarified the overall framework of negotiations that must take place between a SEP holder and a potential licensee when the right holder promised to license his patents under FRAND terms. The Court held that a SEP holder in a dominant position, will not infringe Art. 102 TFEU by seeking injunctive relief in respect of the alleged infringement of a SEP, as long as the following steps of negotiation are respected between the parties:

1. The right holder has *alerted* the alleged infringer of the infringement complained about, by designating the allegedly infringed SEP and specifying the way in which it has allegedly been infringed, before bringing an action for a prohibitory injunction (or for the recall of products);
2. After the alleged infringer has expressed its *willingness* to obtain a licence on FRAND terms, the right holder made a FRAND offer, which specifies the amount of the royalty to be paid and the way it was calculated;
3. The alleged infringer *diligently, and without engaging in delaying tactics*, responded to the offer (i.e. accept the offer or submit a FRAND counter-offer);

¹³² Federal Supreme Court (Bundesgerichtshof – BGH) Judgment of May 10, 2016, court docket: X ZR 114/13 – Wärmetauscher [heat exchanger].

4. If the counter-offer was refused by the SEP holder and the alleged infringer was already using the teachings of the SEP (i.e. without a licence), the later has provided appropriate security in accordance with recognised practices in the field (e.g. bank guarantee or deposit).

If these procedural steps are respected, it is generally considered that seeking injunctive relief will not be an abuse of dominant position under the rules of competition law. However, this does not mean that a court will automatically grant or deny injunctive relief. This is still dependent on the national requirements governing injunctive relief. The procedural framework establishes a potential safe harbour for SEP holders vis-à-vis competition law but does not condition the actual analysis of injunctive relief under the rules of patent law or patent litigation.

Despite the overall added value of the procedural framework in terms of legal certainty, many uncertainties remain and have led national courts to potentially divergent interpretation of the different steps. In particular, questions remain as to what the first notice of the right holder should actually contain, what the “willingness” of alleged infringers means, or how to assess whether a response has been expressed “diligently and without engaging in delaying tactics”. For example, with regard to “willingness” of implementers, German courts are relatively strict on the interpretation of this second step. Under the practice of certain German courts, an implementer who seeks an anti-suit injunction may be considered to show signs of “un-willingness” (see *infra* on anti-suit injunction).

In the UK, injunctive relief is an equitable remedy. Judges benefit from more discretion than European judges and have, in some instances, exercised their discretionary power. However, in practice, injunctive relief is still considered as the normal remedy to infringement. As for consideration of proportionality, in 2013 already, Justice Arnold recognised that “*the time has come to recognize that, in cases concerning infringements of intellectual property rights, the criteria to be applied when deciding whether or not to grant an injunction are those laid down by Art. 3(2) [of the IP Enforcement Directive]: efficacy, proportionality, dissuasiveness, the avoidance of creating barriers to legitimate trade and the provision of safeguards against abuse*”. Therefore, calling for even more flexibility. Since, UK courts have been creative and have tailored some injunctions to particular sets of circumstances. For example, they have denied injunctive relief in case of ‘public interest’, they have allowed for a stay on enforcement of an injunction in order to give time to the infringer to ‘invent around’ and finally, they have created the so-called ‘FRAND injunction’. A FRAND injunction is essentially an injunction ordered by a court but which will only be enforced after a certain period of time if the parties to the dispute cannot reach a FRAND licensing agreement. It is this type of injunction which has notably led to the problems mentioned in the previous section regarding the global nature of FRAND licensing and the national nature of patent remedies (*supra* under point 2).

In the United States, since the seminal decision of the US Supreme Court in *eBay v MercExchange* (2006), injunctions are not issued on an automatic basis. Courts follow four factors test before deciding on the grant of an injunction. These factors are: (1) the applicant has suffered irreparable harm; (2) remedies available at law are inadequate to compensate for the harm; (3) considering the balance of hardship between the plaintiff and the defendant, a remedy in equity is warranted; and (4) a permanent injunction would not disserve the public interest. In practice, first instance courts (ie. district courts) have been relatively strict in applying the *eBay* four factors test in particular vis-à-vis patent assertion entities. However, the CAFC has been less stringent with its application. Leading to some divergence of interpretation between lower courts and appeal courts.

In China, permanent injunctions are granted on an automatic basis upon findings of validity and infringement. There is little information on the role of proportionality vis-à-vis injunctive relief or how a FRAND defence is actually operationalised before Chinese courts.

5.4.3. *Costs: fee shifting*

The question of costs of litigation and in particular the rules on fee-shifting are discussed infra under point 7 – inefficient licensing. Overall, it should not be ignored that disparities between jurisdictions which have adopted a fee-shifting rule and those who haven't as well as divergence of interpretation or application of a fee-shifting rule within a particular jurisdiction are key elements in the choice of the parties to litigate. Whether or not a party can be reimbursed for the costs of litigation is necessarily influencing the decision of “if and where” to start litigation.

5.4.4. *Empirical findings*

The rules regarding where to start litigation (ie. under Brussels I Regulation Recast) apply regardless of whether the patent in dispute is a SEP or not. However, to choose where to litigate first is particularly important in the **SEP/FRAND context** and present some additional layers of complexity. In particular when a national court is willing to engage with the determination of global FRAND licensing rates (as mentioned supra). In this context, additional opportunities exist to forum shop. The possibility to rely on **contract law** as well as **competition law** as legal grounds for litigation rather than patent law exclusively offers diverse options to litigants. In turn, this holds the risk of fragmentation or atomization of the dispute (patent-related questions before one court, contractual issues before another...) which can potentially lead to difficult outcomes to reconcile.

An important element to analyse is therefore whether there is evidence of forum shopping in Europe and whether this is particularly prominent when it comes to SEP litigation.

In the literature, it is generally argued that **three factors** are at the heart of every decision in terms of forum shopping. These factors touch upon the perceived advantages and disadvantages of different jurisdiction in terms of **(1) market coverage; (2) design of litigation system and length of litigation** and **(3) opportunities in terms of remedies**.

SEP disputes have taken place in three broad geographical areas: **Europe, the United States and China**. European and US courts are usual fora for patent litigation whether this involves SEPs or non-SEPs. On the other hand, the rise of the popularity of Chinese courts for SEP disputes compared to non-SEP disputes is fairly new.

Figure 19: Number of SEP/ Non-SEP litigations by jurisdiction and year

Evolution of cases



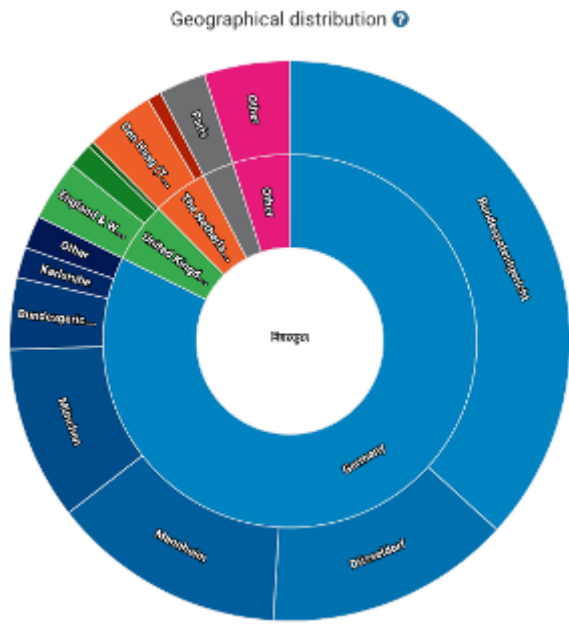
Figure 19 provides an overview of the count of patent litigations involving declared SEPs and other patent litigations in these three regions. In this figure we can see that, over time, **the popularity of Chinese courts for SEP-related disputes has grown** (top part of the graph and red section). On the other hand, the popularity of European courts remains relatively constant (top part of the graph and black section) while the popularity of US courts seems to slowly decrease¹³³ (top part of the graph and blue section). For non-SEP related disputes (bottom part of the graph), we see that the popularity trends are more constant across geographical areas, and the US remains by far the largest jurisdiction in terms of patent litigation counts for non-SEPs.

In Europe, most of the SEP disputes has taken place in **Germany** (**Figure 20**).

Figure 20: Geographical distribution of SEP disputes in Europe¹³⁴

¹³³ This decrease may be related to the fact that some SEPs are owned by Patent Assertion Entities (PAEs). Since the eBay decision in 2006, it is more difficult for PAEs to obtain injunctive relief before US courts.

¹³⁴ Search conducted on Darts-IP. Includes: “Infringement action”, “invalidity/cancellation action”, “action linked to a contract”, “action relating to employee’s invention” and “declaratory action establishing non-infringement” in Europe from 01-01-2012 to 31-12-2021. Limited to patents declared SEPs. Total: 545 cases.



We see that Germany is, by far, the most popular forum in Europe (80% of cases) followed by the UK (6% of cases), the Netherlands (5% of cases) and France (in grey – 3%).

This can be explained when looking at the three factors previously mentioned:

1) **Market coverage:** Germany is the largest market in Europe;

2) **Design of litigation system and length of litigation:** Bifurcation (and the possibility to have a patent found invalid but infringed and the injunction gap), expertise of judges (judges at the *Bundespatentsgericht* [BPatG] are technical judges) and length of litigation

(see infra);

3) **Opportunities in terms of remedies:** Automatic injunctive relief, injunction gap due to the bifurcated system (see supra), determination of damages which is co-dependent to the large size of the market, potential for fee-shifting.

In Germany, these three factors have a tendency to attract patent holders, including SEP holders, more than alleged infringers, including SEP implementers. German courts are generally reluctant to consider arguments of proportionality or flexibility when it comes to injunctive relief. They have also been quite strict in their interpretation of the Huawei/ZTE framework in a way which may favour SEP holders.

However, other jurisdictions have also gained quite some popularity. Arguably, since the UK Supreme Court decision in *Unwired Planet* (2020), UK courts which are willing to engage with the determination of global FRAND licensing rates may also be considered as attractive to litigants in search of such global determination. The same can also be said for Chinese courts. Whether this favours SEP holders or implementers remains to be seen as each type of litigant may have particular interest in obtaining a global or national FRAND determination.

According to the literature, these additional opportunities to forum shop can lead to a ‘race to the bottom’ or a ‘race to the courthouse’. In particular, if every court in the world can claim jurisdiction over FRAND determination and set global rates. A **race to the bottom** between courts could lead to courts adopting less stringent review of procedural and substantive rules in order to boost their dockets.¹³⁵ Moreover, if courts develop a practice of determining high global rates, this could be attractive to right holders. Alternatively, low global rates may be more attractive to licensees. As for the **race to the courthouse**, litigants may opt to file early on at a court considered friendly instead of negotiating. Courts engaged in the practice of issuing ASI (see infra) may seem more favourable than others and may be

¹³⁵ J. L. Contreras, The New Extraterritoriality: FRAND Royalties, Anti-Suit Injunctions and the Global Race To The Bottom In Disputes Over Standards-Essential Patents (February 21, 2019), 25 BU J. Sci. & Tech. L. 251 (2019), University of Utah College of Law Research Paper No. 306, Available at SSRN: <https://ssrn.com/abstract=3339378>; D. Gerardin, D. Katsifis (2022), The use and abuse of anti-suit injunctions in SEP litigation : is there a way forward ? 71(7) GRUR Int. 603-617.

seized first in an attempt to prevent further dispute in foreign (and less favourable) jurisdiction.

A related issue to forum shopping and forum choice is the reliance by parties on **claims of *forum (non) conveniens* or request for venue transfer**. If a party to litigation believes that the court initially seized might not be the best placed (ie. the appropriate forum) to resolve the dispute due to issues of competence, that party may try to have the dispute relocated elsewhere. To some extent, to request a venue transfer may be understood as a counter-mechanism to forum shopping as it may aim to relocate a dispute before a more appropriate forum when the first court has been seized due to perceived advantages rather than competence. Venue transfer of *forum non conveniens* claims are more popular in common law jurisdictions than civil law jurisdictions. This has been confirmed by the cases analysed in this part of the study which concern **essentially US and UK courts**.

Forum non conveniens claims or claims for venue transfer can fall within two broad categories: **(1) internal claims** and **(2) external claims**.

Internal claims touch upon the competence of different courts within one jurisdiction and a request to transfer the dispute from one local court to another local court.

For example, in the US, there are claims of *forum non conveniens* raised before the Western District of Texas (W.D. Texas) to have the case relocated before a district court in the State of California. These claims are usually raised by implementers who believe that the three factors mentioned in the previous sub-section (2.1.1.) would favour SEP holders when litigation takes place before the W.D. Texas and that the court does not have sufficient competence to handle the case. Claims for venue transfer have been particularly popular in the US since the Supreme Court's decision in *TC Heartland LLC v. Kraft Foods Group Brands LLC* (2017). Under US law, a patent infringement action may be brought in the judicial district "*where the defendant resides, or where the defendant has committed acts of infringement and has a regular and established place of business.*" (28 U.S.C. § 1400(b)). Before *TC Heartland* this provision was interpreted with some flexibility and led to quite some forum shopping, in particular before the W.D. Texas. Since then, the reading of "resides" as used in Section 1400(b) has been restricted to include only the defendant's **place of incorporation**. Therefore, many disputes initiated by right holders before the W.D. Texas are now being requested to be transferred to more appropriate forum where a defendant has a place of incorporation (in most cases in the District of Delaware or the Northern District of California).

In China, there has been some claims for venue transfer from a non-IP specialised jurisdiction to an IP specialised court. It may seem counterintuitive to have a SEP-related dispute before a non-IP specialised court. However, as previously mentioned, if courts consider the issues to fall more closely within the scope of contract law (because the dispute focuses on FRAND licensing terms) than patent law (ie. questions of validity and infringement) this may raise so issues in terms of competence. *In fine*, this issue resides in the determination of the *proper nexus* justifying the competence of the court.

In the EU, it is more complicated to see internal claims of venue transfer due to the fact that, in many jurisdictions, there is only one competent court for IP-related disputes (eg. Paris in France, the Hague in the Netherlands, Brussels in Belgium...). There are possibilities to claim internal venue transfer in Germany as patent litigation is particularly popular in Dusseldorf, Mannheim and Munich and that each court presents some particularities which may be considered attractive to certain litigants. However, the principle of *forum non conveniens* has not received the same footing in continental Europe than in common law jurisdictions.

External claims touch upon the competence of different courts from different jurisdictions. For example, in the seminal decision of the UK Supreme Court in *Unwired Planet* (2020) it was argued that UK courts were not competent to solve the dispute but that Chinese courts were a more appropriate forum.

The problem with forum shopping as well as *forum (non) conveniens* claims is essentially twofold: (1) parties to a dispute may try to start (forum shopping) or relocate (*forum non conveniens*) a dispute before a court they believe would be more sympathetic to their cause under the disguise of ‘appropriate competence’. (2) disputes on the proper forum for litigation diverts the time and money spend on litigation away from core issues such as: validity, infringement, essentiality, or licensing terms.

As most patent disputes start with infringement actions (rather than invalidity/revocation actions), these are essentially initiated by right holders. It can be said that right holders engage more often in forum shopping than alleged infringers. However, in some instances, it is possible to consider that alleged infringers also engage in forum shopping. For example, when they engage with so-called *torpedo actions*. Torpedo actions are parallel legal proceedings initiated in a second court with the intent to delay ongoing litigation.¹³⁶ These have been particularly popular in the 1990s before Italian and Belgian courts (reputed to be particularly slow). Some argue that they are regaining some popularity in the SEP/FRAND context. This question is also closely connected to the practice of anti- (anti-) suit injunctions and will be discussed under point 5.

On the other hand, as *forum non conveniens* claims are usually a response to the first court seized, these are more often raised by alleged infringers than right holders. It is argued that these have gained some popularity in recent years. As previously mentioned, this is particularly the case in the US since the *TC Heartland* (2017) decision. We can also see some requests for venue transfer in the UK. It is unclear whether this is due to the *Unwired Planet* (2020) decision and the possibility for UK courts to determine global FRAND licensing terms. If we look at the evolution of cases in which *forum conveniens* claims have been raised over time, it does not look as if *Unwired Planet* (2020) triggered more claims for venue transfer than in the past. However, since *Unwired Planet* is fairly recent, it may be difficult to observe any trend over the past 1.5 year.

5.5. Anti-(anti-) suit injunction

Anti-Suit Injunctions (ASI) are injunctions issued by one jurisdiction to prevent the parties from initiating or continuing parallel litigation in another jurisdiction. They can be understood as means to reduce parallel litigation and divergent outcomes. One jurisdiction claiming the full competence over a particular dispute. **Anti-Anti-Suit Injunctions** (AASI) (and other anti- following) are meant to respond to a first issued ASI and to invalidate it. Thereby trying to restore the competence of foreign courts.

Through the issuance of an ASI, a national court potentially encroaches on the competence of foreign courts and affects the course of litigation. It is considered that ASI raise

¹³⁶ The traditional scenario of torpedo action started with alleged infringers initiating proceedings for a Declaration of Non-Infringement (DNI) of a national as well as foreign patents (or parts of EPs) before a national court known to be slow. Under the *lis pendens* rule of Brussels I Regulation, if the patent holder was to start infringement proceedings for the same patent against the same infringer but in another jurisdiction, the court of that MS seized in second, would have to stay its proceedings until the competence of the court first seized was established. (Art. 29 Brussels I Regulation (1215/2012) [Recast].)

fundamental issue of **international comity**.¹³⁷ As previously mentioned, according to the principle of comity, national courts recognize and enforce each others' legal decisions as a matter of courtesy, or based on the need for reciprocity, but not necessarily as a matter of law. When a court in one jurisdiction issues an ASI, this may frustrate the principle of comity as it may unduly remove the courtesy generally granted to foreign courts to make their own choices in terms of recognition and enforcement. **The use of ASI within the EU is very limited. However, ASI are more commonly used in the US, in the UK and more recently in China.** For the treatment of ASIs and AASIs, a distinction has to be made between the European (and Member States) approach and the international approach.

Anti-suit injunctions within the EU (ie. between MS courts only) are **limited** by the CJEU decision in C-159/02 *Turner v Grovit* (2004) (confirmed by Case C-185/07 *Allianz* 2009). In this decision, the CJEU assessed the compatibility with the Brussels Convention (now Brussels I Regulation 2015/2012 – mentioned supra) of the grant of an injunction preventing the defendant from continuing an action in another MS. The Court essentially held that Brussels I Regulation **precludes** the grant of an **injunction whereby a court of a MS prohibits a party to proceeding pending before it from commencing or continuing legal proceeding before another MS court, even if** that party is acting in bad faith with a view of frustrating the existing proceedings.

In light of this decision, it can be concluded that ASI **between MS courts** would be contrary to Brussels I Regulation as it would **frustrate** the principle of comity, or the general principle of **mutual trust** which is a core principle of EU law. There are therefore limited opportunities for parties to exploit ASIs in the EU. This has been confirmed by the recent instances in Germany and in France. Essentially, German courts have found that ASIs were unenforceable under German procedural law. Moreover, in some instances¹³⁸, they have considered that ASIs could constitute “unlawful interference with proprietary right and access to justice rights” of litigants. In France, it was considered that ASIs are contrary to French *ordre public*.¹³⁹

From these instances, and the jurisprudence of the CJEU, it can be concluded that civil law jurisdictions are generally reluctant to recognize the effectiveness of ASIs and resist the interference by foreign courts.

This European approach does not exclude the possibility for MS courts to issue ASI when a **non-EU court is involved**. The teachings of *Turner* (2004) do not apply outside the framework of Brussels I Regulation. Therefore, in case of international litigation (in particular when US and Chinese courts are involved) there may be some opportunities for litigants to obtain ASI. Additionally, it should be noted that as a consequence of Brexit, UK courts may decide to deviate from *Turner* (2004).

As previously mentioned, **ASIs are also more commonly used in the US, in the UK and more recently in China**. Each jurisdiction applies a different legal test to the grant of an ASI.

In the UK, the test has been established in the UK Supreme Court decision in *Airbus Industrie GIE v Patel* (1999).¹⁴⁰ According to this test, a party seeking an ASI must generally

¹³⁷ OECD, Challenges of International Co-Operation in Competition Law Enforcement (2014) 11. Pedro Caro de Sousa, 'The Three Body Problem – Extraterritoriality, Comity and Cooperation in Competition Law' (2021) in Nuno Cunha Rodrigues (ed) Extraterritoriality of EU Economic Law (Springer) 119.

¹³⁸ Eg.: LG Munich I, 7 O 14276/20 [2021] BeckRS 3995. OLG Munich, 6 U 5689/19 [2019].

¹³⁹ CA Paris, ICom v Lenovo RG 19/21426, 14/2020 [2020].

¹⁴⁰ *Airbus Industrie GIE v Patel* [1999] 1 AC 119.

show that proceedings before the foreign court is or would be ‘vexatious’ or ‘oppressive’. It is necessary to show that (a) England is clearly the more appropriate forum (the natural forum), and (b) justice requires that the claimant in the foreign court should be restrained from proceeding there.¹⁴¹

In the US, the overall framework relies on the teachings of *Gallo Winery* (9th Cir. 2006)¹⁴² and *In re Unterweser* (5th Cir. 1970)¹⁴³. According to the US approach, to obtain an ASI, it should be clear that the parties and issues in the action are *functionally equivalent* to those in the action sought to be enjoined. This part of the assessment highlights that the purpose of the ASI is to reduce duplicative litigation. If this part of the test is satisfied, it should also be determined whether the resolution of the local action would be *dispositive of the foreign action*. If this is the case, then the 4 (alternative) factors test of *Unterweser* should be considered.

Under this test, the power of a court to enjoin parties from litigating in another court is exercised where the foreign litigation would: (1) frustrate a policy of the forum issuing the injunction; (2) be vexatious or oppressive; (3) threaten the issuing court’s in rem or quasi in rem jurisdiction; or (4) where the proceedings prejudice other equitable considerations. As these factors are alternative, if one of the 4 factors is met the court still need to ask itself whether the injunction will have a significant impact on international comity.

In China, it appears from the available case law, that the following factors are considered by Chinese courts before issuing an ASI: (1) what would be the impact of foreign litigation on actions pending before Chinese courts; (2) is the ASI necessary; (3) a balance of interests; (4) the impact of the ASI on the public interest and (5) whether the ASI would frustrate the international principle of comity. However, the legal test for Chinese ASI is still relatively vague and diverges from one instance to the other. A request for information was recently submitted by the EU (via the WTO mechanism) in order to obtain more information on the Chinese approach to ASI.¹⁴⁴ The response from China remained rather vague.¹⁴⁵ Following this request for information, the EU initiated dispute settlement consultations at the WTO against China for “restricting EU companies from going to a foreign court to protect and use their patents”¹⁴⁶.

Overall, it can be said that three different approaches have been adopted vis-à-vis ASIs:

- 1) **EU approach:** reluctance to recognize the effectiveness of ASIs and resistance to interference by foreign courts.
- 2) **International and prudent approach** (US and UK): procedural application of detailed tests, high threshold of “vexatious/oppressive” litigation, and recognition of the importance of the principle of international comity.

¹⁴¹ For a recent interpretation see: *Conversant v Huawei* [2018] EWHC 2549 (Ch). Had it not been withdrawn, the High Court considered that an ASI would have been granted in this case. The ASI would have aimed at prohibiting litigation in China. The Court considered that there was a risk of “*artificial attempt to anchor proceedings in another country when true connection of the case with UK jurisdiction*”. This would have been considered vexatious as these foreign proceedings would have obstructed UK proceedings or undermined the performance of a UK judgement.

¹⁴² E. & J. Gallo Winery v Andina Licores S.A. 446 F.3d 984, 991 (9th Cir. 2006).

¹⁴³ *In re Unterweser Reederri, GmbH*, 428 F.2d 888, 890 (5th Cir. 1970).

¹⁴⁴ Request for information pursuant to Article 63.3 of the TRIPs Agreement. Communication from the European Union to China. IP/C/W/682 (July 2021).

¹⁴⁵ Response to the European Union’s Request for information pursuant to Article 63.3 of the TRIPs Agreement. Communication from China. IP/C/W/683 (Sept. 2021).

¹⁴⁶ Press Release. “EU challenges China at the WTO to defend its high-tech sector” (18.02.22). Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1103 (last accessed: 21.02.22).

- 3) **International and uncertain** but potentially liberal approach (CN): unclear test for issuance of ASI potentially.

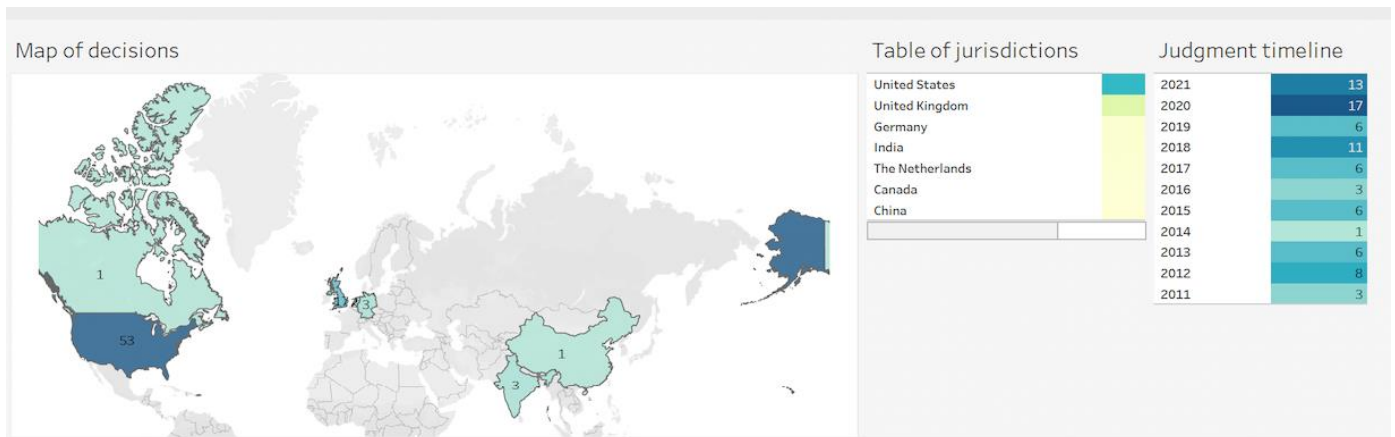
The issues with ASI (as well as AASI) are fairly similar to the issues identified for forum shopping and parallel litigation.

- (1) They generate **costs** and require **time** from litigants.
- (2) Courts' **resources** are **diverted** from engaging with **substantive issues** such as patent validity or infringement or the actual determination of licensing terms.
- (3) Due to the **fragmentation of litigation** between different elements of a dispute (patent- or contract-related), it is difficult to know when two actions are 'substantially identical' instances which could justify the grant of an ASI. Additionally, in **the EU**, the rules on **cross-border jurisdictions and torpedo actions** trigger particular legal frameworks that national courts cannot ignore (see infra).

It is argued that the **global SEP litigation context is seeing an increasing use of ASIs and AASIs**. Overall, over a period of ten years between 2011 and 2021 we found 46 decisions in which an ASI has been requested by a party and 7 decisions in which an AASI has been requested.

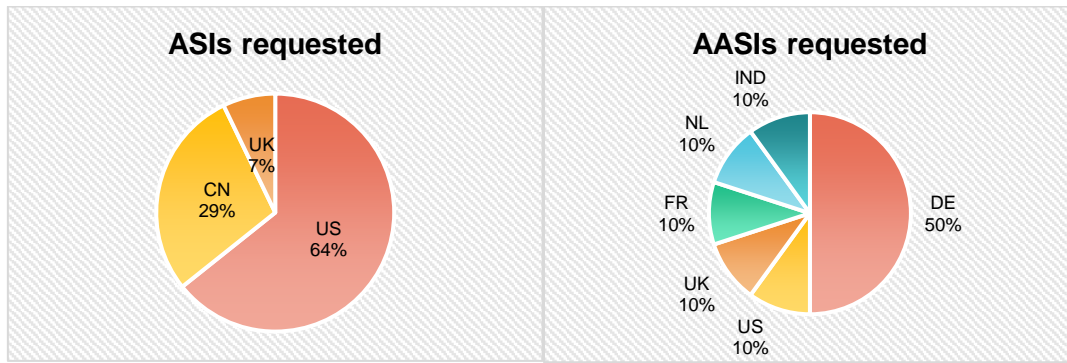
We observe an increase over time for these requests since 2018. Moreover 2020 and 2021 have been particularly busy years for ASI and AASI. We can also see that, as concluded from the literature review on ASI and AASI, the US and the UK have been more heavily solicited than any other jurisdictions (**Figure 21**).

Figure 21: Requests for Anti-Suit and Anti- Anti-Suit Injunctions, by jurisdiction (2011-2021)



From these 53 decisions, we focused on 25 instances (15 ASIs and 10 AASIs) which have specifically touched upon requests for ASI and/or AASI **within the framework of a SEP-related dispute (Figure 22)**. These have taken place between 2012 and 2021. We found that **most ASIs have been requested in the US (9 instances) followed by China (4 instances)**. On the other hand, **most AASIs have been requested in Germany (5 instances)**.

Figure 22: Requests for Anti-Suit and Anti- Anti-Suit injunctions – SEP disputes (2012-2021)



These findings confirm that most ASI requests are made in non-EU MS, whereas courts in EU MS respond to ASIs by issuing AASIs in order to re-establish their jurisdiction. This responsive or defensive approach seems to be particularly important. For example, in order to obtain an AASI in Germany, litigants must demonstrate that there is a “continuous or imminent risk of infringement” or “threat on the enforcement of German patent rights”. In one instance, the LG Dusseldorf granted an *ex parte* AASI in order to pre-emptively restrain the effects of ASIs that could potentially be obtained in foreign courts (in particular Chinese courts). This was nonetheless reversed on appeal in light of the fact that there was no specific threat of ASI which would have prevented the right holders from enforcing their German patent rights.¹⁴⁷ Therefore, without a clear threat of ASI, it may be difficult for litigants to obtain an AASI in Germany.¹⁴⁸ This approach has also been adopted in one instance in the Netherlands.¹⁴⁹

It was previously mentioned that German courts consider ASIs as an “unlawful interference with proprietary right and access to justice rights” of litigants. In two instances¹⁵⁰, the Munich and Dusseldorf courts also considered that, as a general rule, a SEP implementer who files an application for an ASI or threatens to do so **cannot be regarded as a ‘willing licensee’** within the negotiation framework established by the CJEU in the *Huawei v ZTE* (2015) decision. Therefore, the effects of requesting ASIs may directly impact the analysis of the safe harbour developed in the case law of the CJEU. If requests for ASIs continue to increase, it remains to be seen whether this approach will be adopted by other national courts.

There is **not a single jurisdiction** which has been particularly **targeted by ASIs**. Some ASIs have been specifically **tailored** towards one jurisdiction.¹⁵¹ Especially in instances where the parties had either already initiated litigation or showed signs that they were about to start

¹⁴⁷ OLG Dusseldorf I-2 U 25/21 (07.02.22) HEVC Advance v Xiaomi

¹⁴⁸ The Court considered that “there is no objective necessity for a purely preventive anti-suit injunction if there is no anti-suit injunction already requested or no concrete indication of the patent user’s intention to do so – for example, in the form of a serious threat – and if there are not even proceedings on the merits pending between the parties in a jurisdiction that provides for the legal institution of an anti-suit injunction”. OLG Dusseldorf I-2 U 25/21 (07.02.22) HEVC Advance v Xiaomi.

Translation from: Vossius & Partner. Available at: https://www.vossius.eu/fileadmin/220207_EN_convenience_translation_decision_Upper_District_Court_Duesseldorf_I-2_U_27_21.pdf (Last accessed: 21.02.2022).

¹⁴⁹ District Court of the Hague, C/09/618542/ KG ZA 21-914 (16.12.21) Ericsson/Apple.

¹⁵⁰ LG Munich I, 7 O 14276/20 [2021] BeckRS 3995 (InterDigital v Xiaomi). OLG Dusseldorf I-2 U 25/21 (07.02.22) HEVC Advance v Xiaomi.

¹⁵¹ In Germany, the LG Dusseldorf in HEVC Advance v Xiaomi (2021) initially granted an *ex parte* AASI against any ASI requested outside Germany. The scope of the AASI was subsequently reduced to prohibit ASI obtained in China only and not worldwide. This decision was nonetheless reversed on appeal. OLG Dusseldorf I-2 U 25/21 (07.02.22) HEVC Advance v Xiaomi.

parallel proceedings.¹⁵² However, in other instances, and in particular for ASIs issued by Chinese courts, the geographical scope of ASIs was much wider and included a series of potential jurisdictions (sometimes broadly defined as prohibiting litigation “**worldwide**”).¹⁵³

The reluctance of EU MS courts to grant ASIs or to recognise ASIs issued from other jurisdictions, may also be explained in light of the developments around **cross-border jurisdiction** and the evolution of the CJEU case law on this question. It is generally difficult to argue that the jurisdiction of one MS Court can affect the jurisdiction of another MS Court due to the national nature of patent litigation and the territoriality principle. If a dispute may involve the same parties in different jurisdictions, it is never truly about the same patent. It is therefore difficult to claim that the resolution of a dispute in one jurisdiction is actually leading to *res judicata* in another jurisdiction (or should be granted deference) if the dispute is grounded in patent law. In *Roche v. Primus* (2006)¹⁵⁴ the CJEU interpreted Art. 8(1) Brussels I Regulation¹⁵⁵ and held that, for cross-border jurisdiction to be established, this would require to show that there is the “*same situation of law and fact*” in both jurisdictions. However, in patent cases, there could never be the same situation of law as there is no harmonised rules of EU-patent law. The national counterparts of the same EP could not be considered a single legal right that was infringed. As for the same situation of ‘fact’, the Court also considered that since infringers act in a different MS, this could not constitute the same situation of facts.

In more recent decisions, in particular since *Solvay v. Honeywell* (2012)¹⁵⁶, the interpretation of the CJEU is less strict. It is essentially **for national courts to assess if there is a risk of ‘irreconcilable judgments’ in case of parallel litigation and the interpretation of the ‘same situation of law and fact’ includes ‘substantially identical’ instances**. Courts are nonetheless quite protective of their national competence for patent litigation and would rarely recognise that two instances between different courts are so ‘substantially identical’ that it would lead to a situation of *res judicata*.

In the instances observed above, courts which have granted ASI have generally considered that such injunction was required because of a “substantially identical situation of law and fact”. This essentially came from the fact that the parties were involved in a worldwide **SEP/FRAND dispute**. Arguably, this may be more complicated to argue and to accept before EU courts in light of the case law of the CJEU. However, **the District Court of The Hague has recently assumed cross-border jurisdiction in two SEP/FRAND disputes**.¹⁵⁷ Contrary to other EU MS courts, Dutch courts have always shown more willingness to

¹⁵² E.g. for ASIs issued by a US court: *Microsoft Corp. v Motorola, Inc.* 696 F.3d 872 (9th Cir. 2012). *Huawei Techs., Co. v Samsung Elecs. Co.* (N.D. Cal. 2018). For ASIs issued by a Chinese court: *Huawei v Conversant*, Supreme People’s Court of China [2019] 732, 733, [734] Civil Ruling.

¹⁵³ E.g. for ASIs issued by a US court: *TCL Communication Technology Holdings, Ltd. v Ericsson* 943 F.3d 1360 (Fed. Cir. 2019). *Nokia v Continental* (N.D. Cal.) 5:19-cv-02520-LHK. *Lenovo (United States) Inc and Motorola Mobility, LLC v IPCOM GmbH & Co KG*, Case No 5:19- cv- 1389 (N.D. Cal. 2019). For ASIs issued by a Chinese court: *OPPO v Sharp*, Supreme People’s Court (2021) *Zui Gao Fa Zhi Min Xia Zhong No. 517*. *Xiaomi v InterDigital*, Intermediate Court Wuhan, [2020] E 01 Zhi Min Chu [169.1]. *Samsung Electronics Co., Ltd. v Telefonaktiebolaget LM Ericsson*, Intermediate Court Wuhan [2020] E 01 Zhi Min Chu [743].

¹⁵⁴ Case C-539/03, *Roche/Primus* (2006).

¹⁵⁵ Art 8(1) of Brussels I Regulation stipulates that: “A person domiciled in the territory of a Member State may also be summoned: if there is **more than one defendant**: in the courts for the place of residence of one of them, provided that the claims are so closely connected that due process requires their simultaneous hearing and adjudication, in order to avoid adjudication of cases irreconcilable decisions are given;”

¹⁵⁶ Case C-616/10, *Solvay/Honeywell* (2012).

¹⁵⁷ District Court of the Hague, C/09/604737/ HA ZA 20-1236 (15.12.21) *Vestel/HEVC Advance*. District Court of the Hague, C/09/618542/ KG ZA 21-914 (16.12.21) *Ericsson/Apple*.

assume cross-border jurisdiction.¹⁵⁸ This may make them more attractive than other EU MS courts to hear SEP/FRAND dispute and therefore create an opportunity for forum shopping.

Additionally, ASIs may also present similarities with so-called “**torpedo actions**”¹⁵⁹. Similar to torpedo actions, ASIs frustrate the proceedings of parallel litigation and may cause serious delays before an action can be decided.

¹⁵⁸ Dutch courts have opted for a ‘coherence’ between the claims and reasons of ‘effectiveness’ to justify their cross-border jurisdiction. On the other hand, Art 8(1) Brussels I Regulation stipulates that the cases should be ‘closely connected’ and that there should be a risk of ‘irreconcilable decisions’. Additionally, a condition of ‘due process’ should guide national courts in the determination of their cross-border jurisdiction.

¹⁵⁹ The traditional scenario of torpedo action started with alleged infringers initiating proceedings for a Declaration of Non-Infringement (DNI) of a national as well as foreign patents (or parts of EPs) before a national court known to be slow. Under the *lis pendens* rule of Brussels I Regulation, if the patent holder was to start infringement proceedings for the same patent against the same infringer but in another jurisdiction, the court of that MS seized in second, would have to stay its proceedings until the competence of the court first seized was established. This was considered to generate serious delays as the establishment of the competence of the first court seized could take months (if not years) in light of the backlog suffered by certain courts.

II. Challenges

In light of the general characteristics and complexities of SEP licensing, there is a potential for challenges including inefficient licensing (e.g. overly costly or delayed licensing), under-licensing (persistent unlicensed use), and opt-out (decision by potential contributors not to contribute to standards development, or decision by potential standards implementers not to use a standard subject to potential SEPs, because of anticipated challenges in SEP licensing). We will review the evidence base for each of these potential challenges.

6. INEFFICIENT LICENSING

We focus on two types of potential inefficiencies in SEP licensing: the transaction cost of licensing, and licensing delays. Both costs and delays in licensing negotiations are significantly increased when there are disputes, and in particular litigation. We thus first assess the prevalence of SEP litigation, and then assess typical costs and delays of different types of SEP licensing negotiations and/or disputes.

- *Prevalence of SEP litigation:* overall, the prevalence of SEP litigation is low, and not increasing over time. While we assess that there are fewer than 0.05 litigations per license involving major SEP licensors and patent pools; when the licensor is a patent assertion entity (PAE), there are approx. 0.9 litigations per SEP license.
- *Costs of SEP litigation:* over the past decade, we estimate the worldwide cost of SEP litigation at approx. 164 million Euros per year. Only a relatively small share of that cost (12 million Euros) arises in the EU.
- *Costs of SEP licensing* vary substantially between different licenses, and the major licensing cost components differ between different licensing environments. The cost of concluding bilateral licenses between major players is difficult to estimate, and largely driven by negotiation costs (likely more than 2 million Euros total cost per license). Litigation costs are the most significant component of the cost of concluding SEP licenses for PAEs (total cost of 1.75M Euro per license); while set-up and marginal operational costs account for the majority of the costs of pool licensing (total cost of approx. 400k Euro per pool license). In total, the worldwide cost of SEP licensing is estimated at 800M to 1.5bn Euro per year.
- *SEP licensing delays:* we estimate that the average SEP license is concluded 3.75 years after the licensee introduced its first product using the standardized technology covered by the license. Practitioners report that, on average, it takes SEP owners 2-4 years before approaching an implementer in view of concluding a SEP license.
- *The duration of SEP licensing negotiations* is only observable in the case of disputes. Pre-litigation negotiations typically account for the majority of this duration – on average, SEP licensing negotiations have lasted for 2.9 years before the beginning of litigation, whereas SEP litigation itself takes (depending on the jurisdiction) 15 to 32 months to be resolved.

- *SEP licensing through pools* is similarly characterized by some delays – there is an average lag of 4.6 years between the release of a standard and the availability of pool licenses, and it further takes several years for the pools to attract licensees: the median licensee of the median pool joins about three years after the first licensee has joined.

SEP licensing inefficiencies encompass diverse costs and delays potentially arising in the process of concluding SEP licenses. There are at least two potentially important dimension of SEP licensing inefficiency: first, the costs that parties *actually* incur during SEP licensing negotiations (and other related costs); and second, potential SEP licensing costs, i.e. the costs that parties may need to incur to conclude a SEP license on FRAND terms. Actual SEP licensing costs (i.e. empirically observable expenses that parties incur) may be only a fraction of potential SEP licensing costs, because parties may refrain from actually licensing certain SEPs (under-licensing), or because parties may enter into a SEP license on non-FRAND terms rather than incurring the significant expense of negotiating a FRAND license. The potential cost of SEP licensing thus determines parties' SEP licensing behavior, e.g. the extent to which SEPs are comprehensively licensed and the extent to which SEP licenses are concluded on FRAND terms.

Some SEP licensing negotiations entail litigation. In the case of SEP licensing negotiations giving rise to litigation, the cost and duration of litigation is likely to be a very significant contributor to the overall cost and duration of the SEP licensing process. Nevertheless, the share of SEP licensing negotiations resulting in litigation is low. For a better estimation of overall SEP licensing costs and delays, it is thus important to estimate the costs and delays of licensing negotiations and litigation separately; in addition to estimating the share of SEP licensing negotiations resulting in litigation.

Most aspects of SEP licensing negotiations are empirically unobservable. Some aspects of SEP licensing become observable through litigation (e.g. court decisions may describe parties' behavior in SEP licensing negotiations prior to litigation). While SEP litigation may offer a window into SEP licensing processes more generally, negotiations resulting in litigation are not representative of SEP licensing negotiations more generally.

6.1. Incidence of SEP litigation

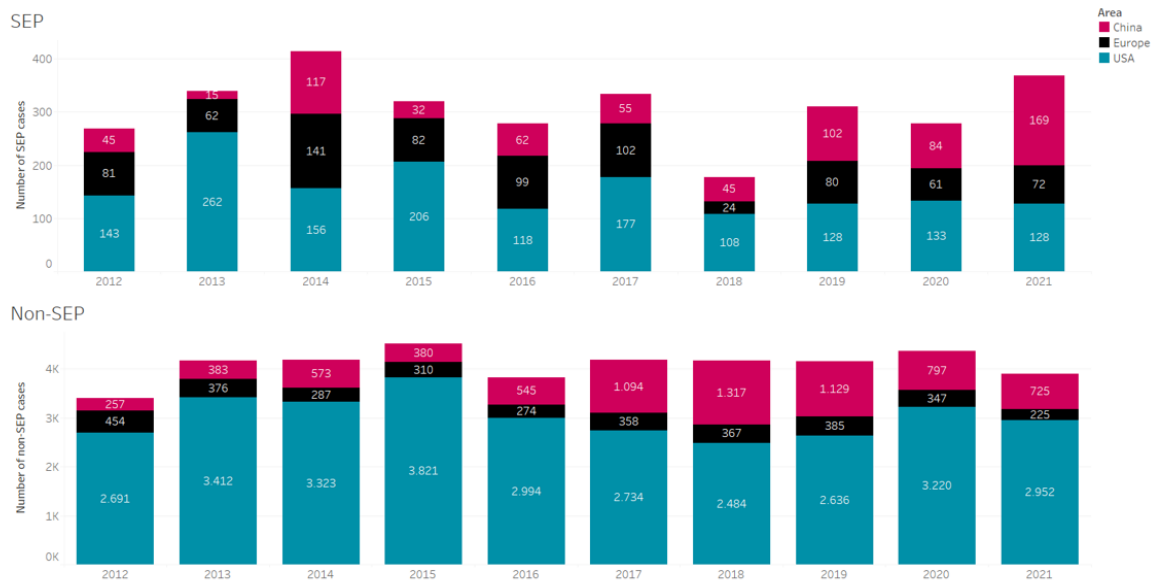
6.1.1. *SEP litigation counts and rates compared to other patents*

Over the past 10 years, there have been on average 80.4 patent litigation cases involving declared SEPs in Europe per year, and 308.9 cases per year in the world (Figure 21).¹⁶⁰ There is no clear trend in the overall number of SEP litigations over this period. Despite large fluctuations from one year to the other, it is possible to detect a general trend of increasing SEP litigation counts in China, offsetting a downward trend in the United States. SEP litigation case counts in Europe vary significantly from one year to the other, with no discernible overall increasing or decreasing trend. This relative stability in SEP litigation

¹⁶⁰ In the following, we generally refer to "SEP litigations". Empirically, we identify SEP litigations as patent litigations in the Darts-ip platform involving at least one declared SEP (from the iplytics platform). Not all declared SEPs are actual SEPs, and not all SEPs are declared. The true number of "SEP litigations" may thus differ from the number of litigations involving declared SEPs.

counts follows a period of significant increases in SEP litigation intensity (with a five-fold increase between 2002 and 2005).

Figure 23: Litigation counts by World region, SEP vs. Non-SEP



A number of studies compared the propensity of declared SEPs to be subject to litigation with patents in relevant comparison samples. Studies based on US patents found that **declared SEPs are more likely to be litigated than other patents** by a factor ranging from four (Bekkers et al., 2014) to seven (Baron and Delcamp, 2012; Darts-ip, 2019). Nevertheless, the average likelihood of any individual declared SEP to be subject to litigation is still low in absolute numbers. Contreras et al. (2017) identified 422 German and 36 UK cases involving 92 (declared) SEP families in the period from 2000 to 2008. This may be contrasted with the 2,492 inpadoc patent families with at least one DE or EP member that was both granted and declared essential as of 2008. Even if each of the 92 SEP families identified by Contreras et al. (2017) was litigated in Germany, one would only about **3.6% of the declared SEP families were subject to any litigation in Germany**, which is by far the jurisdiction with the highest number of SEP litigations in Europe.

In more recent years, the share of declared SEPs subject to litigation has decreased. While the number of inpadoc families with at least one DE or EP member that was both granted and declared essential almost quadrupled from 2008 to 2017 (to 9,819), the number of (potential) SEP litigations in Europe was somewhat lower in the period 2009-2017 than 2000-2008.

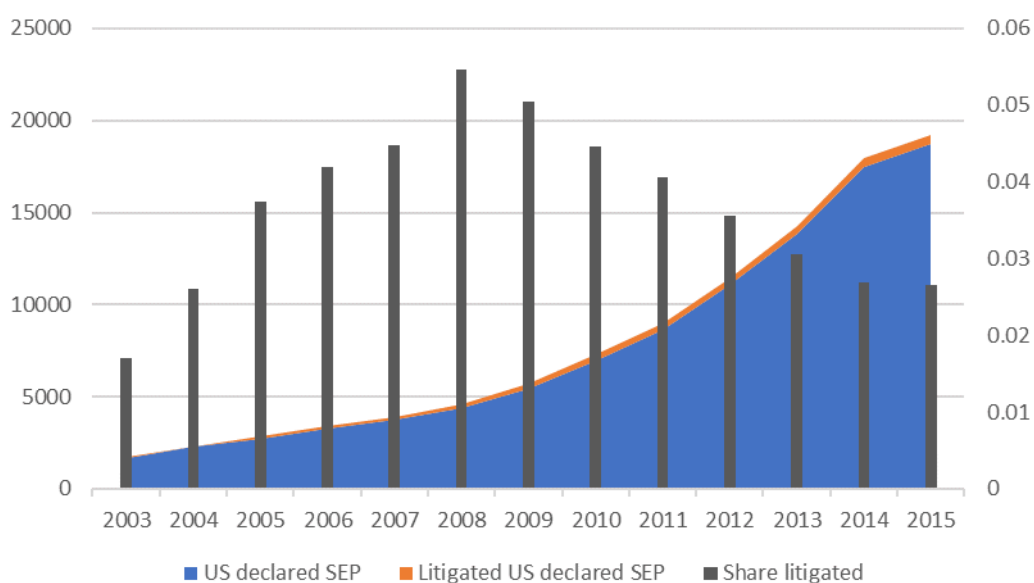
Similar trends can be observed in the US. Bekkers et al. (2014) find that as of 2011, 393 of the 5,768 declared US SEPs in their sample were subject to any litigation; a share of 6.7%. Our own analysis, using a larger number of declared SEPs, yields a share of litigated patents of 4.1% among US patents granted and declared to an SDO by 2011.¹⁶¹ This slightly higher

¹⁶¹ According to the data from Baron and Pohlmann (2018), as of 2011, there were 8,645 issued and declared US SEPs. Matching this data with the USPTO litigation database to identify SEP litigations in the US, we find a share of litigated patents of 4.1%. The sample is thus larger and the share of litigated patents lower than the figures in Bekkers et al. (2014), suggesting that the additional declared SEPs identified by Baron and Pohlmann (2018) were less prone to be litigated in the US than the patents in the smaller sample of Bekkers et al. (2014).

estimated share (compared with our estimate for Germany) is consistent with observable differences between patent litigation counts in Europe and the US more generally.¹⁶²

The share of litigated patents among the declared US SEPs has significantly decreased since 2008 (Figure 24). As of 2017, there were 537 litigated US SEPs, the share of litigated patents in the population of declared and issued US SEPs having decreased to 2.8%, from an all-time-high of 5.5% in 2008. As already mentioned, yearly SEP litigation counts in the US have decreased since 2017; further compounding the trend of a decreasing litigation rate among declared SEPs in the US.

Figure 24: Number and share of litigated patents among declared U.S. SEPs



6.1.2. Likelihood of SEP licensing negotiations to result in litigation

Litigation rates per patent are relatively easy to observe, and have been widely used to compare declared SEPs with other patents. They are also useful to discern trends, such as increases in the (relative) litigiousness of (declared) SEPs until approx. 2008, followed by a decline in more recent years. Nevertheless, the number or likelihood of litigation per patent is of limited informativeness for analyses of the likelihood of litigation in SEP licensing negotiations.

First, SEP licensing negotiations often involve large portfolios of hundreds or even thousands of declared SEPs. While only small numbers of (declared) SEPs may be asserted in litigations, these small numbers of patents-in-suit may account for disputes related to much larger portfolios. Second, implementers often need licenses from the owners of

¹⁶² The USPTO litigation database contains information on 75,996 cases from US district courts <https://www.uspto.gov/learning-and-resources/electronic-data-products/patent-litigation-docket-reports-data>. For comparison, in 2007, the year with the highest count of cases in Europe identified by Cremers et al. (2016), there was a total of 968 cases in the four major European patent jurisdictions combined (excluding invalidation actions at the BPatG), and 2,896 cases in US district courts. The difference between numbers of US and European cases is larger in other years.

multiple complementary SEP portfolios. The risk of facing litigation with a relatively small share of these SEP licensors may be sufficient to dissuade potential standard implementers, or to induce implementers to take a pool license to many SEP owners' portfolios. Third, even if a (declared) SEP is asserted in litigation, it is usually only asserted against one implementer, or a relatively small number of implementers. Not all implementers of a standard subject to declared SEPs are equally exposed to SEP litigation.

For a more informative measure of SEP litigation incidence, it is necessary to compare the number of concluded SEP licenses with the number of SEP licensing disputes resulting in litigation. As the number of SEP licenses is not observable, it is impossible to estimate the general SEP litigation incidence. Nevertheless, we can identify three important segments of SEP licensing, and produce relatively reliable estimates of SEP litigation incidence rates in each of these three segments. The three segments are 1. SEP licensing by major SEP holders; 2. SEP licensing through pools; and 3. SEP licensing by non-practicing entities (NPE). While these three types of SEP licensing do not cover the universe of SEP licensing, together, they probably account for a significant part of that universe.

Overall, we conclude that the incidence of litigation in SEP licensing negotiations is low, but highly variable according to segment. Litigation incidence is lowest among SEP licensing by major SEP holders – we assess a maximum of 0.01-0.03 SEP litigations per SEP license concluded by major SEP holders. Litigation propensity of licensors participating in patent pools varies significantly between different pools; overall, we estimate a maximum of 0.1 SEP litigations per pool license. Finally, the litigation incidence is highest for SEP licensing by NPEs, in particular for patent assertion entities (PAE). We assess that, on average, the number of SEP litigations per SEP license is higher than 1 for PAEs.

6.1.2.1. SEP licensing by major net licensors

A first important segment of SEP licensing is SEP licensing by holders of large portfolios of (declared) SEPs that license these SEPs to other companies to generate significant royalty revenue (major net licensors).

According to Galetovic et al. (2018), the three largest patent licensors in the mobile telecommunications industry (by royalty revenue) in 2016 were Qualcomm, Ericsson, and Nokia. We can compare these companies' (self-stated) number of licensees with the number of patent litigations in which these companies engaged as plaintiffs to approximate the relative litigiousness, i.e. the number of litigations per concluded license. Neither our method to count licenses nor patent litigations is limited to (declared) SEPs. Nevertheless, given these companies' focus on SEP licensing, we use data on these companies' overall patent licensing and litigation data to derive plausible estimates of relative litigiousness in this segment of SEP licensing.

In total, these companies state that they currently license patents to at least 600 licensees.¹⁶³ Using licensing revenue data from Galetovic et al. (2018), we thus calculate that the

¹⁶³ Qualcomm states to currently license its patents to more than 300 licensees ([Licensing | Intellectual Property | Qualcomm](#)); Ericsson states to license to more than 100 licensees ([Patents and licensing: Investing in technology innovation \(ericsson.com\)](#)), and Nokia states to license to more than 200 licensees ([Patent licensing | Nokia](#)).

average yearly royalty revenue per license is no more than 5.8 million USD for Nokia, 11.65 million USD for Ericsson, and 25.5 million USD for Qualcomm. We can also compare the number of current active licensees to the number of patent litigations in which these companies engaged over the last 11 years as plaintiffs. As we estimate that an average patent license lasts no longer than 8 years, and as all three companies report lower bounds to their number of licensees, we assess that 600 is a very conservative estimate of the number of licenses concluded by these three licensors over the last 11 years.

Using Darts-ip, we identify over 400 patent *litigations* filed from 01-01-2010 to 31-12-2021 in which any of these three companies was listed as plaintiff.¹⁶⁴ It is important to understand that “*litigations*” (unique *case grouping ids*) do not mean unique disputes between two companies, but could be different legal proceedings related to the same dispute.¹⁶⁵ In order to know how frequent or big these disputes are, we regroup litigations into larger disputes by parties involved, the dates of the litigation, and the courts in which they took place (see Appendix 8 for a full list of the disputes).

Grouping together different proceedings with identical dates, defendants, and court, we produce a smaller number of “cases”. Many of these “cases” still relate to the same dispute. Only counting the first instance of litigation between two parties in the same court, we identify “unique cases”. These unique cases are unique combinations of plaintiffs, defendants and courts – Ericsson e.g. pursued patent litigation against 19 defendants in 15 different courts, resulting in 44 “unique cases”.¹⁶⁶ The number of unique defendants per plaintiff is the closest approximation of the number of different disputes, i.e. the number of different (potential) licenses subject to litigation. As we observe a period of 11 years, it is possible that some of the litigations between the same set of parties resulted from unrelated licensing disputes. Nevertheless, as we only count each licensee once when determining the number of licenses concluded during the same time period, symmetry requires that we also only count each defendant in litigation once.

Not each “defendant” in patent litigation is an accused infringer. In many complex disputes, implementers initiate different types of legal proceedings against patent owners. We thus manually researched each combination of plaintiff and defendant to identify cases in which Ericsson, Nokia and Qualcomm were asserting their own patents against accused infringers (in bold font in the table), as opposed to countersuits in cases in which these companies were themselves accused of infringing other firms’ patents (italic font in the table).¹⁶⁷

Overall, we assess that Ericsson was engaged in patent litigation against 9 accused infringers, Nokia against 16-18 accused infringers, and Qualcomm against 4 accused infringers. Comparing this to their respective (self-stated) number of licensees, we find that the average relative litigiousness of these major licensors (i.e. the number of disputes in

¹⁶⁴ Within the “Patent” subsection of Darts-ip, we filtered by party, selecting cases where the name of the plaintiff contained the strings “Ericsson”, “Nokia” or “Qualcomm”. In the third collapsible set of filters, called “Search by Court/Date/Reference”, we chose three jurisdictions (China, Europe and the United States), for “Type” we picked the “Court” option and for document date, we used the “Define” option, using the following dates: From 01-01-2010 and to 31-12-2021.

¹⁶⁵ We use counts of unique Darts-ip case grouping ids (counts of “cases” in Darts-ip) for our most basic litigation count. Other litigation counts in the literature are often based on counts of unique docket numbers (equivalent to counts of “Documents” in the Darts-ip database). Counts of litigations using grouping ids are lower than counts using docket numbers (i.e. there can be multiple docket numbers per grouping id, but not multiple grouping ids per docket number).

¹⁶⁶ On average, per defendant, Ericsson initiated litigation in 2.31 different courts; for Nokia, this number is 3.34, and for Qualcomm, 2.33.

¹⁶⁷ There are some edge cases, e.g. cases in which two parties accuse each other of infringing their respective patents, and our classification is based on a relatively cursory assessment. Our goal is to quantify prevalence of litigation in SEP licensing, not to analyze individual disputes.

court relative to the number of concluded licenses) is no larger than 0.051 (31/600), with a range from 0.01 to 0.09. While rare, patent litigation involving these SEP owners is often extraordinarily complex – on average, we record 7.9 “litigations” per plaintiff-defendant pair in this sample. All accused infringers in the sample are large (usually multinational) corporations.

6.1.2.2. SEP Licensing by Non-Practicing / Patent Assertion Entities

It is generally understood that patent licensing by non-practicing entities (NPE) is more likely to involve litigation. Worldwide, a majority of patent infringement cases were initiated by NPEs. According to Darts-ip (2019), this is equally true for SEP (64% initiated by NPEs) and non-SEP (68%) infringement cases. In Europe, NPEs represent a lower share of plaintiffs; but NPEs account for a larger share of SEP than non-SEP cases (44% of SEP and 34% of non-SEP infringement cases in Europe were brought by NPEs). NPEs also feature a higher number of cases filed by number of SEP families; in particular in Europe, where the number of cases filed per SEP family is 2.5 larger for NPEs than for other firms.

NPEs constitute a very heterogeneous population, including R&D specialist firms (e.g. InterDigital), public or semi-public research institutes (Fraunhofer, CSIRO, ETRI.), universities, and different types of patent assertion entities (PAE). PAE are entities that specialize in the licensing and assertion of patents acquired from other parties. This includes state-owned entities (such as Japanese IPBridge or FranceBrevets), “privateering” spinoffs from large operating companies (e.g. Unwired Planet from Ericsson, Panoptis from Panasonic etc), former operating companies who have ceased other activities to concentrate on patent licensing (e.g. Sisvel), and private companies acquiring patents from a variety of predecessors (e.g. IPcom, Uniloc, etc.).

In the U.S., the FTC conducted a comprehensive survey of PAEs, using its authority to solicit data that is not publicly available. The 22 PAEs in the sample of the FTC report constitute a significant share of PAE litigation in the US. Over the study’s observation period, the responding entities reported to have concluded 2,715 license agreements, and initiated 2,452 lawsuits over the same nearly six-year study period,¹⁶⁸ consistent with a relative litigiousness of 0.9 litigations per license. Note that these numbers are for all of the patent portfolios of the 22 entities, and not limited to (potential) SEP portfolios.

As the FTC report does not identify the PAEs in the sample, we are not able to replicate the analysis to derive counts of *worldwide* litigations, and identify *unique cases* that would be comparable to our methodology used above for major net licensors. To provide some basis for comparison, we focused on one PAE well-known to assert declared SEPs (among other patents), Uniloc. In litigation with Apple, Uniloc has provided information on 109 comparable licenses.¹⁶⁹ This is thus a lower bound to the number of Uniloc’s licensees. Using similar methodology as above, we estimate that Uniloc initiated legal actions against 235 unique parties, consistent with a relative litigiousness of up to a maximum of 2.15 litigations (unique disputes) per license. In its SEC report, Uniloc disclosed ongoing litigation

¹⁶⁸ Federal Trade Commission, “Patent Assertion Entity Activity: An FTC Study”, Oct. 2016, pp 54.

¹⁶⁹ [Uniloc v. Apple | Electronic Frontier Foundation \(eff.org\)](#)

against 119 defendants, and an expectation of up to 150 additional licensees (which is clearly an upper bound to the number of resulting licenses),¹⁷⁰ consistent with a relative litigiousness of at least 0.79 litigations per license. This relatively wide range (0.79 to 2.15) for the estimated relative litigiousness is broadly consistent with the FTC’s reported figures for *Litigation PAEs*, a subset of the PAEs in its sample, whose relative litigiousness (number of litigations per license) is between 1.184 and 1.31.¹⁷¹ Despite the different definitions of litigation counts, and the focus on worldwide as opposed to US litigations, we can thus broadly compare the litigiousness rates from the FTC study with our own assessed rates.

The focus on Uniloc also allows for some qualitative observations. According to Darts-ip data, Uniloc has initiated 538 infringement litigations worldwide. Focusing on the most recent 80 litigations, we identify 35 unique defendants in 13 different courts.¹⁷² We thus find that on average there are 2.29 litigations per dispute, well below the average observed in the sample of major net licensors. At first glance, the list of Uniloc’s defendants features a mix of large multinational corporations and medium size companies. Finally, we can observe that Uniloc disclosed to the FTC a combined revenue of 37.5 million USD. Using the 109 comparable licenses produced in litigation with Apple as lower bound estimate of the number of Uniloc licensees, the average revenue per license per year is no greater than 344,000 USD, which is at least one order of magnitude smaller than average royalty revenue per license in the sample of major net licensors.¹⁷³ Considering that the major net licensors are operating companies, and at least some of their licenses also include cross-licensing provisions, the difference in the total economic value per license is even larger.

6.1.2.3. SEP licensing through pools

A third salient segment of SEP licensing is licensing through patent pools. Unlike most individual licensors, many patent pools publish comprehensive lists of current licensees, allowing us to compare concrete numbers of licensees with observable litigation counts.

While even the largest individual licensors and most active PAEs license their patents to no more than a few hundred licensees, some patent pools have thousands of royalty-paying licensees.¹⁷⁴ These licensing programs thus reach much larger numbers of companies. Naturally, this also includes smaller companies, who are not typically licensed or targeted by major licensors or PAEs. This also means that in terms of pure license counts, patent pool licenses are likely to represent the majority of SEP licenses concluded every year.

¹⁷⁰ [ex99-2.htm \(sec.gov\)](https://www.ftc.gov/ex99-2.htm)

¹⁷¹ The FTC states that 76% of these PAEs’ litigations result in a license, and more than 90% of their licenses result from litigation. If $\frac{\#litigations\ resulting\ in\ a\ license}{\#litigations} = 0.76$ and $\frac{\#litigations\ resulting\ in\ a\ license}{\#licenses} = 0.9$, then $\frac{\#litigations}{\#licenses} = \frac{0.9}{0.76} = 1.184$. As the share of licenses resulting from litigation cannot be greater than 1, the maximum ratio is $\frac{1}{0.76} = 1.31$

¹⁷² We thus use the number of 0.4375 unique disputes per litigation to derive our estimated number of unique disputes $538 \cdot 0.375 = 235.375$

¹⁷³ This estimated average royalty yield is considerably higher than the FTC’s estimates for litigation PAEs - the FTC estimates that litigation PAE licenses “typically yielded **total** royalties of less than \$300,000” [emphasis added]; i.e. Uniloc’s average royalty yield per license **per year** exceeds the FTC’s estimate of the total average value of litigation PAEs’ licenses. With an estimated duration of 6 years and a 10% annual discount rate, the total NPV of a license yielding 344,000 USD per year is 1.611 million USD. Conversely, using the same assumptions, the annual royalty yield of a license worth 300,000 USD would be 64,026 USD.

¹⁷⁴ See e.g. <https://www.mpegla.com/programs/avc-h-264/licensees/>

Pool administrators do not always participate themselves in the enforcement of SEPs included in the pool, and SEP litigation between the owner of a patent included in a pool and an implementer may result in the implementer taking a license from the pool or a bilateral license from the patent owner. It is thus not straightforward to relate number of pool licenses and litigations.

We can however discuss individual cases. Contreras et al. (2017) e.g. identified MPEG2 as the standard with (by far) the largest number of implementers targeted by SEP litigation in Europe (with 325 cases). This large number of cases is almost exclusively driven by Sisvel, a company which is both a pool administrator and asserts its own patent portfolio. To put this into perspective, at its peak (in 2010), the MPEG2 patent pool operated by MPEGLA had 1,563 licensees in good standing. Over the pool's 25 years of operation, at least 3,209 different companies were listed as pool licensees.¹⁷⁵ Even if every MPEG2 implementer had taken a license from the MPEGLA pool, Sisvel's litigation campaign would only have reached 10.1% of the MPEG2 standard's implementers, being this number an upper bound. According to the data collected by Contreras et al. (2017), MPEG2 is an extreme outlier; no other standard had nearly comparable numbers of related SEP litigations in Europe.

For a more general analysis, we can use historical licensee data from 19 different pools that publish lists of licensees in good standing, comparing licensee lists from 2012 and 2014 to observe both the current population of current licensees and the number of new pool licenses concluded over a period of approx. 2 years.¹⁷⁶

Between 2012 and 2014, 910 new licensees joined, and 1,100 incumbent licensees left these pool licensing programs (ceased to be listed as licensees). For a larger sample of 26 pool licensing programs, we estimate that 2,563 new licensees joined between 2012 and 2014.

We can compare these numbers of current, new, and exiting licensees with counts of SEP litigations related to potential SEPs for the standards underlying these pools from the Darts-ip platform.¹⁷⁷ These potential SEPs may or may not be included in the pool.

Using the same methodology as before, we identify counts of litigations, cases, and unique cases. In total, 19 different plaintiffs and 95 different defendants participated in 67 unique cases, with 109 different litigations (docket numbers). The number of defendants is larger than the number of unique cases, as multiple defendants can be cited in a single lawsuit. We identify 110 distinct plaintiff-defendant combinations, with 114 unique combinations of

¹⁷⁵ We used archived versions of pools' licensee lists from Internet Archives for historical information about licensees. The data, collected by Justus Baron, is available from Northwestern University at http://www6.law.northwestern.edu/webfiles/searlecenter/InnovationEconomics/pools/TLS_poollicensees_v1.1_02-10-15.csv. To count current, new, and exiting licensees, we carried out a licensee name cleaning (avoiding words like limited, corporation, GMBH, Inc, to name a few), and removed duplicates, before comparing licensee lists from 2012 with 2014.

¹⁷⁶ *Ibid.* At least another 44 pools were operating during these years, but for 7 of them we were not able to search for litigations related to the underlying standard, and the remaining 37 pools did not make lists of licensees available.

¹⁷⁷ We searched by "Projects" in the "Search by Standard Disclosures" menu, selecting the following "projects" from the drop-down list: ATSC 2.0, ATSC 3.0, AVC, DAB, G711_1-07, mp3, MPEG Audio, MPEG2, MPEG4 Systems, MPEG4 Visual, Pool Program: 1394, Pool Program: ATSC, Pool Program: ATSC, 3.0, Pool Program: AVC/H.264, Pool Program: DVB-T, Pool Program: DVB-T2, Pool Program: H.264 SVC AVC, Pool Program: MPEG-2, Pool Program: MPEG-4 Visual, Pool Program: MVC, Pool Program: VC-1, Pool Program: WSS, Product: BD/DVD Hybrid Discs, Product: Blu-ray Disc player, Product: Blu-ray Disc player PC, Product: Blu-ray Disc recorder PC, Product: DVD Combi Software, Product: DVD Playback Software, Product: DVD Recorder Software, Product: DVD-Audio Disc / DVD-ROM part, Product: DVD-ROM disc, Product: DVD-ROM disc DL, Product: DVD-ROM player, Product: DVD-Video disc, Product: DVD-Video disc DL. We set the following filters: for "Search by Court/Date/Reference", we chose three regions (China, Europe and the United States), for "Type" we picked the "Court" option and for document date, we set the range from 01-01-2012 to 31-12-2013.

plaintiff, defendant, and first filing date, for an average complexity of 1.03 litigations per defendant and plaintiff.¹⁷⁸

A large number of these disputes (53 plaintiff-defendant combinations) are driven by a single PAE, Princeton Digital Image, which did not participate in any of the pools in our sample. Excluding these disputes from the sample, we identify 57 distinct disputes, which may have been related to the use of a potential SEP licensed through a pool. This thus provides an upper bound estimate of the number of patent litigations related to potential SEPs licensed through pools. Comparing these 57 unique plaintiff-defendant combinations with the 910 new pool licenses concluded over roughly the same 2-year period with any of the 19 pools in this sample, and taking into account that disputes may or may not be related to SEPs included in the pool, we assess a relative litigiousness of below 0.05 disputes per pool license.

6.2. SEP Licensing costs

We estimate that the costs of SEP licensing differ significantly between licenses that are and those that are not subject to litigation. We thus estimate (average) SEP licensing costs as follows:

$$\text{average licensing cost} = \text{general SEP licensing cost} + \frac{\# \text{disputes}}{\# \text{licenses}} \times \text{cost per dispute}$$

6.2.1. The general costs of SEP licensing

The general costs of SEP licensing are a combination of fixed and marginal costs per license. The average (general) cost per license can be written as

$$\begin{aligned} \text{average licensing cost} \\ = \text{marginal cost of license} + \frac{\text{licensor fixed costs}}{\# \text{licenses} / \text{program}} + \frac{\text{implementer fixed cost}}{\# \text{licenses} / \text{product}} \end{aligned}$$

6.2.1.1. Licensor fixed costs (cost per licensing program)

Licensor fixed costs (per licensing program) include one-time set-up costs and annual running (operation) costs.

¹⁷⁸ Given the methodological differences, it is difficult to compare the cases' complexity (number of litigations per defendant) with the other two samples. We can however compare the number of litigations (docket numbers) per case (Darts-ip case filing id) to compare case "complexity". While in the sample of major net licensors, we found 2.26 docket numbers per case, and 1.45 docket numbers for case for Uniloc, we find 1.49 docket numbers per case in our sample of pool-related standards. The two latter samples are thus characterized by similarly low-complexity patterns of SEP litigation.

Set-up costs

SEP licensors incur a variety of costs when creating a licensing program. As explained in Section 3.3.2.1., SEP licensors usually need to perform some type of technical assessment of their own portfolio in order to formulate a licensing offer, and to prepare technical material in support of licensing negotiations (e.g. lists of patents covered by license, claim charts for selected samples of patents, etc.). Practices in this regard vary widely. On average, our experts estimate the cost of “Rough determination whether any TS could be relevant for given patent at all” to be 355 Euro, and a regular claim chart (“Specific SEP evaluation plus arguments on mapping, i.e., specific correspondence”) to be 4,159 Euro (see Section 3.2.3.2). The largest portfolios for the largest standards include more than 1,000 *potential* SEPs. We may assess that an active licensor of a large portfolio would carry out at least a rough determination of every potential SEP, and regular claim charts for 20-50 patents; for a cost of up to 540,000 Euro for very large portfolios.¹⁷⁹ Licensors of such large portfolios choosing to provide claim charts for every patent that they assess to be essential may need to spend up to 2-3 million Euro.¹⁸⁰

In addition to evaluating their own portfolio, licensors would need to track and evaluate use of their patented technology in the industry. One licensing administrator that we interviewed reported that licensors commonly purchase industry studies to identify implementers that are potential licensees, and to verify this information using the respective company’s own marketing information (i.e. whether the company itself states to offer the technology in its products). The interviewed expert estimated the cost of these activities to range in “the tens of thousands; and sometimes hundreds of thousands Euro”.

In addition to these information-acquisition costs, there is a wide variety of set-up costs related to the creation of a licensing program, including financial and legal analysis, communication, administrative and IT systems, etc. There is little empirical evidence on the magnitude of these expenses. We draw on Merges and Mattioli (2017), who have surveyed pool licensing administrators to evaluate set-up costs. While many of the set-up costs they identified are specific to pools (see below), a significant share of the set-up costs they describe appear to be more generally applicable to any larger SEP licensing program. Via Licensing e.g. reported that “four employees were essential to the establishment of the MPEG Audio patent pool: the company's president, its general counsel, a program manager, and a staff member who helped arrange meetings.”¹⁸¹ Merges and Mattioli (2017) estimate the cost related to their activities at 385,000 USD. Via Licensing furthermore reported 100,000-200,000 USD in IT and administrative costs related to the set-up of the same licensing program.¹⁸² For MPEGLA’s HEVC patent pool, Merges and Mattioli (2017) report that eleven employees were involved in the set-up of the licensing program, including the CEO, senior executives, financial analysts, and contract administrators, costing MPEGLA a total of 1.5 million USD.¹⁸³ In both cases, it is likely that at least some of these employees’ activities are pool-specific. Overall, we thus view 385,000-1,5M USD as an upper bound of

¹⁷⁹ Calculated as $50 \times 4,159 + 950 \times 355$

¹⁸⁰ (based on our estimation that less than 50% of the *potential* SEPs are actual SEPs, the total cost is a combination of an initial assessment of all patents, and a detailed claim chart for approx. half of the patents.)

¹⁸¹ Merges and Mattioli (2017), p. 304

¹⁸² Other reported set-up expenses, e.g. meeting costs and evaluation of potential pool patents, are specific to pools.

¹⁸³ Merges and Mattioli (2017), p. 309

the estimated set-up costs of a bilateral licensing program (in addition to SEP owners' expenses in evaluating their own portfolio).

For the set-up of pool licensing programs, we follow Merges and Mattioli (2017), who estimate these costs (including the pool licensing administrators' and the individual SEP owners' expenses) to range from 4.8M to 7.787M USD.¹⁸⁴

Running costs

There is a range of running costs related to the operation of a SEP licensing program, such as invoicing, record-keeping, accounting fees, IT, etc. Merges and Mattioli (2017) estimate annual operational costs for Via Licensing related to the MPEG Audio pool license at 585,000 USD, and annual expenses for MPEGLA related to the HEVC pool program at 2M USD.

These costs are relatively independent of the number of SEP owners, but increase in the number of licensees. As pools (and in particular the two pools studied by Merges and Mattioli, 2017) have particularly large numbers of licensees, we estimate that these general operational expenses are somewhat lower for bilateral licensors (who generally have much smaller numbers of licensees).

These estimates are broadly consistent with our own interview with a SEP licensing administrator representative, who suggested that licensing administrators have back office staff sizes between 3 and 50 people (potentially for multiple programs). While some PAEs have no permanent back office, such entities would typically leave the market after a few years.

6.2.1.2. Fixed costs of implementation (freedom-to-operate)

As discussed in Section 3.3.2.2., implementers' expenses in freedom-to-operate assessments are likely to vary significantly. Consistent with the responses to the European Commission's public consultation, we estimate that large multi-national corporations operating on the relevant level in the value chain (i.e. the large implementers that are typically responsible for SEP licensing, depending on the industry) would typically spend more than 500k Euro for such assessments. These expenses prepare these firms for bilateral negotiations with large SEP holders. Small implementers do not usually participate in complex bilateral negotiations with large SEP holders. If they engage in SEP licensing, it is most commonly in the form of standard licensing programs, in particular pool licensing; where there is no margin for bilateral negotiation. Within this licensing environment, there is little to gain from technical assessments of the SEP landscape. We assess that the majority of small implementers pay

¹⁸⁴ Note that while we follow Merges and Mattioli (2017) with respect to their interview-based estimates of the costs of establishing and operating a pool licensing program, we disagree with their analysis of bilateral licensing, and do not place any weight on their estimates of the cost savings produced by pools.

less than 10,000 EUR in fixed implementation costs related to the assessment of their SEP exposure.

6.2.1.3. Marginal costs per license

In addition to fixed costs per licensing program and per product, there may be marginal costs, i.e. costs accruing for every individual SEP license.

Set-up (negotiation) costs:

Licensing negotiation costs are notoriously difficult to observe. In a study contributed to the European Commission's Call for evidence, Charles River Associates identify certain common cost elements of these negotiations: the fees charged by lawyers for assistance with preparing a license (including negotiation), and "due diligence" related to "transactional IP work".¹⁸⁵ Based on figures from the American Intellectual Property Law Association's (AIPLA) 2021 Economic Survey, the CRA study estimates these costs at 23,795 Euro per license.

These estimates are likely to severely under-estimate the total cost of SEP licensing negotiations. In particular, a significant part of licensing negotiations is the "technical phase", during which individual patents are assessed. We estimate that in bilateral negotiations, both parties would regularly involve technical experts. According to our estimates in Section 3.2.3.2., Scenario G, the average cost of "Claim chart as to d) with potential objections on novelty, inventive step, and/or added subject-matter" is 7,800 Euro per patent (and per party), for a total expense of more than 15,000 Euro per patent on technical experts alone.

These numbers seem also more compatible with estimates available from the academic literature. Lemley (2000) estimates a 50k USD average cost *per patent* to negotiate a patent license.¹⁸⁶ The relevance of this (dated) estimate to SEP licensing is unclear: on one hand, standard licensing programs are much more prevalent among SEPs than other, non-SEP patents; i.e. a significant share of SEP licenses are concluded with limited expense on bilateral negotiations. On the other hand, bilateral SEP licensing negotiations often involve very large patent portfolios. While large portfolio licenses are indubitably more complex, it is questionable whether the cost of negotiating a license still linearly increases in the number of patents as the number of patents grows very large.

One additional data point is a small survey of SEP licensors conducted by Heiden and Petit (2017). Based on four responses, Heiden and Petit (2017) provide an estimate of the mean cost of negotiating a SEP license. The estimated mean cost (presumably to one party) in the U.S is 0.3M USD (ranging from 0.1 to 0.5M USD); and the estimated mean cost in the EU

¹⁸⁵ Charles River Associates: "SEP licensing for the IoT - A transaction cost perspective". Annex B of Apple's Response to the European Commission's Public Consultation, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13109-Intellectual-property-new-framework-for-standard-essential-patents/F3257505_en pp.17-18

¹⁸⁶ (cited from Merges and Mattioli, 2017).

and China is 0.15M USD (ranging from 0.05 to 0.25M USD in the EU, and from 0.1 to 0.2M USD in China).

While acknowledging significant uncertainty, we tentatively accept the 50kUSD/patent estimate for a portfolio of 20 patents, but much lower marginal costs for any additional patents (as technical discussions of individual patents are unlikely to extend to more than 20 patents). We thus estimate the average negotiation cost (excluding litigation) for a complex bilateral license over 20 SEPs at 1M EUR. For larger portfolios, and for particularly contentious negotiations, the negotiation cost may be even higher, but we are not aware of any reliable quantitative estimates of such costs.¹⁸⁷ The set-up costs of individual licenses to a standard licensing program are likely to be much lower.

In some cases, SEP licensing negotiations may be assisted by third parties, e.g. through mediation or arbitration. Different experts may serve as mediators, and their fees may typically range from 300 to 600 USD per hour. Indicative rates by WIPO suggest that mediation in a small patent dispute (up to 250k USD under dispute) would typically cost a total of 2,750 USD (2,500 USD for the mediator and 250 USD administration fees). A large dispute (more than 10M USD under dispute) would cost 10,000 USD in administration fees, plus the mediator's hourly or daily fees.¹⁸⁸ According to AIPLA surveys, the median costs of mediation (in the U.S.) in patent disputes range from 50k USD (for small disputes with less than 1M USD at risk) to 150k USD (for large disputes with more than 25M USD at risk).¹⁸⁹

Arbitration is more costly. For a small dispute, the minimum cost of WIPO arbitration consists in a 2,000 USD registration fee, 2,000 USD administration fee, and 20,000 USD arbitrator fees.¹⁹⁰ For a large dispute (value under dispute over 13M USD), there is a 2,000 USD registration fee, 40,000 USD administration fee, and arbitrator fees based on indicative hourly rates of 300-600 USD. As for medium value disputes, the arbitration cost is a fixed fee of 40,000 USD, we estimate that the arbitration cost for large disputes is at least 60,000 USD, bringing the total (arbitration, administration and registration fees) to at least 102,000 USD (excluding cost of legal counsel and representation). These estimates are generally consistent with responses to the public consultation, who indicated that arbitration is not necessarily cheaper than litigation, but that case numbers are too low and different cases too heterogeneous to provide a general estimate.

Running costs

After a license has been signed, certain additional costs accrue on an annual basis. While Merges and Mattioli (2017) do not break out licensing administrators' operational costs (e.g. invoicing, auditing, etc.) by license, they provide estimates of each licensee's annual costs. They estimate each licensee's expenses for reporting etc. at 30,000 USD for licensees of Via's MPEG Audio pool, and 40,000 USD for MPEGLA's HEVC pool.

¹⁸⁷ Conservatively, we estimate that the average negotiation cost for licenses for large implementers using large SEP portfolios may fall in a relatively large range between 1 and 10M Euro.

¹⁸⁸ <https://www.wipo.int/amc/en/mediation/fees/index.html>

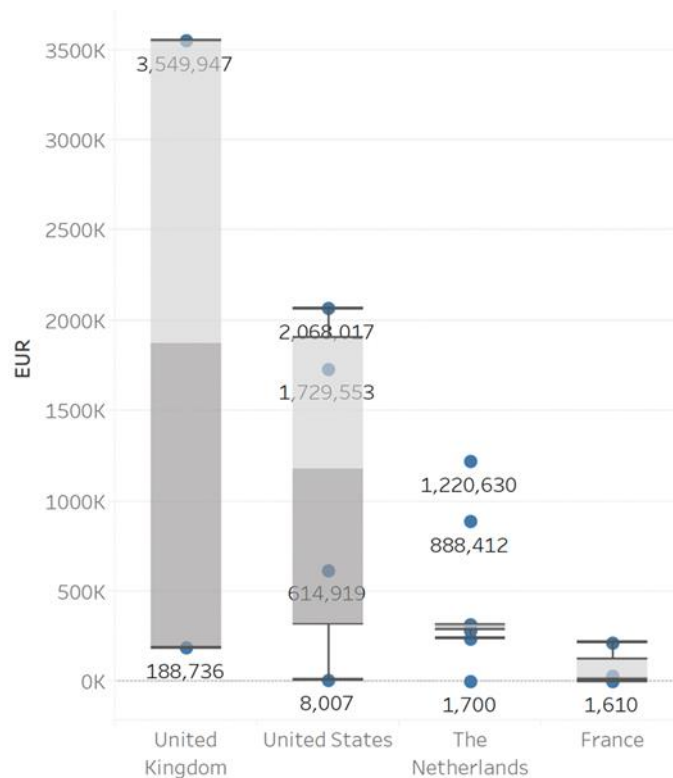
¹⁸⁹ <http://www.ipwatchdog.com/wp-content/uploads/2021/08/AIPLA-Report-of-the-Economic-Survey-Relevant-Excerpts.pdf>

¹⁹⁰ <https://www.wipo.int/amc/en/arbitration/fees/>

6.2.2. *The cost of litigation*

We use information on reimbursed costs in SEP decisions, along with existing evidence on the cost of patent litigation from the literature, to estimate the cost of SEP litigation. While we are not aware of an existing empirical analysis of the cost of SEP litigation, a number of sources provide overviews of different national systems of cost reimbursement (or “fee shifting”) in patent litigation.¹⁹¹ In addition, a number of policy documents, academic publications, and practitioner reports provide estimates of average/median patent litigation costs (in general, not specific to SEPs), which are usually based on surveys and practitioner input. We collect information on reimbursed costs from SEP litigation cases in different jurisdictions (**Figure 25**). In conjunction with the evidence from the literature, and qualitative information on litigation costs and fee shifting in different jurisdictions, we produce tentative estimates of average costs per SEP litigation case.

Figure 25: SEP litigation costs (reimbursed costs), by jurisdiction



6.2.2.1. France

¹⁹¹ https://e-courses.epo.org/wbts_int/litigation/Costs.pdf

In France, the prevailing party is entitled to reimbursement of its legal costs under two different provisions.¹⁹² Article 695 of the Code of Civil Procedure (CCP) provides for reimbursement of certain specifically listed expenses, following standardized fees. These notably include: allowances for witnesses, remuneration of technicians, translation fees etc. Article 700 of the CCP provides for reimbursement of other costs, not included among the expenses under article 695. They mainly consist of lawyers' fees, patent attorney's fees and party experts' fees. Only the non-standardized part of the costs is listed in the decision; nevertheless, based on practitioner input, we believe that reimbursed costs under article 700 are also usually the more important ones.

The court-determined costs under article 700 in SEP litigation cases in France range from 1,500 Euro to 200,000 Euro, with an average of 67,376 Euro.¹⁹³ These are the costs of the prevailing party, to be reimbursed by the losing party. Assuming that both parties face similar costs, this suggests a range of costs of litigation in France between 3,000 to 400,000 Euro, with an average cost of approx. 135,000 Euro (excluding the costs reimbursed under article 695).

Table 12: Reimbursed costs, SEP litigations in France

CASE	COURT	PARTIES' REQUESTS	COURT AWARD
Sisvel v Wiko	Tribunal de commerce de Marseille	Request Sisvel : 15,000 € Request Wiko : 8,000 €	Wiko pays Sisvel 3,000 €
Core Wireless v LG Electronics	Tribunal de Grande Instance de Paris	Request Core : 800,000 € Request LG : 600,000 €	Core pays LG 30,000 €
Conversant v LG Electronics	Cour d'Appel de Paris	Request Conversant: 1,28M € Request LG: 2M €	Conversant pays LG 100,000 €
Ipcom v Lenovo	Tribunal de Grande Instance de Paris	Request ipcom : 250,000 € Request Lenovo, Motorola, Digital River : 150,000 € Request Modelab : 30,000 €	Ipcom pays Motorola et al. 80,000 € IPcom pays Modelabs 15,000 €
Ipcom v Lenovo	Cour d'Appel de Paris	Request Lenovo : 50,000 €	Lenovo pays ipcom 25,000 €

These estimates are subject to a number of qualifications. First, in French proceedings, the involvement of the court is entirely free.¹⁹⁴ The court's expenses, which constitute a part of the total economic cost of patent litigation, are thus borne by the State. Second, not all costs are reimbursed under article 700, as some costs are reimbursed based on standardized fee tables. These costs are not indicated in the decision. Third, the expenses that are eligible for

¹⁹² See Art. 696 CCP – “The losing party is condemned to pay the costs, unless the judge, by a reasoned decision, imposes all or a fraction of them on another party” (Free translation).

¹⁹³ One possible reason for the huge observed variation between different cases in France is that the high-cost cases involved a decision on technical aspects (essentiality and/or validity; example of cases and amounts), whereas the low-cost ones seem to be about purely legal issues with no involvement of technical experts.

¹⁹⁴ See Art. L. 111-2 Code de l'organisation judiciaire (COJ); Veron (2002, p. 400). Cited from Cremers et al. (2017), at 15.

reimbursement under article 700 do not cover certain internal expenses, such as labor cost. Fourth, the judge has considerable discretion in the determination of reimbursement awards under article 700. Article 700 requires the judge to take equity and the economic situation of the losing party into account. These considerations may lead to discrepancies between reimbursed and actual (eligible) costs. Cremers et al. (2017), based on data from Veron (2002), compare estimates of actual costs with estimates of reimbursed costs, and estimate that “in practice the fees are shifted only to a very limited extent.”¹⁹⁵

While we do not have direct evidence on parties’ actual costs, the court decisions indicate the reimbursement amounts *requested* by parties under article 700. Parties asked for reimbursements that were generally about ten times larger than the amounts awarded by courts to the prevailing party.¹⁹⁶ There is no analysis provided of how the court determined the amount of the reimbursement, but the systematic discrepancy between requests and awards indicates that the prevailing party does often not feel that the amount awarded by courts fully compensates their actual expenses.

Similar to other countries, survey evidence is available from the literature, providing an indication of patent litigation costs in general. Mejer and van Pottelsberghe de la Potterie (2012) report an estimated cost range of 50-200k Euro for 1st Instance, and 90-190k Euro for 2nd instance cases. The European Commission in its 2007 Communication reported similar ranges between 50,000€ and 200,000€ at first instance and between 40,000€ and 150,000€ at second instance.¹⁹⁷ At least the Commission estimates apply to the overall cost *for each party*. Furthermore, this is an estimate of litigation costs for a small patent case with an average sum in dispute of around 250k Euro. Overall, these survey estimates indicate that the reimbursed costs under article 700 provide a significant under-estimate of the total patent litigation costs in France. We use 300k EUR per case, including the costs of both parties and courts, as an estimate of the actual average SEP litigation costs in France.

6.2.2.2. Germany

Even though, as a general rule, the prevailing party in German patent litigation is entitled to reimbursement of its legal cost,¹⁹⁸ the reimbursement awarded by courts is generally based on the amount in dispute (*Streitwert*) and a statutory fee schedule, rather than parties’ actual expenses.¹⁹⁹ Certain expenses are exempt from this rule, in particular “fees for necessary

¹⁹⁵ Cremers et al. (2017), at 17

¹⁹⁶ In *Sisvel v Wiko*, the prevailing party requested 15,000, and was awarded 3,000 Euro; in *Core Wireless v LG Electronics* (first instance), the prevailing party requested 600,000 and was awarded 30,000 Euro; in *Conversant v LG Electronics* (second instance), the prevailing party requested 2 million, and was awarded 100,000 Euro; in *ipcom vs Lenovo, Motorola, Digital River, and Modelab*; prevailing defendants collectively requested 180,000, and were awarded 95,000 Euro.

¹⁹⁷ “Enhancing the Patent System”, Communication from the Commission to the European Parliament and the Council, COM(2007) 165 final, at 8

¹⁹⁸ Section 91 *Zivilprozessordnung* (ZPO).

¹⁹⁹ Next to this general rule on recoverable costs, equity arguments may exceptionally play a role in the allocation of costs (under §84(2) and §121(2) PatG). The economic situation of the one party may be taken into consideration (§144(1) PatG), but these occurrences are relatively rare.

expert opinions”.²⁰⁰ Nevertheless, we are not aware of publicly available information on reimbursed costs for expert witnesses in German patent litigation.

Generally, the amount in dispute “is supposed to reflect the plaintiff’s economic interest in the claims asserted with the action”, which bears no necessary relation to parties’ actual efforts or costs.²⁰¹ In practice, the value in dispute is estimated by the plaintiff when filing his statement of claim and the court follows this estimate unless there is some objection from the other party.

Hoppe provides an empirical distribution of values under dispute in German patent litigation, based on a sample of 237 decisions, which can be used to calculate the distribution and average of litigation costs.²⁰² For comparison, we collected information on amounts in dispute for 27 SEP litigation cases in German courts.²⁰³ Of the three relevant district courts (Duesseldorf, Mannheim, Munich), only the Duesseldorf decisions provide systematic information on values under dispute (for 24 cases).

We can thus compare the distribution of amounts in dispute between SEP and non-SEP litigation cases in Germany (**Figure 26**). There are very few low value cases (below 0.5k) for SEPs, which represent a large share of patent litigation cases in general. Based on this small sample of 27 cases, the average value in dispute in SEP litigation is 3.88M Euro, which is slightly larger than in Hoppe’s sample of patent litigation cases in Germany in general (3.28M Euro).

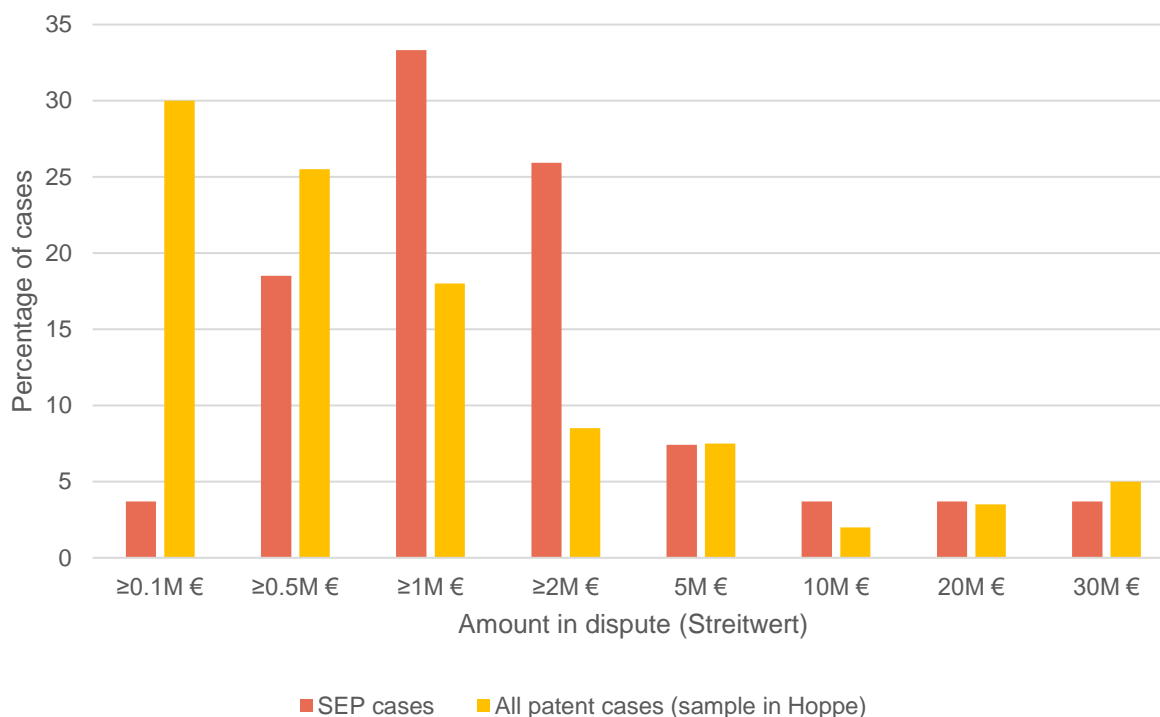
Figure 26: Amounts in dispute, SEP litigation and general patent litigation in Germany

²⁰⁰ Hoppe, “Patent Litigation in Germany – A Quick Guide to German Patent Litigation in 19 Chapters”. <https://preubohlig.de/wp-content/uploads/2019/07/PatentLitigationHoppe.pdf>, at 29

²⁰¹ Hoppe, supra note [], at 24.

²⁰² Hoppe, supra note 1, at 24

²⁰³ We used the cases listed on the SEP Case Law website of the 4ip Council (<https://caselaw.4ipcouncil.com/>), as well as the compilation by German law firm KatherAugenstein (<https://www.katheraugenstein.com/en/frand/>) to identify case numbers, and then searched the courts’ databases for the full text of the decision.



Two components of litigation costs to be borne by the losing party are based on the amount in dispute: lawyers' fees²⁰⁴ (the amount to be reimbursed by the losing to the prevailing party), and court fees.²⁰⁵ Hoppe provides a table with court and lawyers' fees as a function of amount in dispute.²⁰⁶

Table 13: Litigation costs as a function of amounts in dispute, different hypotheses

Amount in dispute	Reimbursed fees (based on Hoppe)		Total cost if lawyers' fees equal...	
	Court fees	Lawyers' fees	reimbursed fees	100,000 each
500,000	10,608	20,000	50,608	210,608
1,000,000	16,008	30,000	76,008	216,008
2,000,000	26,808	50,000	126,808	226,808
5,000,000	59,208	100,000	259,208	259,208
10,000,000	113,208	170,000	453,208	313,208
20,000,000	221,208	320,000	861,208	421,208
30,000,000	329,208	480,000	1,289,208	529,208

²⁰⁴ Section 91(2) ZPO. The specific recoverable amounts are subject to the Law on the Remuneration of Attorneys (RVG).

²⁰⁵ Section 3 Gerichtskostengesetz

²⁰⁶ Hoppe, supra note 1, at 26, Table 1.

While the court fees to be borne by the losing party may generally be a relatively accurate representation of the court’s actual expenses, reimbursed lawyer fees are often only a part of parties’ actually incurred expenses. Hoppe estimates that lawyers’ fees are largely independent of the amount in dispute, and amount to approximately EUR 100,000 (per party),²⁰⁷ which is on the high end of the range of estimates in the existing literature. Cremers et al. (2017) e.g. cite different sources in support of an average cost in the range between 40,000 and 100,000 Euro per party. It also seems unrealistic that actual litigation costs are completely independent of values in dispute. The European Commission in its 2007 communication “Enhancing the patent system in Europe”, provides estimates of patent litigation costs in EU Member States. Focusing on cases with a small amount in dispute (250k Euro), the Commission estimated first instance litigation costs in Germany to be 50k Euro per party – above the 20k Euro of reimbursed costs for that amount in dispute, but below the 100k estimate of Hoppe.²⁰⁸

We thus calculate SEP litigation costs using two different assumptions. In one assumption, the actual court and lawyer costs are proportional to reimbursed costs. We calculate total litigation cost as court fees plus lawyers’ fees multiplied by two.²⁰⁹ In another assumption, court costs are proportional to reimbursed court costs, whereas lawyer costs are always 100,000 Euro per party. Under both assumptions, average SEP litigation costs are slightly larger than average patent litigation costs in general, reflecting the (moderately) larger values under dispute in SEP litigation:

Table 14: Average total cost of patent/SEP litigation in Germany (different hypotheses)

	Total cost (reimbursed fees)	Total cost (constant lawyer fees)
All patent cases	187,060	244,451.3
SEP cases	213,425.9	250,041.2

If parties’ actual expenses are proportional to reimbursed fees, the total cost of a patent litigation is 187k Euro per dispute in Hoppe’s sample, and 244k Euro among the 27 SEP litigation cases. Under the assumption that lawyers’ fees are independent of values in dispute, and amount to 100k Euro per party, the estimated average total cost of a patent litigation in Germany is 244k Euro for patent litigation in general, and 250k Euro per SEP litigation.²¹⁰ We use the middle of the range for SEP cases (approx. 230k Euro) as an estimate.

²⁰⁷ Hoppe, supra note 1, at 26

²⁰⁸ “Enhancing the Patent System”, Communication from the Commission to the European Parliament and the Council, COM(2007) 165 final, at 8

²⁰⁹ We thus deviate from Hoppe’s calculated “Total cost risk”, which is the sum of court fees and one party’s lawyers’ fees (i.e. the amount to be reimbursed by the losing party)

²¹⁰ All estimates, based on different assumptions, also fall within (the upper part of) the 50k-250k range of patent litigation costs in 1st instance cases in Germany provided by Mejer and van Pottelsberghe de la Potterie (2012).

According to Hoppe,²¹¹ reimbursed costs at the Federal Patent Court also depend on the amount in dispute. For the same amount in dispute, reimbursed costs at the Federal Patent Court are slightly lower than in other types of patent litigation. Hoppe claims that these reimbursed amounts “include a certain safety margin and can normally be used as an upper limit”. We thus assess that costs at the Federal Patent Court are somewhat lower than other German courts, and assess a total cost of 200,000 Euro per case.

6.2.2.3. United Kingdom

Under the English rule on costs (Civil Procedural Rule 36, CPR 44, CPR 45), the losing party must reimburse the successful party a significant proportion of its costs. Contrary to other jurisdictions, UK courts determine this portion of recoverable costs on an issue-by-issue basis.²¹² The costs are therefore apportioned between the parties depending on the issues on which each party has been successful.

Additionally, the recoverability of costs depends on the court which deals with patent litigation. The Intellectual Property Enterprise Court (IPEC) deals with low-value claims and has a fixed costs system with a £50.000 costs cap for substantive action and a £25.000 cap for inquiry as to damages or an account of profits. The Patents Court is not limited by this cap of recoverable costs and has wide discretion on the issue of costs.²¹³

We have found two decisions on cost reimbursements for SEP litigations in the UK; at approx. 188k and 3.55M Euro, respectively. While much higher than our estimates of average SEP litigation costs in the EU, these costs are in line with average patent litigation costs in the UK. McDonagh and Helmers (2014) find that the average cost of a full trial at the Patent High Court, encompassing the costs of both sides, falls between 1M and 6M GBP.

Nevertheless, unusually large expenses appear to be associated with the determination of a FRAND rate by a court (something that so far no court in the EU has done). In *TQ Delta v Zyxel*, the court estimated that the FRAND portion of the trial alone would have cost 4 million GBP (which the court seemed to think was unreasonably expensive even for UK standards). In the UK High Court decision in *Unwired Planet v Huawei* (the first determination of a FRAND rate by a UK court), the court noted the “enormous sums spent in costs by the parties in these proceedings” (suggesting once again that the FRAND trial was extraordinarily expensive even for UK standards).

6.2.2.4. United States

In the U.S., as a general rule, each party bears its own legal costs. 35 U.S.C. § 285 however allows for a narrow exception in “exceptional cases”, essentially covering three instances: Vexatious conduct, litigation brought in subjective bad faith or objectively baseless suits.

²¹¹ Hoppe, *supra*, at 31

²¹² For patent litigation in general, there is a detailed analysis in Patent Litigation in England and Wales and the Issue-Based Approach to Costs by Luke McDonagh, Christian Helmers :: SSRN

²¹³ https://e-courses.epo.org/wbts_int/litigation/Costs.pdf

According to academic research on fee shifting in patent litigation in the US, such cases are very rare.²¹⁴²¹⁵

We have identified four SEP litigations in the US, in which the court has awarded attorney costs to the prevailing party. The average award value was 1,1 Million Euro, and awards spanned a wide range from approx. 8,000 to 2 Million Euro. Given the rarity of attorney cost awards in US patent litigation, these numbers cannot readily be extrapolated to the entire population of litigations. The exceptional circumstances of these cases warranting fee shifting may plausibly also have had an effect on the magnitude of litigation costs – it is thus unclear whether attorney fee awards under 35 U.S.C. § 285 are indicative of general US SEP litigation costs.

Patent litigation costs in the United States more generally are nevertheless relatively well-documented. The American Intellectual Property Law Association (AIPLA) e.g. publishes detailed survey reports on litigation costs for different types of litigation, different ranges of values at risk, and different stages of litigation. We used a publicly available excerpt aggregating the results of four bi-annual economic surveys (2013 to 2019, inclusive).²¹⁶

The reported figures are median estimated “total costs”, including outside counsel, exhibit preparation, expert witnesses, and other expenses. All reported costs represent the costs of each party. Costs increase significantly in the value at risk – median costs for a patent infringement litigation inclusive of pre and post-trial, and appeal when applicable, ranges from 700,000 USD for small (less than 1 million USD at risk) to 4 million USD for large (more than 25 million USD at risk) litigation cases.²¹⁷

It is important to note, however, that only a small share of patent infringement litigations in the US proceed to trial. Analyzing a comprehensive dataset of assertions of declared SEPs, Lemley and Simcoe (2018) find that 75.9% of the cases in their sample settled, and 16.1% were resolved on procedural ground. Thus, only 8% of the cases went to merits judgment.²¹⁸

Litigations that settle before merits judgment usually produce significantly lower costs. According to AIPLA survey data, the median cost of “initial case management” ranges from 50,000 USD for small, to 250,000 USD for large patent infringement litigations. Litigation costs increase significantly once litigation reaches the stages of discovery, motions, and claim construction (median cost of 250,000 USD for small, to 2.375 million USD for large patent infringement litigations).

Detailed information on the empirical distribution of SEP litigation cases (both by value at risk and stage of the dispute reached) would thus be necessary to infer an average cost per litigation from the AIPLA survey data. Instead, we rely on a similarly structured survey of

²¹⁴ Lian and Berliner, “Fee Shifting in Patent Litigation”, 2013, at 65

²¹⁵ Nevertheless, two recent Supreme Court decisions have changed the standard for “exceptional cases” in which fees may be reimbursed. (*Octane Fitness, LLC v. ICON Health and Fitness, Inc.* 572 U.S. (2014) and *Highmark Inc. v. Allcare Health Management Systems, Inc.* 572 U.S. (2014)). An exceptional case will be one that stands out from others with respect to the substantive strength of a party’s litigation position (considering both the governing law and the facts of the case) or the unreasonable manner in which the case was litigated. According to a 2016 study, an increasing trend of US courts ordering the loser at trial to pay for certain fees paid by the winner has been witnessed.

²¹⁶ <https://www.ipwatchdog.com/wp-content/uploads/2021/08/AIPLA-Report-of-the-Economic-Survey-Relevant-Excerpts.pdf>

²¹⁷ Median litigation costs; “Patent infringement, all varieties”; AIPLA Report, supra note 2, at 50

²¹⁸ Lemley and Simcoe (2018), at 623. Only a subset of cases going to merit judgments go to trial. In the RPX sample, 66 cases proceeded to summary judgment order, but only 17 cases to trial.

estimated patent infringement litigation costs conducted and published by RPX in 2015.²¹⁹ The RPX survey exclusively focuses on the cost of patent infringement litigation for defendants in litigations brought by an NPE. Nevertheless, this focus does not significantly restrict the applicability of their estimates: first, Lemley and Simcoe (2018) find that 71% of the SEP infringement litigation cases in the US in their sample were brought by NPEs. Second, according to the AIPLA Economic Survey Reports, litigation costs for defendants in cases brought by NPEs do not differ significantly from litigation costs in comparable patent infringement litigation cases in general.²²⁰

We only retain reported legal costs from the RPX survey data.²²¹ RPX reports estimated *average* costs, whereas AIPLA reports *median* cost estimates. Given their skewed distribution of patent infringement litigation costs, the average is probably significantly higher than the median. Against that background, the figures reported by RPX appear generally compatible with the figures reported in the AIPLA economic survey; e.g. RPX reports an *average* estimated legal cost of patent infringement litigation cases proceeding to trial of 5.048 million USD (compared to the *median* legal cost of 0.7 to 4 million USD reported by AIPLA).

The average litigation cost for the 955 cases in the RPX sample is 951,000 USD. These survey estimates for US patent litigation costs in general may not be applicable to SEP litigations. Lemley and Simcoe (2018) note that “SEP cases were significantly more complex than non-SEP cases, generating over one-third more docket entries than non-SEP cases (a mean of 230 entries for non-SEPs and 308 for SEPs).” While this finding may indicate that the average cost of SEP litigation is higher than the average cost of patent litigation more generally, it does not suggest orders-of-magnitude differences between SEP and non-SEP litigation costs. The average patent litigation cost estimate from the RPX data is also reasonably close to the average attorney cost awards in the four SEP litigation cases for which we have such data.

These are legal costs borne by the defendants, exclusively. Following our general hypothesis of an approximate symmetry in legal costs borne by both parties, we would thus estimate an average total litigation cost of approx. 2 million USD per patent infringement litigation in the US. This average cost disguises significant underlying heterogeneity – according to AIPLA data, for any level of litigation reached, the cost per party of litigation with more than 25M USD at risk is about five times larger than the cost per party of a litigation with less than 1M USD at risk.

For comparison with the European data (based on court decisions on costs), it is important to note that this estimated average cost includes a very large share of cases that settled or were dropped before merits judgment. Our data on reimbursed costs in Europe, by contrast, are exclusively based on cases that reached a judgment. According to RPX data on US cases reaching summary judgment order, the average total legal cost of patent infringement cases in the US that reach a merits judgment is approx. 6.5 million USD.²²² Nevertheless, the share of litigations reaching a judgment is very small in the US, and likely to be much larger in Europe.

²¹⁹ <https://www.rpxcorp.com/wp-content/uploads/sites/2/2015/05/Final-NPE-Litigation-Costs-by-Key-Events1.pdf>

²²⁰ “PATENT INFRINGEMENT, DEFENDING CLAIMS OF PATENT INFRINGEMENT BY NON-PRACTICING ENTITY”, AIPLA Report, *supra* note 2, at 51

²²¹ Contrary to our definition of litigation costs, RPX includes settlement amounts in the litigation costs.

²²² Multiplying the RPX estimate of per-party litigation costs by two for an estimate of the total litigation cost.

6.2.2.5. China

We have less solid empirical basis for an estimate of typical patent litigation costs in China. Various online sources support a cost estimate in the range from about RMB 300,000 to RMB 1,000,000 (43,435 EUR to 144,784 EUR), including attorney fee and other costs for the litigation.²²³ Another source estimates the typical cost of attorney's fees to range from 50,000 to 300,000 USD, in addition to potential third party costs, which may include expert fees, investigator fees and demonstrative company fees, among others, which could range from 30,000 to 150,000 USD.²²⁴

In principle, the plaintiff can recover its patent litigation costs from the losing defendant if the costs can be proven and are reasonable.²²⁵ Empirically, mean cost awards by courts appear to be much lower than actual average costs – cost award averages by different regional jurisdiction range from 0 to 16,200 RMB (0 to 2,316 EUR).²²⁶ Zhang and Cao (2020) find average cost awards to range from 999 Euro (average for litigations with domestic right-holders) to 1,773.30 Euro (average for litigations with foreign rights-holders).²²⁷

We have no data on patent litigation costs that are specific to SEP cases. As we have not seen dramatic cost differences between SEP and non-SEP cases in other jurisdictions, we use an estimate of 250,000 EUR total cost per SEP litigation in China, which is comfortably within the ranges of the different quantitative estimates.²²⁸

6.2.2.6. Rest of the World

In addition to the aforementioned countries, a larger number of SEP litigations have been observed in Japan, the Netherlands, and Italy. According to various estimates, typical patent litigation costs in Japan are somewhat higher than in the EU, but lower than in the UK or U.S.²²⁹ We use 600k EUR as estimate of average total litigation costs per case in Japan. Costs in the Netherlands are similar to other EU Member States; according to one estimate, costs

²²³ <https://www.legal500.com/guides/chapter/china-patent-litigation/#:~:text=Typically%2C%20the%20cost%20incurred%20by,RMB%20300%2C000%20to%20RMB%20800%2C000;http://www.copperpodip.com/post/how-much-does-patent-litigation-cost>

²²⁴ <https://www.iam-media.com/global-guide/global-patent-litigation/202/article/patent-litigation-china>

²²⁵ <https://www.iam-media.com/global-guide/global-patent-litigation/202/article/patent-litigation-china>

²²⁶ Brian Love, Christian Helmers, Markus Eberhardt, Patent Litigation in China: Protecting Rights or the Local Economy?, 18 Vanderbilt J. Ent. & Tech. L. 2016 <https://scholarship.law.vanderbilt.edu/cgi/viewcontent.cgi?article=1156&context=jetlaw>

²²⁷ Zhang and Cao (2020): How Fair is Patent Litigation in China? Evidence from the Beijing Courts, China Quarterly, Vol. 241 (March 2020). <https://www.cambridge.org/core/services/aop-cambridge-core/content/view/903913756B46AA075F610C428834C6B5/S0305741019000754a.pdf/how-fair-is-patent-litigation-in-china-evidence-from-the-beijing-courts.pdf>

²²⁸ The most common estimate of RMB 300,000 to RMB 1,000,000 is consistent with a total cost per litigation of 86,870 to 289,568 EUR. The other source's estimates yield a much wider range from to 100,800 EUR (50,000 USD attorney's fees per party) to 907,110 EUR (450,000 USD attorney's fees plus external costs per party).

²²⁹ A WIPO estimate e.g. indicates an average cost per party of 300k USD for first instance, and 100k USD for appeal, as compared to 50k/70k USD in Germany, and up to 4M USD in the U.S. https://www.wipo.int/export/sites/www/wipo_magazine/en/pdf/2010/wipo_pub_121_2010_01.pdf Another estimate places the typical cost of patent litigation in Japan at 550k to 850k USD (compared to 2 to 4M USD in the U.S., and 60k to 250k USD in the EU).

will generally range from 80k to 500k Euro.²³⁰ We use 300k Euro as an estimate of average total cost per case. For Italy, we use 150k Euro average total cost per case, which is within a range of average costs per case estimated by WIPO.²³¹

For other EU countries, we use 250k EUR per case, and for the Rest of the World (including small numbers of cases in Korea, Australia, South America..), we use 500k EUR per case. Given the small number of cases per country in the Rest of the World, these rough estimates have little impact on our overall assessments.

6.2.2.7. Post-grant review

EPO opposition

The cost of EPO opposition involves an opposition filing fee of 840 Euro,²³² as well as attorney's costs. One law firm estimates the cost of preparing and filing the substantive Notice of Opposition at 3,000 – 15,000 GBP (3,500 to 17,500 EUR), and the costs for the opposition procedure and preparing for and taking oral proceedings at 5,000 – 40,000GBP (about 5,800 to 46,600 EUR).²³³ Academic studies estimate post-grant review costs in Europe to range between 7,500 and 45,000 euros (without specifying whether this is cost per party or total cost).²³⁴

We assess a total average cost of opposition (cost to both parties) of 50,000 Euros.

US Inter partes review

Similar to litigation, the cost of Inter Partes Proceedings in the U.S. also depends on the stage of the proceedings that was reached. According to AIPLA survey estimates, and focusing on subject matter in “Electrical/Computer”, the average cost of proceedings through initial filing petition is 105k USD, 275k USD through end of motion practice, 325k USD through PTAB hearing, and 450k USD through appeal.²³⁵ All costs are the cost to one party. We use 250k USD per party as an estimate of the average total cost per proceeding.

²³⁰ <https://www.legal500.com/guides/chapter/the-netherlands-patent-litigation/#:~:text=Costs%20for%20patent%20litigation%20in,between%2015.000%20and%20200.000%20euro.>

²³¹ https://www.wipo.int/export/sites/www/wipo_magazine/en/pdf/2010/wipo_pub_121_2010_01.pdf

²³² <https://my.epoline.org/epoline-portal/classic/epoline.Scheduleoffees?language=en>

²³³ <https://www.mewburn.com/law-practice-library/oppositions>

²³⁴ Nagler and Sorg, The disciplinary effect of post-grant review – Causal evidence from European patent opposition, Research Policy 49 (2020) citing MacDougall and Hamer, 2009

²³⁵ <http://www.ipwatchdog.com/wp-content/uploads/2021/08/AIPLA-Report-of-the-Economic-Survey-Relevant-Excerpts.pdf> , at 52

6.2.2.8. The global annual cost of SEP litigation

Using our litigation cost estimates and counts of SEP litigations per country and category from Darts-ip, we summarize global SEP litigation costs in the period 2009-2018 as follows (Table 15):

Table 15: Total worldwide SEP litigation costs per year

	Number of cases 2009-2018	Avge number cases per year	average cost per case	Total cost per year
EU				
EPO oppositions	214	21.4	50,000	1,070,000
Germany				
First/second instance	185	18.5	230,000	4,255,000
Bundespatentgericht	250	25	200,000	5,000,000
Other EU countries				
France	23	2.3	300,000	690,000
Italy	3	0.3	150,000	45,000
Netherlands	10	1	300,000	300,000
EU (others)	12	1.2	250,000	300,000
Subtotal EU				11,660,000
UK	10	1	3,000,000	3,000,000
USA				
Litigation	635	63.5	2,000,000	127,000,000
IPR/PTAB	220	22	500,000	11,000,000
RoW				
China	303	30.3	250,000	7,575,000
Japan	11	1.1	600,000	660,000
Others	60	6	500,000	3,000,000
Subtotal RoW				152,235,000

Total litigation costs World			163,895,000
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We thus estimate that global SEP litigation produces total costs (incl. attorney and court costs, but excluding more indirect costs such as managerial attention, business uncertainty, etc.) of approx. 164M Euro per year. While significant, the worldwide expense on SEP litigation accounts for approx. 1% of worldwide annual royalty proceeds in the mobile telecommunications industry. Of course, the ratio of litigation costs over royalty proceeds is much larger for the small subset of SEP licenses subject to litigation.

6.2.3. *Total costs per license*

The economic relevance of SEP licensing costs is not directly a function of the total worldwide costs actually arising in the course of SEP licensing negotiations and disputes, but the (potential) costs per license, which determine parties’ behavior in SEP licensing negotiations. We lack direct evidence for many important aspects of these (potential) costs, but we can offer some observations based on approximate estimates, for each of the three segments of SEP licensing identified in Section 5.1.2.

6.2.3.1. *SEP licensing by major net licensors*

SEP licensing by major net licensors is characterized by large average license values. The average yearly royalty value per license in our sample of three major net licensors is approx. 15M Euro.²³⁶ For a 6-year license with a 10% yearly discount rate, this constitutes a net present value of a license of 78M Euro. Licensing contracts in this segment frequently include cross-licensing provisions, so that the royalty proceeds only represent a fraction of the actual value of the license. Conservatively, we estimate that the average NPV of a license in this segment is 100M Euro. On average, the licensors in this segment have 200 licensees. Not each of these licensees is licensed to the same set of technologies, or in the same industry. The fixed costs that licensors incur with respect to the licensing of certain SEPs in a certain industry need to be distributed over the licenses in that industry for those SEPs. We estimate that there are approx. 100 licenses per such “program” on average (with many licensees being licensed under multiple programs).

The likelihood of these licenses to result from litigation is low. In our sample, we estimate that – on average – a bit less than 5% of the licenses in this segment result from litigation. Those litigations however tend to be very complex, with an average 7.9 litigations (unique docket numbers) per dispute. Each of these individual unique litigations is also more costly than the average SEP litigation, because (1) litigation costs increase in the amount in dispute, and (2) high value licenses are more likely to be litigated in high cost jurisdictions (such as the U.S. and UK). Overall, we estimate about 10M Euro as an average estimate of litigation

²³⁶ Throughout this section, and given the current near-parity between currencies, we use USD and EUR estimates interchangeably.

costs per dispute in this segment of SEP licensing. As approx. 5% of the licenses are subject to litigation, the litigation cost per license is 500k Euro.

Negotiation costs are particularly large in this segment. Based on section 5.2.1.3., we assess an average negotiation cost of 1 to 10M Euro per license in this segment. Other marginal costs per license, such as audit and annual reporting costs, are less significant (we assess more than 100k Euro per license for an audit, and 30k-40k EUR per year annual reporting, i.e. an NPV of 155 to 200k Euro for reporting costs per license).

The licensors' and licensees' fixed costs are relatively significant, including the cost of assessing potential SEPs, a set-up cost, and the NPV of annual operation costs. Total costs for the assessment of the licensor's own SEP portfolio may reach 3M Euro. Our only estimates of other set-up costs and annual operational costs are based on the non-pool-specific part of pool licensing administrators' costs. It seems plausible that the fixed costs of major net licensors are at least at the higher end of this range, for a total fixed cost of more than 10M Euro per program. Nevertheless, as these fixed costs are distributed over approx. 100 licenses, the fixed cost per license is only about 100k-150k Euro.

Licensees in this segment are generally large multinational corporations (MNC), who take licenses from many patent holders, and who have incentives to make significant fixed investments assisting them in each of these bilateral negotiations, including freedom-to-operate assessments (patent landscaping, assessment of the size and quality of different portfolios, etc.). Many large companies report costs of more than 500k Euro related to these activities. If we allocate a large share of these fixed costs to these licensees' interactions with large licensors (and another large share to their interaction with PAEs); and divide fixed costs by the 5-10 licenses that large licensees would need to take from major net licensors, the cost per license is much smaller (for the sake of argument, we estimate 50k EUR per license).

Overall, we assess an average cost per license in this segment of 2M-11M Euro. The largest part of this cost, and the major reason for the size of the range, is the initial negotiation cost, for which we lack tangible estimates, but which are assessed to be significant for bilateral negotiations between large licensors and large licensees. Litigation costs, which are easier to estimate, play a much less significant role. Overall, the average cost of SEP licensing per license is definitely much lower than the average value per license. This means that SEP licensing costs are unlikely to result in under-licensing in this segment, or to fundamentally alter the calculus of major patent holders whether to contribute to standards development, or the calculus of major implementers whether to use a standard. In other words, while SEP licensing in this segment produces significant, and salient, costs, these costs are unlikely to produce major economic inefficiencies.

6.2.3.2. SEP licensing by PAEs

Licensing by PAEs often involves much lower per-unit values. We estimate the average yearly royalty value of a PAE SEP license at 300k Euro; with no cross-licensing component and six years duration, this represents an NPV of less than 1.5M Euro.

The litigiousness in this segment is very high; we estimate that there are approx. 0.9 disputes per license. On one hand, these disputes disproportionately take place in high cost jurisdictions (PAE litigation represent a larger share of SEP litigation in the US than in the EU or China). On the other hand, the average complexity of these disputes is low (with only

2.29 litigations, or unique docket numbers, per dispute). Overall, we estimate a total cost of 1M Euro per dispute. Given the high litigiousness rate, this translates to a litigation cost per license of 900k Euro.

Negotiation costs per license are difficult to estimate. In general, portfolios in this segment are small (<10). In keeping with the general assumption of 50k EUR negotiation cost per patent, we estimate that negotiation costs are less than 500k Euro per license, plus audit and reporting costs. For licensors' fixed costs, we use the estimates based on the non-pool-specific set-up and annual operation costs of pool licensing programs. Given the small portfolio size, we focus on the lower end of the range, for a fixed cost of approx. 3M Euro distributed over up to a hundred licenses per program. Even a full claim chart for every potential SEP does not constitute a significant fixed cost per program (<50k Euro).

Licensees in this segment are large and medium-size companies. Large firms incur larger fixed costs related to freedom-to-operate assessments, but are also able to distribute these fixed costs over a larger number of licenses. While medium size companies can only use the information produced in a small number of negotiations, these negotiations disproportionately often involve PAEs. As these negotiations are particularly contentious (as evidenced by the high litigiousness), we estimate that both large and medium size companies incur a cost per license of 50k Euro.

In total, we estimate a total cost per license of approx. 1.75M Euro per license, with the largest part related to disputes, followed by negotiation costs. If these costs are approximately equally shared between licensor and licensee, PAEs spend more than half of their royalty revenue on licensing costs (leaving less than half for the acquisition of patent rights and PAEs' net profits).

Overall, the ratio of licensing costs over royalty revenue is low in this segment. A very large share of the average cost per license consists in marginal costs (which accrue for every individual license). This means that there are many (potential) licenses in this segment that are unprofitable for licensors, leading to unsystematic or inconsistent licensing and enforcement. It also means that for many (potential) licensors and licensees, the cost of vigorously defending a particular negotiation position is too large compared to the potential cost savings, e.g. from obtaining a better rate. Therefore, if licenses are concluded in this segment, they may frequently be concluded on rates that are unreasonably high or unreasonably low.

6.2.3.3. SEP licensing through pools

The third segment of SEP licensing we analyzed is SEP licensing through "traditional" pools (excluding more recent pools, incl. Avanci).²³⁷ Licensing through the pools in our sample produces very different costs. Disputes (litigations) are rare, with less than 0.05 disputes per license. When disputes arise, they are of low complexity (close to one litigation per dispute), and litigations more commonly take place in lower cost jurisdictions (e.g. Germany). We estimate a cost per dispute of 500k EUR, for a total litigation cost per license of less than

²³⁷ This analysis is based on a sample of pools primarily in the audio-visual coding area; results should not be extrapolated to other pools in different industries. While Avanci shares many of the institutional features of the pools in our sample, the per unit value of licenses is larger than is typical of the pools in our sample, and the observable behavior in SEP licensing negotiations (in particular litigiousness, type and complexity of disputes, etc.) is more similar to what we observed for SEP licensing by major net licensors (who participate in Avanci).

25k EUR. Negotiation costs are small.²³⁸ Costs for audit and reporting are similar to other licensing forms, for a total cost of approx. 250k EUR per license.

There are significant set-up and operation costs for the pool, for a total of 7.5M to 17.1M EUR (see Merges and Mattioli, 2017). The number of licensees per pool thus has a large impact on the average cost per license. This number varies significantly between pools, with an observable range spanning approximately from 50 to 2,000. These ranges are consistent with licensor fixed costs per license ranging from 4k to 340k EUR. Licensee fixed costs are negligible – many licensees of pools are small companies, who do not generally incur large expenses related to the study of the SEP landscape. While also large companies may take a pool license, these companies carry out such analyses primarily to support their negotiations with individual licensors and PAEs, not to study pool licensing offers.

Overall, we estimate an average cost per license in this segment to range from 300k to 600k Euro. The marginal cost per license is below 300k EUR, primarily consisting in operational costs (auditing, reporting,...). This low marginal cost means that pools can profitably offer low-value licenses. Combined with the fact that pool licenses often cover large numbers of (potential) SEPs, this means that pool licenses can profitably be offered to small implementers, even if their value creation from using a standardized technology only supports a total economic licensing cost (aggregate royalty plus costs) of less than 100k EUR per year. To sustain the significant fixed set-up and operational costs of the pool, pools require a certain number of licensees, or at least some larger licensees.

6.2.3.4. Overview

Overall, we estimate that licensing in the three segments of SEP licensing that we analyzed generates significant costs. The major cost factor differs by segment – in the case of bilateral SEP licensing between large SEP owners and major implementers, marginal negotiation costs are the largest cost, and the main source of uncertainty in our assessment of costs. In the case of PAEs, the dispute cost (i.e. the cost of litigation, multiplied by the relative litigiousness of SEP licensing) is the largest cost factors. In the case of pools, purely transactional costs, such as auditing and reporting costs, are the largest contributor to total costs.

In total, we estimate that SEP licensing in the three segments generates approx. 800M-1.5bn EUR in costs per year, worldwide. While significant, in absolute terms, this is less than 10% of the total annual royalty payments related to these licenses. The ratio between licensing costs and royalty payments is particularly unfavorable in the case of PAE licensing.

²³⁸ In this sample, many licensees take the pool license “as is”, and only a smaller number of large implementers negotiations side letters with incremental adjustments. Once again, practices are likely to differ in pools in other industry segments, in particular Avanci.

Table 16: Average licensing costs, by segment of SEP licensing

	Major net licensors	PAEs	"Traditional" Pools
# SEP Licenses per year (Total)	100-150	low hundreds	1,000-2,000
# SEP Licenses per program	100	<100	250
Licensees (types)	Large firms	Large and medium-size firms	Large, medium-size and smaller firms
Average yearly royalty value (royalty revenue per license)	15M EUR	300k EUR	low
Non-royalty value per license (e.g. cross-licensing)	substantial	none	none
Duration of license	6 years	6 years	6 years
Estimated NPV per license	100M EUR	1.5M EUR	?
relative litigiousness (#Disputes/#Licenses)	<0.05	0.9	< 0.05
Complexity of disputes (#Litigations/#Disputes)	7.9	2.29	1.03
Estimated cost per dispute (total expense - both parties)	10M EUR	1M EUR	500k EUR
Dispute cost per license (Cost per dispute * litigiousness)	500k EUR	900k EUR	<25k EUR
Marginal costs per license			
Negotiation cost	>1M EUR	<500k EUR	small
Audit	>100k EUR	>100k EUR?	>100k EUR?
Annual reporting cost	30k-40k EUR	30k-40k EUR	30k-40k EUR
NPV reporting costs	150k-200k EUR	150k-200k EUR	150k-200k EUR
Total marginal costs	>1.25M-1.3M EUR	<>750k-800k EUR	<>300k EUR

Licensors fixed costs			
Set-up costs	385k-1.5M EUR	385k-1.5M EUR	4.8M-7.8M EUR
SEP evaluation	500k-3M	<50k EUR	included
Annual operation cost	<585k-2M EUR	<585k-2M EUR	585k-2M EUR
NPV annual operation cost	<2.7-9.3M EUR	<[2.7-9.3M EUR]	2.7-9.3M EUR
Total licensors fixed costs	<3.585M-13.8M EUR	<3.1M-10.8M EUR	17.1M EUR
Fixed cost per license	<35.9k-138k EUR	<>31k-108k EUR	68.4k EUR
Licensee fixed cost			
FTO assessment cost	>500k EUR	50k-500k EUR	<10k EUR
Fixed cost per license (fixed cost per program/#licenses per program)	50k EUR	50k EUR	<2k EUR
Total cost per license	>2M EUR	<>1.75M EUR ²³⁹	<>400k EUR
Total costs per year	200M-300M EUR	<>200M-400M EUR	400M-800M EUR
Total NPV licenses (royalties only)	10-15bn EUR	<>150-300M EUR	?

6.3. SEP Licensing delays

In addition to significant licensing costs, SEP licensing may be subject to substantial delays. A licensing delay is the difference between the adoption date of the standard by the implementer and the effective licensing date. Therefore, measurement of licensing delays requires information on effective licensing dates and actual adoption dates (Section 6.3.1.). Licensing delays correspond to periods of unlicensed use of the patented technology. In many cases, goods produced and sold during that unlicensed period may be retroactively licensed, and corresponding royalties paid, when a license is subsequently signed.

²³⁹ The total cost per license can be larger than the average NPV per license, because the total cost is borne by both licensors and licensees. Assuming that dispute, negotiation, and auditing costs are equally shared, but that licensees bear the cost of reporting; in the case of PAEs, licensees incur approx. 950k-1M EUR costs, for a total economic cost of 2.45M-2.5M EUR per license. Licensors bear 850 EUR in costs, for a net value of 650k EUR per license. This is consistent with estimates in the literature (Bessen and Meurer, 2008) that PAEs only redistribute a fraction of the economic cost generated by PAE patent assertion to inventors.

Licensing delays typically consist in various periods. In the case of bilaterally negotiated licenses, there often is a period of unlicensed use prior to negotiations, followed by the duration of bilateral negotiations (period from first contact to conclusion of a licensing agreement) (Section 6.3.2.). The duration of licensing negotiations is usually unobservable, but litigation offers a window into this aspect of SEP licensing.

In the case of licensing through standard licensing programs (in particular pools), there is a delay in creating the licensing program (duration from first implementation of the standard to effective availability of licenses through the program), followed by a delayed uptake of the standard licensing offer (duration between first availability of licenses and the date of implementers' effective entry into the licensing program) (Section 6.3.3.).

6.3.1. Licensing delays in bilateral negotiations

We observe licensing delays in a sample of major (known) SEP licensors and licensees. While not representative of other SEP licenses, licensing contracts between these companies are more likely to be observable; and they constitute a highly relevant segment of SEP licensing.

6.3.1.1. Data collection and measurement

In order to measure licensing effective dates, adoption dates, and other qualitative information on potential frictions between licensors and licensees, we collected a list of licensing deals for 4G standards between prominent SEP holders and implementers:

- First, using google searches for publicly available information (news reports, announcements, etc.), we compiled a list of licensing deals between the following firms: Ericsson, Apple, Samsung, Nokia, LG, Sony, HP and Huawei.
- Second, we supplemented our list with information from Love and Helmers (2022), who compiled publicly available information on licensing deals, court decisions, settlements, and arbitration awards.²⁴⁰
- Third, we collected information on product release dates from GSMArena.

This methodology resulted in a sample of 48 SEP licenses with available effective licensing dates (or jury, arbitration resolution and settlement dates). Some of the deals involve not only 4G but also 3G and, to a lesser extent, 2G or 5G. The full list of deals is reported in Appendix 9.

We measured the two relevant dates required to calculate possible licensing delays relative to the adoption date as follows:

²⁴⁰ Love, B.J. and Helmers, C., 2022. Are Market Prices for Patent Licenses Observable? Evidence from 4G and 5G Licensing. Evidence from 4G and 5G Licensing (January 28, 2022).

-
- **Licensing date:** effective licensing date of the agreement as indicated in the sources from which we retrieved the deal.
 - **Adoption date:** release date of the first product incorporating the standard for the licensee (from GSMarena)

Based on these two dates, we calculate **Licensing lags**; i.e. the time lapse between date of 4G adoption by the implementer and licensing date.

The kick off date for adoption of 4G can be set at April 2008, when the first industry announcements on licensing programs for 4G were made.²⁴¹ According to GSMarena data, by 2016, around 70% of new cell phone models implemented 4G, with adoption taking off mostly after 2012.

We collect individual release dates for 4G and 3G for the licensees in our sample (i.e. release dates of the first product of each company using 3G and 4G, respectively).

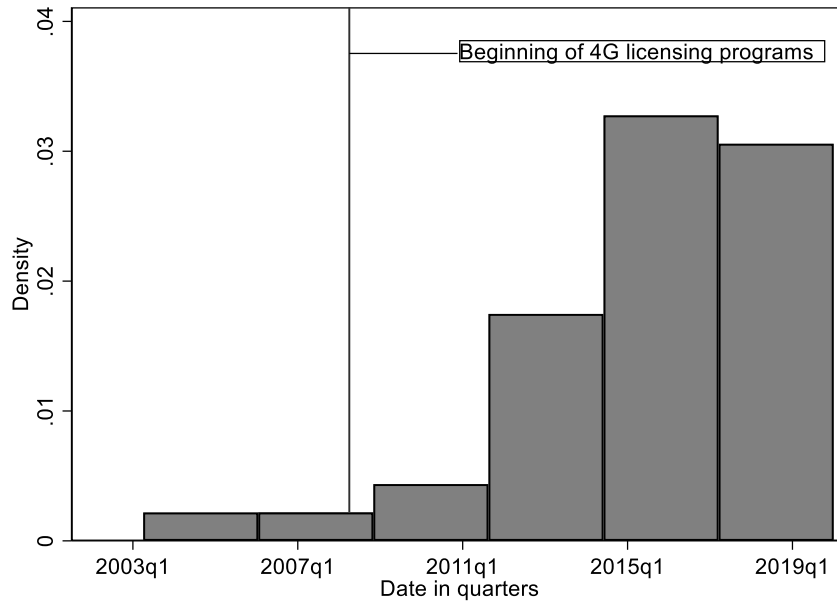
6.3.1.2. Stylized facts

Licensing dates

Figure 27 reports the distribution of licensing dates for the deals in our sample. The mean and median licensing dates are 2015Q2 and 2016Q1. The minimum and maximum licensing dates are 2008 and 2020 respectively.

Figure 27: Number of sample 4G licenses by year, by date of agreement

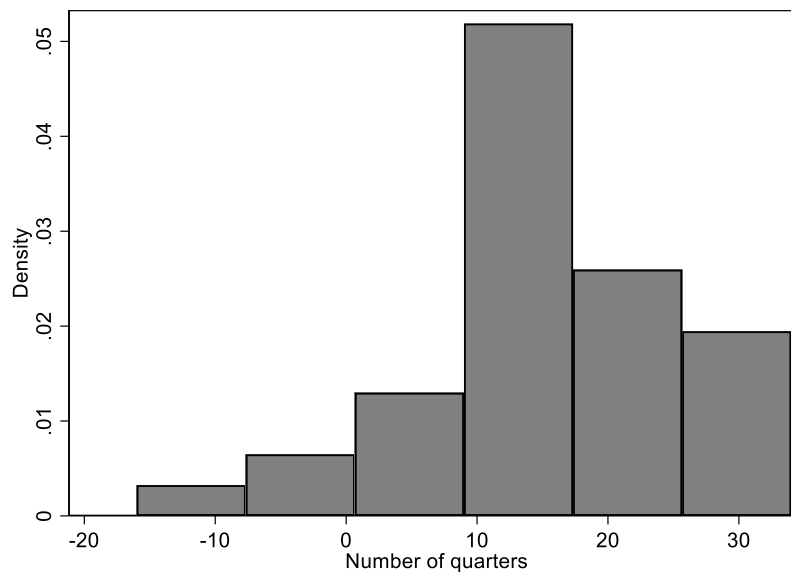
²⁴¹ See Stasik, Eric. "Royalty Rates and Licensing Strategies For Essential Patents on LTE(4G) Telecommunication Standards," *les Nouvelles*, Sep. 2010, pp. 114-119.



Licensing lags:

Figure 28 reports the distribution of licensing lags using individual licensee information on the timing of adoption as measured by release dates of the first product incorporating the standard. The average licensing lag is of fifteen quarters (i.e. 3.75 years) with a minimum value of minus sixteen quarters, (i.e. -4 years) and a maximum of thirty four (i.e. 8.5 years). Negative values could capture licensing dates taking place prior to the release date of the product or measurement error due to the licensing date capturing licenses for earlier standards.

Figure 28: Distribution of licensing delays, in quarters



We thus find that SEP licenses are generally concluded several years after introduction of the first products using the patented technology. Even if there is considerable delay, once the two parties reach an agreement, payments often include compensating payments covering the periods of unlicensed use. Therefore, licensing delays do not necessarily imply

that SEP holders cannot monetize their technologies or that implementers free ride. Payments for uses of the standard during the unlicensed period are deferred in time, rather than withheld entirely.

Ongoing licensing relationships

Many licensor-licensee pairs have ongoing licensing relationships. Deals are extended or renegotiated periodically, generally following new standard releases, to include the new standards (e.g. from 3G to 4G, or from 4G to 5G). This could introduce some measurement error in our measurement of exact licensing dates for particular standards. Firm pairs with ongoing relationships in our sample include: Ericsson-Huawei, Ericsson-LG, InterDigital-Blackberry, InterDigital-Huawei, InterDigital-Samsung, InterDigital-Sony, Nokia-Samsung, Nokia-Apple, Qualcomm-Apple, Qualcomm-Sony, Qualcomm-Samsung and Qualcomm-LG. There could be other pairs with ongoing relationships not detected through our data collection exercise.

Protracted litigation

A fairly large number of deals in our sample involve litigation that often spans several years. These are the most remarkable cases of protracted litigation:

- Huawei-Samsung: Samsung delayed negotiations that began in July 2011. Litigation started in 2016 and a settlement agreement was signed in 2019.
- Nokia-Blackberry: Arbitration was initiated in 2016 for a disagreement about a 2012. This suggests that even if two firms have reached an agreement in the past, such agreements can be subject to frictions and disagreements.
- Nokia-Apple: Litigation started in 2009 and the two firms signed a licensing agreement in June 2011. The two firms settled another dispute in 2017, but we do not have information on the exact date when litigation started.
- Qualcomm-Apple: Signed a licensing agreement in 2007 that was extended in 2011. In 2016 the two firms initiated litigation procedures, with settlement in 2019.

6.3.1.3. Survey evidence

Heiden and Petit (2017) report the results of a survey of 12 SEP licensors, which may complement our descriptive analysis. The respondents of the survey report average licensing lags (“Time to License”) of 32 months, for a range from 18 to 60+ months. Survey respondents also allege that this delay causes significant reduction in SEP licensing rates (44%, for a range from 0 to 80%).

6.3.2. *Duration of SEP Licensing negotiations and disputes*

While our sample of 48 major SEP licensing deals offers indications of typical licensing delays, it does not allow us to distinguish between different reasons for that delay – in particular, it conflates periods of tolerated or undetected unlicensed use, negotiations, and litigation. In order to disentangle these different time periods, we use different methods and samples.

6.3.2.1. Duration of unlicensed use until first contact

It is common that implementers begin using standardized technology protected by SEPs prior to initiating licensing negotiations, and that SEP licensing negotiations are initiated by SEP holders. In the public consultation, company representatives were asked how much time after the first implementation of a standard in one of their products, on average, their companies were contacted by SEP holders with an invitation to take a license. 21 respondents provided quantitative responses. The majority of these respondents (11) indicated average durations of 2-4 years. Equal numbers of respondents (five each) indicated shorter and longer average durations; so that 2-4 years represents both the mode and the median of the distribution.

6.3.2.2. Duration of SEP licensing negotiations

Licensing negotiations are usually confidential, making it difficult to produce representative statistics on the duration of licensing negotiations (and their different steps). Practitioners reported a wide range of negotiation durations, ranging from 12 months to 15 years (from first contact to conclusion of a license). At least one practitioner with extensive experience on both sides of SEP licensing negotiations estimated that 2 to 3 years is a plausible estimate for the median duration of SEP licensing negotiations; while negotiations for particularly complex licensing programs (e.g. involving multiple SEP portfolios, or related to new industries with limited prior SEP licensing experience) would often last more than 5 years.

Descriptive analysis of empirical evidence from German court cases

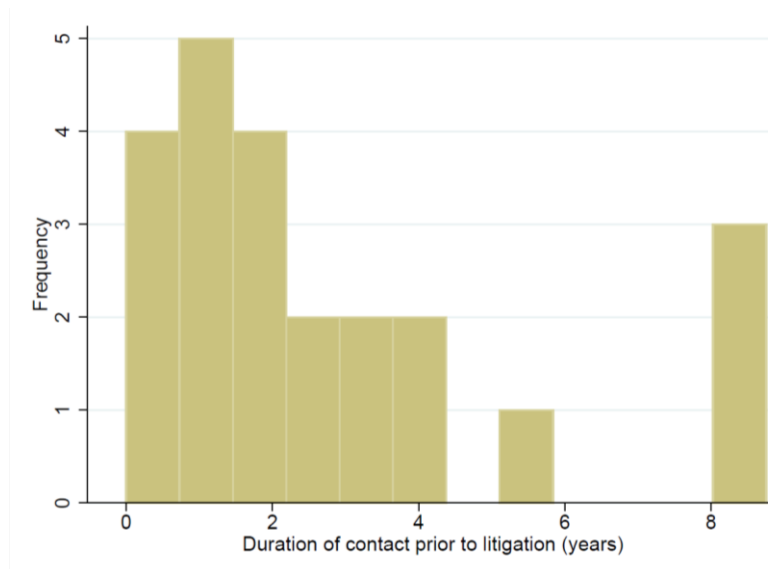
For more specific analyses, we can use empirical observations from courts' descriptions of pre-litigation negotiations. Since the *Huawei v ZTE* decision of the CJEU, parties' conduct during SEP licensing negotiations plays a significant role in determining whether injunctive relief is available to SEP owners against unlicensed use of their technology by standard implementers. National courts in EU Member States, and in particular Germany, thus often describe and analyze the negotiation process in their decisions regarding the award of injunctions.

We have analyzed 24 first instance court decisions from German cases initiated and decided after the *Huawei v ZTE* decision, in which a SEP holder requested injunctive relief. In each

of these cases, the court applied the Huawei v ZTE framework to determine whether injunctive relief should be granted. In doing so, the court describes the progress of the negotiations prior to litigation; in particular, we observe or infer from each decision the date of first contact between the parties, the date at which the SEP holder has given (sufficient) notice to the implementer that he is infringing her patents, the date of the first (observed) licensing offer by the SEP holder, and the date at which the lawsuit was filed. In several cases, SEP holders first filed a lawsuit requesting rendering of accounts and damages, and subsequently extended this lawsuit by filing an additional request for injunctive relief.

We observe significant heterogeneity in the *duration of negotiations* prior to litigation, ranging from 0 to almost 9 years; with a median duration of 2.1 years (mean duration 2.9 years) from the first contact to the filing of the (first) lawsuit (**Figure 29**).²⁴²

Figure 29: Duration of (pre-litigation) SEP licensing negotiations:

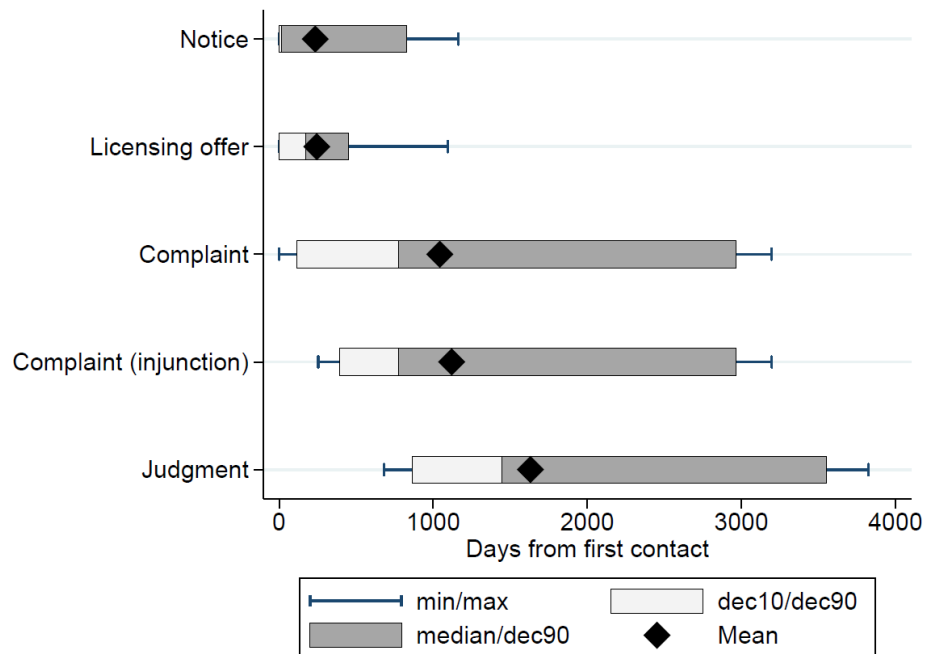


In addition to the total duration of pre-litigation contact between the parties, we can observe the timing of different individual events in the negotiation process (**Figure 30**). In many cases, SEP holders initiated the contact by giving notice of the infringement of their patent by the implementer. Nevertheless, in the majority of cases, courts identify some subsequent communication from SEP holders as the first sufficient notice of infringement (e.g. because SEP holders did not identify any specific patents in their first communication, or because the list of patents provided in the first communication did not include the patent that would eventually be the subject of litigation). Empirically, we find that the median duration between first contact and sufficient notice of infringement is 15 days, and the average is 235 days (or 7.5 months); but there are also individual cases in which the court identified a communication occurring several years (up to 3.2 years) after initial contact as the first sufficient notice of infringement.²⁴³

²⁴² Note that we observe pre-litigation contact durations of 0, even though the CJEU decision in Huawei v ZTE requires SEP owners to provide sufficient notice of infringement to implementers prior to initiating a lawsuit in pursuit of injunctive relief. In line with the obligations for SEP holders under the Huawei v ZTE framework, in each of the 24 cases that we observed, the SEP holder has given notice of infringement to the implementer prior to filling a lawsuit requesting injunctive relief; however, there is at least one case in which the first observable contact between the parties was a lawsuit requesting rendering of accounts and damages (and in at least three cases the court considered the filing of a lawsuit requesting rendering of accounts and damages to be the date at which the SEP holder first gave sufficient notice of the infringement).

²⁴³ Note that courts usually only seek to establish *whether* the SEP holder has given sufficient notice of infringement at any time prior to initiating a lawsuit for injunctive relief. Once one such sufficient notice can be identified, there is no need to assess whether possible prior communications also constitute sufficient notice.

Figure 30: Timing of individual events in SEP licensing negotiations and disputes



In many cases, the notice of infringement coincides with a first licensing offer by the SEP holder. Nevertheless, there are also cases in which the SEP holder made a first licensing offer before or after giving sufficient notice of infringement.²⁴⁴ There are also at least four cases in which the SEP holder made no licensing offer prior to initiating litigation, e.g. because it considered the implementer to be unwilling to participate in negotiations, or because it relied on a lawsuit requesting rendering of accounts and damages as providing the implementer with sufficient notice of infringement. Note that we identify the date of the first licensing offer by the SEP holder mentioned in the decision, regardless of whether that offer was considered FRAND by the court.

Acceptable delays in SEP licensing negotiations

In addition to statistical analyses of typical SEP licensing delays, we can use the German FRAND jurisprudence under the *Huawei v. ZTE* framework as well as responses to the public consultation to make observations about delays in particular steps of the negotiation process that are considered acceptable (or not):

²⁴⁴ The licensing offer can occur before the notice of infringement, e.g. because the SEP holder has made a portfolio offer (including through a patent pool) that was communicated to the implementer, without identifying the specific patent that would eventually be subject to litigation.

- *Response to notice of infringement:* The Huawei v. ZTE framework requires SEP holders to initiate the contact by providing sufficient notice of infringement. Once such notice has been given, the implementer must respond by indicating its willingness to license. SEP holders report that many (alleged) infringers of their patents do not respond to a notice of infringement. Nevertheless, failure to respond to a notice of infringement may relatively quickly result in being considered an unwilling licensee. At least in Germany, the existing caselaw indicates that a response must occur **within two months** to be considered timely; unless there are specific circumstances that would justify shorter or longer time-limits.²⁴⁵ Delays of more than three months would as a general rule be considered unreasonable.²⁴⁶

In the public consultation, stakeholders offered mixed views on what constitutes a reasonable delay in responding to a notice of infringement. Only a minority of respondents suggested specific time periods, whereas other respondents indicated that **fixed time limits are not desirable**, or provided “Other” (qualitative) responses. The majority of respondents identifying with implementer viewpoints indicated that fixed time limits are not desirable. The majority of respondents identifying with SEP holder viewpoints suggested that implementers should respond within less than five months. Half of all respondents in this category (and the vast majority of those respondents who have indicated specific time periods) indicated that the implementer’s **response should occur within 1-3 months**.

- *Response to licensing offer:* Once an implementer has indicated its willingness to license, it is incumbent upon the SEP holder to make a FRAND licensing offer. The implementer must respond to this offer, either by accepting the offer or formulating a FRAND counter-offer. The SEP holder must set a reasonable time-limit for the implementer to respond. In one case, the District Court of Mannheim ruled that a time-limit of 4 weeks (or 22 business days) did not provide the implementer with sufficient time to assess the offer and respond. In its assessment, the court indicated that a time-limit of **three months** would have been sufficient to allow the implementer to carefully assess the offer and respond.²⁴⁷

Responses in the public consultation to the question within what period of time an implementer should respond to a specific licensing offer by the SEP holder largely mirror stakeholders’ viewpoints on the previous step. While a majority of respondents identifying with implementer positions again indicated that **fixed time**

²⁴⁵ “Dabei ist regelmäßig ein zeitlicher Abstand von nicht mehr als 2 Monaten nach Zugang des Verletzungshinweises als noch angemessene Reaktionszeit anzusehen, sofern nicht besondere Umstände des Einzelfalls eine kürzere oder längere Frist rechtfertigen (vgl. OLG Karlsruhe, Urteil vom 30. 10.2019 - 6 U 183/16 -, juris Rn. 115 - Datenpaketverarbeitung; ähnlich OLG Düsseldorf, GRUR 2017, 1219 - Mobiles Kommunikationssystem” District Court of Mannheim, 21.08.2020; 2 O 136/18.

²⁴⁶ Ibd. See also District Court of Duesseldorf, 07.05.2020 (ruling that a response six months after notice of infringement is unreasonably late). 4c O 56/18

²⁴⁷ “Weder die von der Klägerin gesetzten Frist von einer Woche (18. April 2018), die verlängerte Frist von nicht einmal vier Wochen (7. Mai 2018) noch die Zeit bis zur Einreichung der Klageerweiterung am 15. Mai 2018 waren ausreichend, um der Beklagten eine sorgfältige Überprüfung der Frage zu ermöglichen, ob das Lizenzvertragsangebot gegen das Diskriminierungsverbot verstößt. [...] Hierfür reichte bei objektiver Betrachtung der Zeitraum von 22 Werktagen bei weitem nicht aus. Ein weiteres Zuwarten war der Klägerin auch zumutbar. [...] Der Zeitraum, der der Beklagten bzw. ihrer Muttergesellschaft bis zum Schluss der mündlichen Verhandlung am 13. Juli 2018 zur Verfügung stand, wäre zwar grundsätzlich ausreichend gewesen, um der Beklagten eine sorgfältige Prüfung des Angebots zu ermöglichen.” 7 O 165/16. District Court of Mannheim, 13.07.2018.

limits are not desirable, a majority of respondents identifying with SEP holder position indicated that such response should occur within less than 5 months. Among respondents indicating a specific time limit for the implementer's response to a specific licensing offer, the most common answer is **a period of 1-3 months**. At least some respondents indicated tolerance for a somewhat longer delay in the response to the specific licensing offer, compared to what they view as a reasonable delay in the response to the initial notice of infringement. While similar proportions of respondents indicated specific time periods for the completion of each step, 65.2% of those respondents that did indicate a specific time period suggested that implementers should respond to the initial notice of infringement within 1-3 months, whereas only 52.3 % of these respondents indicated that implementers should respond to a specific licensing offer within this period of time.

In addition to unilateral delays in the negotiation process, certain steps of the SEP licensing negotiation process may result in delays. Practitioners concordantly reported that the first step of SEP licensing negotiations usually consists in negotiating a non-disclosure agreement (NDA), allowing the parties to share information in the negotiation process. Some practitioners report practices that lead to delays; for instance, some implementers allegedly refuse to enter any NDAs; while some SEP holders are alleged to insist on over-inclusive NDAs that bar implementers from using necessary information in litigation.²⁴⁸ Differences between parties' preferences over the scope of NDAs may result in protracted negotiations. In one case, the District Court of Duesseldorf observed that negotiations over the scope of the NDA had taken 8 months.²⁴⁹ Practitioners report that the usual duration of negotiations over an NDA is about 1 month; but that these negotiations can also take 1-2 years.

6.3.2.3. The duration of SEP litigation

The duration of SEP litigation by country

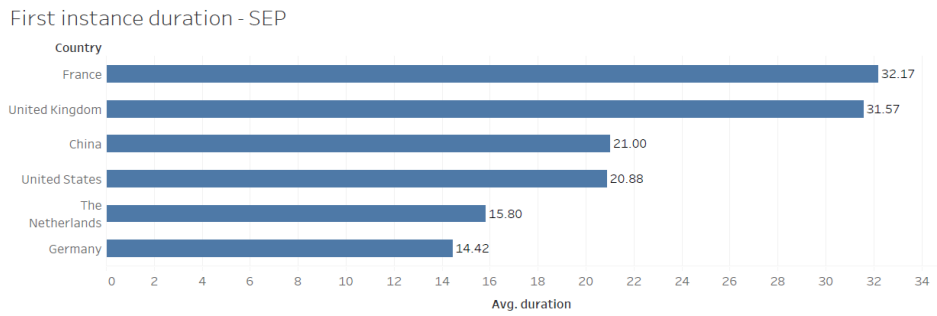
We use Darts-ip data to study the duration of SEP litigation. Once a complaint has been filed, the average duration of SEP litigation cases (the period from first filing date to resolution) range from 14.4 months in Germany, to 32.2 months in France (only first instance).²⁵⁰ Litigation durations in the Netherlands (15.8 months) are similar to those in Germany, whereas durations of litigation in the UK (31.6 months) are more similar to those in France. China (21 months) and United States (20.9 months) have intermediate litigation durations (**Figure 31**).

²⁴⁸ While

²⁴⁹ 4a O 16/16; District Court of Duesseldorf; 13.07.2017

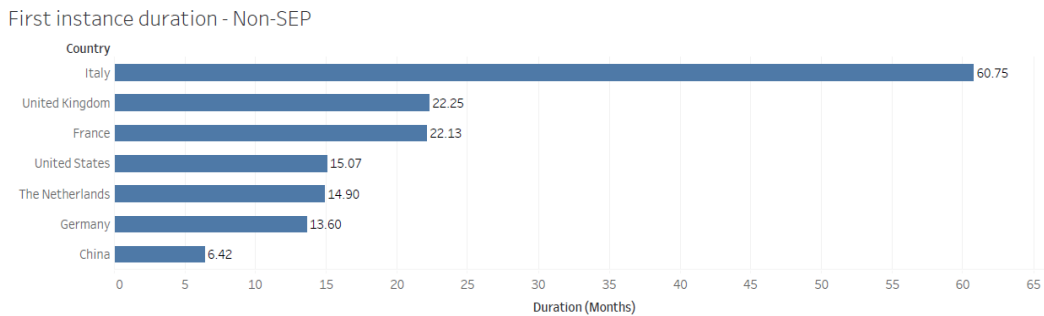
²⁵⁰ These averages are based on Darts-ip data and all cases involving declared SEPs. Among the 24 cases in Germany involving a FRAND analysis under the Huawei v ZTE framework discussed above, the average duration of litigation is 18 months. It's possible that SEP cases not involving a FRAND analysis (including the litigations regarding validity at the Bundespatentgericht) take less time, thus leading to a lower average duration of all SEP litigations in Germany.

Figure 31: Duration of SEP litigation, by jurisdiction



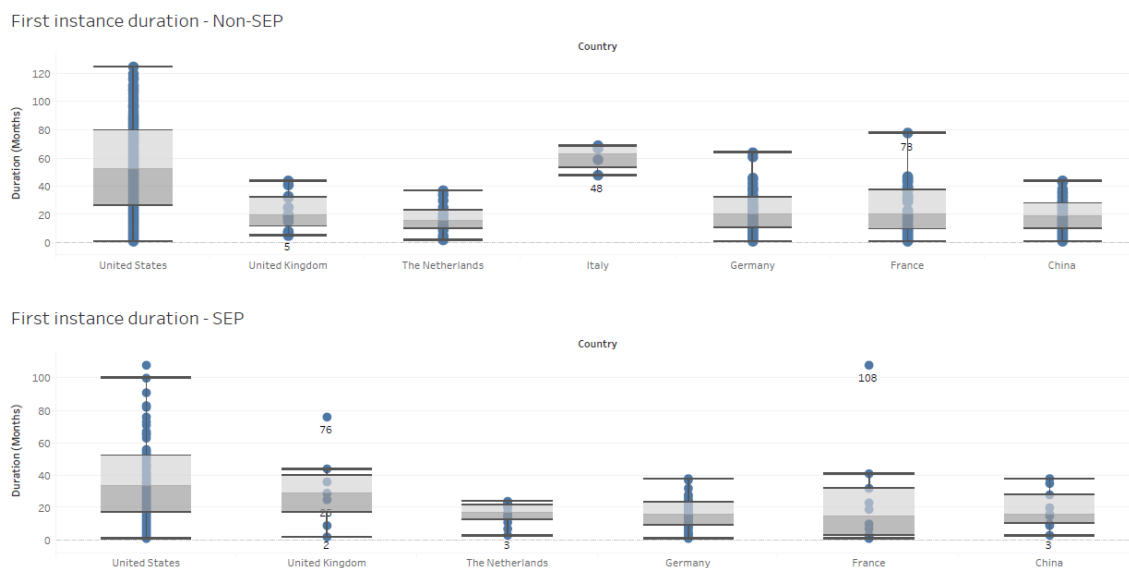
We can compare these SEP litigation durations with litigation durations in the same countries typically observed for (otherwise comparable) non-SEPs.²⁵¹ In all countries with significant numbers of SEP litigations (France, UK, China, US, Netherlands, Germany), *average* litigation durations are longer for SEPs than for comparable non-SEPs (**Figure 32**). At the same time, in most of these countries (except the Netherlands), *median* litigation durations for SEP cases are shorter than for non-SEP cases (Figure 33). This suggests that in the case of SEPs, a smaller number of outliers lead to significantly higher average durations; while the “normal” (median) SEP litigation case does not take longer than other patent litigation cases to be resolved.

Figure 32: Average duration of non-SEP litigation cases (selected comparable patents)



²⁵¹ See Darts-ip (2019)

Figure 33: Distribution of SEP and non-SEP litigation durations, by country



Durations of appeals provide a similarly inconsistent picture. In most countries (but not in Germany), the average durations of appeals cases regarding SEPs are longer than the durations of appeals cases regarding other, comparable patents (**Figure 34**). Nevertheless, in most cases, the median duration of non-SEP cases is longer than the median duration of SEP cases (**Figure 35**). Overall, these comparisons are based on small numbers of observations, with large variations among SEP and among non-SEP cases; these differences are therefore unlikely to be statistically significant.

Figure 34: Average duration of appeal cases by country – SEP and non-SEP cases

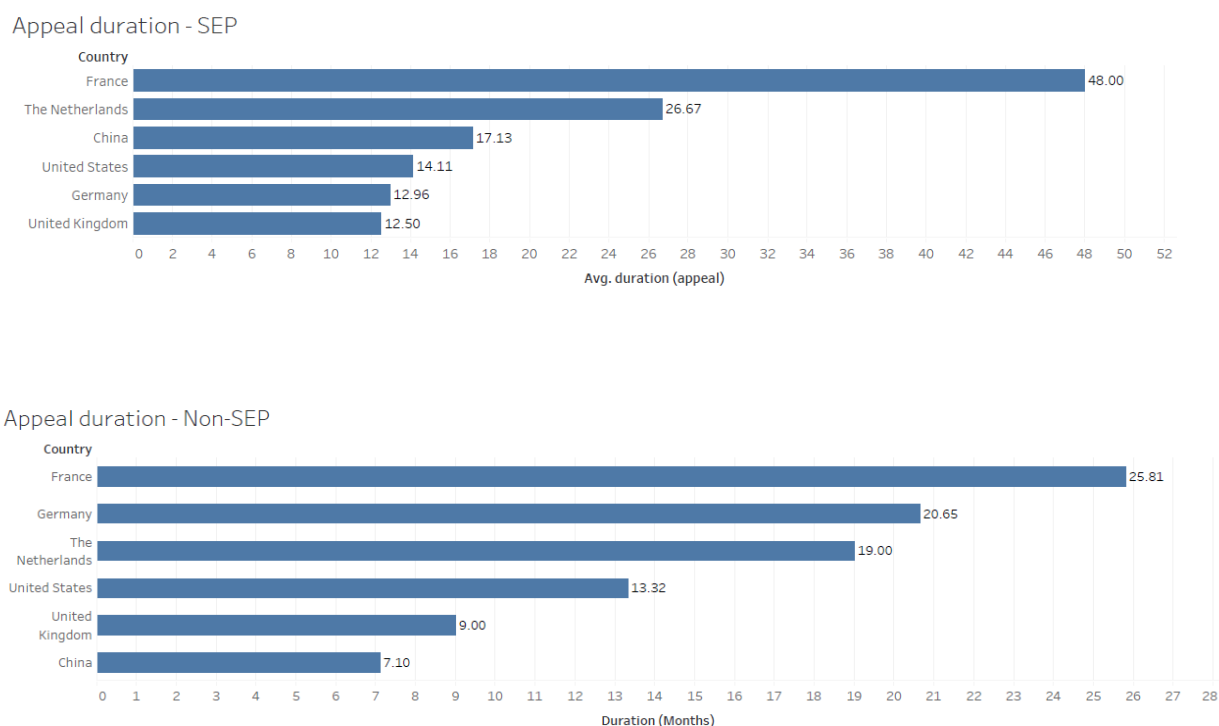
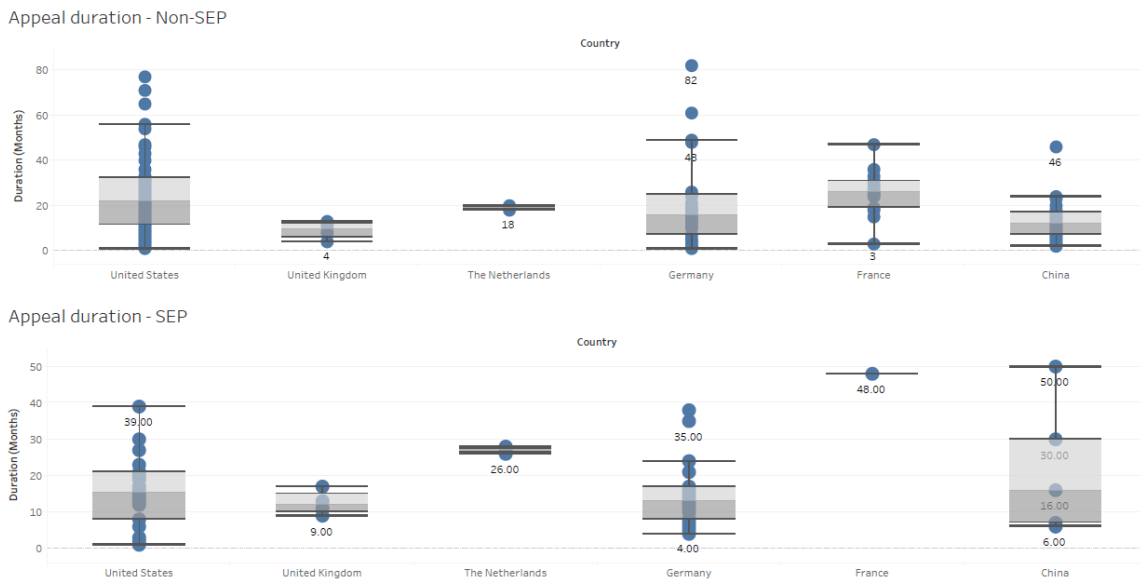


Figure 35: Distribution of appeal cases duration by country – SEP and non-SEP cases



Comparisons between countries appear to be more consistent; in particular, litigation durations in France appear to be significantly longer than those in Germany. Nevertheless, it is also important to keep in mind that as a consequence of Germany’s bifurcated system, resolution of one dispute more often requires multiple litigations in Germany, whereas the same dispute could be resolved in one litigation in France.

Comparing duration of negotiations and litigation

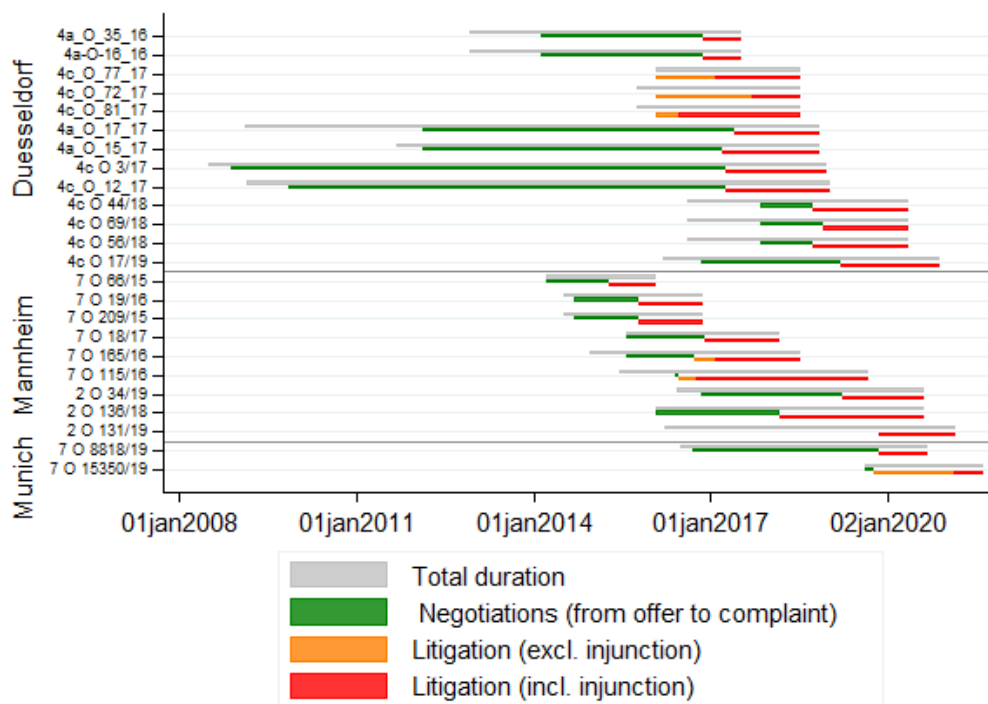
As stated in Section 6.3.2.1., stakeholders report that it typically takes SEP holders 2-4 years after first introduction of a product to approach an implementer with a request to enter into a license. In Section 6.3.2.2., we have identified certain empirical patterns in the duration of subsequent SEP licensing negotiations; finding that the median duration of these negotiations is 2.1 years (mean duration 2.9 years). Finally, in the first part of Section 6.3.2.3., we find that (depending on the jurisdiction) SEP litigation typically takes 15 (Germany, the Netherlands) to 32 (France, UK) months to be resolved.

Taken together, our assessments of the duration of these individual steps are somewhat inconsistent with our estimate of overall SEP licensing delays. In our sample of 48 observable SEP licenses, we observed an average licensing delay of 3.75 years. The incompatibility of these figures (licensing delay should equal the duration of the period from implementation to first contact plus the duration of the period from first contact to resolution) is indicative of differences between the different samples – licensing negotiations resulting in litigation for instance may plausibly take much longer than negotiations resulting in a license without litigation.

In the following, we compare durations of litigation and pre-litigation negotiation within the same sample of licensing disputes. We once again focus on our sample of 24 SEP litigations in German courts, and consider the time from the first licensing offer to the filing of the (first) lawsuit as the “pre-litigation negotiation”. Only considering the 20 cases in which the

SEP holder has made a licensing offer prior to filing a lawsuit, we find that the average duration of pre-litigation negotiations is significantly longer than the duration of litigation itself (920.7 compared to 547.7 days, statistically significant at 5%). The duration of pre-litigation negotiations is also significantly more variable: considering the 10th and 90th percentile, we find that pre-litigation negotiations last between 189 and 2,315 days, whereas litigation itself lasts between 289 and 896 days (**Figure 36**).

Figure 36: Duration of pre-litigation negotiations and litigation



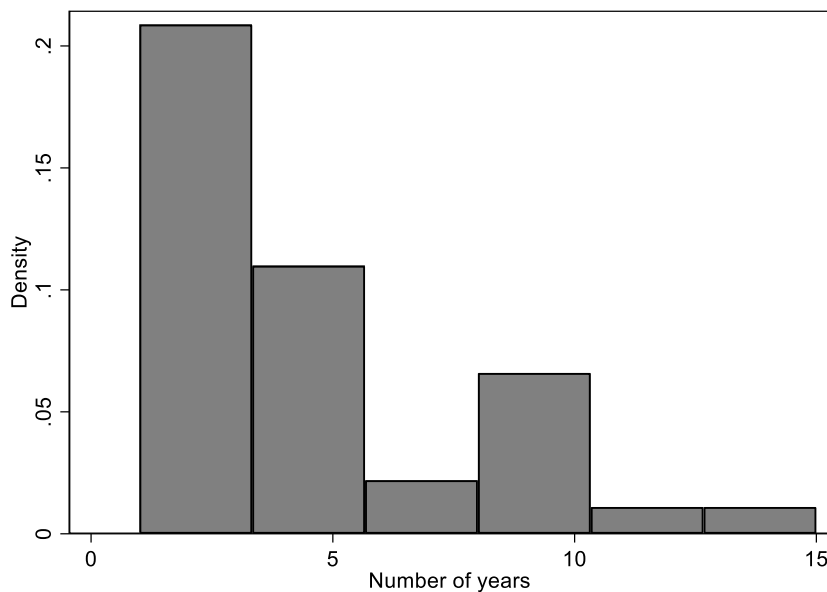
6.3.3. Licensing delays in patent pool licensing

It is also interesting to measure licensing delays in pool licensing rather than in licensing through bilateral negotiations. The focus on pools allows distinguishing between supply- and demand-driven delays in SEP licensing. A supply-driven delay consists in the period between the commercial availability of the standardized technology and the date of first availability of licenses from the pool. A demand-driven delay in the context of a pool licensing program can be defined as the time it takes for implementers to accept a licensing offer from the patent pool since the moment licenses become available. Note however that supply and demand for pool licenses are intrinsically inter-related – SEP holders may fail to offer pool licenses for lack of demand from implementers, and implementers may fail to demand a license from existing pools e.g. because many relevant SEP holders are missing from the pool.

6.3.3.1. Supply-driven delays

Frictions in the formation of patent pool licensing programs can result in supply-driven delays in the availability of licenses to willing licensees. **Figure 37** reports the distribution of licensing lags in years, measured as the time lapse from standard release to availability of the first pool license, drawing on information about 60 (attempted) pool creations from 1992-2014, available from Bekkers et al. (2014).²⁵² The **average licensing lag is of 4.6 years**, with a minimum value of one year and a maximum of fifteen years. These lags capture a time window over which it is not possible for implementers to license the technology via a patent pool licensing program. Therefore, these are delays in the provision of licensing programs; as opposed to delays in the adoption of licensing programs by implementers.

Figure 37: Distribution of delays in first license with respect to pool formation



6.3.3.2. Demand-driven delays

Growth of pool programs in numbers of licensees

Next, we can study delays in the adoption of pool licensing offers by implementers. We analyze data on the number of licensees from fifteen pools for which licenses became available before 2010, which allows us to track licensing activity over a sufficiently long time span.²⁵³ To avoid truncation issues for recent pools, we restrict to the first ten years of licensing activity for each pool.

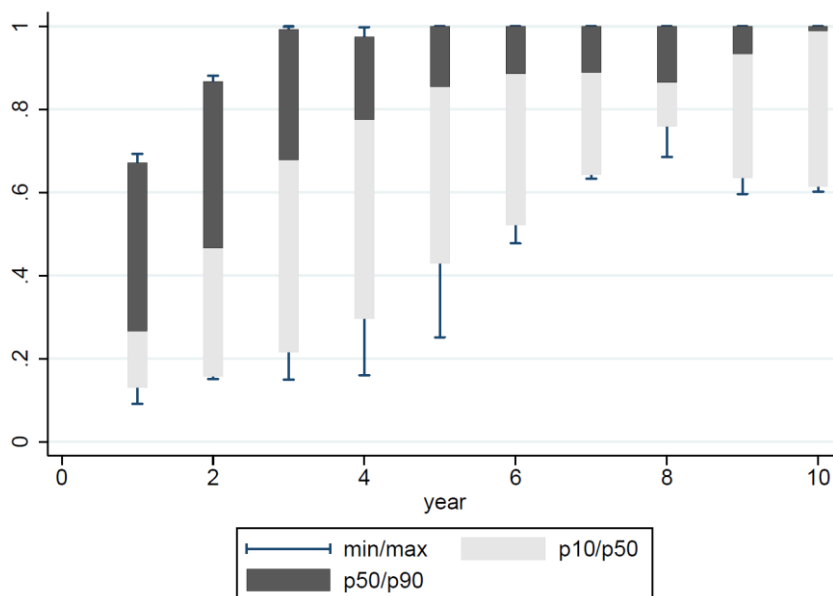
Figure 38 summarizes the number of years it takes for pools to reach their maximum size (within their first ten years). The median pool reaches half of its maximum size after 2-3

²⁵² See Table 21 in Bekkers et al. (2014). This table provides relevant information for 60 attempted or effective pool creations between 1992-2014, which resulted in 45 pools and 11 failures, 4 calls for patents still being open as of 2014.

²⁵³ Longitudinal data on pool licensees up to 2014 is available from Northwestern University, http://www6.law.northwestern.edu/webfiles/searlecenter/InnovationEconomics/pools/TLS_poollicensees_v1.1_02-10-15.csv. For the selected 15 pools, we complemented this data with yearly observations of the number of licensees up to 2021.

years; i.e. **the median licensee of the median pool joins about 3 years after the first licensees join**. There is considerable variation across pools, **with 8 out of 14 pools reaching their maximum size ten years after the date licenses became available** or later.

Figure 38: Growth of patent pools in % of licenses over time



Pool licensing delays and deferred pool licensing revenue

The slow growth of pools' number of licensees may indicate gradual uptake of the standardized technology by implementers; or actual licensing delays, i.e. delays between implementers' adoption of the standard and their acceptance of the pool's licensing offer, resulting in periods of unlicensed use. Once these implementers accept the pool license, they usually have to pay retroactive royalties for past infringing use of the patented technology.

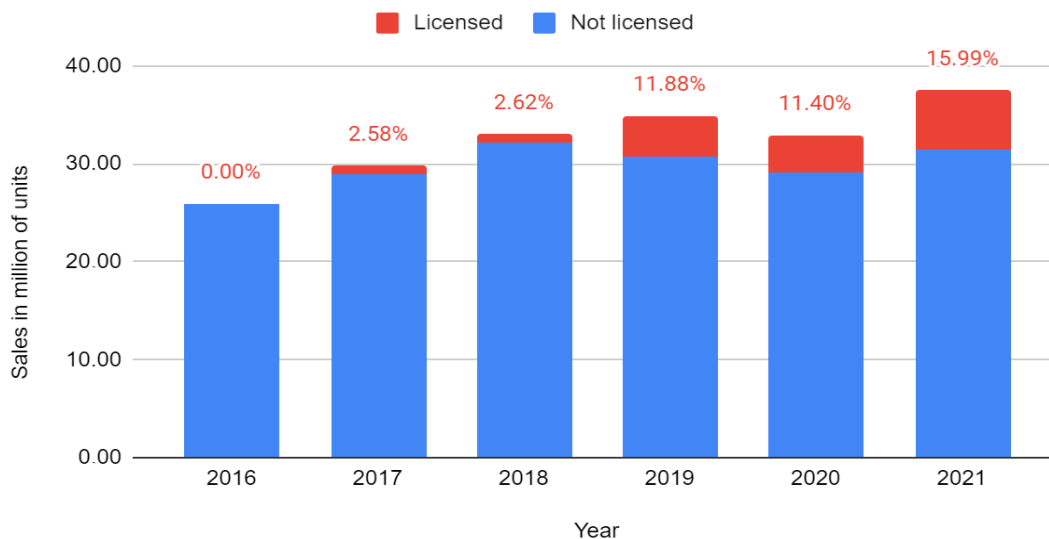
In order to better understand demand-driven delays in pool licensing, it is important to put into perspective the timing of the roll-out of the licensing program with the timing of the diffusion of the underlying standardized technology. Furthermore, as the population of standard implementers (and potential pool licensees) is highly heterogeneous, it is important to obtain information on different implementers' respective extent of use of the standardized technology.

Focusing on one individual pool allows us to offer this detailed contextual information. The Avanci pool offers licenses to 2G, 3G, and 4G connectivity technology to carmakers. We can observe the date at which individual carmakers accepted Avanci's licensing offer, and make reasonable estimations of the number of (connected) cars sold worldwide per year and by brand; allowing us to estimate the growth of Avanci's licensing program, the relative extent of licensed and unlicensed use over time, and Avanci's revenue per year in current and deferred royalty payments.

First, using announcements by Avanci and external news reports, we created a list of auto brands that signed an Avanci license, with portfolio (i.e. eCall/2G/3G only, or 4G included)

and signing date when available (see the table in Appendix 10).²⁵⁴ After that, we searched the annual reports for each auto group or brands from 2016 up to 2021 for revenues and number of vehicles sold,²⁵⁵ along with information on worldwide sales for the whole industry.²⁵⁶ This time range was chosen because Avanci was founded in 2016, and because of the availability for annual reports for the vehicle brands up until 2021. Since only connected vehicles, and not all new vehicles, require an Avanci license, and none of the brands studied provided specific numbers for the number of connected vehicles sold, we performed a linear approximation, applying the yearly percentage of connected vehicles over the whole market sales to each company's reported total sales volume per year in order to produce an estimate of the number of connected vehicles per year and per brand.²⁵⁷ Using the date of companies' acceptance of Avanci's licensing program to produce longitudinal information on Avanci's licensees over time, we can then compare the number of licensed and non-licensed connected vehicles sold per year (**Figure 39**).

Figure 39: Avanci - Licensed and unlicensed connected vehicle sales per year



Using the estimated number of licensed connected vehicle sales per year, and our estimate of the licensing program under which these cars were licensed, we can then produce estimates of two types of royalty revenue: current royalty revenue, related to the yearly sales of current licensees; and retroactive royalty revenue, related to past sales of newly joining licensees (**Figure 40**). For companies that signed an Avanci license in 2022 (as to August 4, 2022), or that upgraded their license in that year, we calculated how much they had to pay retroactively in 2022, without adding the number of vehicles sold in 2022, since no company reports on 2022 sales are available at the time of writing.

²⁵⁴ Note that for brands with no information on which portfolio had been agreed upon, we chose 4G (\$15 per vehicle for licenses signed before of the 1 September 2022, it also includes eCall, 2G and 3G).

²⁵⁵ Some of the licensees were missing from their group's reports or did not offer the number of vehicles sold in each year. They were: Cupra, Lamborghini, Bugatti (not listed by the Volkswagen AG within their reports), Volvo Group (apart from cars), Navistar, Volta and Lucid.

²⁵⁶ [Worldwide motor vehicle sales by type 2021 | Statista](#)

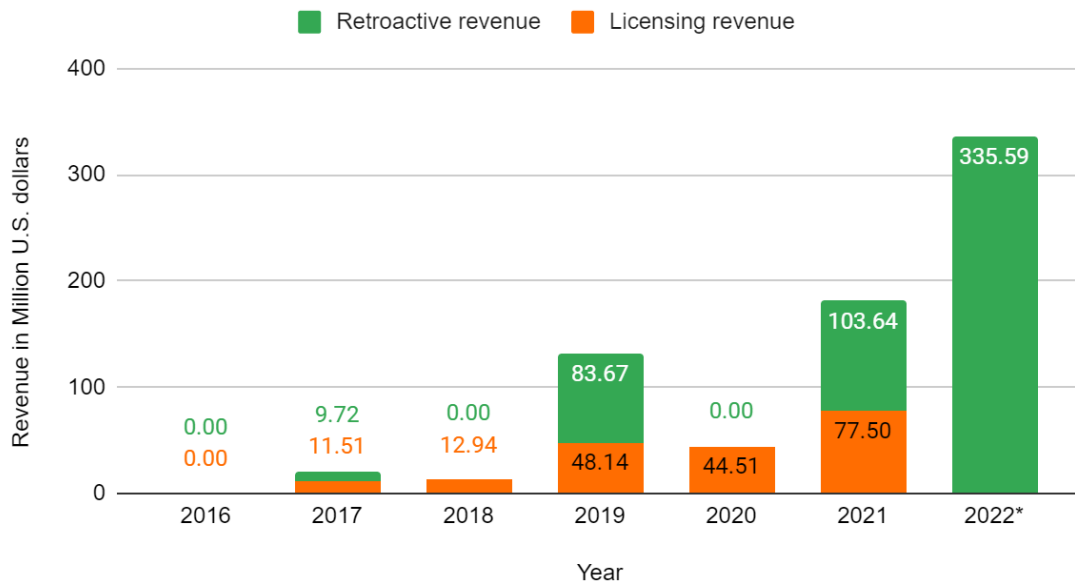
²⁵⁷ [How many connected cars are sold worldwide? - Smartcar blog](#)

[Vehicle Connectivity is Surging, but Consumer Paid Subscription Share is in Sharp Decline \(abiresearch.com\)](#)

[Connected cars worldwide - statistics & facts | Statista](#)

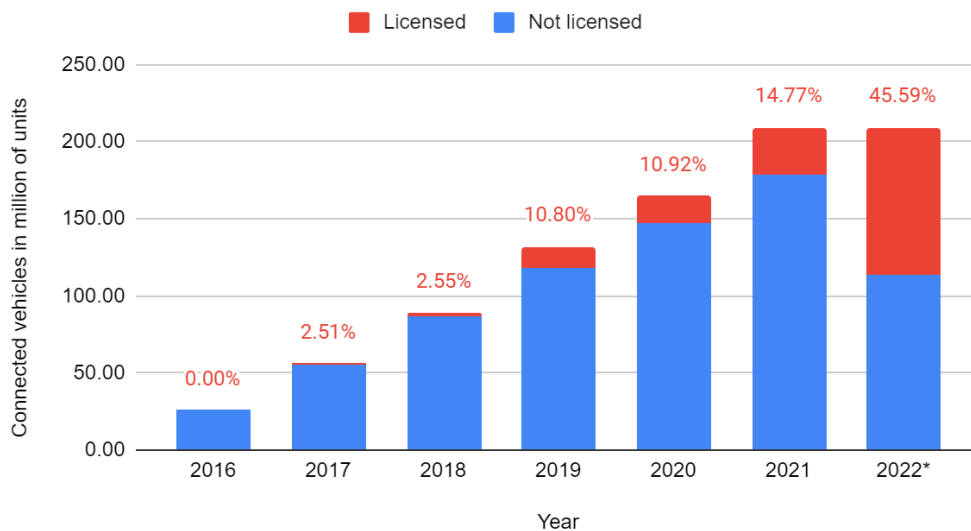
[Connected car report 2016 | Strategy& \(pwc.com\)](#)

Figure 40: Avanci licensees' current and retroactive royalty payments



We can also estimate the share of licensed cars among the total number of connected vehicles sold up to a certain date. According to our estimates, slightly over 200 million connected vehicles were sold by the end of 2021. By the end of 2021, 14.77% of these sales were licensed. Including licenses signed up to August 4, 2022, we estimate the share of licensed sales among these sales to reach 45.59%; which is in line with Avanci's own announcements (**Figure 41**).²⁵⁸

Figure 41: Accumulated sales of licensed and unlicensed connected vehicles



²⁵⁸ On July 5, 2022, Avanci reported that it had "almost 50% of connected cars on the market under license". <https://news.bloomberglaw.com/ip-law/avanci-is-turning-automakers-patent-licensing-on-its-head>

7. UNDER-LICENSING

Technology standards may remain unlicensed due to both supply and demand-driven considerations. First, implementers may be willing to take a license, but SEP holders may not be ready or willing to offer one under the desired conditions (e.g. due to the limited scope of existing SEP licensing programs, failed patent pool launches, or disagreements over the level of the value chain that is licensed). Second, SEP licensors may be prepared to offer licenses, but some or all of the implementers may refuse the offer and continue to use the standardized technology without a license. We assess the prevalence of under-licensing for each of these reasons.

- *Unlicensed use due to the absence of licensing offer - Limited scope of existing SEP licensing programs:* Existing licensing programs are often limited in terms of field of use (e.g. Avanci's licensing program for automotive applications), or technology (e.g. Avanci licenses covering 3G and 4G, but excluding 5G). There may be no comparable licensing offer for other fields of use, and it may take several years for licensing programs for new standards to be offered.
- *Unlicensed use due to the absence of licensing offer - Failed patent pool launches:* Bekkers et al. (2014) e.g. document 11 failed pool launches and 11 abandoned pools out of 60 attempted pool creations between 1992-2014.
- *Unlicensed use due to the absence of licensing offer - Disagreements over the level of the value chain that is licensed:* e.g. Continental, a supplier of devices with wireless connectivity to automotive manufacturers, argues that SEPs should be licensed directly to them, but Avanci is not authorized to offer licenses to suppliers such as Continental because SEP holders prefer to license patents directly to car manufacturers
- *Unlicensed use due to the refusal of implementers to accept a licensing offer – evidence from infringement notifications:* the percentage of implementers that signed a license out of the total number of recipients of infringement notifications (sent by one pool administrator) ranges between 6% and 25%. The percentage of firms that either signed a license or gave a response to the infringement letter, indicating willingness to engage in negotiations, ranges between 40% and 56%.
- *Unlicensed use due to the refusal of implementers to accept a licensing offer – evidence from licensor surveys:* SEP licensors surveyed by Heiden and Petit (2017) report that the percentage of licensed users among firms implementing wireless communication technology protected by their SEPs has decreased from 73% in 2006, to 59% in 2011, and to 39% in 2016. On average, 39% of potential royalty income is lost due to unlicensed use.
- *Unlicensed use due to the refusal of implementers to accept a licensing offer – evidence from court decisions:* e.g. in German SEP litigation opposing Tagivan (a member of a pool administered by MPEG-LA) to Huawei, there appeared to be agreement between parties that most implementers in the Chinese market were using the technology without being licensed.

While many unlicensed standards implementers eventually take a SEP license and pay retroactive royalties for past infringing use, other implementations of the standards remain permanently unlicensed to at least some of the SEPs that are used. Products are unlicensed, because (1) no licensing offer for these products exists; or (2) existing offers are not accepted by the implementer.

As with many aspects of SEP licensing, the available empirical evidence on the extent of (permanently) unlicensed use is very limited. While we can occasionally observe limitations in the scope of existing licensing programs, and limitations in the coverage of existing programs, we only can use anecdotal or partial survey evidence on entirely non-existent SEP licensing.

7.1. Absence of licensing offer

A first category of unlicensed implementers are users of standardized technology who have no access to a SEP license.

7.1.1. Limited scope of existing SEP licensing programs

Some well-functioning licensing programs offer a fragmented supply either because they restrict to specific fields of use or because they license specific standards. For example, Avanci currently licenses 2G, 3G and 4G cellular communication technology to car and truck manufacturers, but not (or not yet) to companies in other industries making significant use of 4G technologies (such as cellphones or tablets, IoT, etc.). Furthermore, Avanci currently does not extend 5G licenses.²⁵⁹ Such practices limit the scope of licensing programs to certain targeted fields, and may limit the availability of licenses in other fields. Note however that companies in these other fields may be able to get a SEP license through other means (e.g. bilateral licenses with individual SEP holders).

7.1.2. Failed patent pool launches

On occasions, there are failed attempts to launch patent pools or pools are launched under unsatisfactory conditions. Bekkers et al. (2014) document 11 failed pool launches and 11 abandoned pools out of 60 attempted pool creations between 1992-2014.²⁶⁰ Failed attempts at pool launches or abandoned pools can be due to many reasons. In many cases, the underlying standard or technology fails in the market. Therefore, failed launches could be a reaction to insufficient potential demand for the technology, and it is not possible to readily

²⁵⁹ Avanci announced its 5G licensing program on July 29, 2020; after receiving a favorable business review letter by the U.S. Department of Justice. According to industry observers, as of December 2021, “the automotive industry is awaiting with interest the (delayed) announcement of Avanci’s 5G pool rate.” <http://www.fosspatents.com/2021/12/daimler-takes-avanci-patent-license-all.html>

²⁶⁰ See Table 21 in Bekkers et al. (2014)

identify any causal role that SEP licensing frictions may have played in discouraging wider standard adoption.

However, in other cases, licensing programs fail to be created or to gain significant traction even though the underlying technology standard is widely implemented. Such (relatively) unsuccessful licensing programs may e.g. suffer from disagreements between licensors, resulting in failure to agree on a single pool licensing program;²⁶¹ long delays in the creation of a pool program,²⁶² and/or failure of the most significant SEP owners to join the pool.²⁶³ Salient cases of standards that are widely implemented in the market, but for which no encompassing SEP patent pool licensing program exists, are LTE and WiFi. Nevertheless, there is active SEP licensing around these standards, mostly through bilateral licensing negotiations.

7.1.3. *Disagreements over the level of the value chain that is licensed*

Even if licenses are made available to implementers, there could be disagreement over the level of the value chain that is licensed. This means that licenses are available, but not to all participants in the value chain. This is exemplified in the case *Continental vs Avanci*.²⁶⁴ Continental, a supplier of devices with wireless connectivity to automotive manufacturers, argues that SEPs should be licensed directly to them because it is precisely the wireless devices that they manufacture that incorporate the baseband chip that uses 4G. Avanci, however, is not authorized to offer licenses to suppliers such as Continental, because SEP holders prefer to license patents directly to car manufacturers rather than to their suppliers. Such practices are also common in the cellular industry, in which SEPs are often licensed directly to cellphone manufacturers rather than to suppliers; e.g. cellular chipset manufacturers.

Component manufacturers in the automotive industry argue that SEP holders' preference for licensing at the end product level is problematic, because contracts between end product manufacturers and their suppliers may include *indemnification clauses*, holding the component maker responsible for any patent infringement claims arising out of the use of the component in the car.²⁶⁵ From their perspective, component manufacturers should be

²⁶¹ A significant number of standards are or previously have been subject to "split pools", i.e. different licensing administrators providing pool licenses to different, complementary portfolios of SEPs for the same standard; including mp3 (MPEG Audio), DVD, BluRay, HEVC, and LTE. Implementers of these standards thus need licenses from various pools and/or individual SEP owners in order to lawfully implement the standard. The situation of implementers may be even more complicated when individual patent owners participate in multiple pools, such as has been the case of MPEGLA's and Access Advance HEVC patent pools, which reportedly "shared" around 5,160 patents. <https://www.streamingmedia.com/Articles/ReadArticle.aspx?ArticleID=136123> In this case, while implementers generally need multiple licenses to lawfully operate, companies licensed to both pools may be entitled to refunds for overpayments.

²⁶² Based on the dates of announcements on the pool licensors' websites, Bekkers et al. (2014) e.g. observed that four years elapsed between the first announcement of Sisvel's effort to form a WiFi pool and the date at which first licenses became available.

²⁶³ While both Sisvel and ViaLicensing formed pools for LTE, only Via currently offers licenses to a pool of SEPs owned by a larger number of different companies. None of the largest known SEP licensors, both in terms of number of declared SEPs and known SEP royalty income, participate in either of these licensing programs. A fact-finding study by IPlytics (2020) e.g. found that the largest portfolios of declared SEPs for 4G are owned by LG Electronics, Samsung, Huawei, Qualcomm, Nokia, ZTE, and Ericsson. According to Galetovic et al. (2018), the largest licensors in the mobile telecommunications industry in terms of royalty revenue in 2016 were large SEP owners Qualcomm, Ericsson, Nokia, InterDigital, Philips, as well as IBM and Microsoft. None of these companies has participated in any of the LTE patent pools.

²⁶⁴ <https://images.law.com/contrib/content/uploads/documents/403/16984/Continental-v.-Avanci.Complaint.pdf>

²⁶⁵ See <https://www.lawinsider.com/clause/patent-infringement-indemnification> for a sample patent infringement indemnification clause.

allowed to participate in licensing negotiations, as often it is the component supplier who will eventually bear the economic cost of a license between end product makers and SEP owners.

SEP owners dispute that an indemnification promise by a component maker to an end product maker in and of itself creates an obligation for patent holders to license component makers. SEP owners may argue that it is not good practice for component makers to offer indemnification related to the infringement of patents to which they are not currently licensed.²⁶⁶ From the perspective of SEP owners, component makers may be sufficiently protected by SEP owners' general enforcement practices (component makers can not claim to be excluded from the market if SEP owners do not assert their SEPs against component makers) and "*have made rights*", i.e. the right of licensed end product manufacturers to have their components manufactured by a supplier of their choice.

7.2. Unlicensed use (failure by implementers to accept licensing offer)

Another form of unlicensed use arises when implementers fail to accept a SEP licensing offer. That is, even though SEP licensors are prepared to offer licenses to their SEPs to a certain category of implementers, some or all of these implementers refuse this licensing offer and continue to use the standardized technology without a license.

7.2.1. SEP Licensor reports of unlicensed use of their SEPs

7.2.1.1. Measuring (un)licensed use from infringement notifications

Implementers often first adopt the technology standard, before securing licenses to all SEPs. The rights holders then have to notify implementers of the infringement, and indicate their willingness to offer licenses on FRAND terms. Such a process can result in a licensing agreement if the implementer expresses its willingness to obtain a license. Alternatively, notification of infringement can result in litigation, or protracted infringement, if implementers choose to keep infringing (e.g. due to low assertion risks).

The negotiation process offers an opportunity to calculate the rate of licensed use as follows:

$$\% \text{ of licensed users} = \frac{\textit{infringement notification recipients that license}}{\textit{total number of infringement notification recipients}}$$

²⁶⁶ Rutkowski (2008) e.g. warns that "Indemnification of patent infringement claims is an important riskshifting mechanism that ought to be carefully considered at the time vendor contracts are drafted"; and that indemnitors have no *per se* right to control or otherwise participate in the defense of an indemnitee against patent infringement assertions. <https://www.bakerlaw.com/files/uploads/Documents/News/Articles/INTELLECTUAL%20PROPERTY/2015/Rutkowski-VW-Vendor-Indemnification-of-Patent-Infringement-Claims.pdf>

Such a measure is an **imperfect indicator** of the true percentage of unlicensed uses. On one hand, the rights holders have incentives to send letters to a large list of firms, including firms that are not implementers, to avoid missing actual implementers. On the other hand, patent holders may have incomplete knowledge of the scope of implementation of their patents; or they may choose to only approach a subset of implementers for a variety of reasons. Therefore, the number of infringement letter recipients (i.e. the denominator in the formula above) is an approximation for the true number of implementers. Consequently, the percentage of licensed users calculated according to the formula above will be an **approximation for the true percentage of actual licensees**.

We have information on the percentage of letters that resulted in licenses for a series of programs, provided by one important pool administrator. The percentage of eventually licensed users out of the total number of letter recipients ranges between 6% and 25%. Out of the letter recipients that had not signed license agreements, some gave a response to the rights holder, which could indicate a beginning of bilateral negotiations that may eventually result in signed licensing agreements. The percentage of firms that signed a license or at least gave a response to the infringement letter ranges between 40% and 56%.

Besides the caveats discussed above, it is important to bear in mind that pools are just one licensing channel for firms. Some implementers that do not license from the pool could be doing so bilaterally with the rights holder, introducing yet another source of underestimation of true licensed uses.

7.2.1.2. Licensor survey responses on extent of unlicensed use

Seven SEP licensor representatives surveyed by Heiden and Petit (2017) reported significant and increasing unlicensed use of their companies' SEPs. According to their (averaged) estimates, the percentage of licensed users among firms implementing wireless communication technology protected by their SEPs has decreased from 73% in 2006, to 59% in 2011, and to 39% in 2016. On average, these licensor representatives report that 39% of potential royalty income is lost due to unlicensed use.²⁶⁷

7.2.2. Evidence of unlicensed use from court decisions

While SEP licensors' accounts of unlicensed use are difficult to verify, some court decisions offer more objective information suggestive of pervasive unlicensed use. For example, in German SEP litigation opposing Tagivan (a member of a pool administered by MPEG-LA) to Huawei, there appeared to be agreement between parties that most implementers in the Chinese market have been using the technology without being licensed. In particular, the

²⁶⁷ In addition to the limitations related to the small sample size of this survey, it is important to keep in mind that SEP licensors participating in a survey on the extent of unlicensed use of SEPs may not be representative of SEP licensors more generally. Furthermore, these companies may have incentives to over-represent the extent of unlicensed use for political reasons.

defendant's allegations that its main competitors in the Chinese market remained unlicensed were undisputed between the parties.²⁶⁸

Note that the fact that some prominent implementers remain unlicensed for a period of time, does not imply that they will not sign licensing agreements in the future.

7.2.3. *Economic considerations on unobserved licensed uses by licensee size*

Enforcement is costly; therefore, rights holders need to develop an explicit strategy against whom to assert their patents, and in which order. While it is plausible that the cost of assertion increases in the prospective value of the license, many components of the cost of assertion are independent of the value of the license. Rights holders thus generally have greater incentives to enforce their patents against larger implementers, for which the expected benefit (defined by the value of the potential license) is more likely to outweigh the cost of assertion. Assertion of patent rights against smaller implementers are more likely to be individually *unprofitable*, i.e. the cost of each assertion outweighs the potential revenue that patent holders can derive from licensing each individual implementer.

Such economic logic suggests that licensed uses will vary greatly depending on the revenues of the implementers. In particular, we expect the following patterns across different revenue size groups:

- **Implementers with large revenues** – widely licensed: many patent holders will find it profitable to assert their patents against the implementers with largest revenues; resulting in licenses. Large implementers represent a large share of sales in their industries and consequently, also a large share of revenues in royalty for licensors. For example, about 61% of Interdigital's total licensing revenue stems from only four large licensees.²⁶⁹
- **Implementers with intermediate revenues** – some licensed: there is likely to be a relatively large number of middle-sized implementers against which it is profitable to assert for some licensors. Such licensees might not represent a large share in terms of total royalty income but they could form the majority of licensees in the industry. Data on such licenses is not easily available to produce evidence because many of such licensees are not publicly traded and are not required to disclose information, even though some deals could end in the public domain through court cases.
- **Implementers with low revenues** – unsystematically licensed: the cost of negotiating and administering bilateral licenses with smaller implementers often outweighs the potential revenue that many SEP holders can derive from licensing

²⁶⁸ "To the extent that the companies "Lenovo", "Oppo", "Xiaomi", "Vivo" and "ZTE" remain, which indisputably have not concluded a license agreement, this initially results in a starting point for unequal treatment from the point of view of selective legal prosecution, which the plaintiff objectively justifies." English translation of paragraph 442 of the original (German) decision. The decision (in German) is available here:

https://www.justiz.nrw.de/nrwe/lgs/duesseldorf/lg_duesseldorf/j2018/4a_O_17_17_Urteil_20181109.html

²⁶⁹ Interdigital states in its 2017 10-K form that "Apple, Huawei, Samsung and Blackberry comprised approximately 21%, 14%, 13% and 13% of our total 2017 revenues".

such implementers. Nevertheless, SEP holders may set up licensing programs offering standard terms and conditions, or join patent pools offering standard licenses to implementers of all sizes. While assertions and enforcement through litigation against small implementers is individually unprofitable, SEP holders or licensors may initiate litigation against some implementers to uphold a sufficiently credible threat of enforcement, which may motivate larger numbers of smaller implementers to enter into licensing programs (usually on standard terms).²⁷⁰ Licensing programs such as MPEGLA's programs for MPEG2 and AVC may thus collect royalty payments from several thousand implementers. Nevertheless, most SEP licensors (including owners of some of the largest portfolios of declared SEPs) have negotiated licenses with much smaller numbers of implementers.²⁷¹ This suggests that many of the smaller users of SEP-protected technologies are not even licensed to the largest SEP portfolios.

On one hand, small implementers may benefit from this unsystematic licensing; as they have access to patented technology without the necessity to pay royalties and/or incur the costs of negotiating FRAND licenses. On the other hand, if such firms ever grow in revenues, they will eventually be exposed to a greater risk of assertion.

²⁷⁰ In the only instance in Europe in which a SEP licensor has initiated litigations against larger numbers of smaller infringers of SEPs, Sisvel initiated 316 assertions in Germany against implementers of the MPEG2 and DAB standards from 2000 to 2013. See Table 3 in Contreras, J.L., Gaessler, F., Helmers, C. and Love, B.J., 2017. *Litigation of Standards-Essential Patents in Europe: A Comparative Analysis*. Berkeley Technology Law Journal, 32(4), pp.1457-1488.

²⁷¹ Ericsson e.g. states that it has granted licenses to its 60,000+ granted patents worldwide to "100+" licensees. <https://www.ericsson.com/en/patents> Qualcomm reportedly has licensed its 2G, 3G, and 4G patents to over 300 licensees. <https://techxplore.com/news/2020-09-years-qualcomm-stability-patent.html#:~:text=Qualcomm%20has%20entered%20into%20more,%2C%20Xiaomi%2C%20Oppo%20and%20Vivo>. As stated above, InterDigital and other large SEP licensors disclose that very small numbers of licensees account for the majority of their licensing income.

8. OPT-OUT

We assess empirical evidence regarding the occurrence of opt-out from standards-related innovation as a consequence of current SEP licensing conditions. We first assess the evidence for potential contributor opt-out, i.e. a refusal by potential innovators to invest in R&D related to potential contributions to technology standards and make patented inventions available for inclusion into a standard. We then assess the evidence for potential implementer opt-out, i.e. a refusal by potential producers to create new products making use of standards subject to declared SEPs.

- *Specific contributor opt-out*: It is exceedingly rare that patent holders use the SDOs' patent disclosure process to declare that a patented invention is not available for inclusion into a standard subject to FRAND licensing obligations. Observed instances of "negative declarations" appear to be related to idiosyncratic provisions of individual SDOs' patent policies, rather than general frictions in SEP licensing.
- *Profitability of inclusion of patented technologies into standards*: based on the available evidence, it appears that the inclusion of a patented technology into a standard is usually profitable to the patent holder, despite FRAND licensing obligations. While this does not rule out that there can be specific opt-out in individual circumstances, under current circumstances, it does not seem plausible that this may arise at significant scale.
- *General contributor opt-out*: it is very difficult to estimate whether (potential) contributors to standards development are currently investing significantly less in standards-related innovation than they would in the absence of SEP licensing frictions. Evidence from a limited number of SDO policy changes, sometimes used to assess the causal effects of SEP licensing obligations, does not provide a reliable basis for such an assessment.
- *Patent-related incentives to contribute to standards development*: Econometric evidence suggests that at least in some circumstances, a significant share of contributions to standards development rely on patent-related incentives. Potential causal effects of incremental changes to SEP licensing obligations are much more difficult to assess.
- *Implementer opt-out*: There is no evidence that SEP licensing frictions have a significant impact on implementers' choice between standards subject to declared SEPs licensed on FRAND terms and alternative formats.
- *Delays in standard implementation*: Diffusion curves of standardized technologies subject to SEP licensing on FRAND terms offer no indication that current SEP licensing conditions systematically depress or delay standard implementation.
- *Idiosyncratic SEP licensing frictions*: Observable instances of implementation delays, or declining levels of market uptake of different standard generations, may possibly be attributed to idiosyncratic frictions in the conditions for SEP licensing, which are specific to individual technologies.

(Potential) frictions in SEP licensing may create incentives to "opt out" of the development and implementation of open technology standards including patented technologies subject

to FRAND licensing requirements. We distinguish between contributor and implementer opt-out.

8.1. Contributor opt-out

(Potential) contributors of technological inputs may opt out of contributing to standards development. Policy measures reducing SEP licensing frictions may reduce such “contributor opt-out”, e.g. by increasing the licensing revenue available to owners of SEPs. Policy measures imposing additional costs on SEP holders, or otherwise reducing the profits of contributors to standards development, may reduce contribution incentives and exacerbate “contributor opt-out”.

Specifically, **companies may decide not to participate in standards development** (extensive margin), **or to reduce the extent of their contribution** (intensive margin). Instead of contributing their inventions to the development of open technology standards, companies may develop them as proprietary technology (i.e. fail to contribute their proprietary technologies to open standards development); or they may reduce their R&D investment (i.e. fail to develop potential standard contributions).

Contributors could reduce the effort they put into developing the standardized technology due to a combination of ex-ante and ex-post effects. The ex-ante incentive that implementers have to invest in R&D declines if they anticipate that the expected returns to contributing to the standard is low due to delayed licensing. The ex-post ability to upgrade and improve the standard also declines if companies’ revenues decrease and therefore have lower internal cash-flows to fund subsequent R&D.

SEP licensing frictions may reduce both patent- and product-driven contribution incentives (Baron et al., 2019). SEP licensing frictions may reduce the revenue generated by the owners of SEPs, thus, reducing patent-related incentives to contribute to standards development. SEP licensing frictions may also increase the cost of licensing for standard implementers, thus reducing the profitability of implementing the standard, and reducing product-related incentives to contribute to standards development. **To analyse the effect of licensing frictions on participation in standards development, it is thus necessary to distinguish between licensing costs borne by licensors, and costs borne by licensees.**

Empirically, there currently is limited evidence on the magnitude of contributor opt-out. Nevertheless, there has been empirical research on a number of important aspects of this question. In order to assess the empirical support for concerns about contributor opt-out, we will **distinguish between specific opt-out and general opt-out.**

8.1.1. *Specific contributor opt-out*

By specific opt-out, we mean the failure to make existing, suitable patented technologies available for inclusion into a standard.

8.1.1.1. Negative declarations

First, companies may **explicitly state that their patented technology is not available for inclusion into a standard**. Some companies have an obligation to disclose patents that could potentially become essential to a standard under development. Depending on the SDO, such an obligation may arise out of a company's membership in the SDO, or its participation in a specific standards development activity. Many SDOs offer patent holders the opportunity to declare that they are not willing to make licenses to their patents available to standard implementers on the terms requested by the SDO's policy. In that case, the SDO would usually seek not to include the patented technology in its standards. This would be a clear instance of specific opt-out – an existing patented technology that would potentially be suitable for inclusion in the standard is not being made available by a patent owner.

At ETSI (which provides patent owners with an opportunity to tick a box indicating that they are “not prepared to grant licenses”), 100% of the patent declarations posted on the SDO website indicate that patent owners are prepared to grant licenses pursuant to the SDO's policy.²⁷²

The “Patent Statement and Licensing Declaration” form for ISO, IEC, and ITU similarly offers three boxes: indication that the patent holder is prepared to grant licenses free of charge, prepared to grant licenses on RAND terms, and unwilling to grant licenses in accordance with either of these provisions. The ITU-T patent database currently lists seven “negative declarations” from three different companies.²⁷³ This has to be compared with 7.116 declarations under option 2 (FRAND), and 216 declarations under option 1 (royalty-free).²⁷⁴ ISO's patent database only distinguishes between declarations following options 1 and 2 (presumably indicating that no negative declarations were made).

Since IEEE's (still) current patent policy has taken effect on 15.03.2015, 36 “negative LoAs” regarding the IEEE 802.11 standard or one of its amendments (i.e. declarations that an owner of a potentially essential patent claim is not prepared to grant licenses on the terms requested by IEEE's patent policy) have been submitted and published on IEEE's website.²⁷⁵ Pursuant to IEEE's patent policy, such negative declarations do not automatically lead to the exclusion of the patented technology from the standard; rather, such declarations “shall be referred to the Patent Committee”. While the negative declarations may not have prevented the inclusion of patented technology into IEEE standards, they have (at least temporarily) precluded some IEEE standards from being accredited as American National Standards by ANSI,²⁷⁶ and led ISO to pause fast-track approval of certain IEEE standards as international ISO standards.²⁷⁷

²⁷² Based on Iplytics data.

²⁷³ In December 2001, Corning Cable Systems submitted five negative declarations, TeraLogic Inc. submitted one negative declaration in November 2000, and intoPIX SA submitted one negative declaration in June 2020; <https://www.itu.int/ipr/search.aspx>

²⁷⁴ <https://www.itu.int/ipr/search.aspx>, last consulted on 27.01.2022

²⁷⁵ <https://standards.ieee.org/wp-content/uploads/import/governance/patcom/xls-files/ieee-802.11-amendments.xlsx> last consulted on 19 September 2022. There are indications that additional “negative LoAs” were received by IEEE, but not approved and published on its website.

²⁷⁶ <https://mlexmarketinsight.com/news-hub/editors-picks/area-of-expertise/antitrust/electrical-engineer-institutes-new-wifi-measures-wont-get-american-national-standard-designation>

²⁷⁷ <https://ipeurope.org/blog/more-headaches-for-ieee-this-time-with-iso/>; see also <https://mentor.ieee.org/802-ec/dcn/22/ec-22-0047-00-00EC-ieee-sa-response-to-iso-iec-jtc1-on-802-11ax-05nov2021.pdf>

Negative disclosures are also possible at W3C. Similar to IEEE's patent policy, W3C's policy refers such situations to an ad-hoc Patent Advisory Group, or 'PAG'. Nine disclosures excluding all claims of a patent from W3C's royalty-free licensing commitment have e.g. been submitted by Nokia on 13.02.2013 related to the "Push API" specification. The Push API PAG issued a report, concluding that "the Nokia Patents do not read on the Push API Specification". In August 2021, Apple disclosed 26 patents believed to be essential for the implementation of the "Open Screen Protocol". In July 2022, the Second Screen Working Group PAG published a report, concluding that "the excluded claims do not read on the Open Screen Protocol specification and/or are disclosed in the prior art" – i.e. the patents that Apple did not offer to make available on royalty-free basis were alleged to be either not essential to the proposed W3C standard, or invalid for lack of novelty.²⁷⁸ On the basis of this assessment, the PAG recommended that the Second Screen Working Group continues to work on developing the "Open Screen Protocol"

Overall, this form of "specific opt-out" thus seems to be of limited empirical relevance at most SDOs. One notable exception to this is IEEE, where a significant number of negative declarations have been made by patent owners. Another exception is W3C, where negative declarations have repeatedly prompted W3C committees to seek ad hoc solutions to resolve potential conflicts with patents not available on the royalty-free licensing terms requested by W3C's patent policy. Nevertheless, in both cases, **these negative declarations appear related to patent owners' disagreement with specific policy provisions of these SDOs, rather than general SEP licensing frictions.** Furthermore, it is empirically unclear to what extent the existence of such negative declarations has hampered the inclusion of patented technologies into these SDOs' standards.

8.1.1.2. Patents held by outsiders

Arguably, negative declarations are rare (at least for most SDOs) because this particular form of opt-out often makes little economic sense. Provided that a company has participated in the development of a standard, and it has developed patented technologies suitable for inclusion into that standard, a company will usually be willing to have this technology included into the standard. If a company does not wish to make its patented technology available for inclusion into a standard, it will often also not be willing to participate in the development of that standard.

Situations in which non-participants are unwilling to make their technology available are empirically more difficult to identify. In some cases, potential SEPs owned by outsiders are disclosed to the SDO. Some SDOs' policies e.g. encourage SDO members or participants to bring to the SDO's attention potential SEPs owned by non-participants.²⁷⁹ Nevertheless, in most circumstances, non-participants do not have a patent disclosure obligation, and potentially essential patents owned by such parties are unlikely to be disclosed to the SDO.

In principle, **three** different **scenarios** could arise.

First, a company owning potentially essential patents chooses not to participate in the SDO in order not to be constrained by the licensing obligations arising out of the SDO's patent policies. In this case, the company does not seek to withhold its patent from inclusion into

²⁷⁸ <https://www.w3.org/2021/08/secondscreen-pag/report.html> last consulted on 19.09.2022

²⁷⁹ Contreras (2016) analyzes assertions of *declared* potential SEPs by SDO non-members.

the standard; rather, it seeks to license the patent to standard implementers on terms that are not constrained by the SDO's patent policy.²⁸⁰ It is empirically unclear how many undeclared, but effectively essential patents exist, and are asserted against standard implementers. While theoretically plausible, the incentives of patent holders to stay out of SDOs in order to escape FRAND licensing obligations may in practice be limited. At least in some circumstances, obligations to license SEPs on FRAND terms may already arise out of the patent being essential to a standard, even in the absence of a FRAND licensing commitment by the SEP owner.²⁸¹ Incentives to stay out of SDOs in order to escape the SDO's licensing obligations are thus more likely to arise in the case of SDOs that formulate licensing obligations that are more stringent or more specific than potential patent licensing obligations arising e.g. out of competition law. This is consistent with observable incidences of assertion of patents against implementers of so-called "royalty-free" standards by SDO outsiders (e.g. Bluetooth,²⁸² AV1/VP9²⁸³).

Second, a patent owner may indeed be unwilling to make its patented technology available for inclusion into an SDO's standards, or unaware of an SDO's effort to include its technology. If the SDO nevertheless includes that technology into its standards, the patent owner may not have an obligation to make licenses available to implementers of that standard; effectively preventing lawful implementation of that SDO standard. The extent to which this has effectively happened is empirically unclear, but individual cases suggest that this is a real possibility.²⁸⁴

Third, in order to avoid the two other scenarios, an SDO may choose to avoid the use of the patented technology held by an outsider (resulting in effective "opt-out", i.e. the failure to include a potentially suitable technology into a standard). Once again, the extent to which

²⁸⁰ Layne-Farrar and Llobet (2014) e.g. model a standardization process, in which technology contributors prefer offering their IPR to standards implementers on unconstrained terms rather than joining an SSO whose patent policy limits royalty requests to the technology's "incremental value".

²⁸¹ In the seminal *Orange Book standard* decision of the Bundesgerichtshof, in which the German High Court developed its first framework for the interpretation of SEP owners' licensing obligations, the asserted SEP was not subject to a licensing commitment given to an SDO. In *Huawei v ZTE*, the European Court of Justice identifies two circumstances that distinguish SEPs from patents that are not essential, and because of which a SEP owner's refusal to license such SEPs may, in principle, violate Article 102 TFEU: first, "the fact that the patent at issue is essential to a standard established by a standardisation body, rendering its use indispensable to all competitors which envisage manufacturing products that comply with the standard to which it is linked" (at 49); and second "that the patent at issue obtained SEP status only in return for the proprietor's irrevocable undertaking, given to the standardisation body in question, that it is prepared to grant licences on FRAND terms." (at 51). The licensing commitment by the SEP owner to the SDO is thus only one of two bases for SEP owners' FRAND licensing obligations; and licensing obligations may arise also for patents not subject to FRAND commitments, for the sole reason that the patent is indeed essential to a standard. In *CSIRO v Cisco*, the Court of Appeals agreed with Cisco that the district court erred in failing to account for the extra value accruing to the patent because of the fact that it was essential to an IEEE standard. CSIRO argued that rules excluding the value of standardization from patent infringement damages awards only apply to patents encumbered by a specific licensing commitment, whereas CSIRO had consistently resisted making a licensing commitment to the IEEE. The Court of Appeal ruled that "reasonable royalties for SEPs generally—and not only those subject to a RAND commitment—must not include any value flowing to the patent from the standard's adoption." <http://cafc.uscourts.gov/sites/default/files/opinions-orders/15-1066.Opinion.12-1-2015.1.PDF>

²⁸² Bandspeed, Inc. e.g. sued 45 hardware manufacturers for allegedly infringing its patents through the implementation of Bluetooth technology in their products. While Bandspeed Inc. was a member of Bluetooth SIG until at least December 2002; Bandspeed Inc. claimed that it had withdrawn from the Bluetooth SIG by the time of adoption of the final Bluetooth Specifications accused of infringing its patents. See https://insight.rpxcorp.com/litigation_documents/9186740 and <https://support.bluetooth.com/hc/en-us/articles/360049492351-Patent-Infringement-Litigation-Initiated-by-Bandspeed-LLC-Frequently-Asked-Questions-FAQ>

²⁸³ AV1 video codec, the successor to VP9, was developed by the Alliance for Open Media (AOMedia). While AOMedia members, including Amazon, Apple, ARM, Cisco, Facebook, Google, IBM, Intel, Microsoft, Netflix and Samsung, are bound by AOMedia's royalty-free licensing requirements, numerous other companies that did not participate in AOMedia claim to own patents related to AV1, and offer licenses to their patents on other terms. 18 companies currently participate in Sisvel's "Video Coding Platform" patent pool, offering royalty-bearing licenses to patents alleged to be essential to VP9 and AV1 standards. <https://www.sisvel.com/licensing-programs/audio-and-video-coding-decoding/video-coding-platform/introduction>

²⁸⁴ Rembrandt IP secured a 15.7 million USD jury verdict against Samsung for infringement of its patents by Samsung's Bluetooth 2.0 enabled products. During trial, inventor Gordon Bremer testified he first read the Bluetooth 2.0 specification in 2007, three years after the publication of the specification, and ten years after the first application date of the allegedly infringed patents. <https://arstechnica.com/tech-policy/2015/02/patent-troll-claims-to-own-bluetooth-scores-15-7m-verdict-against-samsung/> See also Contreras (2016).

this happens is empirically unclear. For SDOs operating in particularly “patent-intensive” fields, “standardizing around” patented technologies is believed to be difficult even in the case of potential SEPs disclosed under the SDO’s disclosure obligations. It is likely to be even more difficult for SDO working groups to identify and avoid undeclared potentially essential patented technologies owned by companies not participating in the development of a TS.

Overall, there is limited empirical evidence on unavailability of licenses to outsiders’ patent rights hampering the development and implementation of technology standards. Empirically, it appears that the vast majority of the large assignees of patents in the relevant technological classes are members of the relevant SDOs (and thus usually subjected to disclosure obligations). While it would be difficult to empirically measure this form of “contributor opt-out”, it thus seems that the unavailability of access to patented technology owned by SDO outsiders is not usually a major concern, at least for major SDOs operating under a FRAND patent policy.

8.1.1.3. Profitability of inclusion of patented technologies into standards

Indirect evidence of the empirical relevance of concerns about this form of opt-out can be useful. In particular, concerns about “specific contributor opt-out” are only plausible if – for at least some patent holders – inclusion of a patented technology into an SDO standard is not profitable.

Policy and legal discussions of FRAND licensing principles are often premised on the idea of a trade-off, whereby patent holders benefit from a wider implementation of their patented technology thanks to standardization, and in return make significant concessions, most notably a commitment to make licenses available on FRAND terms.

There is some evidence for the existence of a positive effect of standardization on the use of a patented technology. Using patent citations as an indicator of follow-on inventive activity building on a patented technology, Rysman and Simcoe (2008) document a significant positive effect of a patent’s declaration as potentially standard-essential.²⁸⁵ This evidence provides some empirical support for the suggestion that the inclusion of a patented technology into a standard increases its use.

Nevertheless, evidence for a positive average effect of standardization on the use of patented technologies does not preclude that individual patent holders may find it profitable to withhold their patented technologies from inclusion into an SDO standard.

First, even if the effect of standardization on the extent of use of patented technologies is confirmed to be empirically relevant and significant, this does not guarantee that this benefit outweighs the cost of the obligations arising out of a patent’s standard-essentiality. That is, while standardization may increase the use of a patented technology, it may not necessarily increase the private value of these patents.

²⁸⁵ Rysman and Simcoe (2008) use the disclosure of a patent as potentially standard-essential as indicator for the inclusion of patented technology into a standard. Brachtendorf et al. (2021) extend this analysis by showing that this positive effect of SEP declaration is conditional on a patent’s semantic similarity to the standard, which they find is a significant predictor of a declared SEP’s probability to actually be essential to this standard. This extension corroborates the interpretation that the positive effect of SEP declarations on the number of patent citations is attributable to the benefits of the selection of patented technology into a standard.

There is consistent empirical evidence that declared SEPs are more valuable to their owners than other (comparable) patents – e.g. declared SEPs are more significantly correlated with a firm’s market valuation (Husinger and Schwiebacher, 2015) and operating profits (Pohlmann et al., 2016). Declared SEPs are also significantly more often renewed (Baron and Delcamp, 2011; Baron and Pohlmann, 2018), a common indicator of a patent’s private value (Lanjouw et al., 1998). Nevertheless, these studies do not account for selection effects, which Rysman and Simcoe (2008) have shown to be significant – i.e. are declared SEPs more valuable than other patents because of the benefits of standardization, or are more valuable patents more likely to be declared standard-essential?²⁸⁶

Another indication of the value of standard-essentiality for patent owner is the extent of litigation, in which patent holders seek confirmation that their patents indeed are essential.²⁸⁷ Given that licensing obligations under SDOs’ policies generally only arise to the extent that declared SEPs are indeed essential, the fact that many patent owners seek judicial confirmation of their patents’ essentiality indicates that at least for these patent owners the benefits of essentiality outweigh the costs related to SEP licensing obligations. Nevertheless, there have also been litigations in which a patent holder argues that patent is not essential; whereas the accused infringer argues that the patent is essential to a standard.²⁸⁸

Second, a positive average effect of a patented technology’s inclusion into a standard does not preclude that the balance of the different effects may be negative for individual technologies. It is thus possible that some individual patent holders would elect to opt-out of making their patented technologies available for inclusion into standards; even if the majority of patent holders find such an inclusion to be highly profitable.

To summarize, the existing evidence suggests that the inclusion of a patented technology into a standard usually has – on average – a positive effect on the implementation and use of that technology. It is plausible that this increased use often is sufficient to compensate patent holders for the costs arising out of the inclusion of their patented technology into a standard; e.g. the obligation to make licenses available on FRAND terms.

Nevertheless, there is no specific evidence that would compare the magnitude of these two effects. Furthermore, even if patent holders *on average* benefit from the inclusion of their patented technology into a standard, opt-out incentives may exist for individual patents.

²⁸⁶ Bekkers et al. (2017) argue that patent assertion in litigation is an indicator of patent value; and find that disclosure of a patent as potentially standard-essential has (in most SDOs) a positive effect on a patent’s likelihood to be asserted. While often used as an indicator of patent value, litigation is a problematic indicator in the context of SEP declaration – does increased litigation reflect the patented technology’s increased value and use; or does litigation increase after declaration because of the frictions and contentious legal controversies around SEP licensing?

²⁸⁷ See Contreras (2017) for a list of such cases.

²⁸⁸ In *KPN v Sierra Wireless* before the District Court of the District of Delaware, KPN claimed that Sierra had infringed on its patents, and the implementer (Sierra) filed counterclaims alleging that KPN had breached its contractual obligations arising out of its licensing commitment to 3GPP. The court followed KPN’s argumentation that Sierra did not establish that KPN had licensing obligations, because Sierra did not establish that the patents are indeed essential. Koninklijke KNP N.V. SIERRA WIRELESS, INC. and : SIERRA WIRELESS AMERICA, INC., C.A. No. 17-90-LPS MEMORANDUM OPINION April 16, 2020 https://www.ded.uscourts.gov/sites/ded/files/opinions/17-90_0.pdf Hon Hai v. Ge Fang <http://patentblog.kluweriplaw.com/2015/02/23/to-be-or-not-to-be-seps/> In *Lotes v Foxconn*, Foxconn disputed that its patents were essential to the USB 3.0 specification and thus covered by Foxconn’s commitments to the USB Implementer Forum to make licenses available on “RAND-z” (royalty free) basis. <https://www.essentialpatentblog.com/2013/02/catching-up-on-lotes-v-foxconn-randantitrust-dispute-over-usb-3-0-standard-essential-patents/> In *Cellular Eqpt v. ZTE* (U.S. District Court in 2018). CCE first argued that its patent was, then that it wasn’t essential. Request to dismiss FRAND defense on that basis was denied. See Contreras (2017)

While the existing evidence does not rule out that such opt-out incentives exist, observable instances of specific hold-out are rare, and appear mostly related to controversies about individual SDOs' patent policies. For other SDOs, specific contributor opt-out, i.e. the refusal to make existing, and potentially suitable patented technologies available for inclusion into a standard, thus *currently* appears to be a concern of minor empirical relevance.

8.1.2. *General contributor opt-out*

A more relevant concern may be general contributor opt-out. By *general opt-out*, we mean the failure to develop suitable patented technologies that could be included into a standard, or generally reduced investments related to contributions to standards development. While costs associated with SEP licensing may not be sufficiently prohibitive to discourage patent holders from making already existing technologies available for inclusion into a standard, they certainly have the potential to reduce firms' incentives to invest in the development of such technologies in the first place. Such general opt-out may induce firms to alter the direction of their technological investments; e.g. to invest in the development of proprietary, firm-specific technologies as opposed to developing potential contributions to collaboratively developed open standards. Opt-out may also induce firms to reduce their overall R&D efforts.

It is impossible to observe individual instances of such general opt-out – there is no empirical evidence on technologies that were not developed, and thus do not exist. Nevertheless, empirical economic research may uncover the relationship between SEP licensing and incentives to contribute to standards development. Broadly, two empirical strategies are available to study the role of SEPs (and SEP licensing) as incentive for active participation in standards development: first, a number of studies used changes in individual SDOs' patent policies as “experiments” for the effect of SEP licensing conditions on incentives to contribute to standards development. Second, a number of studies used a variety of econometric techniques to infer the general role of patents for SDO contribution incentives.

8.1.2.1. The role of patents for SDO participation incentives – Empirical evidence

Evidence from SDO policy changes

First, a number of studies have analyzed the rate of companies' participation in standards development at individual SDOs before and after significant changes in these SDOs' patent policies. All of these studies examined SDO policy changes tightening the obligations for owners of potential SEPs, including Vita's introduction of an obligation for SEP holders to disclose most restrictive licensing terms prior to standardization (Contreras, 2013); a patent policy change at Oasis allowing SDO working groups to operate in a “royalty-free” mode (Stoll, 2014); a policy change at W3C generally requiring royalty-free licensing of SEPs (Simcoe and Zhang, 2021); and the much-discussed patent policy change at IEEE-SA, introducing a more restrictive interpretation of “reasonable” royalty rates and curtailing SEP owners' access to injunctive relief (Pohlmann, 2017; Mallison, 2017; Gupta and Efraimidis

,2018; Bonani, 2022; Simcoe and Zhang, 2021). These studies may thus (potentially) provide evidence on the standardization participation incentives generated by general FRAND licensing of SEPs, as compared to less generous remuneration of SEPs under individual SDOs' policies. Indirectly, this evidence may provide an indication of the general importance of patent licensing revenue for standardization participation incentives, including potentially foregone SDO participation incentives due to SEP licensing frictions (under-licensing, licensing delays, costs of licensing, etc.).

The aforementioned studies (most of which have yet to be published in a peer-reviewed academic journal) produce a very inconsistent picture of the role of SDOs' IPR policies for SDO participation and innovation incentives. While some studies document significant declines in SDO participation and/or innovation after restrictive IPR policy changes (Mallison, 2017; Gupta and Effraimidis, 2018; Bonani, 2022), other studies find that the pace of contributions to standards development in SDOs that tightened their patent policy did not significantly change (Contreras, 2013; Pohlmann, 2017; Simcoe and Zhang, 2021). Some studies find a compositional change, indicating that some firms left these SDOs or significantly reduced their participation, while others joined or increased their extent of participation (Contreras et al., 2013; Stoll, 2014).

All these studies share significant limitations, which limit the light they can shed on the general role of SEP licensing for innovation and SDO participation incentives: first, the non-random nature of SDO policy changes reduces the probative value of the "experiments".²⁸⁹ Second, studies using different metrics of "innovation" or "SDO participation" may produce inconsistent results, and there is no agreement on the relative metric.

Third, and perhaps most importantly, the very nature of the observed SDO policy "changes" itself is disputed. While W3C adopted in 2003 its first formal patent policy, requiring members of W3C working groups to license their SEPs royalty-free, there never was an established tradition of FRAND licensing of SEPs related to W3C standards.²⁹⁰ Unlike W3C, Oasis and Vita made changes to an existing policy allowing for SEP licensing on RAND terms. Nevertheless, FRAND licensing of SEPs remains possible at individual Oasis working groups, and Vita's policy applies to a very small population of patents – as mentioned in Section 4.2.1, Vita received merely 14 disclosures in the 15 years since entry into force of the policy.

The revision of the IEEE-SA patent policy in 2015 constitutes the most significant policy change in an SDO with extensive and established SEP licensing on FRAND terms. Nevertheless, the nature of the policy change is highly disputed. On one hand, some stakeholders claim that the policy "update" merely clarifies what had always been the correct interpretation of IEEE's patent policy. Furthermore, the additional provisions and definitions introduced into IEEE's patent policy relate to an evolving and contentious general legal framework for SEP licensing; and some stakeholders believe that some of the more

²⁸⁹ Specifically, policy changes are endogenous to conditions that may correlate with changes in the general level of innovation and SDO participation, as well as the relative level of participation by companies that are more or less reliant on SEP licensing revenue; e.g. SDOs may have changed their patent policy in recognition of a trend of increasing contributions from companies whose business model does not rely on SEP licensing.

²⁹⁰ According to Contreras (2015), until the late 1990s W3C had no formal patent policy, and followed a "gentleman's agreement" of royalty-free licensing. When a small firm in 1999 attempted to license patents alleged to be essential to W3C standards, W3C obtained legal expertise to argue that implementations of the W3C standard did not infringe upon the patent. In 2001, W3C proposed a first patent policy, allowing working groups to decide whether to work in royalty-free or RAND mode. W3C communicated in response to public comments that the policy would not constitute "the end of royalty-free licenses for W3C Recommendations", and that RAND licensing of SEPs is common *at other SDOs* (such as ETSI and IETF). <https://www.w3.org/2001/10/patent-response#option> Nevertheless, the proposed policy faced significant opposition from proponents of royalty-free access to W3C Recommendations, who claimed that large corporate interests were "hijacking" the historically open tradition of W3C (Contreras, 2015). Overall, the record indicates that (F)RAND licensing of SEPs was never firmly established at W3C. The patent policy of 2003 codified what many participants understood to be longstanding practice at W3C.

contentious provisions of the IEEE patent policy are generally applicable to all SEPs.²⁹¹ On the other hand, it is unclear to what extent the 2015 patent policy has ever become effective. As noted in Section 8.1.1.1., a larger number of companies have declared that they are not prepared to make licenses available under the terms of the 2015 patent policy; other companies continue to contribute under the terms of IEEE-SA's previous patent policy (of 2007).²⁹² While a larger number of companies have made affirmative declarations that they would license any patents essential to IEEE standards on terms compliant with the 2015 policy, these companies do not include any of the known active licensors of SEPs related to WiFi standards.²⁹³

First, it is thus not clear to what extent the SEP licensing obligations for companies participating in IEEE standards development really have changed.²⁹⁴ Second, to the extent that there are significant observable changes in participation, it is not clear whether firms are responding to a modified level of patent-related incentives; or to other changes created by the 2015 policy. Any changes observable in particularly patent-intensive parts of the standards development activities at IEEE-SA may more directly reflect disagreements between proponents and opponents of the 2015 policy, rather than the softening of patent-related contribution incentives induced by any actual modifications in the obligations that are applicable to the licensing of SEPs for IEEE standards.²⁹⁵ If it was possible to causally attribute particular changes to the policy change, it would still be unclear whether these changes reflect changes in the "patent-friendliness" of the policy, or changes in the extent to which the policy is clear, certain, and consistent with other SDOs' policies.

Overall, evidence on the role of SEP licensing for contribution incentives from SDO policy changes is thus inconclusive.

Other econometric evidence

In addition to aforementioned studies of individual SDO policy changes, a number of empirical studies have analyzed the role of patents for SDO participation incentives using other methods. Some studies investigate the correlation between patenting and SDO participation at the firm level. While Blind and Thumm (2004) e.g. find that firms strongly relying on patents tend to participate less in standards development, Gandal et al. (2004) find a positive correlation between patenting and SDO participation. These correlations are not necessarily indicative of a causal role of patents for SDO participation. Using a conjoint study approach, Fischer and Henkel (2013) find that patenting and contributions to standards

²⁹¹ (e.g. severe restrictions on access to injunctions, exclusion the value of standardization from the "reasonable" compensation of SEP holders, etc.)

²⁹² , either claiming that their contributions are covered by a blanket assurance given before the introduction of the new policy, or using a provisional mechanism whereby IEEE allows companies to continue to make licensing assurances under its former patent policy for certain standards

²⁹³ While these companies certainly contribute to IEEE standards development and may own significant numbers of (potential) SEPs related to IEEE standards, it is not clear if any of these companies currently actively licenses these patents on terms governed by the IEEE policy, or whether the policy had any effect on the licensing intentions or practices of these companies.

²⁹⁴ Perhaps patent-driven contributions to IEEE standards development may continue unabated, because the relevant SEP owners and contributors (for now) can continue to contribute under the 2007 version of the policy; or perhaps patent-related contribution incentives are unchanged because the new policy terms are just a clarification of what had always been a requirement.

²⁹⁵ Because of the existence of negative declarations, certain IEEE standards have e.g. been refused accreditation as American National Standards (ANS). Both opponents and proponents of the IEEE policy may furthermore change their level in IEEE participation in order to further a broader political agenda (i.e. demonstrate support or opposition to the policy, in order to influence other SDOs' policy choices). Various stakeholders reported that the controversy regarding the IEEE's patent policy largely related to potential "spillover" effects on other SDOs (see Baron et al. 2019).

development are strategic complements (i.e. the extent to which a firm engages in one of the two activities increases in the extent to which it engages in the other), but this complementarity is only observable at lower levels of patenting and contributions. Overall, this evidence is inconsistent, and does not support strong conclusions regarding the causal role of patents for SDO participation. More recently, Rosa (2022) offers a structural empirical model of participation in standards development, and finds that changing 3GPP's IPR policy to royalty-free would suppress contributions to standards development by 18%.

8.1.2.2. Assessment of potential for general contributor opt-out because of SEP licensing frictions

Overall, empirical evidence suggests that SEP licensing on FRAND terms may play an important role in incentivizing firms' contributions to standards development, but the magnitude of this effect is contested, and likely to vary significantly from one SDO to the other. Furthermore, the empirical effect of SEP licensing *frictions* on contribution incentives differs from the more general role of FRAND licensing as contribution incentive; i.e. the question whether significant numbers of contributions to standards development may be lost if FRAND royalties were generally unavailable differs from the question whether significant additional contributions may be generated by reducing frictions in SEP licensing.

First, there is no reliable evidence on the magnitude of potential SEP royalty revenue lost to licensing frictions. While some SEP holders claim licensing revenue shortfalls due to "hold-out", estimating what royalty revenues could be generated in a scenario with lower SEP licensing costs is challenging.

Second, the role of currently realized FRAND royalty revenue for firms' SDO contribution incentives (i.e. the difference between observable contribution levels and counterfactual contribution levels in a hypothetical, royalty-free benchmark) may differ from the marginal effect of any increases in royalty revenues beyond their current level.²⁹⁶

Third, SEP licensing affects contribution incentives driven by both patent- and implementation-related revenue. Generally, companies may contribute to SDOs in view of potential licensing SEP licensing revenue, and/or in view of revenue from standard-related product sales (see Baron et al. 2019-1). Increasing SEP royalty levels increases patent-related revenue, thus increasing patent-related incentives to contribute. At the same time, higher royalties for SEPs usually means that lower profits are available for standard implementers, thus limiting the role of prospective standard-related product sales as contribution incentives. Reducing SEP licensing frictions produces different effects: it (usually) increases the potential for patent-related revenue, thus increasing net licensors' patent-related incentives to contribute; and (on average) it lowers licensing costs for implementers and increases standard-related product sales, thus potentially strengthening product-related contribution incentives. As variations in the level of SEP royalties affect contribution incentives through different channels than variations in the cost of SEP licensing, the effect of SEP licensing frictions on SDO contribution incentives cannot be

²⁹⁶ The marginal effect of increasing royalty revenue on R&D and contribution incentives is likely to be higher at low royalty levels. Baron et al. (2014) e.g. find that there is a socially optimal royalty level. Below that socially optimal level, increases in royalty rates increase companies' incentives to participate in the development of a socially valuable standard; above that level, further increases in royalty rates induce wasteful duplicative R&D spendings and patent races.

directly inferred from the (limited) available evidence on the role of SDOs' licensing policies.

To summarize, there is no indication that there currently is pervasive *specific* contributor opt-out: when companies have developed and patented a technology that is suitable for inclusion into an SDO standard governed by a FRAND licensing policy, they usually make this technology available. While SEP licensors warn that systemic problems in SEP licensing (such as pervasive licensee hold-out, or severely limited FRAND rates) may cause patent holders to prefer other ways for bringing their technologies to the market, there is no evidence that this is currently taking place at significant levels. The more relevant concern is *general* contributor opt-out; i.e. companies concerned about SEP licensing conditions may reduce their investments in developing potential contributions to standards development in the first place; either by generally reducing their R&D efforts, or by changing the direction of their R&D (giving preference to proprietary technologies). It is plausible that reduced royalty revenue for SEP holders lead to reduced SDO contribution incentives. It is unclear however how much potential SEP royalty revenue is currently being lost to SEP licensing frictions, what the elasticity of contributions to royalty revenue is at the current level of SEP remuneration (i.e. what the marginal effect of increases of SEP holders' revenue beyond their current level would be on their incentives to contribute), and what the social utility of any additional contributions would be (i.e. whether additional incentives to contribute to standards development generate significantly better standards, or increase duplicative spendings and wasteful R&D races).

8.2. Implementer opt-out

Another *potential* concern is implementer opt-out. Because of (anticipated) SEP licensing frictions, implementers may opt out of implementing standards subject to SEPs. There are **at least five possible scenarios** of implementer opt-out.

8.2.1. *Adoption of inferior royalty-free alternatives to FRAND-encumbered standards*

In some cases, technology adopters may have a choice between different standards, where one of these standards is subject to SEPs licensed on FRAND terms, whereas the other standard is available for implementation without the necessity to pay royalties (e.g. standards subject to royalty-free licensing policy, or standards without SEPs). In the absence of SEP licensing frictions, implementers will implement the FRAND-encumbered standard if the technical advantage of this standard is sufficient to compensate for the cost of the necessary SEP licenses. In a frictionless environment, SEP holders would make licenses available on terms that take the existence of a competing standard into account (i.e. terms that are sufficiently advantageous so that the FRAND-encumbered standard is implemented whenever it is the technically superior standard). In this hypothetical, friction-less scenario,

the existence of SEPs subject to FRAND licensing terms should thus not affect the adoption choice between different standards.

The existence of frictions in SEP licensing, e.g. related to the sequence of standardization, implementation, and licensing decisions, may result in departures from this technically efficient outcome. In that case, implementers may adopt an inferior but royalty-free standard, e.g. because SEP holders cannot credibly commit to keep the aggregate royalty burden below the value of the technical advantage of the FRAND-encumbered standard. In that case, implementers may choose (or entire industries converge on) the royalty-free option, even when the FRAND-encumbered standard is technically superior. This use of a suboptimal technology generates an overall loss in social welfare.

Empirically, it is difficult to reliably identify instances in which (potential) SEP licensing inefficiencies have driven adoption choices away from a standard subject to FRAND licensing. The IEEE 1394 (“FireWire”) standard has been cited as an example of a standard subject to SEPs licensed on FRAND terms that failed to gain widespread and sustained market adoption, while an alternative standard subject to royalty-free licensing requirements (in this case USB) was widely implemented.²⁹⁷ Indeed, at least at some stages of their respective development stages, FireWire appeared to be superior along at least some relevant technological dimensions.²⁹⁸ The USB Adopters Agreement stipulates a royalty-free licensing requirement;²⁹⁹ whereas royalty-bearing SEP licenses for IEEE 1394 are made available inter alia by a patent pool administered by MPEGLA.³⁰⁰

Nevertheless, empirical research on the causes for the success of USB in its competition with IEEE 1394 has identified a variety of different factors, such as the greater flexibility of the USB consortium’s standards development processes.³⁰¹ Furthermore, in spite of the existence of a royalty-free licensing requirement in the USB Adopters Agreement, there has been patent litigation related to implementations of the USB standard.³⁰² In the absence of further empirical research and an explicit identification strategy, it is not possible to assess the effect of USB-IF’s royalty-free patent policy, or the SEP licensing practices surrounding IEEE 1394, on the relative product-market success of the two standardized technologies.

There are several other examples of standards subject to FRAND licensing commitments competing with standards subject to royalty-free patent licensing requirements. A number of video and audio coding standards developed in open SDOs compete with open-source codecs; resulting in users having a choice between formats available on royalty-bearing and royalty-free basis. Advanced Video Coding (AVC), standardized as ISO/IEC 14496.10 and ITU-T H.264, has competed (at least in some implementations) with VP8. VP8 is subject to

²⁹⁷ Baron et al. (2018), at p. 67

²⁹⁸ According to a blog article comparing IEEE 1394 (FireWire) and USB 2.0, “The main difference between the two is that FireWire is made to handle more data than USB, particularly audio and visual information. For example, a 2.0 USB can handle a data transfer rate of 480 Mbps, whereas an 800 FireWire can take on 800 Mbps.” <https://computer.howstuffworks.com/difference-between-firewire-usb.htm#:~:text=The%20main%20difference%20between%20the,can%20take%20on%20800%20Mbps>. Note that with USB 3.0, data transfer rate has increased to 4.8 Gbit/s, a tenfold improvement over USB 2.0

²⁹⁹ USB 3.0 ADOPTERS AGREEMENT, clause 2.1. https://usb.org/sites/default/files/USB%203_0%20Adopters%20Agreement%20PDF%20Submission%20Update%2020210617.pdf

³⁰⁰ <https://www.mpegla.com/programs/1394-program/>

³⁰¹ Chikako Takanashi & Kyoung-Joo Lee: “Standard development by committees and communities: a comparative case study of IEEE1394 and USB”, *Technology Analysis & Strategic Management* Volume 25(1), 2013

³⁰² *Lotes v. Foxconn*, District Court of the Southern District of New York.

an irrevocable patent promise by Google. In spite of competition from royalty-free formats, AVC has achieved wide market implementation.³⁰³

AVC's successor High-Efficiency Video Coding (HEVC), standardized as ITU-T standard H.265 and MPEG-H Part 2, is also subject to the ISO/IEC/ITU Common Patent Policy. While a single patent pool offered a one-stop licensing solution for at least a very significant share of the SEPs for AVC, several licensing administrators offer royalty-bearing licenses to different portfolios of HEVC SEPs.³⁰⁴ HEVC is competing with different formats, including "open source" codecs such as AV1 and VP9 (which are both based on VP8). AOMedia Video 1 (AV1) was developed by the Alliance for Open Media; whose patent policy stipulates a royalty-free patent licensing requirement. Many studies comparing the technical efficiency of AV1, VP9, HEVC, and other video coding formats suggest that the technical performance of these formats is similar (at least to the extent that each of these formats is superior to both AVC and VP8).

In spite of the competition from different open-source formats, and the failure of HEVC SEP holders to agree on a one-stop SEP licensing solution, a large number of product market implementations of HEVC have been announced and released since 2012.³⁰⁵ Nevertheless, the HEVC patent pools (currently) list much smaller numbers of licensees than AVC.³⁰⁶ As HEVC is also a more recent technology, it is important to compare uptake of the HEVC patent pool licensing offers over time, compared with previous generations. Figure X represents the number of licensees listed on pool licensing administrators' websites over time, beginning with the date of first publication of a list of licensees. It is apparent that the number of licensees of the HEVC patent pools grows more slowly than pools for previous generations of video coding technologies. This may provide an indication that HEVC patent pools are currently not on track to achieve the industry coverage that previous generations of pools have achieved.

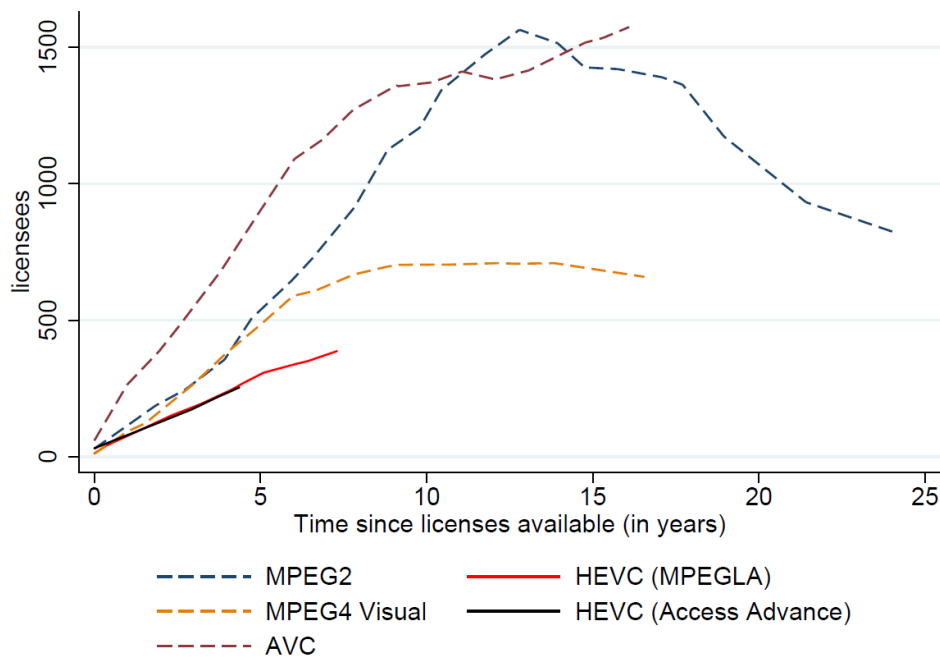
Figure 42: Roll-out of pool licensing programs for different generations of video compression technology standards

³⁰³ One indication of this wide product market implementation is the large number of licensees of MPEGLA's AVC patent pool licensing program. At our most recent visit, MPEGLA's website listed 1577 AVC licensees. <https://www.mpegla.com/programs/avc-h-264/licensees/> (last consulted on 31 January 2022). In the view of at least some observers, AVC has an "implementation advantage" rather than a technical advantage over VP8. <https://www.streamingmedia.com/conferences/west2010/presentations/SMWest-2010-H264-VP8.pdf>

³⁰⁴ See e.g. MPEGLA's licensing program, <https://www.mpegla.com/programs/hevc/>; as well as the licensing program by Access Advance <https://accessadvance.com/licensing-programs/hevc-advance/>

³⁰⁵ https://en.wikipedia.org/wiki/High_Efficiency_Video_Coding_implementations_and_products

³⁰⁶ MPEGLA's HEVC program currently lists 384 licensees. <https://www.mpegla.com/programs/hevc/licensees/> Access Advance lists 249 HEVC pool licensees in good standing, and 4 licensees out of compliance. <https://accessadvance.com/hevc-advance-patent-pool-licensees/> (both last consulted on 31 January 2022).



It is not clear from this analysis whether the HEVC standard (currently) has a smaller number of implementers [implementer opt-out], or (so far) a lower share of the HEVC implementations are licensed under these patent pool licensing programs [under-licensing]. Nevertheless, in either case, the failure of HEVC patent owners to agree on a single pool, compounded by the fact that some patents were included in multiple pools, may have had a negative effect on the growth of HEVC SEP licensing programs.

It is also important to note that the fact that a standard is subject to a royalty-free licensing requirement does not guarantee that all SEPs for that standard are effectively available royalty-free, or that no patent litigation arises against implementations of such a standard. There has been patent litigation around USB 3.0 and VP8,³⁰⁷ and Sisvel offers royalty-bearing SEP licenses for the “royalty-free” AV1/VP9 standards.³⁰⁸

While it is thus certainly possible to identify instances in which standards subject to SEPs licensed on FRAND terms compete with standards subject to royalty-free licensing policies, it is more difficult to assess to what extent SEP licensing on FRAND terms influences product market implementation choices between these formats. There are individual instances in which “royalty-free” formats appear to have prevailed (USB), as well as cases in which standards subject to FRAND licensing have achieved an “implementation advantage” over competing open-source formats (AVC). It is certainly plausible that SEP licensing frictions are less significant in driving adoption choices away from standards subject to a more comprehensive one-stop licensing process (AVC) as opposed to standards with a more “fragmented” SEP licensing landscape (HEVC). It is evident that the existence of royalty-free competing formats constrains SEP owners’ royalty requests, and it is plausible that significant competition from royalty-free formats may exercise some discipline that encourages the formation of more encompassing patent pools.³⁰⁹ Nevertheless,

³⁰⁷ <http://www.fosspatents.com/2013/03/nokia-comments-on-vp8-patent.html>

³⁰⁸ <https://aomedia.org/license/patent-license/>

³⁰⁹ Industry stakeholders have e.g. pointed to “fragmentation” in the licensing of HEVC SEPs to influence SEP licensing intentions for the successor generation, VVC: <https://www.streamingmedia.com/Articles/Post/Blog/VVCs-Adoption-Hampered-by-Patent-Uncertainty-and->

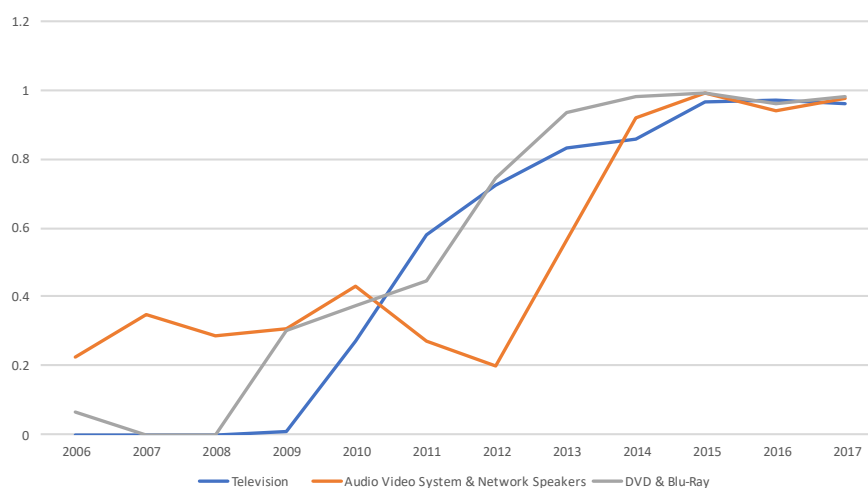
concerns over SEP licensing terms seem to significantly affect producers' implementation choices only when competing formats achieve similar performance (or consumers' valuation for further performance increases is low). Overall, there is thus no strong evidence that SEP licensing frictions currently lead to significant distortions in product market implementation decisions and widespread adoption of inferior, but royalty-free technologies.

8.2.2. *Decision not to adopt a certain functionality*

Another possible form of “implementer opt-out” is the decision not to adopt a certain feature or functionality. Standardized technologies subject to SEPs may constitute optional instead of essential features of a certain product. In that case, the cost associated with (anticipated) SEP licensing frictions may discourage implementers from including such optional features into their products; even though this feature could potentially add value to the product.

Empirical evidence from different standards does not provide a consistent picture regarding the empirical relevance of this form of opt-out. On one hand, standards subject to the largest numbers of declared SEPs (which are also the standards associated with a significant share of observable SEP licensing disputes) have spread to an increasing number of industries, and are frequently implemented in products that do not (strictly) require this functionality. WiFi technology e.g. has gradually been implemented in an increasing share of consumer electronics products such as television sets, audio/video systems, and DVD/Blu-Ray players. While these devices pre-existed WiFi technology, over a period of about seven years, the share of new products in these categories implementing WiFi technology increased from close to 0 to close to 100%.

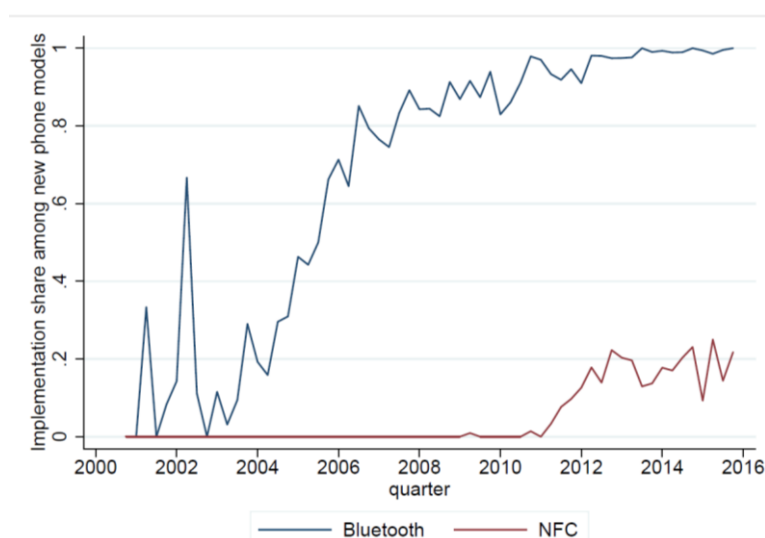
Figure 43: WiFi implementation share in different product categories (from DLNA)



On the other hand, some other technologies subject to FRAND licensing of SEPs did not reach (or at least for some time did not reach) comprehensive market coverage of the products for which they were intended. Bluetooth and NFC are two different low-distance wireless communication technologies. While Bluetooth is standardized by the IEEE-SA, it is developed by the Bluetooth SIG consortium, which has a royalty-free SEP licensing policy.³¹⁰ NFC, on the other hand, was standardized by ISO/IEC, (and later ECMA), and is thus subject to the ISO/IEC/ITU Common Patent Policy. Different licensors offer royalty-bearing licenses to patents declared to be essential to NFC.³¹¹ While other licensing administrators had worked towards creating pool licensing programs for NFC, these programs do not seem to have resulted in comprehensive pool licensing of SEPs related to NFC.³¹²

At least until 2019, NFC does not seem to have achieved fully comprehensive coverage of relevant product markets. While, as of 2009 (8 years after the launch of the first phone with Bluetooth functionality), close to 100% of all new phone models introduced in the market have Bluetooth functionality, in 2019 (8 years after the launch of the first phone with NFC functionality), NFC was incorporated in only 36% of new phone models. Of course, NFC and Bluetooth are different technologies, rather than competing formats for the same functionality, and comparing diffusion curves of different technologies is problematic. Many different reasons can have contributed to NFC's slower diffusion, and empirical research with an explicit identification strategy would be required to identify the causal effect of the different licensing terms for SEPs related to these different standards.

Figure 44: Bluetooth/NFC implementation share in mobile phones



8.2.3. Continued use of an inferior legacy technology

Another potential form of implementer opt-out is continued use of the legacy standard. While cellular connectivity e.g. is an essential feature for a mobile phone, mobile phones

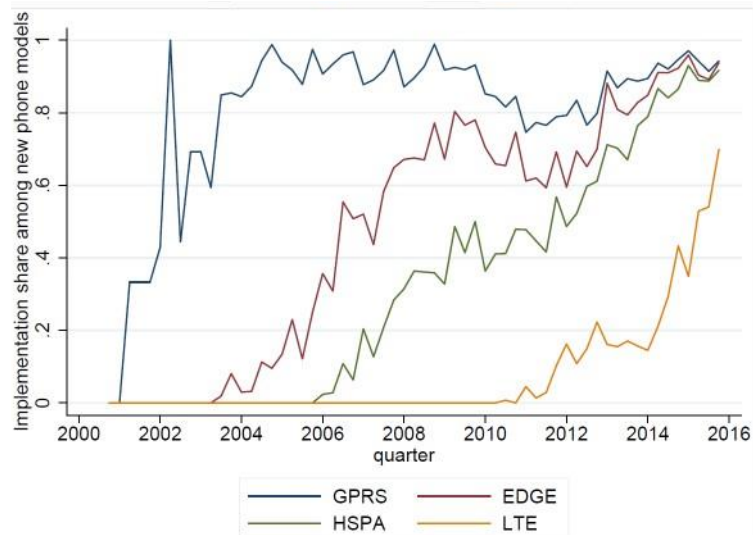
³¹⁰ BLUETOOTH PATENT/COPYRIGHT LICENSE AGREEMENT <https://www.bluetooth.com/wp-content/uploads/2019/03/PCLA-E-Sign-Version-Version-11.pdf> Clause 5.a

³¹¹ E.g. <https://www.francebrevets.com/en/10-programme-de-licence-nfc>

³¹² Via Licensing announced a pool licensing program for NFC in 2009, but the program is not currently listed among Via Licensing's patent pools. <https://www.insidesecond.com/Company/Press-releases/VIA-LICENSING-AND-PARTICIPATING-LICENSORS-ANNOUNCE-AVAILABILITY-OF-DISCOUNTS-OR-CAPS-ON-NFC-ESSENTIAL-PATENT-LICENSE-FEES-FOR-NFC-CONSUMER-DEVICE-MANUFACTURERS>

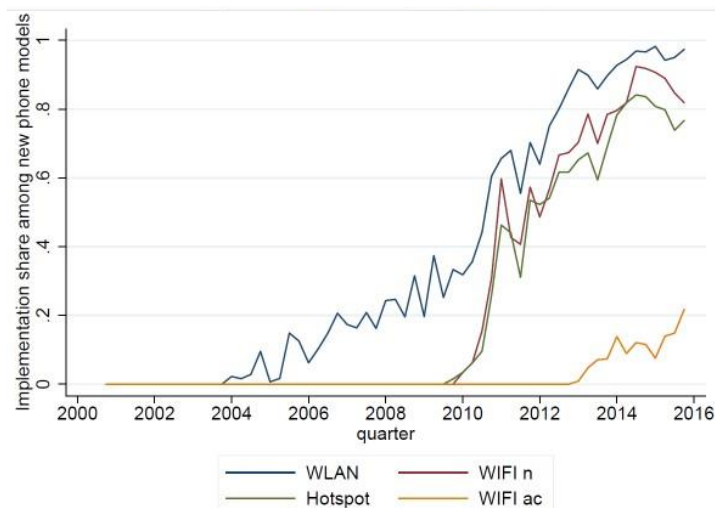
that are only capable of 2G/3G/4G cellular communication continue to be usable, even though 5G cellular communication technology is also available. Historically, each new standard generation has been adopted gradually in the market; with higher-end models being first to implement cutting-edge standardized technology. Nevertheless, over time, newer generations of cellular communication technology have consistently achieved close to 100% coverage of new phone model releases.

Figure 45: Implementation share of different generations of cellular connectivity technology in mobile phones



A similar trend can be observed for WiFi technology. In spite of the existence of large numbers of “blanket declarations” of potential SEPs for WiFi technology, significant SEP litigation surrounding WiFi, and (more recently) sustained controversy around IEEE’s patent policy, newer generations of WiFi have generally gradually achieved comprehensive product market coverage in relevant markets.

Figure 46: Implementation share of different WiFi generations in mobile phones



8.2.4. *Delay in market implementation*

The diffusion curves displayed in Sections 8.2.2 and 8.2.3 illustrate the gradual diffusion of a new technology after first product market introduction. The diffusion of new technologies very often follows an “S-shaped diffusion curve”;³¹³ and mobile communication technology is known to follow similar patterns.³¹⁴ Indeed, our data illustrate S-shaped diffusions of technologies subject to both FRAND (WiFi, EDGE, LTE,..) and royalty-free (Bluetooth) licensing of SEPs.

Of course, between different diffusion curves, there is substantial variation in diffusion speeds. For example, 4G LTE seems to have implemented more quickly in a larger share of new phone models than previous 2.5G EDGE and 3.5G HSPA; and WiFi n appears to have spread more quickly than both preceding and succeeding generations of WiFi technology.

Analyzing the causal effect of SEP licensing on these diffusion speeds is an important, but challenging task. Many different factors contribute to determine the speed at which new communication technology standards diffuse – e.g. competition between standards (e.g. HD-DVD vs. BluRay, competing 2G standards in the US), high cost of spectrum licenses and infrastructure investments (3G in Europe), and reglementary fragmentation (3G, 4G, and 5G in Europe) have all been discussed as potential causes of substantial delays in the implementation of new technology standard generations. This co-existence of multiple factors makes it difficult to isolate the individual causal effect of SEP licensing; especially because there is limited variation in and absence of systematic empirical data on SEP licensing conditions.

There are however qualitative assessments of the role of SEP licensing conditions for technology diffusion. Bekkers et al., (2014-1) suggest that the existence of SEP licensing programs was crucial for fast adoption of certain standardized technologies (e.g. BluRay), characterized by competition between different standards.³¹⁵ At the same time, other standards (such as GSM) achieved fast diffusion rates in spite of significant SEP licensing frictions.³¹⁶ Bekkers et al. (2014-1) also observe that the potential for SEP licensing frictions to cause implementation delays is mitigated by pervasive ex post licensing.³¹⁷ Overall, these qualitative discussions support the suggestion that licensing frictions have the *potential* to cause implementation delay; but that the actual occurrence of such delays is rare; first, because the potential for such adverse effects creates discipline on SEP holders’ licensing practices (where concerns about SEP licensing conditions may discourage implementation, SEP holders are more incentivized to form pools or otherwise address such concerns); and

³¹³ A seminal analysis of different mechanisms that could explain such S-shaped diffusion patterns is Geroski, (2000). “Models of technology diffusion”, Research Policy

³¹⁴ See e.g. Wu and Chu (2010), “Diffusion models of mobile telephony”

³¹⁵ “To facilitate a fast take-up of the technology the Blu-ray licenses are marketed via two patent pools (One-Blue – covering 15 licensors – and BD Premiere – covering 6 licensors). A fast take-up was necessary to gain a competitive edge vis-à-vis HD DVD in the ‘race’ for the market.” Bekkers et al. (2014-1), at 71

³¹⁶ “By 2000 the mobile penetration rate in most EU countries was between 60 to 90%, whereas only 40% of Americans had a mobile phone connection. Only in 2008 did the United States have a penetration of around 80%. By that time, the European economy showed mobile penetration rates (far) beyond 100%.” (Bekkers et al. (2014-1) at 114)

³¹⁷ “The time-to-market problem is mitigated in some industries (for instance in ICT) by the fact that, as a matter of current practice, patent holders allow implementation to occur before the licence agreements have been finalized.” Bekkers et al. (2014-1), at 114..

second, because most implementers choose to bring the product to the market first, and take care of SEP licensing later.

8.2.5. *Failure to offer a certain product at all*

It is difficult to provide empirical evidence on products that do not exist. Similar to “general contributor opt-out”, the most general form of “implementer opt-out”, i.e. the decision not to create a certain product because of potential SEP licensing risks, can only be identified through rigorous empirical economic research assessing the elasticity of product market innovations with respect to SEP licensing conditions.

Nevertheless, there are isolated instances of “specific implementer opt-out”, in which implementers (temporarily) withdrew certain products from a certain market in response to an adverse event in SEP licensing disputes. These are clear instances of implementer opt-out – an existing product for which a positive demand exists is not being made available (or is temporarily unavailable) in a certain market because of SEP licensing frictions.

Florian Mueller compiled a list of such instances in a recent blog post on his blog FOSS Patents.³¹⁸ The most recent instance is Oppo’s decision to suspend sales of smartphones and smart watches in Germany following a Munich court’s award of an injunction in a SEP licensing dispute with Nokia. Awards of injunctions in SEP licensing disputes are not exceptionally rare in Germany, but usually, these injunctions are not enforced, and lead to the conclusion of a SEP license rather than the withdrawal of the infringing product. In Mueller’s judgment, Oppo’s decision was “shocking”, as it is the first instance of a major smartphone maker exiting a major market over a SEP licensing dispute.

In previous instances of product market withdrawals discussed by Mueller, smartphone makers including Apple withdrew some, but not all of their products from the German market, and/or suspended a certain feature. These partial withdrawals also were temporary (and short-lived) in nature. By contrast, Oppo’s withdrawal may impact up to 10% of the smartphones sold in Germany.³¹⁹ Whether this *unprecedented* situation will really result in the effective elimination of a significant product offering from the German market thus depends on how long Oppo’s withdrawal will last, and whether Nokia will seek (and succeed) to effectively shut down supply of Oppo products to German consumers through imports from other countries.

This case, and Mueller’s discussion, provide two useful insights on the risk of “specific implementer opt-out”. First, instances of specific implementer opt-out are currently highly exceptional – despite the relatively large number of SEP licensing disputes in European courts, it is very rare that such a dispute makes an allegedly infringing product effectively unavailable for EU consumers. Second, there is a real possibility for global SEP licensing disputes to result in situations in which products are (at least temporarily) withdrawn from a certain national market. Implementers are most likely to exit a market in response to a national court’s injunction (or the risk thereof) if their profits in that particular market are small compared to the effect of the court’s decision on worldwide royalty payments. In turn, SEP holders are likely to seek injunctions in markets that are sufficiently large to provide

³¹⁸ <http://www.fosspatents.com/2022/08/shocking-nokia-patents-other-lawsuits.html>

³¹⁹ Nevertheless, in the short term, the impact on German consumers will be limited, as most consumers procure their phones from re-sellers who are not currently impacted by the withdrawal.

them with sufficient leverage in SEP licensing negotiations. In the EU, at least in the short term, German consumers are most at risk of losing access to certain products, because of the preponderant role of German court decisions in EU-wide SEP litigation. Other EU Member States may face different situations. On one hand, courts in smaller markets are less attractive for SEP holders, as their injunctions provide less leverage. On the other hand, if litigation in a smaller country were to result in an injunction related to a worldwide SEP licensing dispute, such an injunction would be more likely to cause an implementer to exit that particular market, rather than changing its views on FRAND licensing terms for a global SEP license.

8.3. Overall empirical assessment of opt-out

The question to which extent there is opt-out from SEP-related innovation – e.g. failure to develop a certain invention, failure to make a patented invention available for inclusion into a standard, or failure to implement a standard subject to (potential) SEPs – is of significant policy relevance.

At least currently, we see no evidence for large scale opt-out that would reduce the availability of standards-related innovations to European consumers. Instances of specific contributor or implementer opt-out (e.g. declarations that certain patented inventions are not available for inclusion into a standard, or withdrawals of certain products from a certain market in response to SEP licensing disputes) are very rare, and often related to idiosyncratic disputes, rather than general SEP licensing frictions.

Clearly, these instances would only represent the tip of the iceberg of potential opt-out due to SEP licensing frictions. More general, and less explicit, forms of opt-out may include reduced or delayed implementation, or declines in innovators' investments in standard-related R&D. More rigorous econometric research is needed to assess the possible effect of SEP licensing frictions on contributions to standards development and standard implementation. While certainly not providing causal evidence on the role of SEP licensing, existing descriptive evidence on certain standards subject to SEPs (e.g. Galetovic et al, 2015) indicates that many of these standards experience healthy innovation and wide adoption. In our assessment, opt-out from SEP-related innovation is (at least currently) more a theoretical possibility than an empirical reality.

9. CONCLUDING REMARKS

In this study, we have gathered and analyzed empirical evidence on complexities and challenges in the licensing of (potential) SEPs.

SEP licensing is characterized by a number of *inherent complexities*: there are often multiple patents that are potentially essential to the same standard, and a standard subject to SEPs may be implemented by multiple products. In addition to the sheer number of patents and standard specifications involved, differences between SDOs' disclosure obligations and the complexity of SDO databases further contribute to make it difficult to identify what patents (potentially) relate to which standard. Furthermore, there is significant uncertainty which patents are actually essential, and which patents would be found to be fully valid if challenged. There are further aspects that may potentially produce uncertainty and disagreements between parties of SEP licensing negotiations; e.g. uncertainty and disagreements over the correct interpretation of FRAND licensing principles and obligations, and lack of transparency over the terms at which SEP licenses are being offered and/or concluded. Finally, when disputes arise in the course of SEP licensing negotiations, the resolution of disputes over usually global SEP licenses in national courts can be complex, and lead to outcomes that are difficult to predict.

These complexities may result in significant *challenges* for parties participating in SEP licensing negotiations. We assess that significant costs arise in the course of SEP licensing negotiations. While most of these costs are generally very difficult to observe or estimate, we discuss the types and plausible orders of magnitude of transaction costs arising in different forms and segments of SEP licensing. We also analyze delays in SEP licensing; which may contribute to potentially significant time lags between the date when a product that implements a standard subject to SEPs is introduced to the market, and the date when relevant SEP licenses covering this implementation are concluded. While disputes (litigations) are relatively rare, they are more common and more complex on average than for other patents; and may contribute to significantly exacerbate the costs and delays arising in SEP licensing.

These challenges have the *potential* to produce significant adverse effects. The costs associated with SEP licensing, and the difficulty to resolve licensing disputes through national courts, may lead to persistent under-licensing – i.e. a significant share of standard implementations remain unlicensed to a significant share of the relevant SEPs that they infringe. At least in principle, the loss of licensing revenue due to under-licensing and licensing delays, in addition to the cost of negotiating SEP licenses, may discourage potential contributors from participating in standards development or from making their patented technology available for inclusion into a standard. On the other hand, the lack of transparency over SEPs and SEP licensing terms, as well as the potential costs of negotiating SEP licenses, may discourage potential implementers from incorporating standards subject to SEPs into their products.

Existing empirical evidence on the causal effects of current SEP licensing conditions is largely inconclusive. Empirically observable outcomes do not indicate the existence of pervasive “opt-out” from standards-related innovation as a consequence of SEP licensing conditions; i.e. it does not appear that the observed challenges in SEP licensing are sufficiently severe as to systematically discourage potential contributors from participating in standards development, or discourage potential implementers from creating products that use technology standards subject to potential SEPs.

We acknowledge that our empirical observations are subject to significant uncertainties. In addition to the unobservability of many important aspects of SEP licensing, and the lack of convincing causal evidence regarding the effects of SEP licensing conditions on consumer welfare, there is significant heterogeneity between SEP licensing practices in different industries. Our observations are largely based on empirical data from industries with a relatively long history of SEP licensing. It is difficult to assess to what extent these observations are applicable to industries in which SEP licensing has emerged more recently.

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Appendix 1: Assessed number of potential SEP families

To estimate the current number of *potential* SEP families in the EU, we start from the **43,852** *inpadoc* patent families with an EP member in the IPlytics Platform database. This includes families with a member that was declared to an SDO as potentially essential, or was included in a patent pool reserved to SEPs. This is a subset of the total number of 74,840 *inpadoc* patent families in the *iplytics* platform (see Figure 3). Approx. 70% of the patents in the IPlytics Platform database were declared to ETSI.

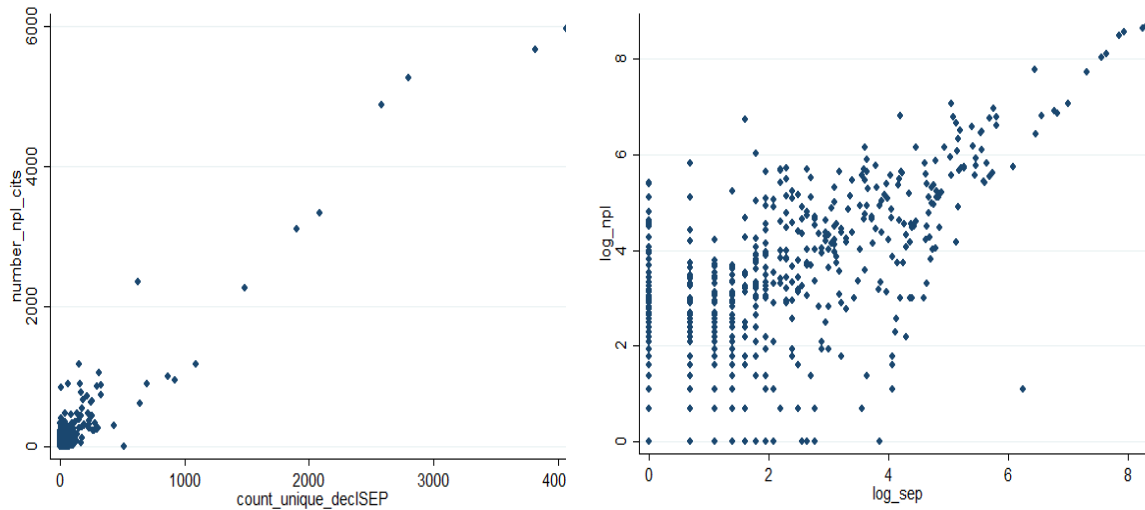
These statistics of declared potential SEPs are broadly in line with other estimates in the literature. Bekkers et al. (2021) e.g. retrieved declarations data from the ETSI database in February 2019, and identified 25,072 disclosed families, following ETSI’s family definition, which differs from the *inpadoc* definition. Most of the difference between these counts is attributable to recent growth in the number of SEP declarations. Refining the IPlytics Platform to the end of 2018 it includes 40,275 patent families declared– with an ETSI share of 70%, this would imply approx. 28,200 patent families declared to ETSI at the end of 2018. Nevertheless, the estimate in Bekkers et al. (2021) strikes us as a bit low, as ETSI’s family definition is narrower than our *inpadoc* definition, and should thus result in larger counts of patent families. ETSI currently (July 2022) lists 72,686 declared patent families, using its own definition.

The IPlytics Platform includes data on potential SEPs from firms’ declarations to SDOs, as well as from patent pools. However not all SDOs require participants to specifically disclose all potential SEPs (these SDOs instead allow participants to rely on *blanket disclosures*). In addition, there are potential SEPs that are not subject to SDOs’ disclosure obligations, as firms were not SDO members and did not participate themselves in standards development.

Realistically, blanket disclosures appear to be the largest source of uncertainty regarding the number of potential SEPs. ISO, IEC, ITU, and IEEE-SA are among the major SDOs (in terms of relevance to SEPs) that generally allow blanket disclosures; IETF furthermore allows blanket disclosures for potential SEPs subject to royalty-free commitments.

These different disclosure policies contribute to different numbers of declared patents (patent families). Up to the end of 2017, patents belonging to 29,978 different inpadoc patent families were declared to ETSI, as compared to 2,090 for ITU-T, 506 for IETF, 485 for IEEE-SA, and 381 for ISO (incl. ISO/IEC JTC1).

While different SDOs have different disclosure policies, all patents are subject to the same requirements to disclose relevant prior art, and describe the invention within its relevant context. In this context, many potential SEPs make citations to the standard to which they are potentially essential as part of the “Other References”. We take advantage of ETSI’s specific disclosure obligation, and count all US patents declared to be potentially essential to each of 3GPP’s TS (declarations up to 2017, including applications). We also count the number of granted US patents citing each of these TS. It turns out that the two numbers are highly and significantly correlated – at a correlation coefficient of 0.96! The number of patents citing a standard is thus, at least within 3GPP, a very good approximation of the number of potential SEPs, i.e. those patents that would be disclosed under a specific disclosure obligation.



Using this methodology, we find approx. 42,000 granted US patents citing an ETSI standard and/or a 3GPP TS. We also find 29,984 granted US patents citing an IETF RFC; 14,719 granted US patents citing an IEEE standard; 12,070 granted US patents citing an ISO standard; and 3,463 granted US patents citing an ITU-R or ITU-T standard. On one hand, somewhat reassuringly, the SDOs with the largest number of declared SEPs are also the SDOs with the largest number of citing patents. On the other hand, these figures document significant under-disclosure: ETSI accounts for about 89.6% of the specifically declared SEPs, but only for 41% of the patents citing an SDO standard. If the number of potential SEPs is proportional to the number of patents citing an SDO standard not only within 3GPP, but also across SDOs, the total number of potential SEPs is approx. 84% larger than the patents that are currently declared in public databases. Overall, we arrive at a total number of 62,000 to 65,000 potential SEP families (inpadoc family definition) in the EU. Conservatively, we estimate the number of potential SEP families at 60,000.

Appendix 2: Patent number matching of declared potential SEPs

The automatic patent number matching method follows a logic similar to that of the EPO Espacenet “Smart Search”. The patent number modification shows in detail how a given declared SEP is matched to the patent legal status data. **Table 7** provides an extraction of the match results and the reported match level, matching types and modifications. The different columns illustrate how the originally declared patent number is identified by its match type (in this case by application number matching), by match level (in this case the whole number is available, but the kind code is not given) and how the original declared SEP number was modified to be matched to the worldwide patent database. This matching method ensures that possible wrong matches (false positives) are omitted because e.g. the patent number was wrongly declared in the first place, or when the kind code is missing and multiple numbers match.

Table A1: Extract of the matching history of the database

Declared number	Type	Match type	Match level	Number modification	Kind code	Matched application
WO2006KR03250	application	application	[Kind Code]	wo_year_cc_drop_zeroes	False	WO2006KR3250A
KR20020063942	application	application	[Kind Code]	cc_year_drop_zeroes	False	KR200263942A
KR20020063942	application	application	[Kind Code]	cc_year_drop_zeroes	False	KR200263942A
HK20010104144	application	application	[Kind Code]	cc_year_drop_zeroes	False	HK2001104144A
KR19980053228	application	application	[Kind Code]	cc_year_drop_zeroes	False	KR199853228A
KR19990054258	application	application	[Kind Code]	cc_year_drop_zeroes	False	KR199954258A
US20060420323	application	application	[Kind Code]	cc_year_drop_zeroes	False	US2006420323A
US201113303489	application	application	[Kind Code]	cc_drop_year	False	US13303489A
US20050218277	application	application	[Kind Code]	cc_year_drop_zeroes	False	US2005218277A

Appendix 3: Validity uncertainty and probabilistic portfolio sizes

Assume we want to determine a FRAND royalty rate using a comparable licenses analysis, and will apply a Relative Portfolio Strength factor that is strictly numerically proportional to the relative number of valid patents in one portfolio compared to the other. This corresponds to the maximal potential impact of uncertainty regarding patent validity – plausible divergences in estimates are lower for apportionment in top down than for relative portfolio strength assessments in the context of comparable licenses; and strict numerical proportionality is the maximum plausible dependency of FRAND rates on numbers of valid patents.

Consider a portfolio i consisting of n patents (e.g. potential SEPs), including an unknown number of k_i valid patents. To derive a FRAND royalty rate, we will compare portfolio i with portfolio j , also consisting of n patents and an unknown number k_j valid patents. To estimate a FRAND rate, we use an estimate of the relative portfolio size of i compared to j , which we denote $\partial = \frac{k_i}{k_j}$. Given that k_i and k_j are unknown and probabilistic, we don't know ∂ , but we can estimate a confidence interval $[\check{\partial}, \hat{\partial}]$, so that there is a known probability that the true ∂ is within that range. Specifically, we will focus on estimating the maximum relative portfolio size $\hat{\partial}$ with 95% and 90% confidence. For our 5% estimate, there is thus a 5% probability that the true relative portfolio size of i compared to j is larger than $\hat{\partial}_{5\%}$.

The probability of each portfolio of n patents to include exactly k valid patents is given by the following expression, where p denotes the probability of each individual patent to be valid:

$$\frac{n! (p)^k (1 - p)^{n-k}}{(k)! (n - k)!}$$

We can then compute the specific probability of each combination of k_i and k_j to derive the probability distribution function of $\partial(p, n) = \frac{k_i}{k_j}$. Specifically, we derive our results using the following program (written in Stata 16):

```

clear
gen prob = .
gen rel_num_i_ul_5 = .
gen rel_num_i_ul_10 = .
gen n = .
save "results.dta", replace

clear

foreach n in 20 50 100 150 {
  foreach j in 0.2 0.5 0.8 {

    clear

    set obs `n'
    gen n = `n'
    gen i = _n
    gen prob = `j'
    gen prob_success = round(exp(lnfactorial(`n')),1)*`j'^i*(1-`j')^(`n'-i)/(round(exp(lnfactorial(i)),1)*round(exp(lnfactorial(`n'-i)),1))
    save "temp.dta", replace
    expand `n'
    rename i j
    rename prob_success prob_success_j
    bysort j : gen i = _n
    joinby i using "temp.dta"
    gen comb_prob = prob_success*prob_success_j
    gen rel_num_i = i/j
    sort rel_num_i
    gen cum_prob = sum(comb_prob)
    foreach x in 5 10 {
      gen high`x' = cum_prob >= 1-`x'/100
      gen higher`x' = sum(high`x')
      replace higher`x' = 0 if higher`x' > 1
      gen rel_num_i_`x' = rel_num_i * higher`x'
      egen rel_num_i_ul_`x' = max(rel_num_i_`x')
    }
    keep prob rel_num_i_ul* n
    duplicates drop
    append using "results.dta"
    save "results.dta", replace
    clear
  }
}

```

This program produces the following output:

Table A2: Estimated upper boundaries of relative portfolio size confidence intervals

N	PROB	$\hat{\delta}_{.5\%}$	$\hat{\delta}_{.10\%}$
20	.2	4	2.667
20	.5	1.714	1.5
20	.8	1.308	1.214
50	.2	2	1.714
50	.5	1.4	1.3
50	.8	1.182	1.135
100	.2	1.615	1.444
100	.5	1.267	1.2
100	.8	1.123	1.095
150	.2	1.478	1.348
150	.5	1.211	1.16
150	.8	1.1	1.078

When comparing two small portfolios of 20 patents each, different assumptions about the overall validity rate of granted patents result in very different confidence intervals. If we believe, following Henkel and Zischka (2019), that only about 20% of granted patents are fully valid, the relative number of fully valid patents in portfolio i may be up to 4 times larger or smaller than the number of fully valid patents in portfolio j (specifically, has a 5% likelihood of being more than 4 times larger, and a 5% likelihood of being more than 4 times smaller). If (like de Rassenfosse et al., 2020) we are much more confident about the validity of granted patents and believe that 80% of these patents are actually valid, the plausible range of relevant portfolio sizes is much smaller (portfolio i has a 95% likelihood of being no more than 1.308 times larger than portfolio j).

For larger portfolios, these uncertainties are much less relevant. For two portfolios of 150 patents each, the number of valid patents in portfolio i is with 95% likelihood no more than 1.1. to 1.478 times larger (or smaller) than the number of valid patents in portfolio j . At this portfolio size, if we estimate 0.5 to be the average probability for an individual granted patent to be actually valid (which we view as a rather pessimistic estimate), we can rule out divergences of more than a factor 1.21 with very high (95%) confidence. For even larger portfolios, we cannot compute our program (factorials for numbers larger than 150 become too large), but the range of plausible relative portfolio sizes become increasingly narrow. This means that uncertainty regarding the validity of individual patents becomes increasingly irrelevant for the determination of FRAND rates for larger portfolios.

Appendix 4: Comparison of litigating parties' views of FRAND rates

Table 10 in Section 4.3.3. provides a succinct summary overview of parties' views of the FRAND rate for a SEP license under dispute. This summary overview is based on parties' licensing demands or offers from the court proceedings; we thus do not compare courts' awards with business press or practitioner reports of parties' (alleged) licensing requests prior to and outside of litigation. To make offers and requests comparable, we attempted to standardize the base, scope (technology, product and market), and unit of the royalty.

In the following tables, we provide more detailed information on the intermediate steps of our analysis. In particular, we specifically identify the document that we used for our comparisons, and the common technology, base, product, and market that we identified or selected.

Table A3: Comparative views on FRAND rates in litigation – common base, unit, and scope

Cases	Date	Tech	Rates			
			Base			
			Unit	From	Product	Market
DE						
General Inst Corp v Microsoft Case 2:10-cv-01823-JLR Document 324-7	2/5/2012	H.264	Euros per unit	-	Not specified	
INDIA						
Ericsson v Intex I.A. No. 6735/2014 in CS(OS) No.1045/2014	13/3/2015	GSM, GPRS & EDGE	Percentage	Net selling price	Handsets	India
Ericsson v Micromax CCP No.71/2015 in CS(OS) 442/2013	2/12/2015		Percentage	Net selling price	Handsets	India
LM Ericsson v Gionee Communication Equipment CS(OS) 2010/2013 IA No. 10602/2015	15/9/2015	GSM, GPRS & EDGE	Percentage	Net selling price	Handsets	India
UK						
Unwired Planet v Huawei Case No: HP-2014-000005	5/4/2017	Handset				
		2G	Percentage	Net selling price	Not specified	Worldwide
		3G	Percentage	Net selling price	Not specified	Worldwide
		4G	Percentage	Net selling price	Not specified	Worldwide

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		RAN Infrastructure				
		2G	Percentage	Net selling price	Not specified	Worldwide
		3G	Percentage	Net selling price	Not specified	Worldwide
		4G	Percentage	Net selling price	Not specified	Worldwide
US						
Microsoft v Motorola CASENO.C10-1823JLR 10-CV-01823-ORD	25/4/2013	H.264	Dollar per unit	-	Xbox & Windows	Worldwide
		802.11	Dollar per unit	-	Xbox	Worldwide
Hynix v Rambus Case 5:00-cv-20905-RMW Document 4244	8/5/2013	SDRAM	Percentage	Total sales US	Total/not specified	US
Ericsson v DLink Case 6:10-cv-00473-LED-KFG Document 615	6/8/2013	802.11	Dollar per unit	-	Not specified	Worldwide
In re Innovatio Case: 1:11-cv-09308 Document #: 975	27/9/2013	802.11	Dollar per unit	-	Wi-Fi chip	Worldwide
			Dollar per unit	-	Wi-Fi chip	Worldwide
			Dollar per unit	-	Wi-Fi chip	Worldwide
			Dollar per unit	-	Wi-Fi chip	Worldwide
Realtek v LSI Case5:12-cv-03451-RMW Document324	26/2/2014	802.11	Percentage	Net selling price	Wi-Fi chip	Worldwide
CISCO v CSIRO Case 6:11-cv-00343-LED Document 324	23/7/2014	802.11	Dollar per unit	-	Wi-Fi chip	Worldwide
TCL v Ericsson Case 8:14-cv-00341-JVS-DFM Document 1802-1	8/11/2017	2G	Percentage	Net selling price	Handsets and tablets	US
			Percentage	Net selling price	Handsets and tablets	EU
			Percentage	Net selling price	Handsets and tablets	Rest of the World
		3G	Percentage	Net selling price	Handsets and tablets	US
			Percentage	Net selling price	Handsets and tablets	EU

			Percentage	Net selling price	Handsets and tablets	Rest of the World
		4G	Percentage	Net selling price	Handsets and tablets	US
			Percentage	Net selling price	Handsets and tablets	EU
			Percentage	Net selling price	Handsets and tablets	Rest of the World
HTC v Ericsson Case 6:18-cv-00243-JRG Document 538	23/5/2019	4G	Dollar per unit	-	4G device	Worldwide

Table A4: Comparative views on FRAND rates in litigation – licensors’, implementers’, and courts’ rates

Cases	Date	Tech	Rates						
						Difference			Closest proponent
			Licensor	Implementer	Court	Lic/Ct	Ct/Imp	Lic/Imp	
DE									
General Inst Corp v Microsoft Case 2:10-cv-01823-JLR Document 324-7	2/5/2012	H.264	3,50	0,02	n.a.				Licensor
INDIA									
Ericsson v Intex I.A. No. 6735/2014 in CS(OS) No.1045/ 2014	13/3/2015	GSM, GPRS & EDGE	1,875	?	?				
Ericsson v Micromax CCP No.71/2015 in CS(OS) 442/2013	2/12/2015		1,625	1,625	1,05	1,548	0,646	1,000	Implementer
LM Ericsson v Gionee Communication Equipment CS(OS) 2010/2013 IA No. 10602/2015	15/9/2015	GSM, GPRS & EDGE	1,625	0,9	?				
UK									
Unwired Planet v Huawei Case No: HP-2014-000005	5/4/2017	Handset							Implementer
		2G	0,28	0,045	0,064	4,375	1,422	6,222	
		3G	0,28	0,046	0,032	8,750	0,696	6,087	

EUROPEAN COMMISSION

			4G	0,55	0,059	0,052	10,577	0,881	9,322		
			RAN Infrastructure								
			2G	0,21	0,045	0,064	3,281	1,422	4,667		
			3G	0,21	0,046	0,016	13,125	0,348	4,565		
			4G	0,42	0,061	0,051	8,235	0,836	6,885		
Cases	Date	Tech	Rates								
								Difference			Closest proponent
			Licens or	Impleme nter	Court	Lic/Ct	Ct/Im p	Lic/I mp			
US											
Microsoft v Motorola CASENO.C10-1823JLR 10-CV-01823-ORD	25/4/2013	H.264	4,5	0,00197	0,00555	810,811	2,817	2284,264	Implementer		
		802.11	4,5	0,05	0,03471	129,646	0,694	90,000			
Hynix v Rambus Case 5:00-cv-20905-RMW Document 4244	8/5/2013	SDRAM	2,5	?	0,825	3,030					
Ericsson v DLink Case 6:10-cv-00473-LED-KFG Document 615	6/8/2013	802.11	0,5	?	0,15	3,333					
In re Innovatio Case: 1:11-cv-09308 Document #: 975	27/9/2013	802.11	3,39	0,01905	0,0956	35,460	5,018	177,953	Implementer		
			4,72	0,01905	0,0956	49,372	5,018	247,769			
			16,17	0,01905	0,0956	169,142	5,018	848,819			
			36,9	0,01905	0,0956	385,983	5,018	1937,008			
Realtek v LSI Case5:12-cv-03451-RMW Document324	26/2/2014	802.11	0,29	0,017	0,19	1,526	11,176	17,059	Licensor		
CISCO v CSIRO Case 6:11-cv-00343-LED Document 324	23/7/2014	802.11	1,8	0,2	1,275	1,412	6,375	9,000	Licensor		
TCL v Ericsson Case 8:14-cv-00341-JVS-DFM Document 1802-1	8/11/2017	2G	0,8	0,21	0,164	4,878	0,781	3,810	Implementer		
			0,8	0,21	0,118	6,780	0,562	3,810			
			0,8	0,21	0,09	8,889	0,429	3,810			

		3G	1,2	0,21	0,3	4,000	1,429	5,714	
			1,2	0,21	0,264	4,545	1,257	5,714	
			1,2	0,21	0,224	5,357	1,067	5,714	
		4G	1,5	0,16	0,45	3,333	2,813	9,375	
			1,5	0,16	0,314	4,777	1,963	9,375	
			1,5	0,16	0,314	4,777	1,963	9,375	
HTC v Ericsson Case 6:18-cv-00243-JRG Document 538	23/5/2019	4G	2,5	0,1	2,5	1,000	25,000	25,000	Licensors

Appendix 5: Comparable licenses proposed in FRAND disputes

Tables A5: Comparable licenses

Case	Proposed Licenses	Proponent		Judge Decision	Dates	Jurisdiction	License (geo scope)
		Licensor	Licensee	Comparable			
Unwired Planet v Huawei	Unwired Planet - Lenovo 2014	Behind it?	?	NO	2014	?	?
	Unwired Planet - Samsung 2016	Poor comparable	Best comparable	NO	2016	?	worldwide
	Ericsson - Huawei 2016	?	Good comparable	NO	2016	?	?
	Ericsson - Samsung 2014	Against it	Behind it	YES	2014	?	?
	Ericsson - Huawei 2009	Against it	Behind it?	NO?	2009	?	?
	Ericsson - [M] 2013	?	Behind it?	NO	2013	?	?
	Ericsson: [N,O,P]	Behind it	Against it?	?	?	?	?
	Ericsson - ZTE 2011	Behind it?	?	?	2011	Europe?	?
	Ericsson - RIM	?	?	?	2013?	?	?
	Ericsson - Apple 2008	?	?	NO	2008	?	?
	Ericsson - Sony 2012	Behind it	Against it	NO	2012	?	?
	The Ericsson licenses as a whole	-	-	YES	-	-	-
	Qualcomm licenses	?	?	NO	?		?
	Other Litigations discussed						
	Microsoft v Motorola	?	?	NO	?	Germany	All the numerous comparable licenses in evidence are global.
	Innovatio	?	?	NO	?	Germany	
Ericsson v D-Link	?	?	NO	?	Germany		
Samsung v Apple	?	?	NO?	2014?	Japan		
Huawei v InterDigital	?	?	NO	2013?	China		

For Ericsson – Huawei see section 432.

For Samsung v Apple see section 472 and 474.

For Ericsson – ZTE “Europe?” it is said that the license follows lawsuits in Europe.

Case	Proposed Licenses	No n-SE Ps	Crosslicenses	Royalty Rates	Running Rate	# lump sums	\$ lump sums	Tech	Products	
Unwired Planet v Huawei	Unwired Planet - Lenovo 2014	X	NO	0,20%	?	2	\$ 100.000.000,00	?	?	
	Unwired Planet - Samsung 2016	X	YES	25-100%	?	?	?	2G/3G/4G	Handsets	
	Ericsson - Huawei 2016	?	NO	?	?	?	?	?	?	
	Ericsson - Samsung 2014	?	NO	?	?	?	?	?	?	
	Ericsson - Huawei 2009	?	NO	?	?	?	?	?	?	
	Ericsson - [M] 2013	?	NO	?	?	?	?	?	?	
	Ericsson: [N,O,P]	?	NO	?	?	?	?	?	?	
	Ericsson - ZTE 2011	?	NO	?	?	?	?	?	?	
	Ericsson - RIM	?	NO	?	?	?	?	?	Handsets	
	Ericsson - Apple 2008	?	NO	?	?	?	?	?	?	
	Ericsson - Sony 2012	?	NO	?	?	?	?	?	?	
	The Ericsson licenses as a whole	-	-		0,80%/0,67%	?	-	-	2G/3G/4G	Handsets; Inf.
	Qualcomm licenses				Much Higher	?	?	?	?	?
	Other Litigations discussed									
	Microsoft v Motorola				?	?	?	?	NOT 2G/3G/4G	?
	Innovatio				?	?	?	?	NOT 2G/3G/4G	?
Ericsson v D-Link				?	?	?	?	NOT 2G/3G/4G	?	
Samsung v Apple				5%	?	?	?	3G	?	
Huawei v InterDigital				0,019%	?	?	?	?	?	

Case	Proposed Licenses	Proponent		Judge Decision	Dates	Jurisdiction	License (geo scope)
		Licensor	Licensee	Comparable			
Microsoft v Motorola	Motorola - Vtech	YES	NO	NO?	2010	Texas, USA	?
	Motorola - RIM	YES	NO	NO	2010	?	?
	Symbol - Proxim	YES	NO	NO?	2003	?	?

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Symbol - HHP	YES	NO	NO?	2004	?	?
Symbol - Terabem	YES	NO	NO?	2006	?	?
MPEG LA BL264 Patent Pool	NO	YES	NO?	2003*	?	?
Via Licensing 802.11 Patent Pool	NO	YES	NO?	?	?	?
Marvell WiFi Chip	NO	YES	NO?	?	?	?
InteCaps	NO	YES	NO?	?	?	?

(*)Date of the start for the pool formation.

There is no clear pronouncement on comparability outside of the Motorola - RIM license, the reasons for this can be found in section 425.

Patent pools present several detractors, which can be found in sections 500. - 501.

Marvell and InteCaps seem to provide a useful ceiling, but they are pools so are not considered directly comparable.

Case	Proposed Licenses	Non-SEPs	Crosslicences	Royalty Rates	Running Rate	# licenses	\$ lump sums	Tech	Products
Microsoft v Motorola	Motorola - Vtech	X	NO	2,25%	?	1?	\$ 12.000.000,00	802.11 and H.264?	Corded and cordless phones, tablets
	Motorola - RIM	X	YES	?	?	1?	?	?	Wireless cellphones?
	Symbol - Proxim	?	NO?	6,00%	?	?	?	802.11	?
	Symbol - HHP	?	NO?	?	?	?	?	802.11	Wireless cellphones?
	Symbol - Terabem	?	NO?	?	?	?	?	802.11	?
	MPEG LA BL264 Patent Pool	?	NO	0,197 cents per unit	0,555 cents per unit	?	?	H.264	Xbox, Windows?
	Via Licensing 802.11 Patent Pool	?	NO	5 cents per unit	6,114 cents per unit	?	?	802.11	Xbox, Windows?
	Marvell WiFi Chip	?	NO	1,00%	?	?	?	802.11	WiFi chips
InteCaps	?	NO	0,8-0,6 cents per unit		?	?	802.11	Xbox	

Case	Proposed Licenses	Proponent		Judge Decision	Dates	Jurisdiction	License (geoscope)
		Licens or	License e	Comparable			
In re INNOVATION IP VENTURES	Innovatio license to Broadcom	NO	NO	NO	2011	?	?
	Motorola Mobility, Inc./VTech License	YES	NO	NO	2011	?	?
	Symbol Licenses with Proxim	YES	NO	NO	2004	Delaware, USA	?
	Symbol Licenses with Terabeam	YES	NO	NO	2006	?	?
	Symbol/LXE License	YES	NO	NO	?	?	?
	Qualcomm/Netgear License	YES	NO	NO	2013	?	?
	The Via Licensing Patent Pool	NO	YES	NO	2003	?	?
	Non-RAND Comparable Licenses						
	CSIRO/Radiata license	NO	YES	NO	?	?	?
	CSIRO/Netgear settlement	NO	YES	NO	?	?	?
	ARM chip license	NO	YES	NO	?	?	?
CSIRO/HP settlement	NO	YES	NO	?	?	?	

Case	Proposed Licenses	No n-SE Ps	Crossli censes	Royalty Rates	Run ning Rate	# lu m p su ms	\$ lu m p su ms	Tech	Products
In re INNOVATION IP VENTURES	Innovatio license to Broadcom	?	Maybe	?	?	?	?	802.11	?
	Motorola Mobility, Inc./VTech License	?	NO	?	?	?	?	802.11 and H.264	Tablets/consoles
	Symbol Licenses with Proxim	?	NO	6,00%	?	?	?	802.11	Wireless bar code scanners
	Symbol Licenses with Terabeam	?	YES?	6,00%	?	?	?	802.11	?
	Symbol/LXE License	?	NO	?	?	?	?	802.11	Wearable and non-wearable barcode reader
	Qualcomm/Netgear License	?	NO	?	?	?	?	802.16 and 802.20	?
	The Via Licensing Patent Pool	?	NO	0.03 & 4.16 cents	?	?	?	802.11	?

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Non-RAND Comparable Licenses								
CSIRO/Radiata license	?	NO	?	?	?	?	?	?
CSIRO/Netgear settlement	?	NO	?	?	?	?	?	?
ARM chip license	?	NO	?	?	?	?	?	?
CSIRO/HP settlement	?	NO	?	?	?	?	?	?

Case	Proposed Licenses	Proponent		Judge Decision	Dates	Jurisdiction	License (geo scope)
		Licensor	Licensee	Comparable			
TCL v Ericsson	Ericsson - Apple License	YES?	NO?	YES?	2008/2015	?	Global
	Ericsson - Samsung License	YES?	NO?	YES?	2015	?	Global
	Ericsson - Huawei License	YES?	NO?	YES?	2016	?	Global
	Ericsson - LG License	YES?	NO?	YES?	2014	?	Global
	Ericsson - HTC License	YES?	NO?	YES?	2014	?	Global
	Ericsson - ZTE License	YES?	NO?	NO?	2014/2016	?	Global

YES?: The court only unpacks the licenses; they do not make any comment on comparability.

NO?: For the Ericsson – ZTE License, they reject the unpacking carried out by David Kennedy.

Case	Proposed Licenses	No n-SEPs	Crosslicenses	Royalty Rates	Running Rate	# lump sums	\$ lump sums	Tech	Products
TCL v Ericsson	Ericsson - Apple License	?	YES	NO?	NO?	1	REDACTED	2G, 3G, 4G?	Phones
	Ericsson - Samsung License	?	YES	?	?	YES	?	2G, 3G, 4G	Phones, Thin Modems
	Ericsson - Huawei License	?	YES	?	?	NO	?	2G, 3G, 4G	Phones? Infrastructure?
	Ericsson - LG License	?	YES	?	?	YES	?	2G?, 3G?, 4G	Phones
	Ericsson - HTC License	?	YES	?	?	YES	?	2G?, 3G, 4G	Phones, Tablets
	Ericsson - ZTE License	?	NO	?	?	YES	?	2G, 3G, 4G	Phones? Infrastructure?

Case	Proposed Licenses	Proponent		Judge Decision	Dates	Jurisdiction	License (geo scope)
		Licensor	Licensee	Comparable			
HTC v Ericsson	?	YES?	NO?	YES	?	?	?
	?	YES?	NO?	YES	?	?	?
	?	YES?	NO?	YES	?	?	?
	?	YES?	NO?	YES	?	?	?
	?	YES?	NO?	YES	?	?	?
	?	YES?	NO?	YES	?	?	?

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	?	YES?	NO?	YES	?	?	?
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CL 25: The Court, likewise, is of the view and concludes that based on the whole of Ericsson’s submitted comparable licenses, both of Ericsson’s offers to HTC—\$2.50 or 1% with a \$1 floor and a \$4 cap per 4G device—were fair, reasonable, and non-discriminatory.

Case	Proposed Licenses	Non-SEPs	Cross licenses	Royalty Rates	Running Rate	# lump sums	\$ lump sums	Tech	Products
HTC v Ericsson	?	?	YES?	1,00%	?	?	?	4G	Handsets
	?	?	YES?	1,50%	2,4-3,0%	?	?	4G	Handsets
	?	?	YES?	2,20\$?	?	4G	Handsets
	?	?	YES?	2,30\$?	?	4G	Handsets
	?	?	YES?	1,30%		?	?	4G	Handsets
	?	?	YES?	1,40%		?	?	4G	Handsets
	?	?	YES?	1,00%		5?	\$ 39.000.000,00	4G	Handsets

Case	Proposed Licenses	Proponent		Judge Decision		Dates	Jurisdiction	License (geo scope)
		Licensor	Licensee	Comparable				
General Inst Corp v Microsoft	AT&T	NO	YES	YES		Varied	?	Worldwide
	VC-1 (pool)	NO	YES	YES		?	?	?
	MPEG-4 (pool)	NO	YES	NO		?	?	Worldwide
	MPEG 2 (pool)	NO	NO	NO		?	?	Worldwide
	Pool licenses for less similar techs	NO	YES	NO		?	?	?

Case	Proposed Licenses	Non-SEPs	Cross licenses	Royalty Rates	Running Rate	# lump sums	\$ lump sums	Tech	Products
General Inst Corp v Microsoft	AT&T	?	X	\$ 0,18	\$ 0,10	-	-	H.264/AVC	Not disclosed
	VC-1 (pool)	?	X	\$ 0,20	\$ 0,10	-	-	VC-1	Not disclosed

	MPEG-4 (pool)	?	X	\$ 0,25		-	-	H.264	Not disclosed
	MPEG 2 (pool)	?	X	\$ 4	\$ 2	-	-	H.262	Not disclosed
	Pool licenses for less similar techs	?	X	\$ 0,10	\$ 1,00	-	-	Others	Not disclosed

Appendix 6: Parties' proposed patent counts (denominator) in SEP litigation

Table A6: parties' proposed patent counts – numerator and denominator

Cases	Tech	Patent count									
		Numerator					Denominator				
		Licens or	Implemen ter	Cou rt	Difference		Licens or	Implemen ter	Cou rt	Difference	
Unwired Planet v Huawei	Handset										
	2G	2	1	2	1	2	102	350	154	0,6623 38	0,44
	3G	1	2	1	1	0, 5	324	1089	479	0,6764 09	0,4398 53
	4G	6	6	6	1	1	355	1812	800	0,4437 5	0,4415 01
	RAN Infrastructure										
	2G	1	1	1	1	1	85	305	134	0,6343 28	0,4393 44
	3G	2	4	2	1	0, 5	274	886	390	0,7025 64	0,4401 81
4G	7	5	7	1	1, 4	306	1554	684	0,4473 68	0,4401 54	
Microsoft v Motorola	H.26 4	16	?	2	8		?	?	250 0		
	802. 11	24	?	11	2,1818 18		?	?	221		
In re Innovatio	802. 11	23	19	19	1,2105 26	1	500	3000	300 0	0,1666 67	1
TCL v Ericsson	2G	12	12	?			?	446	365		0,8183 86
	3G	24,65	19,65	?			?	1116	953		0,8539 43
	4G	111,51	69,88	?			?	1796	148 1		0,8246 1
HTC v Ericsson	4G	?	?	?			?	?	?		
General Inst Corp v Microsoft	H.26 4	17	17	17	1	1	?	270	?		

Appendix 7: Parallel litigation

Table A7: Key considerations for global FRAND rate determination

INSTANCES	INDUSTRY NORM	PARTIES' INTENTIONS AND/OR INTERESTS	LEGAL RULES
[UK] Vringo v ZTE (2015)	It is the norm in the industry	ZTE did NOT want a global license	Conflict national injunction/ global licensing
[UK] Unwired Planet (2020)	<p>More practical from commercial and economical point of view;</p> <p>Efficiency benefits by saving transaction costs for licensors and licensees and by obviating the need to determine a royalty rate on a patent-by-patent basis;</p> <p>ETSI standards are intended for use around the world by manufacturers and consumers;</p> <p>Vast majority of licenses in the industry are granted on a worldwide basis;</p> <p>Normal practice in the industry</p>	<p>The patent portfolio at stake was sufficiently large and had sufficiently wide geographical scope that a licensor and licensee acting reasonably and on a willing basis would have agreed on a worldwide license and would have regarded country-by-country licensing as madness;</p> <p>UP had always taken the position that in all circumstances a FRAND license would be a worldwide license</p>	[a] FRAND license should not prevent a licensee from challenging validity or essentiality of licensed patents and should have provisions dealing with sales in non-patent countries
[US] TCL v Ericsson (C.D. Cal. 2017)	Industry norm but also consider regional variations in patent values and royalty rates	<p>Consent of the parties for the court to set global rates;</p> <p>voluntary negotiations between the parties for a global portfolio license</p>	N/A
[US] Optis v Huawei (E.D. Tex. 2018)	<p>Industry norm but also regional variations: major markets [includes 40 countries – US, CAN, FR, DE, JP] and other markets and China);</p> <p>Variation in patent values and royalty rates;</p> <p>Technology variations (2G, 3G, 4G)</p>	<p>NO agreement</p> <p><i>PanOptis</i> never made a US-only offer to <i>Huawei</i>;</p> <p>No evidence that <i>PanOptis</i>' offer was FRAND as to U.S. patents only;</p> <p>"Not easy" to unpack the global rate into country-specific, patent-specific components</p>	N/A
[CN] Oppo v Sharp [2020] ³²⁰	SEPs have the characteristics of global distribution	<p>The offer proposed by Sharp Corporation is also global licensing, which indicates that the parties' concurrence of mind regarding the global licensing of the SEPs involved;</p> <p>All the parties involved in this case are willing to agree on global licensing terms for the SEP involved;</p> <p>NO consent? The determination of global licensing rates is grounded by jurisprudence and also the objective</p>	<p>Contractual disputes even if it also has certain characteristics of patent infringement disputes;</p> <p>Main places of implementation, business operation or source of revenue of implementers (OPPO) is China.</p> <p>As of December 31, 2019, OPPO's sales in</p>

³²⁰ Only Chinese decision for which there is an available (but unofficial) translation in English.

		need for settling the licensing disputes once and for all	China, Europe and Japan accounted for 71.08%, 0.21% and 0.07% respectively. According to the above data, the percentage of OPPO's smart terminal products sold in China is much higher than that in Germany, Japan and other countries
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Table A8 : Forum non conveniens claims

JURISDICTION	INSTANCE	DATE
UK	First instance	
	Samsung v Ericsson [2016] EWCA Civ 489	27.05.16
	Apple v Qualcomm [2018] EWHC 1188 (Pat)	22.05.18
	IPCom v Vodafone [2019] EWHC 1255 (Pat)	10.05.19
	Vestel Elektronik v HEVC [2019] EWHC 2766 (Ch)	21.10.19
	Mitsubishi & Sisvel v Archos et al. [2019] EWHC 3477 (Pat)	19.12.19
	Interdigital v Lenovo [2020] EWHC 1318 (Pat)	20.05.20
	Koninklijke Philips v TCL [2020] EWHC 2553 (Ch)	25.09.20
	Philips v Xiaomi [2021] EWHC 2170 (Pat)	30.07.21
	Nokia v Oppo [2021] EWHC 2952 (Pat)	04.11.21
	Court of Appeal	
	Shenzhen Senior Technology Material v Celgard LLC [2020] EWCA Civ 1293	09.10.20
	Vestel Elektronik v Access Advance LLC [2021] EWCA Civ 440	26.03.21
	Supreme Court	
Unwired Planet Intl. Ltd. v Huawei Techs. Co. Ltd. [2020] UKSC 37.	26.08.20	

China	OPPO v Sharp, Intermediate Court Shenzhen [2020] Guangdong 03 Min Chu 689 No. 1	16.10.20
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Table A9: Parallel litigation

2 COUNTRIES	OPPO/NOKIA (CN, DE) OPTIS WIRELESS/HUAWEI (CN, US) HUAWEI/SAMSUNG (CN, US) UNWIRED PLANET/SAMSUNG (UK, DE) PHILIPS/ARCHOS (DE, NL)	CORE WIRELESS/LG (FR, US) OPTIS/APPLE (UK, US) HTC/ERICSSON (US, DE) IV/ERICSSON (US, DE)
3 countries	Sharp/Oppo (CN, JP, DE) Unwired Planet/Huawei (CN, DE, UK) IPCom/Lenovo (FR, UK [EP 1 841 268 B2], US)	Interdigital/Lenovo (US, UK, CN) Nokia/Interdigital (UK, FI, US) Samsung/Ericsson (US, CN, DE)
4 countries	Apple/Qualcomm (CN, JP, UK, US) Conversant/Huawei (CN, DE, UK, SP) Xiaomi/Interdigital (CN, DE, IND, SP)	IPCom/Nokia (DE, UK, IT, US) Sisvel/Xiaomi (DE, UK, NL, CN) Sisvel/ZTE (DE, IT, CN, US)
6 countries	Sisvel/Wiko (DE, NL, US, FR, IT, SP)	
7 countries	Vringo/ZTE (DE, RO, NL, FR, UK, CN, US, AUS)	

Table A10: Instances in which an ASI and/or AASI has been requested/granted

JURISDICTION	INSTANCE	DATE	TYPE OF INJUNCTION	RESPONDING TO	COUNTRY TARGETED BY FIRST INJUNCTION	OUTCOME OF ASI/AASI
DE	First instance					
	LG Mannheim, 7 O 182/08	18.12.09	?			
	LG Munich, 21 O 11384/19	30.10.20	?			

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	<p>LG Munich I, 7 O 14276/20 [2021] BeckRS 3995 (InterDigital v Xiaomi)</p>	<p>25.02.21</p>	<p>AASI and AAAASI</p>	<p>ASI and AAASI from CN</p>	<p>DE</p>	<p>Granted</p> <p>Balance of parties' interest; AASI would not impair Xiaomi's rights in CN or CN proceedings;</p> <p>Implementer requesting or threatening to request ASI cannot be considered a willing licensee within <i>Huawei/ZTE</i>; ASI = unlawful interference with proprietary right and access to justice rights of SEP holder; DE courts have the power to grant AASI even if a foreign ASI has not yet been granted but there is a 'risk of first infringement' of patent rights; risk particularly present when implementer has requested or threatened to request an ASI</p>
	<p>LG Munich, 7 O 36/21 [2021] Huawei v IP Bridge</p>		<p>AASI</p>	<p>?</p>	<p>?</p>	<p>Considered: an implementer seeking a foreign ASI cannot be considered as a 'willing licensee' in the context of a potential FRAND defense raised in the main proceedings</p>
	<p>LG Munich, 21 O 8690/21 [2021] Nokia v OPPO</p>		<p>AASI</p>			
	<p>Sharp v OPPO</p>		<p>AASI</p>			

	LG Munich 2020??					
Appeal						
	OLG Munich, 6 U 5689/19 [2019] [Nokia v Continental] PI confirmed from LG Munich I, 21 O 9333/19 [2019] BeckRS 25536	12.12.1 9	AASI	ASI from US	DE	Granted Prevents Continental from enforcing the US ASI in DE. ASI unlawfully limit the property law content of patents and deprive Nokia of its legal standing and protected legal interests (access to justice and effective judicial protection of its rights). AASI does not affect US proceedings on FRAND qualification. AASI = only effective means against ASI threatening patent holder's property rights. No infringement of international or EU law.
	OLG Munich, 6 U 5042/19 [2020] GRUR 379					
	OLG Dusseldorf I-2 U 25/21 (07.02.22) Appeal from: LG Dusseldorf (4c O 73/20; 4c O 74/20; 4c O 75/20) LG Dusseldorf, 4c O 49/20; 4c		AASI (ex parte)			Revoked No specific threat of Xiaomi seeking a Chinese antisuit injunction that would have prevented the patentees from enforcing their German patent rights. The mere fact that

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	O 50/20; 4c O 68/20 [2021] (unpublished). [HEVC Advance v Xiaomi]					<p>Xiaomi had obtained a Chinese antisuit injunction against InterDigital under fundamentally different circumstances was not deemed sufficient to suspect that the same might happen in the HEVC Advance cases</p> <p>Granted</p> <p>First instance: Pre-emptive grant – no proof of continuous or imminent risk of infringement</p> <p>1st Scope of AASI: Any ASI outside DE and not limited to the patents in dispute.</p> <p>Tailoring of the scope: Limits the scope of original AASI to ASI in CN and only for patents involved in the dispute.</p>
France	Appeal					
	CA Paris, v Lenovo RG 19/21426, 14/2020 [2020] Confirming: T. Jud. Paris, v Lenovo, RG 19/60318 (20.01.20)	03.03.20	AASI	ASI from US	FR	<p>Granted</p> <p>ASI are contrary to French public order unless they seek to enforce contractual arbitration or jurisdiction clauses; in the case at stake the ASI sought by Lenovo in the U.S. would</p>

						<p>limit ICom's fundamental rights to protect and enforce its French property rights and to have access to fair legal proceedings</p> <p>On appeal: ASI would</p> <p>inflict on ICom manifestly illicit harm by preventing it from filing any new infringement</p> <p>action; manifestly unlawful disturbance posed by Lenovo</p>
UK	First instance					
	Unwired Planet v Huawei [2017] EWHC 2831 (Pat)	12.10.17	??			
	Conversant v Huawei [2018] EWHC 2549 (Ch)	02.10.18	ASI	/	China	<p>Withdrawn</p> <p>Risk: Artificial attempt to anchor proceedings in another country when true connection of the case with UK jurisdiction; vexatious: proceedings could obstruct UK proceedings or undermine performance of a UK judgement.</p> <p>ZTE amended its Shenzhen complaint "to remove all claims for liability that might involve . . . damages or other financial relief . . . other than in relation</p>

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						to the FRAND royalty rate and FRAND licence terms for [Conversant’s] Chinese [p]atents.”
	IPCom v Lenovo Tec. & Motorola Mobility [2019] EWHC 3030 (Pat)	08.11.19	AASI	ASI from US	UK	Granted Vexatious and oppressive to prevent IPCom from litigating infringement and validity of UK patents; Limited scope; no material interference with US proceedings (focus on FRAND and declaration of non-infringement of US patents). Caution: AASI present an “even greater danger of interfering improperly with the conduct of foreign proceedings”
US	Microsoft Corp. v Motorola, Inc. 871 F. Supp. 2d 1089 (W.D. Wash. 2012). Appeal: Microsoft Corp. v Motorola, Inc. 696 F.3d 872 (9 th Cir. 2012)	2012	ASI	/	DE Findings of infringement and Microsoft enjoined from selling products	Granted Prevents the enforcement of the DE injunction. Basis: if Motorola is found in the US to have breached its FRAND obligation to the relevant SDOs, then it would not be entitled to seek injunctive relief against Microsoft in any jurisdiction, including Germany.

Vringo, Inc. v. ZTE Corp., No. 14-cv-4988(LAK) 2015 WL 3498634, (S.D.N.Y. June 3, 2015).	03.06.15	ASI	/	CN ZTE + Antitrust action - AoDP using info under US NDA	Denied “[a] decision holding that ZTE breached the NDA would not necessarily foreclose the antitrust action in the Shenzhen court”; other evidence possible
TCL Comm’n Tech. Holdings Ltd. v. Ericsson (C.D. Cal. 2018) No 2:15-cv-2370-JVS TCL Communication Technology Holdings, Ltd. v Ericsson 943 F.3d 1360 (Fed. Cir. 2019)	2015	ASI	/	FR, UK, DE, Russia, Brazil, Argentina	Granted both parties “indicated their desire that this action should result in a ‘global resolution’ of the SEP patent licensing and damages claims”.
InterDigital v Pegatron N.D. Cal. ?	06.2015	ASI	/	Taiwan – (+ ask to dismiss suit)	Granted?
Apple Inc. v. Qualcomm Inc., No. 3:17-cv-00108-GPC-MDD, (S.D. Cal., Sep. 7, 2017).	07.09.17	ASI	/	UK, Japan, China and Taiwan	Denied FRAND Commitment from Qualcomm, not Apple. à Qualcomm “failed to demonstrate that the issues in Apple’s U.S. and foreign actions [were] functionally similar in the sense that an adjudication [of the claims] on the merits [before the U.S. court] would dispose of [Apple’s foreign antitrust, infringement or other claims].” To enjoin Apple’s foreign actions

						<p>“would effectively deprive the relevant foreign courts of [their] jurisdiction to consider whether [Qualcomm’s licensing agreements] have anticompetitive effects” within their jurisdictions — a result intolerable to international comity”.</p>
	<p>Optis Wireless Tech., LLC v. Huawei Techs. Co. Ltd, No. 2:17-Cv-00123-JRG-RSP (E.D. Tex., May 14, 2018).</p>	<p>14.05.18</p>	<p>ASI</p>	<p>/</p>	<p>CN</p> <p>Breach of contract and antitrust violations</p> <p>+ order to cease all civil infringement actions against Huawei.</p>	<p>Denied based on:</p> <p>Huawei’s written representation that it would not seek an injunction; and on the fact that: “the Chinese actions only relate to Chinese patents. Thus, although there may be similar factual disputes about PanOptis’s global offer, and whether that offer complied with its FRAND obligations, the scope of any relief awarded by this court or the Chinese court extends only as far as</p> <p>jurisdiction allows. There is nothing obviously vexatious or oppressive in</p> <p>allowing the lawsuits to proceed simultaneously, nor would any relief</p>

						awarded by either court overlap with relief awarded by the other”.
	Huawei Techs., Co. v Samsung Elecs. Co. (N.D. Cal. 2018). No 3:16-cv-02787-WHO, 2018 WL 1784065	13.04.18	ASI	/	CN Findings of infringement and Samsung enjoined from manufacturing and selling products in CN.	<p>Granted</p> <p>As both actions asked whether the other party breached its FRAND commitment to ETSI, the U.S. court’s answer to this question would, indeed, dispose of the Chinese action;</p> <p>allowing the Chinese action to continue would undermine the U.S. court’s “ability to determine the propriety of injunctive relief in the first instance.”;</p> <p>the injunction poses significant commercial risks to Samsung around the world and would “interfere with equitable considerations by compromising the court’s ability to reach a just result []”;</p> <p>the limited scope of the proposed anti-suit injunction (a single order relating to two Chinese patents) and its limited duration (it would likely be less than six months until the U.S. court determined whether</p>

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						Samsung had breached its FRAND commitment) would present a “negligible” impact on international comity.
Nokia v Continental (N.D. Cal.) 5:19-cv-02520-LHK	12.06.19	ASI	/	DE and elsewhere	Granted	
Lenovo (United States) Inc and Motorola Mobility, LLC v ICom GmbH & Co KG, Case No 5:19- cv- 1389 (N.D. Cal. 2019)	2019	ASI	/	UK and elsewhere	Granted	ICom barred from continuing infringement in the US or elsewhere pending US proceedings.
Ericsson v Samsung (E.D. Tex. 2021) No. 2:20-cv-00380-JRG	11.01.21	AASI	ASI from CN	US	Granted	Strong public interest; risk for the legitimate jurisdiction of US courts; “[i]f unaddressed, the ASI would frustrate and delay the speedy and efficient determination of legitimate causes of action” before the U.S. court, while the causes of action had no implication on the speedy and efficient determination of the issues raised before the Chinese court; CN proceedings were vexatious and oppressive; suits before US court and CN court involve separate legal questions; not duplicative; ASI would

						<p>unfairly put Ericsson in a weaker negotiation position; no inequitable hardship for Samsung if litigation proceed in both courts.</p> <p>Caution: extraordinary remedy that should be narrowly tailored.</p> <p>Restrains Samsung from seeking injunctions that would impair the jurisdiction of the US court or from filing lawsuits or administrative actions to enforce or defend its United States patent rights; indemnifies Ericsson; and requires Samsung to provide Ericsson with copies of all court papers in the Wuhan matter</p> <p>Refused to order Samsung to withdraw the ASI or bar Samsung from taking part in the CN lawsuit.</p>
China	Supreme Court					
	Huawei v Conversant, Supreme People's Court of China [2019] 732, 733, [734] Civil Ruling	08.2020	ASI 'act preservation order'	/	DE Injunction granted	Granted Same parties and overlapping subject matter (ie FRAND assessment); enforcement of DE injunction would produce a negative impact on CN trial; risk of irreparable damage for

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						<p>Huawei if out of DE market of had to accept Conversant's license (higher FRAND rate than in CN); limited damage to Conversant's right to litigate in DE; no prejudice to public interest or comity principle (timeline [CN before DE litigation], appropriate jurisdiction, moderate extraterritorial effect of CN trial on DE decision)</p> <p>Fine in case of violation of ASI: RMB 1 million per day.</p> <p>Rem: Final outcome: Global settlement agreement</p>
	OPPO v Sharp, Supreme People's Court (19.08.21) Zui Gao Fa Zhi Min Xia Zhong No. 517	19.08.21	ASI	/	Worldwide ("other countries or regions")	Granted?
First instance						
	Xiaomi v InterDigital, Intermediate Court Wuhan, [2020] E 01 Zhi Min Chu [169.1]	23.09.20	ASI and AAASI	AASI from India	India and worldwide	Granted
	Samsung Electronics Co., Ltd. v Ericsson, Intermediate Court Wuhan [2020] E 01 Zhi Min Chu [743].	03.2021	ASI and AAASI	/	US and worldwide	<p>Granted</p> <p>Bars Ericsson from (1) seeking injunctive relief on 4G and 5G SEPs around the world; (2) seeking a FRAND</p>

						adjudication anywhere other than Wuhan; and (3) seeking an AASI (à de facto issued and AAASI).
The Netherlands	Court of The Hague, Case No C/09/618542 / KG ZA 21-914 (2021) Ericsson v Apple	2021	AASI	ASI from US	?	Denied Not clear how Ericsson is threatened; erroneous reference to US proceedings of ASI between Apple and Qualcomm
India	High Court of Delhi, Case IA 8772/2020 in CS(COMM) 295/2020 (2021), InterDigital v Xiaomi	2021	AASI	ASI from CN	CN	Granted Labelled as “anti-enforcement injunction” An order without due justification can negatively impact the legitimate invocation of legal remedies available in another sovereign country; court must react against the unlawful incursion on its jurisdiction and on the fundamental right to demand legal redress; International comity could not avoid granting AASI.

Appendix 8: Counts of litigations and unique disputes, by segments of SEP licensing

Table A11: Patent litigation counts per party, from Darts-ip

SEP holder	# Litigations	# Cases	#Unique	#Courts	#Defendants	Defendants	# licensees
Ericsson	112	57	44	15	9 (19)	<i>Koninklijke KPN; Two-Way Media; Apple; TCL; Univ. of Minnesota; Samsung; Uniloc; Intellectual Ventures; Huawei; Iridescent Networks; Wiko; HTC; LG; Ipcom; NMS Wi-Lan; D-Link; High Point; Acer; ZTE</i>	>100
Nokia	227	91	87	28	16-18 (26)	Reflection Investment; Oneplus; Daimler; Sierra Tomtom; Nvidia; Lenovo; Intellectual Ventures; Huaqin; Oyster Optics; Gpne; Neptune Subsea IP; Continental; Apple; Evolved Wireless; Huawei; IPcom; Global Touch Solutions; Trendon Touch Technology; High Point; HTC; Viewsonic; STMicroelectronics; BlackBerry; 基伍伟业通讯设备深圳; Bosch; Pantech Wireless; 林.	>200
Qualcomm	92	42	21	16	4 (9)	Apple; Meizu; DSS Technology Management; ParkerVision; Gabriel Technologies; Norman Krasner; Broadcom; PJC Logistics; Philips	>300

#Litigations	#Cases	#Unique	#Courts	#Defendant	Defendants
80	55	45	13	35	Acronis; ADP; Akamai; American Broadcasting Companies; Apple; AT&T; Athenahealth; AVG

					Technologies USA; Big Fish Games; Blackboard; BOX; Cardo Systems; Cisco; Ericsson; Google; H&R Block; HTC America; Hulu; Infor; Kaspersky Lab; LG Electronics; Microsoft; Motorola; Netflix; Netsuite; Nexon; Paychex; Riot Games; Roku; Samsung; Sling TV; Square Enix; Tencent; Verizon; Zenpayroll
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#Litigations	#Cases	#Unique	#Courts	#Plaintiff	#Defendant	#First action dates	Combinations of Defendants and Plaintiffs	Combinations of Defendants and Plaintiffs and dates
109	73	67	12	19	95	24	110	114

Appendix 9: Selected SEP licenses, with date of product introduction**Table A12 :** Dates of product introduction and effective licensing date, selected bilateral SEP licenses

Licensor	Licensee	Standard	Release date first product incorporating 4G	Release date first product incorporating 3G	Effective licensing date	Litigation
Conversant Wireless / Core Wireless	Apple	3G, 4G	2012q1	2008q3	Dec-16	Yes
Conversant Wireless / Core Wireless	Huawei	4G Only 4G Multimode	2012q2	2007q1	Sep-19	Yes
Conversant Wireless / Core Wireless	LG	3G, 4G	2011q2	2003q3	Sep-16	Yes
Ericsson	HTC	4G Multimode	2011q1	2006q2	May-19	Yes
Ericsson	TCL	4G Only			Nov-17	Yes
Ericsson	Huawei	4G Multimode	2012q2	2007q1	Jan 2016; extends earlier agreement	Yes
Ericsson	Apple	4G	2012q1	2008q3	Dec-15	Yes
Ericsson	HTC	4G	2011q1	2006q2	Dec-14	
Ericsson	LG	4G	2011q2	2003q3	June 2014; extended in July 2018	
Ericsson	Samsung	4G (also for 2G, 3G)	2010q3	2004q1	Jan-14	Yes
Ericsson	Sony	2G, 3G, 4G	2011q4	2003q4	Jan-12	

Godo Kaisha IP Bridge	TCL	3G, 4G			Nov-18	Yes
Huawei	Samsung	4G	2010q3	2004q1	Samsung delayed negotiations that began in July 2011. Litigation started in 2016, settled in 2019.	Yes
Huawei	Apple	4G	2012q1	2008q3	2015	
Intellectual Ventures	Ericsson / T-Mobile	4G (infrastructure)			Feb-19	Yes
InterDigital	Huawei	2G, 3G, 4G	2012q2	2007q1	Feb-13	Yes
InterDigital	Apple	3G, 4G	2012q1	2008q3	Q4 2016	
InterDigital	Blackberry	3G, 4G	2012q3	2006q2	[2003 2G]; [2007 extended to 3G]; [2012 extended to 4G]	
InterDigital	Huawei	video codec, WiFi, 3G, 4G, 5G, 3G, 4G	2012q2	2007q1	[Q3 2016: 3G and 4G] [Q2 2020: 3G, 4G, 5G]	

Table 1 (continuation)

Licensor	Licensee	Standard	Release date first product incorporating 4G	Release date first product incorporating 3G	Effective licensing date	Litigation
InterDigital	LG	3G, 4G, 5G	2011q2	2003q3	Q4 2017	

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InterDigital	Samsung	3G, 4G	2010q3	2004q1	Nov 2008 agreement after settling dispute; Another agreement in Q2 2014, automatically extended in 2018 until 2022	
InterDigital	Sony	3G, 4G	2011q4	2003q4	Q3 2015, extends agreement in Q4 2012	
InterDigital	Ericsson				2003	
IPCOM	Deutsche Telekom	3G, 4G				
IPCOM	Samsung	3G, 4G	2010q3	2004q1		
Nokia	Blackberry	WiFi, 3G, 4G	2012q3	2006q2	Arbitration initiated in 2016 (disagreement about 2012 license)	Yes
Nokia	LG	3G, 4G	2011q2	2003q3	Jun-15	Yes
Nokia	Samsung	3G, 4G	2010q3	2004q1	2007; extended in Jan 2014 and 2018	Yes
Nokia	Apple	video codec, 3G, 4G, other video codec, 3G, 4G, other	2012q1	2008q3	June 2011 (litigation started in 2009); Settled another dispute in 2017	Yes
Nokia	Blackberry	WiFi, 3G, 4G	2012q3	2006q2		
Nokia	Huawei	3G, 4G	2012q2	2007q1	Q4 2017	
Nokia	Sony	2G, 3G, 4G	2011q4	2003q4	Jun-15	Yes

Qualcomm	Apple	3G, 4G, 4G, 5G	2012q1	2008q3	2007, extended in 2011, settlement in 2019	Yes
Qualcomm	Huawei	4G Only 4G Multimode 4G, 5G	2012q2	2007q1	Dec-14	
Qualcomm	Sony	4G Only 4G Multimode	2011q4	2003q4	May 2012, September 2015	
Qualcomm	Samsung	3G, 4G	2010q3	2004q1	[Nov 2009: 3G, 4G]; [2018: extends to 5G]	
Qualcomm	Nokia	GSM, EDGE, CDMA, WCDMA, HSDPA, OFDM, WiMAX, LTE	2012q2	2003q4	In litigation since 2007; settlement in 2008;	Yes

Licensor	Licensee	Standard	Release date first product incorporating 4G	Release date first product incorporating 3G	Effective licensing date	Litigation
Qualcomm	LG	4G	2011q2	2003q3	[Nov 2009: 4G]; [2019: 3G, 4G, 5G]	
Samsung	Apple		2012q1	2008q3	Jun-18	Yes
Samsung	Sony	Not sure it is over SEPs	2011q4	2003q4	Dec-14	
Sol IP / ETRI	Ericsson	4G (infrastructure)				
Unwired Planet	Lenovo	3G, 4G	2013q4	2011q3		

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Unwired Planet / Optis	Huawei	4G	2012q2	2007q1	Aug-18	Yes
Unwired Planet / Optis	Huawei	4G Multimode (handsets) 4G Only (infrastructure)	2012q2	2007q1	May-17	Yes
Vringo	ZTE	4G (infrastructure)	2012q3	2008q1	Dec-15	
Wi-LAN	Apple	4G	2012q1	2008q3	Jan-20	Yes
Wi-LAN	Samsung	3G, 4G	2010q3	2004q1		

Appendix 10: Avanci licensees, with date of agreement

Table A13: Avanci pool licensees, date of announcement of license

<i>Brand or Group</i>	<i>Announcement date</i>	<i>Portfolio</i>
BMW AG	01/12/2017 ³²¹	4G
BMW	01/12/2017	4G
Mini	01/12/2017	4G
Rolls Royce	01/12/2017	4G
Volvo Cars	?	?
Volvo	12/03/2019 ³²²	4G
Polestar	?	?
Volkswagen AG	06/05/2019 // 08/03/2022	3G // 4G
Volkswagen	06/05/2019 // 08/03/2022	3G // 4G
Bentley	06/05/2019 // 08/03/2022	3G // 4G
MAN	06/05/2019 // 08/03/2022	3G // 4G
Skoda	06/05/2019 // 08/03/2022	3G // 4G
Scania	06/05/2019 // 08/03/2022	3G // 4G
Seat	06/05/2019 // 08/03/2022	3G // 4G

³²¹ [Avanci Announces Patent License Agreement – BMW Group Becomes New Licensee of the Avanci Platform, Securing License to Standard Essential Patents for Cellular Standards – Avanci](#)

³²² [Avanci Announces New Patent License Agreement with Volvo Cars – Avanci](#)

Porsche	25/04/2019 ³²³	4G
Audi	25/04/2019 ³²⁴	4G
Cupra	?	?
Lamborghini	?	?
Bugatti	?	?
Jaguar Land Rover	03/11/2021 ³²⁵	4G
Jaguar	03/11/2021	4G
Land Rover	03/11/2021	4G
Aston Martin	03/11/2021 ³²⁶	4G
Daimler AG/Mercedes-Benz AG	22/12/2021 ³²⁷	4G
Daimler	22/12/2021	4G
Mercedes-Benz	22/12/2021	4G
Maybach	22/12/2021	4G
Smart	22/12/2021	4G
GM	03/05/2022 ³²⁸	4G

³²³ [Avanci Announces New Patent License Agreements with Audi and Porsche – Avanci](#)

³²⁴ Ibid

³²⁵ [Avanci Announces new Patent License Agreement with Jaguar Land Rover – Avanci](#)

³²⁶ [FOSS Patents: Avanci patent pool signs up Jaguar, Land Rover, Aston Martin: 4G SEP licenses without prior litigation](#)

³²⁷ [Avanci agrees licensing deal with Daimler to round-off a successful 2021 - IAM \(iam-media.com\)](#)

³²⁸ [Avanci Announces Patent License Agreement with General Motors – Avanci](#)

Chevrolet	03/05/2022	4G
GMC	03/05/2022	4G
Cadillac	03/05/2022	4G
Buick	03/05/2022	4G
Ford	31/05/2022 ³²⁹	4G
Lincoln	31/05/2022	4G
Tesla	2021 ³³⁰	4G
Lucid	?	?
Volta	?	?
Navistar	?	?

³²⁹ [Avanci Announces Patent License Agreement with Ford – Avanci](#)

³³⁰ [FOSS Patents: Tesla, Toyota, Honda finally file correct amicus brief--which doesn't say that Tesla is presumptive Avanci licensee](#)
[Spate of patent litigation dismissals involving Tesla points to possible Avanci deal - IAM \(iam-media.com\)](#)

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