Europäisches Patentamt
European Patent Office
Office européen des brevets

Standards and the European patent system

Insights from a new EPO dataset linking patents and standards, with early perspectives into SEP litigation under the Unified Patent Court

May 2025

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Foreword

Technology standards are the backbone of our digital economy, ensuring seamless connectivity across devices and the rapid technology diffusion. Standardisation is set to play an important role to accelerating the adoption of emerging technologies such as artificial intelligence and quantum communications, both vital to securing Europe's technological sovereignty as indicated in Mario Draghi's landmark report.

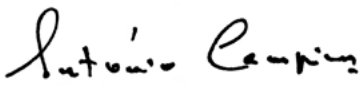
The patent system plays a key role in the development of technology standards, as it incentivises research and development and facilitates the exchange of technical knowledge. Technology standards that meet market needs often require the use of innovation solutions protected by patents. A balanced relationship between the patent and standardisation systems, which appropriately aligns incentives for developing optimal technical solutions with the promotion of widespread dissemination, is crucial for enhancing Europe's competitiveness.

The EPO stands ready to support a balanced and transparent system, providing the expertise needed to strengthen Europe's technological leadership and secure its digital future. To this end, its Observatory on Patents and Technology has launched a programme exploring the interactions between patents and standards. Related studies and material relevant for this topic will be made available on a new section of our website epo.org/standards.

The first milestone in this programme is the present study, which explores the relationship between standards and the European patent system. The study is supported by the EPO's unique prior-art collection of over 5 million documents from standards development organisations. Examiner citations to these documents create a natural link between patents and standards that we have compiled into a new dataset. This publicly accessible dataset supports practical applications relevant to practitioners and provides new opportunities for academic research. The study provides initial empirical findings.

The study also offers insights into litigation in Europe involving standard essential patents (SEP). While most agreements between SEP holders and implementers of standards are reached on fair, reasonable and non-discriminatory (FRAND) terms without recourse to litigation, the licensing of SEPs can sometimes be contentious and may lead to litigation as a last resort when bilateral negotiations fail. Since its establishment on 1 June 2023, the Unified Patent Court (UPC) has emerged as a forum with the potential to centralise and harmonise SEP disputes. In just 19 months, the UPC has been seized with 23 SEP-related disputes. This shift is helping to avoid parallel litigation and enhancing legal certainty. In addition, the upcoming launch of the UPC's Patent Mediation and Arbitration Centre (PMAC) in late 2025 will provide a dedicated forum for resolving global SEP disputes through alternative dispute resolution and will include a dedicated procedural framework for disputes involving SEPs within its Arbitration, Mediation and Expert Determination Rules.

This project was carried out by the EPO Observatory in close collaboration with 21 national patent offices across Europe: Austria, Belgium, Bulgaria, Croatia, Czech Republic, Finland, France, Germany, Greece, Italy, Latvia, Lithuania, Luxembourg, Monaco, Netherlands, Poland, Portugal, Spain, Sweden, Türkiye and the United Kingdom. We look forward to continuing this fruitful cooperation as we expand our efforts to improve knowledge and tools at the intersection of patents, standards, and innovation.



António Campinos
President, European Patent Office

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List of abbreviations

ADR	Alternative dispute resolution
AI	Artificial intelligence
AV1	AOMedia Video 1
AVC	Advanced Video Coding
DVB	Digital Video Broadcasting
EPC	European Patent Convention
EPO	European Patent Office
ETSI	European Telecommunications Standards Institute
FRAND	Fair, reasonable and non-discriminatory
HEVC	High Efficiency Video Coding
ICT	Information and communication technology
IEEE-SA	Institute of Electrical and Electronics Engineers Standards Association
IEC	International Electrotechnical Commission
IPR	Intellectual property rights
IPC	International patent classification
IETF	Internet Engineering Task Force
IoT	Internet of Things
ISR	International search report
ITU-T	International Telecommunication Union's Telecommunication Standardization Sector
JPEG	Joint Photographic Experts Group
LTE	Long-term evolution
MoU	Memoranda of understanding
NPL	Non-patent literature
NPO	National patent office
PCT	Patent Cooperation Treaty
PGP	Patent grant procedure
PMAC	Patent Mediation and Arbitration Centre
R&D	Research and development
SDO	Standards development organisation
SEP	Standard-essential patent
TC	Technical specification
UPC	Unified Patent Court
VVC	Versatile Video Coding
WiFi	Wireless Fidelity
WIPO	World Intellectual Property Organization
3GPP	3rd Generation Partnership Project
3G	Third generation of mobile networks
4G	Fourth generation of mobile networks
5G	Fifth generation of mobile networks

List of countries

AT Austria
BE Belgium
BG Bulgaria
HR Croatia
CZ Czechia
FI Finland
FR France
DE Germany
GR Greece
IE Ireland
IT Italy
JP Japan
LV Latvia
LT Lithuania
LU Luxembourg
MC Monaco
NL Netherlands
CN China
PL Poland
PT Portugal
KR Republic of Korea
ES Spain
SE Sweden
TR Türkiye
UK United Kingdom
US United States of America

Executive summary

Technology standards are essential for enabling interoperability and driving innovation across digital economies. Standards for wireless connectivity (e.g. 3G, 4G, 5G, WiFi), audio/video compression (e.g. MPEG, HEVC/VVC, AVC, AV1, VP9), data storage and exchange, broadcasting, and home audio/video interoperability (e.g. NextGen TV, DVB) are particularly important. These standards have been widely adopted in the information and communication technology (ICT) sector, including in telecommunications equipment, mobile phones, computers, tablets and TV sets. They have also supported the expansion of Internet of Things (IoT) applications such as connected cars, drones and smart devices. Similar standardisation efforts may be required for emerging technologies like artificial intelligence and quantum communications.

Standards development organisations and similar bodies (hereafter both referred to as "SDOs" for simplicity) develop and standardise the best technical solutions to ensure standards meet real market needs. The resulting technology standards often incorporate patented innovations from multiple contributors. This has led to a close interconnection between standards and patent systems.

The patent system plays a key role in standardisation by promoting early disclosure of technical innovations, facilitating the exchange of knowledge needed to develop and refine standards. It also provides incentives for R&D and enables firms to recoup their investment and earn royalties that adequately reflect the value of their contributions through licensing agreements with standard implementers.

Patents that protect technology included in a standard and that must be used to comply with the standard are called standard-essential patents (SEPs). To avoid the holder of such an SEP from using its patent rights to prevent or restrict access to the standard, and to ensure wide dissemination and use of the standard, most SDOs have adopted Intellectual Property Rights (IPR) policies. While some of these IPR policies require standards participants to identify and declare their patents that they believe are or may become essential to a standard, they generally require participants who want their proprietary technology to be included in the standard to provide an undertaking to licensing their SEPs on fair, reasonable, and non-discriminatory (FRAND) terms and conditions. However, these FRAND licensing undertakings made in the context of the standardisation process do not themselves grant implementers of the standard a right to use the patented technology.

SEP licensing agreements are negotiated privately between SEP holders and implementers, often involving complex patent portfolios that span multiple products. These negotiations can be complex because, among other things, views may diverge on technical issues such as the determination of essentiality, validity or infringement of asserted SEPs, or because the parties may disagree on what constitute FRAND terms and conditions. As a result, the licensing of SEPs can be contentious and may lead to litigation as a last resort if bilateral negotiations fail, although most agreements are reached without litigation.

Despite these complexities, industries that rely heavily on standards have experienced dynamic growth in recent decades, with standardisation enabling many new players to enter the market. Potential contributors have not been systematically discouraged from participating in standard development, nor have implementers been deterred from developing products based on standards involving potential SEPs. Nonetheless, continued efforts are needed to ensure a balanced, transparent, and predictable relationship between the patent and standardisation systems to support innovation and strengthen European competitiveness.

This study, conducted under the aegis of the EPO Observatory on Patents and Technology, is a first milestone in a broader agenda that seeks to improve transparency in the relationship between standards and patents in Europe. The focus on Europe is justified for two reasons. First, the extensive scope of the EPO's standard-related libraries and their integration into prior-art searches naturally create new links between patents and standards, offering valuable opportunities for empirical analysis. Second, the newly established Unified Patent Court (UPC) creates a new framework for the resolution of SEP-related disputes across Europe that merits attention.

The study unfolds in three main sections:

First, it describes the infrastructure and procedures in place at the EPO to improve the quality of search reports in areas where standardisation is important. When new technology is disclosed in standards development processes that are not subject to a secrecy obligation, this is considered to be a public disclosure. Standards documentation arising from such processes is therefore considered to be state of the art under the European Patent Convention (EPC Guidelines G-IV,7.6). The EPO has invested significantly since the early 2000s in incorporating standards-related documentation into its internal databases and utilising them as an integral part of the patent grant process (PGP) to enhance prior art searches. With its unique collection of over 5.5 million documents that have been produced during standards development processes, the EPO ensures that patents are only granted for inventions which are novel and involve an inventive step, and not for technology already openly disclosed in standards development proceedings or for minor further developments. In 2024, over 4% of all EPO search reports included at least one examiner citation to standard-related documents. These citations create a natural link between patents and standards.

Second, the study builds on the link between patents and standards created through examiner searches to produce a new dataset: the **EPO Cited SDO Documents Dataset**, available for download at epo.org/standards. This connects 190 116 patent applications to 168 620 SDO documents identified by XP number (a unique identifier assigned by the EPO to non-patent literature). This new PGP-based linkage connects the patent and standards worlds beyond traditional self-reported standard-essentiality declarations. The dataset supports practical applications for both SEP holders and implementers, such as identifying potential commercial or technological relationships between authors of standard documents and owners of citing patents. It also enables academic research into the dynamics of standardisation and innovation. In addition, the dataset provides a valuable foundation for developing methods to predict essentiality based on observable patent-standard characteristics.

Third, the study examines litigation involving SEP in Europe, with a particular focus on the early impact of the Unified Patent Court (UPC). Historically, patent litigation was fragmented in Europe across national courts. Since its launch in June 2023 the UPC has begun to centralise enforcement and validity challenges. By the end of 2024, 23 SEP-related disputes had been filed at the UPC, indicating its emergence as a key forum absorbing much of the caseload previously directed to national courts. The frequency of multi-jurisdictional SEP disputes in Europe has declined notably, suggesting the UPC is helping consolidate litigation in a single forum. In addition, the upcoming launch of the UPC's Patent Mediation and Arbitration Centre (PMAC) in late 2025 will provide a dedicated forum for resolving global SEP disputes through alternative dispute resolution and will include a dedicated procedural framework for disputes involving SEPs within its Arbitration, Mediation and Expert Determination Rules.

Key findings

1. The EPO has extensive standard development organisation databases used in prior art searches, now containing some 5.5 million standards-related documents.

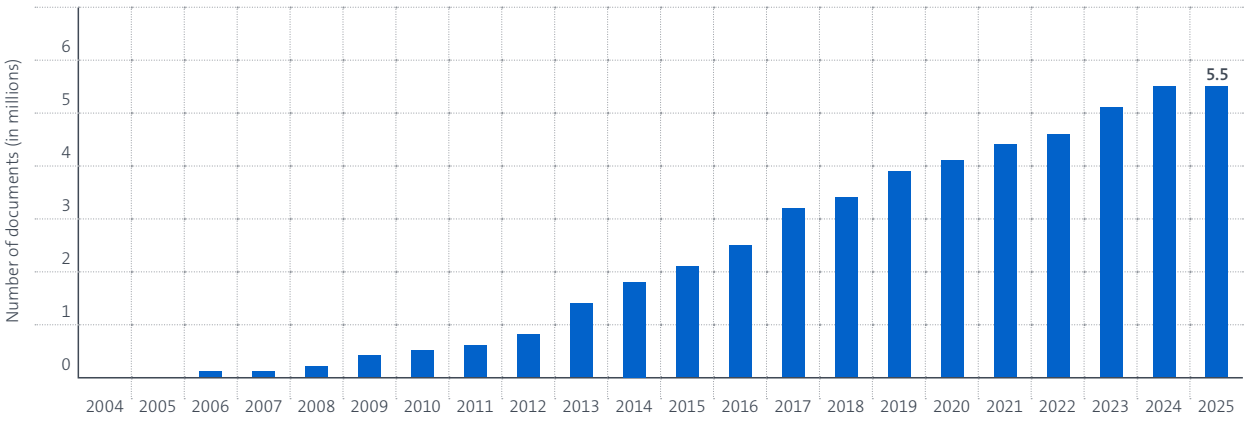
To achieve the highest possible quality in the patent-granting process, the prior art search must identify documents relevant to novelty and inventive step from all pertinent sources. In areas where standardisation is important, such as information and communication technology (ICT), patent examiners must systematically consider standards-related prior art when assessing the patentability of an invention, ensuring that patents are granted only for truly novel and inventive contributions.

To enhance prior art searches, the EPO has invested significantly since the mid-2000s in incorporating standards-related documentation into its internal databases and utilising them as an integral part of the patent-granting process. The EPO follows a policy of close co-operation with standard-developing organisations (SDOs), which has led to the creation of 13 dedicated internal databases covering standards-related documents from 15 SDOs, including 3GPP, ETSI, the ITU-T, the IEEE-SA, the IETF, the IEC and others.

These EPO SDO databases now contain more than 5.5 million documents that have been produced during standards development processes, including technical contributions, drafts or meeting minutes. More than 2.7 million of these originate from the 3rd Generation Partnership Project (3GPP), which unites seven telecommunications SDOs from around the globe, highlighting the critical role of telecommunications standards, particularly those related to 4G and 5G. The next largest databases are XPITU, with 0.61 million documents and XPETSI, which holds 0.52 million documents. XPI3ES is close in size, with 0.52 million documents.

Figure E1

Number of documents in the EPO SDO databases



Note: The graph shows the cumulative number of documents (in millions) in EPO SDO databases, based on their date of inclusion in the database. The date of inclusion for documents published before the creation of the respective SDO database is the creation date of the database; for documents published afterward, the publication date.

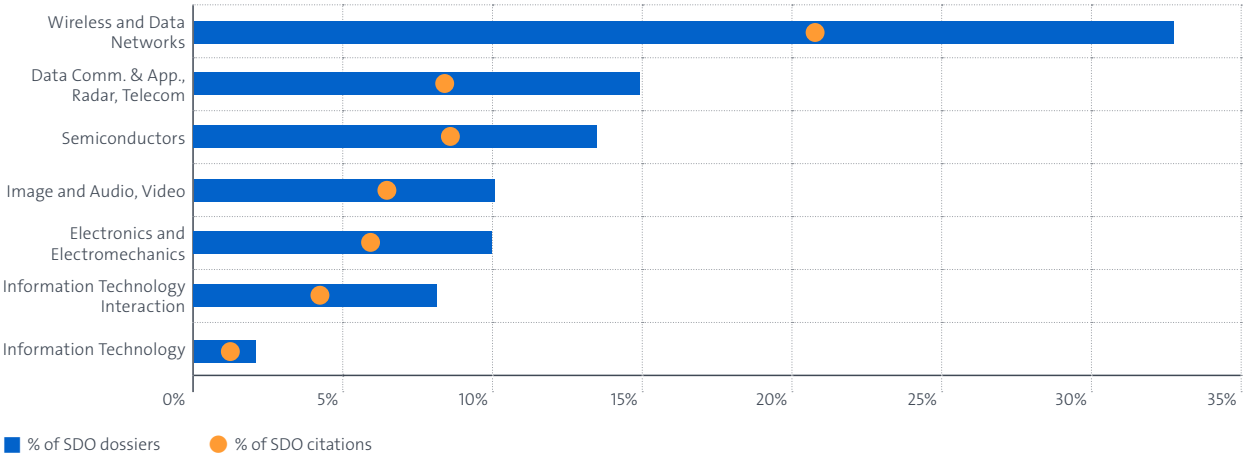
2. The integration of SDO databases into the patent grant process has led to a steady rise in examiner citations of these documents. In technology areas with intense standardisation activity, over 30% of search reports involve SDO-related dossiers.

SDO documents undergo bibliographic data extraction and are processed into the EPO's search tools to support efficient prior art searching. The integration of the SDO databases into the patent grant procedure (PGP) has translated into a steady increase in the number of examiner citations of such documents. This reflects both a move away from less systematic sources of information previously used by examiners and a net rise in the overall number of citations due to an increase in search efficiency.

In 2024 nearly 12 000 EPO search reports included at least one citation of a document from the SDO databases, accounting for over 4% of the total. In examiner units focused on technologies with high levels of standardisation activity, this share is significantly higher. For example, in the Wireless and Data Networks unit, more than 30% of search reports involve SDO-related dossiers, and over 20% include at least one SDO citation. For specific examiner unit and patent application technology class combinations this percentage is considerably higher (these percentages are not presented in Figure E2, but can be found in other related figures in the study). For instance, patent applications in the International Patent Classification (IPC) technology class video compression and coding technologies (H04N19) handled by the examiner unit Image and Audio, video has a percentage of SDO dossiers close to 70%.

Figure E2

Percentage of SDO search reports and SDO citations by examiner unit



Note: The graph shows the percentage of SDO search reports (search reports that cite at least one document in the EPO SDO databases) and SDO citations by examiner unit. The sample covers examiner units handling applications where standard-related invention is more frequent and is restricted to search reports completed during the period 2015-2024.

3. Examiner citations of documents in the SDO databases establish a natural link between standards and patent applications. We have extracted, documented and shared this information in a new dataset: the EPO Cited SDO Documents Dataset.

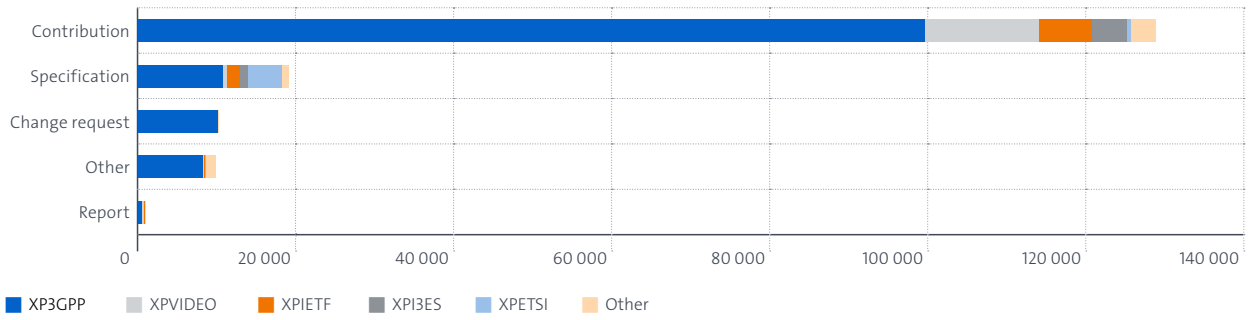
Examiner citations through the PGP establish a natural link between patents and standards. We have created a new dataset identifying all examiner-cited documents in the SDO databases. We document and describe the dataset, offering a guide for interested users. The dataset is available for download from epo.org/standards.

The resulting dataset includes 168 620 distinct XP numbers (a unique identifier assigned by the EPO to non-patent literature) identifying documents in the SDO databases (level of observation of the dataset), referenced in 417 951 distinct citations by 190 116 distinct patent applications. The dataset offers a linkage between patents and standards, connecting PATSTAT patent data (through XP numbers) and SDO documents.

This PGP-based linkage provides a novel perspective on the relationship between patents and standards, moving beyond traditional datasets based on self-reported standard-essentiality declarations. The linkage has applications of potential interest to practitioners. It could help implementers assess potential essentiality. It might also help SEP holders track citations to standard contributions, uncovering commercial or technological relationships. Beyond practice, it opens new avenues for research into how standards and patents interact to drive innovation and growth.

Figure E3

Number of standard documents cited in published applications, by type of document and SDO database



Note: The graph shows the number of distinct standard documents cited by published applications, by type of standard document. Contributions are inputs submitted by members in the standardisation process that bring new technical material to a working group; specifications are the normative text of the technical standard approved through the SDO's ballot or consensus process; change requests specify detailed changes that are proposed to a specification; reports include feasibility studies, technical studies and reports submitted to working groups for informational purposes; other includes minutes, liaisons, white papers, unknown document types and other document types.

4. There is considerable overlap between the presence and number of citations of SDO documents and the likelihood of a patent being declared a standard-essential patent (SEP).

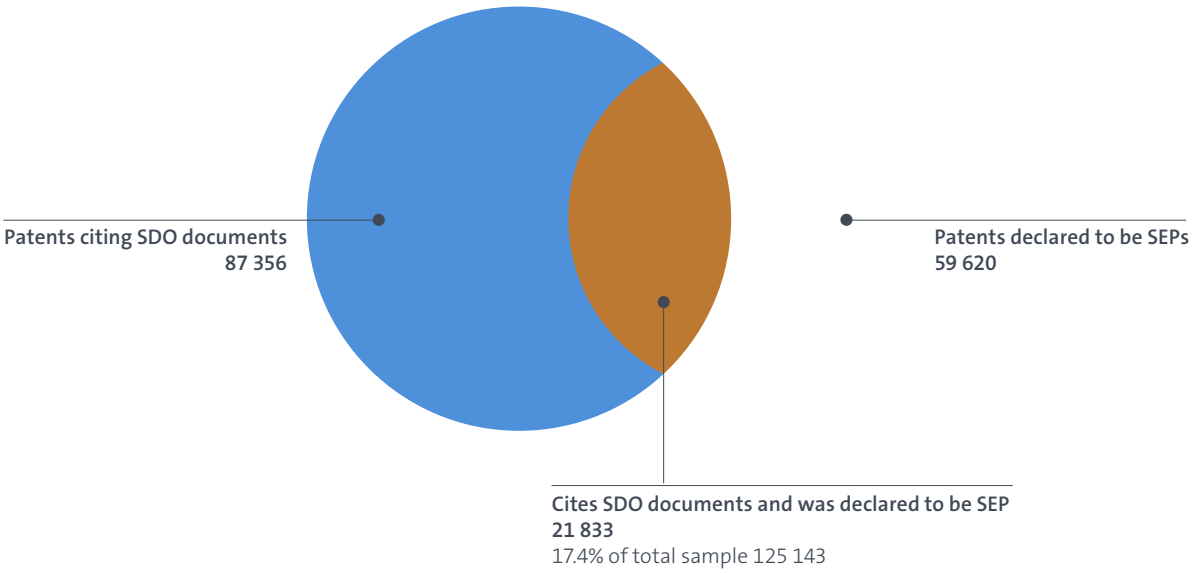
There is considerable overlap between SDO-citing patents and declared SEPs. Among patents that either cite SDO literature or are declared SEPs, 17.4% fall into both categories. Focusing on the subset of SDO-citing patents, 25% of these are declared SEPs. Alternatively, focusing on declared SEPs, 37% cite at least one SDO document. It is important to note that not all SDOs require participants to declare potential SEPs, which implies that the actual overlap between SDO-citing patents and potential SEPs may be even higher than observed.

A positive and statistically significant relationship is also found between the intensity of citations of SDO documents and the likelihood of a patent being declared an SEP. This relationship holds even after accounting for patent-level, citation-related and company-specific characteristics in a logistic regression analysis. Characteristics of the relationship between the citing and cited parties, the citation or the cited SDO document also help predict the likelihood of SEP declarations. In particular, patents citing contributions are more likely to be declared SEPs than those citing technical specifications. This likely reflects two factors. First, contributions have identifiable authors with incentives to assert ownership, while technical specifications are issued collectively by SDOs. Second, technical specifications are enablers of innovation and more influential for technological development than contributions. Citations of technical specifications likely reflect follow-on innovation by implementers or firms advancing the next generation of the standard.

The positive correlation between citations of SDO documents and SEP declarations suggests that the new linkage between patents and SDO documents could serve as a useful indicator for assessing potential essentiality. This approach may support the development of data-driven tools to predict essentiality based on observable patent and standard-related characteristics.

Figure E4

Overlap between SDO-citing published applications and SEP declarations



Note: The graph is based on a sample of 125 143 published patent applications resulting from the union of the following two samples: a) PATSTAT applications that cite documents in the EPO SDO databases and b) patent Orbis IP applications that are declared SEPs. Only applications published by the EPO or WIPO between 2010 and 2019, years in which both sources are comparable, are included.

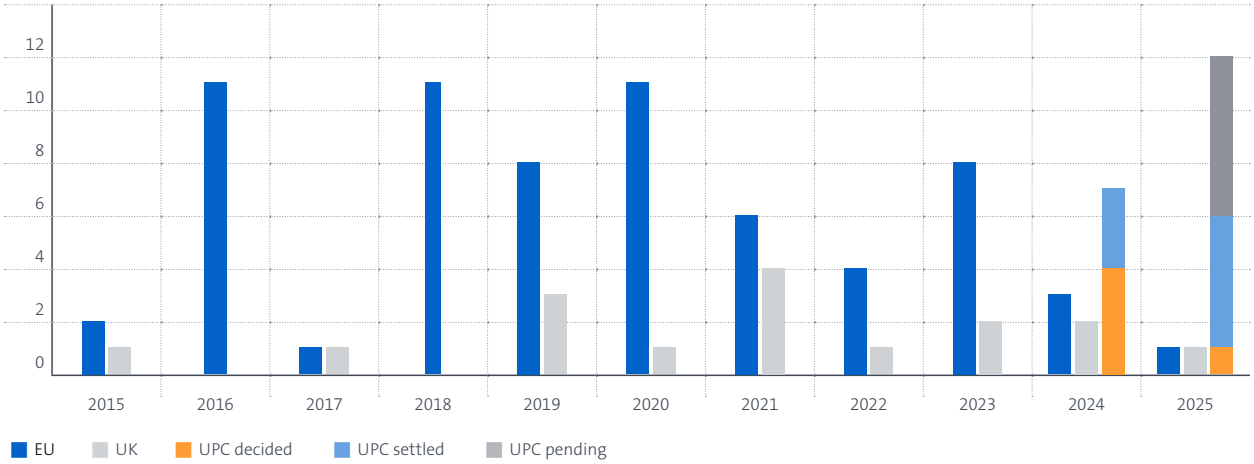
5. The Unified Patent Court has established itself as an important venue in SEP litigation

Over the past decade, SEP litigation in Europe was predominantly handled by national courts in Germany and the UK, and to a lesser extent the Netherlands and France. However, with the inception of the Unified Patent Court (UPC) in June 2023 a new venue has emerged, offering a uniform, specialised and efficient framework for patent litigation at a European level enhancing legal certainty for all users. The UPC has exclusive jurisdiction over European patents with unitary effect (Unitary Patents) and "classic" European patents. The exclusive jurisdiction over "classic" European patents is, however, shared with competent national courts or authorities during a transitional period of seven years running initially to 2030. Furthermore,"classic" European patents can be opted out from the UPC's jurisdiction. However, despite this option for patent holders to exclude UPCs jurisdiction, 74% of European patents (and 71% of declared SEPs) remain within the competence of the UPC. This underscores the UPC's role in driving a significant shift in the European patent litigation landscape.

Analysis of recent SEP litigation disputes documents the first emerging trends as the system remains in its ramp-up phase. The UPC is rapidly establishing itself as a key forum for resolving SEP-related patent disputes in the EU. As of 14 March 2025, 23 SEP-related disputes have been initiated at the UPC, averaging more than 13 cases per year since launch in mid-2023. This is a considerable number, also by comparison to the number of disputes brought to national courts in different European jurisdictions. The UPC appears to have absorbed a significant share of disputes that would previously have been brought before the national courts of the member states participating in the UPC, in particular Germany. It should be noted that counts for recent years are affected by pendency and publication lags, both in the filing of patent applications and disputes associated with these applications. The results must be interpreted with caution as we are still in the early days of the UPC.

Figure E5

Number of SEP disputes by jurisdiction and decision year



Note: This figure reports a unique number of disputes involving declared SEPs, collapsed by European jurisdiction and decision year related to European SEP disputes in the sample. The unit of observation is at the dispute level. In the case of parallel disputes, collapsing is done by the decision year with the highest priority. Importantly, in the case of the UPC, settled and pending cases are included to reflect harmonization effects of the UPC and consider the amount of cases where decisions will likely be taken in 2025, while this is not done for other jurisdictions.

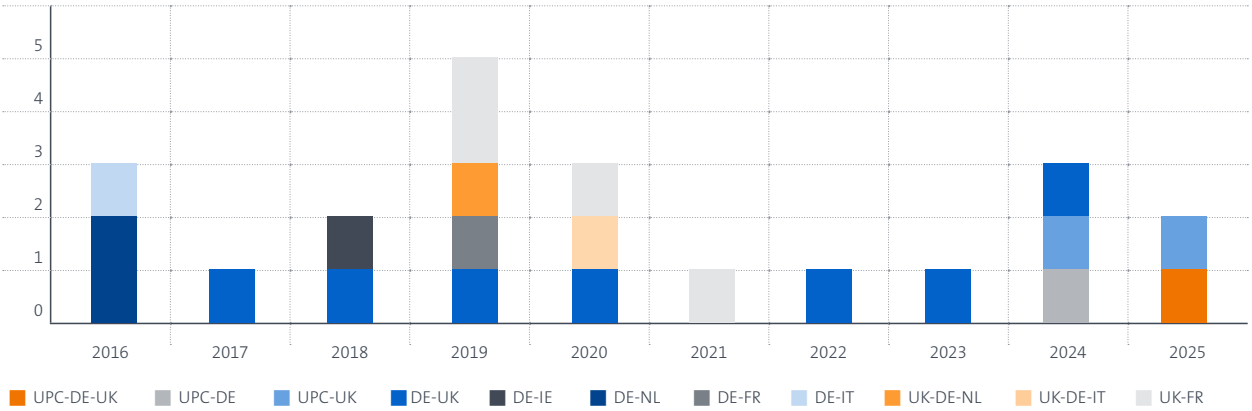
6. The UPC is harmonising SEP litigation across Europe

The UPC is rapidly establishing itself as a key forum for resolving SEP-related patent disputes in the EU, absorbing a share of disputes that would previously have been brought before courts of EU Member States. Another margin through which the UPC could be harmonising SEP litigation is by reducing the incidence of "parallel litigation", as measured by the number of SEP disputes spanning multiple European jurisdictions or the jurisdictional combinations observed in such disputes. The incidence of parallel litigation is rather low, with only one fifth of SEP-related disputes involving decisions from courts in multiple European jurisdictions, most involving just two jurisdictions. This figure has been approximately constant over the past years, including those following the establishment of the UPC. In terms of combinations of jurisdictions, in the years immediately preceding the UPC's creation, most cross-jurisdictional SEP disputes involved combinations of UK and EU national courts (e.g. UK-FR in 2019 and 2021, UK-DE-NL in 2020, and UK-DE in multiple years). Since the UPC opened its doors in June 2023 these combinations have shifted, with new disputes often involving the UPC and the UK. This reflects the fact that although the UK is not an EU Member State and as such cannot participate in the new system, the UPC has often substituted for the national courts of the participating Member States in the UPC Agreement for patents under its jurisdiction.

The UPC's Patent Mediation and Arbitration Centre (PMAC), set to launch in late 2025, has announced its intention to provide a dedicated forum for resolving SEP disputes through alternative dispute resolution (ADR). The PMAC will include a specific procedural framework for SEP cases within its Arbitration, Mediation and Expert Determination Rules. ADR can offer a flexible and efficient approach in resolving global SEP disputes, allowing parties to avoid the territorial limitations and high costs of litigation while benefiting from specialised expertise, confidentiality and the ability to address complex, cross-border issues in a single procedure.

Figure E6

Number of SEP disputes spanning multiple European jurisdictions, by combinations of jurisdictions involved



Note: This figure shows the number of SEP disputes spanning multiple European jurisdictions by jurisdiction combination and year of decision date related to this dispute in the data. The figure excludes disputes that do not result in court decisions (e.g. settled or pending cases). The figure includes 22 disputes spanning more than one jurisdiction.

1. Introduction

1.1. The relevance of technical standards for progress

Technology standards are an invisible but fundamental part of our daily lives. They ensure the interoperability of devices and support the seamless integration of smart technologies, driving innovation and economic growth in Europe (Blind et al., 2024). By bringing great benefits to businesses and consumers, creating a level playing field for companies and boosting consumer confidence, standards contribute significantly to Europe's competitiveness. At the same time, standards also play an important role in ensuring Europe's technological sovereignty and reducing dependencies.

Particularly important for growth are those standards that support the digitalisation of economies. These include standards for wireless connectivity (e.g. 3G, 4G, 5G and WiFi) and audio/video compression and decompression (e.g. MPEG, HEVC/VVC, AVC/H.264, AV1, VP9 and AAC); also, to a certain extent, data storage and exchange, photo formats, broadcasting and home audio/video interoperability (e.g. ATSC, NextGen TV and DVB). These standards are mostly used by producers in the ICT sector, including telecommunications equipment, mobile phones, computers, tablets and TV sets. More recently, they have also supported the rise of sectors based on the internet of things (IoT), including connected cars, drones, payment terminals, tracking devices, smart meters, EV chargers and other smart devices. Upcoming technologies such as quantum communications could also require substantial standardisation efforts and follow a similar model.

The main purpose of standardisation is to define technical or quality requirements for existing or future products, processes or services. Standards can cover a variety of areas, but are particularly important in creating compatibility and interoperability between complementary products and services. Some of the best-known standards are developed in recognised SDOs with voluntary and consensus-based participation by all interested parties (e.g. wireless technology standards such as 4G and 5G developed by ETSI/3GPP, the specifications on video codecs by the ITU-T and the WLAN specifications developed by the IEEE-SA). However, many standards that are also widely accepted and used are developed in a standards-like framework such as a consortium or industry group (e.g. Bluetooth SIG, the NFC Forum, the DVB project, etc.).

The operation of the various SDO and similar bodies can vary according to technology, membership composition and region, and there is also desirable competition between the different models. Members of SDOs can be very heterogeneous, ranging from prospective implementers of the standard, technology developers, end users, intermediate users (such as network operators in telecommunications) and component suppliers (such as makers of chip sets or software). Members attend meetings, make proposals and vote on standardisation decisions, engaging in cooperative decision-making to reach a consensus about the exact content of the standard.

With the exception of de facto ones set by a single company, standards are typically horizontal agreements among competitors that promote competition and innovation. They support new product development, enable market entry, reduce transaction costs and ensure interoperability. However, under certain circumstances, standardisation may also have restrictive effects on competition, especially if some companies are unjustifiably denied effective access to the standard development process or its results. To ensure the pro-competitive effects of standardisation outweigh the negatives, the ability to participate in the standardisation process must be guaranteed and the procedure for adopting standards must be transparent. It must also be ensured that third parties are granted access to the standard on **fair, reasonable and non-discriminatory (FRAND)** terms.

1.2. The importance of patents for standards development

A number of SDOs aim to develop and standardise the best available technical solutions to ensure their standards meet the real needs of consumers and the market. In today's digital economy, where standards provide interoperability and the pace of development is unprecedented, standards often integrate new patented technologies. As a result, the standardisation and patent systems have become closely intertwined.

Members of SDOs who contribute as technology developers invest in R&D to develop the standard, often years in advance of any return on investment. In this context, patents have a positive impact which is not

always well understood and properly appreciated. The patent system encourages early disclosure of innovative technical solutions, facilitating the exchange of technical knowledge necessary to develop state-of-the-art standards. In the absence of patents, firms would be more likely to rely on secrecy, limiting access to new technologies and hindering collaborative innovation. Patents also provide the right incentives to innovate by allowing firms to capture a share of the value generated by the standardised technology that is attributable to their contributions.

At the same time, the inclusion of patented technologies in a standard can increase the risk of restricting access to the standard. Patents grant subjective exclusion rights, including in particular the power to prohibit others from using the protected technical teaching. Standards, on the other hand, aim at wide dissemination and use by as many people as possible. This tension can lead to difficulties if use of a patented invention is necessary to comply with a standard. The owner of a **standard-essential patent (SEP**) can then use its exclusive right to prevent or restrict access to the standard, either by refusing to grant a licence, or by imposing unreasonable licensing conditions or discriminating without objective justification. Where the standard is widely used and switching to alternative technologies is no longer readily possible, such behaviour by the patent holder may under certain circumstances have anti-competitive effects.

An appropriate solution to this tension requires a fair balance between the objective interests of all parties involved, which on the one hand promotes the widest possible participation in standardisation and thus access to the best available technologies while preserving a fair and adequate return for the contributions, and on the other hand ensures smooth and wide dissemination of standardised technologies based on FRAND access conditions.

SDOs seek to address this tension through their IPR policies, sometimes referred to as patent policies. These are contractual self-regulatory mechanisms that may be part of the SDO's bylaws, the membership agreement or rules of procedure of the SDO and which each member of the SDO or participant in standardisation is required to comply with. While the IPR policies of SDOs vary, many are based on two pillars. First, an obligation to identify and declare any patents (and published patent applications) that may be essential. Second, a requirement that participants in the standards development process who wish to include their patented technology in a standard provide an irrevocable written undertaking that they are prepared to grant licenses on FRAND terms and conditions. However, most SDO policies do not define what constitutes FRAND, which can result in controversies over its meaning (Ménière and Thumm, 2015). The FRAND undertaking does not itself grant implementers of the standard a right to use the patented technology. This has to be negotiated in private licensing agreements between SEP holders and implementers outside of the SDO.

1.3. SEP licensing

Licensing of SEPs is characterised by a number of complexities which are the result of the inherent tension between patents and standards. Most notably, a number of standards are underpinned by large numbers of SEPs owned by distinct companies and may be implemented in multiple products commercialised by different companies. As a result, SEP licensing can present a number of challenges for the parties involved. Some implementers may need to monitor a large number of portfolios to assess the extent of their SEP exposure and need the capacity to negotiate licenses with multiple patent holders. In turn, SEP holders may find it difficult to detect and effectively license all the uses of their patented technology.

Besides the SDO's IPR Policies, governmental authorities, policy makers and court cases have produced numerous documents that provide guidance for the licensing of SEPs. For example, the Communication from the Commission on "Intellectual Property Rights and Standardization" of 1992 laid the foundation for how IPRs interact with standardisation within the EU.[1] The 2017 Communication on Standard-Essential Patents by the Commission provides significantly expanded elements of interpretation of the meaning of FRAND.[2] The "Horizontal Guidelines" provide guidance on how joint agreements, including those related to standardisation, should comply with EU competition law as well as some guidance about

[1] White Paper 4.3.1. and 4.3.3.; at 16

[2] Communication of 2017; at 6-7.

licensing on FRAND terms and the requirement to declare potential SEPs. The Technology Transfer Block Exemption Regulation (TTBER) and its accompanying "Guidelines for the Transfer of Technology" address the licensing of technology and assess how agreements impact market competition. Landmark judgments such as Huawei v. ZTE by the Court of Justice of the European Union (CJEU) in 2015 clarified the availability of injunctive relief for infringements of SEPs for which a FRAND undertaking has been provided and establish frameworks for bilateral negotiations.

The market has also generated several mechanisms to navigate complexities. SEP holders have made ex-ante announcements with information on intended licensing terms, giving implementers early insights into potential licensing costs. Some licensors also publish standard licensing terms on their websites, further clarifying expectations. Patent pools, which aggregate SEPs from multiple SEP holders under a single license can contribute to streamlining licensing, reducing litigation costs, and facilitating access to essential technologies (Lerner and Tirole, 2004).

Despite existing mechanisms, scholars, policymakers and some companies worry that the complex nature of SEP licensing could have adverse effects (Baron et al., 2023; Bekkers et al. 2014; Bekkers et al. 2020a; Pentheroudakis and Baron, 2017). A long-standing concern is that SEP holders might exploit system complexities like uncertainty over essentiality or licensing terms to demand excessive royalties and use the threat of injunctions or enforcement thereof to extract supra-FRAND rates (Shapiro, 2001; Lemley and Shapiro, 2007; Bekkers et al., 2020a). More recently, scholars and policymakers have also pointed out that frictions in SEP licensing provide incentives for prospective licensees to behave opportunistically, delaying licensing to reduce royalty payments (Galetovic et al., 2018; Llobet and Padilla, 2023; Spulber, 2019; Helmers and Love, 2024; Heiden and Petit, 2017). Abusive behaviour by unwilling licensees has potentially large detrimental effects on R&D and innovation by SEP holders.

Although there are challenges in SEP licensing, they do not appear severe enough to systematically discourage potential contributors from engaging in standard development or deter implementers from developing products based on standards involving potential SEPs (Baron et al., 2023, p. 185). Nonetheless, continued efforts are needed to maintain a smooth and balanced relationship between the patent and standardisation systems, ensuring that both can function effectively in support of innovation. A transparent and predictable environment is essential to strengthen European competitiveness.

1.4. The role of standard documentation in the European patent system

When new technology is disclosed in standards development processes that are not subject to a secrecy obligation, this is considered to be public disclosure. Standards documentation arising from such processes is therefore considered to form part of the state of the art under the European Patent Convention (EPC Guidelines G-IV,7.6). This applies both to final standards and preparatory documents such as contributions submitted and discussed while SDO members are developing the standard.

To improve the quality of prior art searches, the EPO has invested significantly since the mid-2000s in incorporating standards-related documentation into its internal databases and utilising them as an integral part of the patent grant process (PGP). A policy of close co-operation with SDOs has led to the creation of 13 SDO databases covering standards-related documents from 15 SDOs including 3GPP, ETSI, the ITU-T, the IEEE-SA, the IETF, the IEC, and others. These databases now contain more than 5.5 million standards-related documents, including contributions, meeting minutes, technical specifications and other forms of disclosure.

This unique collection of standards-related prior art ensures that patents are only granted for inventions which are novel and involve an inventive step, and not for technology already openly disclosed in standards development proceedings or for minor further developments. The integration of the SDO databases into the PGP has translated into a steady increase in the number of examiner citations of such documents (note that the trends could also reflect an increase in the importance of technology standards). In 2024 over 4% of all EPO search reports included at least one SDO citation, with the figure exceeding 30% in standardisation-intensive fields like wireless and data networks. These examiner citations establish a natural link between patents and standards.

With the aim of improving transparency on the link between patents and standards, the EPO is now releasing the **EPO Cited SDO Documents Dataset**, available for download from epo.org/standards. This identifies documents in the SDO databases which are cited by patent publications in PATSTAT. It also provides several bibliographical fields of interest for the cited documents. These documents are identified through the XP number ranges assigned to the different SDO databases.[3]

The dataset includes 168 620 distinct XP numbers identifying documents in the SDO databases (level of observation of the dataset), referenced in 417 951 distinct citations by 190 116 distinct patent applications. It offers a linkage between patents and standards, connecting PATSTAT patent data (through XP numbers) and SDO documents (through contribution and specification identifiers). This PGP-based linkage provides a novel perspective on the relationship between patents and standards, moving beyond traditional datasets based on self-reported standard-essentiality declarations (e.g. Baron and Pohlman, 2018; Bekkers et al., 2012).

We present initial empirical insights derived from the new dataset, including an overview of the most common source SDO databases, the types of standard documents cited, and their main authors. The analysis also uses citation-level data to identify the most frequently referenced standard documents, the technological fields of the citing patents, and the precise reasons why examiners referenced these documents. The dataset also enables the study of citation lags from the publication of the standard document to the filing of the citing patent application and highlights the companies most actively citing standards. These insights can reveal citation-based links between firms and offer a deeper understanding of the role standards play in technological development.

This new dataset offers practical applications of interest to practitioners. For instance, it could be of use to implementers to help them establish whether certain patents are linked to specific standard documents, offering insights into potential essentiality. It could also be of use to SEP holders, and authors of contributions or technical specifications, for identifying which standard contributions are most frequently cited and by whom, potentially revealing commercial or technological relationships.

Beyond practical uses, the dataset opens new avenues for academic research into the interplay between patents, standards and technological change. It can support studies on how standards are integrated into patented technologies and how they contribute to commercialisation and follow-on innovation (in the spirit of Bergeaud et al., 2022). It also offers a valuable basis for analysing the broader role of patents in the standardisation process (Baron et al., 2014; Bekkers et al., 2002; Kang and Bekkers, 2015; Leiponen, 2008). It could help advance the literature aimed at predicting essentiality based on patent-standard characteristics (Brachtendorf et al., 2023; Baron and Pohlman, 2021; Rangan and Yonamine, 2021).

1.5. Recent European case law in SEP licensing

The vast majority of SDOs require participants in the standards development process who wish to include their patented technology in a standard to provide an irrevocable written undertaking to license them on terms that are FRAND. In addition, some SDOs require standards participants to identify and declare their patents that they consider essential or potentially essential to a standard. However, SDOs do not help clarify if the declared patents are indeed essential and need to be licensed when implementing a standard, nor are the SDOs part of the commercial discussions between an SEP holder and an implementer of a standards, nor do they specify what licensing terms are FRAND. Determining these factors in bilateral negotiations can sometimes be contentious and, while most agreements are reached without recourse to litigation, disputes may nevertheless arise that can lead to litigation in European courts.

SEP litigation is a topic of significant policy relevance. Courts may resolve disputes concerning various aspects of SEP licensing, including the essentiality or validity of declared SEPs, their infringement by standard-compliant products, and disagreements over FRAND licensing terms or the parties' good faith obligations during licensing negotiations.

[3] XP numbers are unique identifiers assigned by the EPO to non-patent literature in its prior art libraries.

The European Patent Office (EPO) centrally examines and grants European patents for the 39 contracting states of the European Patent Convention, which include not only all the EU Member States but a number of other European countries too, saving inventors the costs of parallel patent applications at several national patent offices and at the same time ensuring patents granted are of a high quality. However, a granted European patent is not a unitary right but a bundle of national patents, meaning it has to be validated and maintained individually in each country in which it is to take effect, which can be costly and cumbersome. The creation of the Unitary Patent has eliminated these shortcomings and enabled inventors to obtain uniform patent protection for the entire territory of the EU Member States participating in the system more simply and cheaply. Since its launch in June 2023, more than 54,000 Unitary Patents have been registered by the EPO, meaning that unitary effect has been requested for more than one in four European patents, with the conversion rate steadily increasing.

Similarly, judicial enforcement in Europe has recently become simpler. So far, the national courts have had exclusive jurisdiction over patent litigation. For example, infringement and revocation actions against European patents had to be brought before national courts, but each court's revocation decision has effect only for the territory of the state concerned, leading sometimes to parallel litigation in different member states, with the resulting fragmentation being not only costly and highly complex for all parties but also entailing a risk of conflicting national decisions. The UPC has introduced a uniform, specialised and efficient framework for patent litigation at a European level. Since 1 June 2023 the UPC provides an option for unified patent enforcement and for efficiently dealing with post-grant challenges across the current 18 participating EU Member States.

Since starting operations, the UPC has published over 800 orders and decisions, including several relating to declared SEPs. Both, the Unitary Patent and the UPC make Europe more attractive for innovators and investors and provide users with a cost-effective option for patent protection and dispute settlement across Europe, and so stimulate research, development and investment in frontier technology.

We examine SEP litigation in Europe between 2015 and 2025, highlighting the growing role of the UPC as a forum for resolving SEP-related disputes. We present evidence on the UPC's contribution to reducing jurisdictional fragmentation and offer insights into the most prevalent outcomes of SEP disputes across different jurisdictions.

1.6. Structure of the report

This study is structured into five main sections. Following the introduction in Section 1 and Section 2 describe the EPO SDO databases used in prior art searches, focusing on their integration into the PGP and their subsequent usage by examiners as captured by citations to these documents. Section 3 presents the EPO Cited SDO Documents Dataset, including documentation, descriptive statistics and empirical insights. The analysis characterises the cited SDO documents, the authors of the cited standards, the citing patent applications and citation patterns. It explores the relationship between the number of patent citations of SDO documents and the patent essentiality declarations. Section 4 reviews recent SEP case law in Europe, with a focus on the role of the UPC. Section 5 concludes.

2. EPO SDO databases and integration into PGP

The creation of a standard is a collaborative and consensus-driven process where SDO members exchange technological contributions through workgroup meetings and written proposals. When new technology is disclosed in standards development processes that are not subject to a secrecy obligation, this is considered to be public disclosure. Standards documentation arising from such processes is therefore considered to form part of the state of the art under the European Patent Convention (EPC Guidelines G-IV,7.6).

To achieve the highest possible quality in the patent-granting process, the prior art search, a key element in maintaining quality, must identify documents relevant to novelty and inventive step from all pertinent sources. In areas where standardisation is important such as ICT, patent examiners must systematically consider standards-related prior art when assessing the patentability of an invention, ensuring that patents are granted only for truly novel and inventive contributions.

Subsection 2.1 introduces the EPO SDO databases, detailing their creation, ongoing maintenance and integration into the PGP. Subsection 2.2 examines how they are used in EPO search reports, as reflected in examiner citations of SDO documents. It also provides back-of-the-envelope estimates of the net effect of their introduction on overall citation patterns.

2.1. SDO databases

To enhance prior art searches, the EPO has invested significantly since the mid-2000s in incorporating standards-related documentation into its internal databases and utilising them as an integral part of the patent-granting process. The EPO has a policy of co-operation with SDOs such as 3GPP, ETSI, the ITU-T, the IEEE-SA, the IETF and the IEC and has collated documentation from these and many other sources. The nature of these co-operation agreements varies across SDOs. Some are formalised through SDO memberships (e.g. EPO is an ETSI member since 2003) or memoranda of understanding (MoUs), while others remain informal, serving primarily to facilitate database access. The SDO databases resulting from these agreements are described in Box 1.

The EPO has developed a dedicated organisational structure to maintain and optimise these databases. This involves permanent roles such as SDO documentalists assigned to each SDO database and an SDO coordinator. The SDO documentalists serve as the primary representative for examiners interacting with SDO data and oversee data quality, content selection and process improvements. The SDO coordinator oversees the activities of the documentalists, manages strategic planning, prioritises workload based on operational needs and ensures business continuity in alignment with EPO's Strategic Plan. This structure ensures that the EPO's SDO prior art databases remain accurate, comprehensive and aligned with evolving examination needs.

Standards documents are incorporated into the EPO's SDO databases on publication, provided the necessary agreements with the pertinent SDOs are in place. Importantly, SDO documents undergo bibliographic data extraction to enable efficient searching, rather than simply being stored as copies. This processing ensures they can be accessed through ANSERA, the EPO's search tool, allowing examiners to conduct prior art searches within a single system.

Box 1: The EPO SDO databases

Table 2.1.1 provides a detailed overview of the SDO databases used for prior art search at the EPO, which include 13 databases from 15 different SDOs. As of March 2025, EPO SDO databases included 5 505 940 documents, mainly contributions and technical specifications, used in the PGP. These represent 13% of all 42 126 361 non-patent literature (NPL) documents hosted in EPO libraries, highlighting the importance of NPL in standard-related searches.

Specific XP number ranges are assigned to SDO databases, enabling systematic identification of standards-related prior art. XP numbers are unique identifiers assigned to every entry in the EPO's NPL databases. The mapping between XP numbers and SDO documents is not necessarily one-to-one, as each XP number identifies a distinct record. A single document may be assigned multiple XP numbers if it appears more than once in the SDO databases supplied to the EPO.

The XP numbers assigned to the SDO databases do not represent the full set of XP numbers related to SDO prior art. Examiners may also cite relevant prior art identified from other sources, even if it is not included in the SDO databases. In such cases, the system generates XP numbers outside the SDO database ranges. However, these additional citations are relatively rare.

Comprehensiveness of SDO databases: SDO databases must be comprehensive to account for all relevant prior art. Comparing the EPO's SDO databases with independent measurement exercises confirms this is the case. For example, Baron and Gupta (2015) undertook a major effort to compile a dataset of 463 717 3GPP documents, including contributions (2005-2013), technical specifications (1994-2013) and change requests (1994-2012). By contrast, the XP3GPP database at the EPO includes 484 838 documents from 2005-2012 alone, indicating that it not only matches but potentially exceeds the coverage of previous independent collection efforts.

Table 2.1.1

EPO SDO databases

Database	SDO	Year	Content description
XP3GPP	"3GPP (ETSI)"	2008	Contains all relevant technical documents published by the 3rd Generation Partnership Project (3GPP) standards group, under the administration of ETSI, which unites seven telecommunications standard development organisations from Europe, the US, China, India, Japan and Korea. The 3GPP standards group is responsible for telecommunication standards in the fields of radio access technology (e.g. GSM, UMTS and LTE), core network circuit switch technology (e.g. GSM), packet network technology (e.g. GPRS, Evolved Packet Core) and multi-media systems (e.g. IMS).
XP3GPP2	3GPP2	2013	Documents from the 3rd Generation Partnership Project 2 (3GPP2) which is the standardisation group for the CDMA2000 suite of 3G standards used in mobile communications mainly in the US, China and Japan.
XPCRYPT	"EMS BSI NIST"	2012	Documentation devoted to all aspects of cryptography, IT security and data protection. It contains the documents from the International Association for Cryptologic Research ePrint archive and has been augmented with documentation from Usenix and EMVCo (EMV standards). It also includes guidelines from government bodies such as the NIST, ANSSI and the BSI.
XPDVB	"DVB ARIB ATSC"	2010	Documents mostly from the Digital Video Broadcasting Project (DVB) an industry-led consortium of around 250 broadcasters, manufacturers, network operators, software developers, regulatory bodies and others in over 35 countries committed to designing open technical standards for the global delivery of digital television and data services.
XPETSI	ETSI	2014	Documents from the European Telecommunications Standards Institute (ETSI), which develops and publishes standards for Europe for all technologies having telecommunication aspects. This covers DAB (Digital Audio Broadcasting), TETRA networks (police communication), power line communication (internet access via the electrical network), satellite communication, communication of medical devices implanted in the human body, maritime communication, aeronautical communication (Single European Sky), smart grids, machine to machine communication and security (SAGE, lawful interception, smart card, Quantum cryptography).

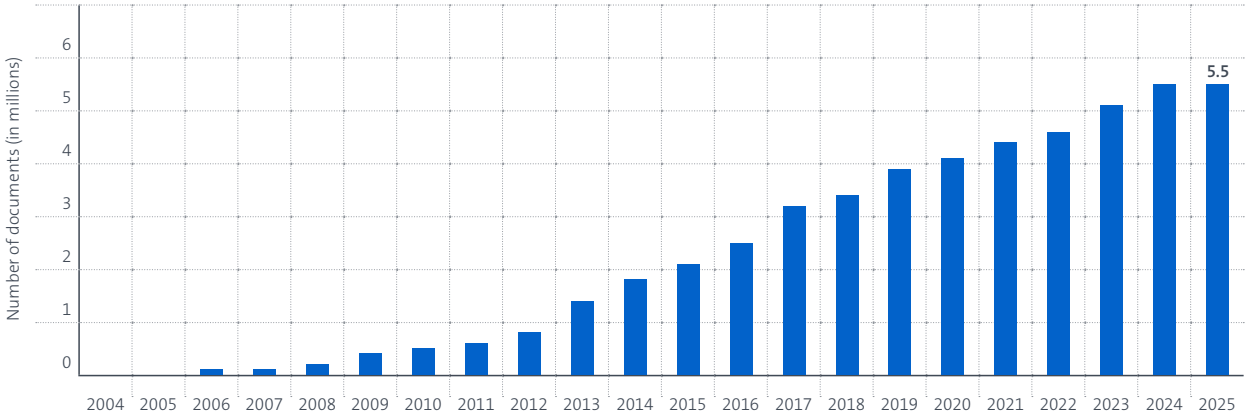
Database	SDO	Year	Content description
XPI3ES	IEEE-SA	2009	Documents from the Institute of Electrical and Electronics Engineers Standards Association (IEEE-SA), which develops and publishes standards, drafts and contributions for aerospace electronics, antennas and propagation, batteries, communications, computer technology, consumer electronics, electromagnetic compatibility, green and clean technology, healthcare IT, industry applications, instrumentation and measurement, nanotechnology, national electrical safety code, nuclear power, power and energy, power electronics, smart grid, software a nd systems engineering, transportation, wired and wireless.
XPIEC	IEC	2017	Documents produced by the International Electrotechnical Commission (IEC), the world's leading organisation for the preparation and publication of international standards for all electrical, electronic and related technologies. The IEC provides a platform to companies, industries and governments for meeting, discussing and developing the international standards they require.
XPIETF	IETF	2003	Documents from the Internet Engineering Task Force (IETF), an open standards organisation that develops and promotes internet standards in close co-operation with other standardisation organisations such as W3C, 3GPP, ISO/IEC. It deals in particular with standards related to the TCP/IP protocol suite.
XPITU	ITU-T	2006	The International Telecommunication Union - Telecommunication Standardization Sector (ITU-T) covers heterogeneous topics in ICT, from service definition to network architecture and security, from broadband DSL to Gbit/s optical transmission systems to Next-Generation Networks (NGN) and internet-related issues. The collection includes both the preparatory documents submitted to the different study groups from 1997 onwards and all of the standards, both expired and in-force.
XPM2M	OneM2M	2016	Contains prior art documents produced by OneM2M, a major standards group dedicated to machine-to-machine (M2M), and IOT. OneM2M is a global standardisation project coordinated by ARIB, ETSI, TIA, ATIS, the CCSA and others. Its purpose is to standardise a common M2M service layer that can be embedded within various hardware and software and relied upon to connect devices in the field with M2M application servers worldwide.
XPOMA	OMA	2013	Documents from the Open Mobile Alliance (OMA), a standardisation body which develops open standards for the mobile phone industry, particularly useful for examiners in telecoms, AVM and computers, especially in the fields of mobile phones, wireless networks, multimedia, computers etc.
XPVIDEO	"ISO IEC ITU"	2007	Video-related standards documents from different standard working groups and organisations. Mostly, JTC1 standardisation efforts by the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC) and the International Telecommunication Union (ITU).
XPJPEG	"ISO IEC ITU"	2006	Documents produced by JPEG (the Joint Photographic Experts Group) and JBIG (the Joint Bi-level Image Experts Group).

Note: The year is based on the completion date of the earliest EPO search report citing a document from the respective SDO database, marking the point at which the EPO began using that database.

Figure 2.1.1 shows that the number of documents in EPO SDO databases has been increasing steadily since the creation of the first database, XPETSI, in 2004. A significant growth phase began after 2008 with the inclusion of the XP3GPP database, which continues to expand, reflecting the growing importance of 3GPP standards, particularly in the development of 4G and 5G technologies. In contrast, the XP3GPP2 database remains unchanged in size, as key industry players abandoned the 3GPP2 Ultra Mobile Broadband (UMB) project originally intended as the successor to CDMA2000, in favour of 3GPP's LTE project. Other SDOs including XPITU, XPETSI, XPI3ES and XPVIDEO have exhibited a more sustained and steady increase, contributing consistently to the pool of standardisation documents.

Figure 2.1.1

Number of documents in the EPO SDO databases

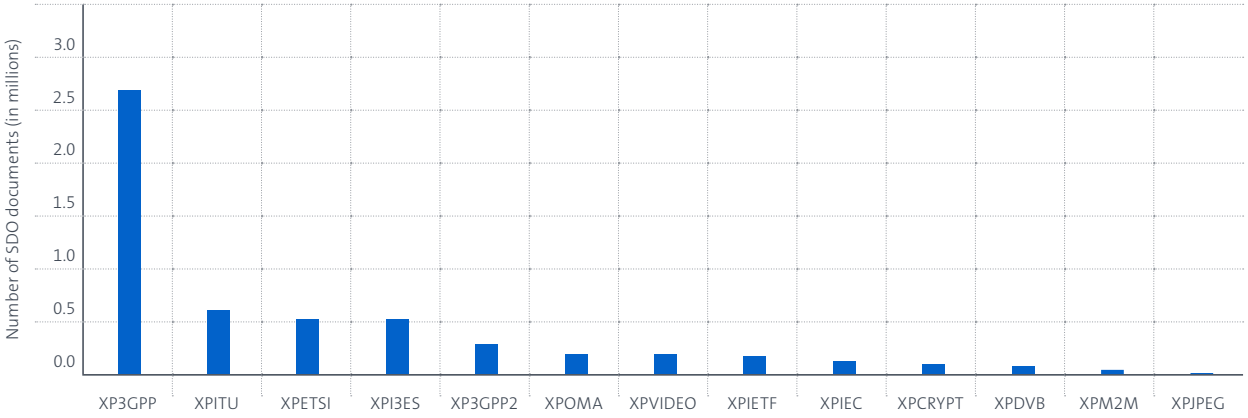


Note: The graph shows the cumulative number of documents (in millions) in EPO SDO databases, based on their date of inclusion in the database. The date of inclusion for documents published before the creation of the respective SDO database is the creation date of the database; for documents published afterward, the publication date.

Figure 2.1.2 shows that the majority of the documents originate from the XP3GPP database, which contains over 2.7 million documents, highlighting the critical role of telecommunications standards, including 4G and 5G. The next largest databases are XPITU, with 0.61 million documents and XPETSI, which holds 0.52 million. XPI3ES is close in size with 0.52 million. Other notable databases include XP3GPP2 (0.28 million), XPOMA (0.19 million), XPVIDEO (0.19 million), and XPIETF (0.17 million), all of which are of a similar size.

Figure 2.1.2

Number of standard documents by SDO database



Note: The graph shows the number of standard documents in the EPO SDO databases as of February 2025 by database.

2.2. Using the SDO databases in EPO search reports

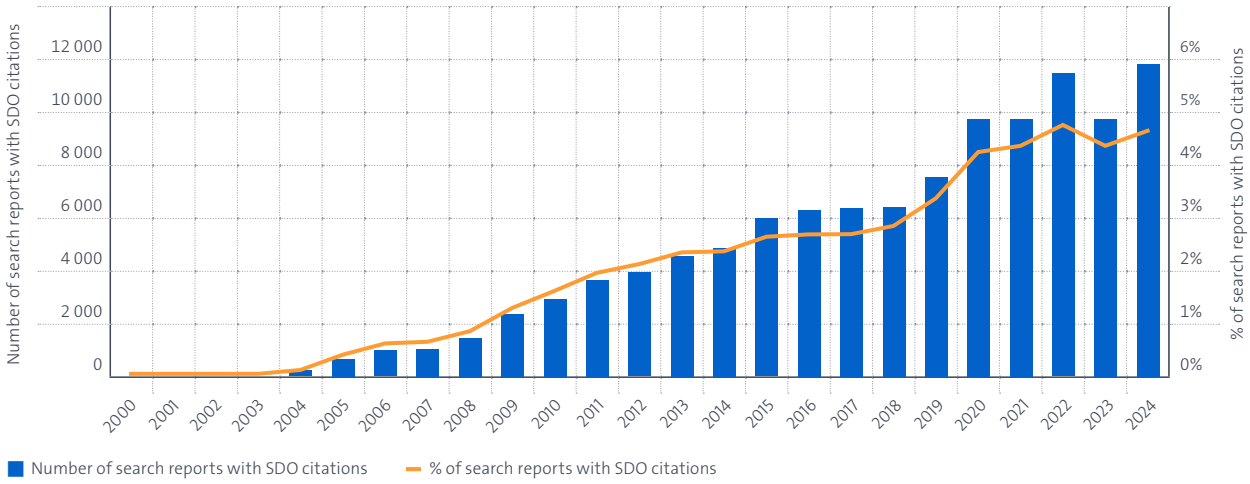
Integrating the SDO databases into the PGP immediately translated into a steady increase in the number of examiner citations of such documents. Figure 2.2.1 shows that the number of search reports citing at least one SDO document has increased steadily since 2004, when the first EPO SDO databases came into play. Similarly, the percentage of search reports containing at least one citation of a document in the SDO databases has also risen, exceeding 4% of the total by 2024. Figure 2.2.2 shows a similar pattern for the number and percentage of examiner citations of SDO documents, both of which present a steady increase over time. The upward trends reflect both the rising role of SDO databases in supporting prior art searches and of standard-related patenting activity in the telecommunications sector.

Box 2: EPO search reports

The data used in this section are based on all EPO search reports completed between 2000 and 2024, including those for European patent (EP) and international Patent Cooperation Treaty (PCT) applications, as well as national search reports conducted by the EPO on behalf of national patent offices (NPOs). The data include completed search reports that have been finalised and sent to applicants. Years are based on dossier completion dates. The final cleaned sample contains 21 130 816 examiner citations stemming from 4 718 232 search reports. Of these, 111 551 include at least one citation of documents in the SDO databases. These SDO dossiers cite 128 298 distinct XP numbers in the SDO databases through 245 130 citations. More details are provided in Annex 1.

Figure 2.2.1

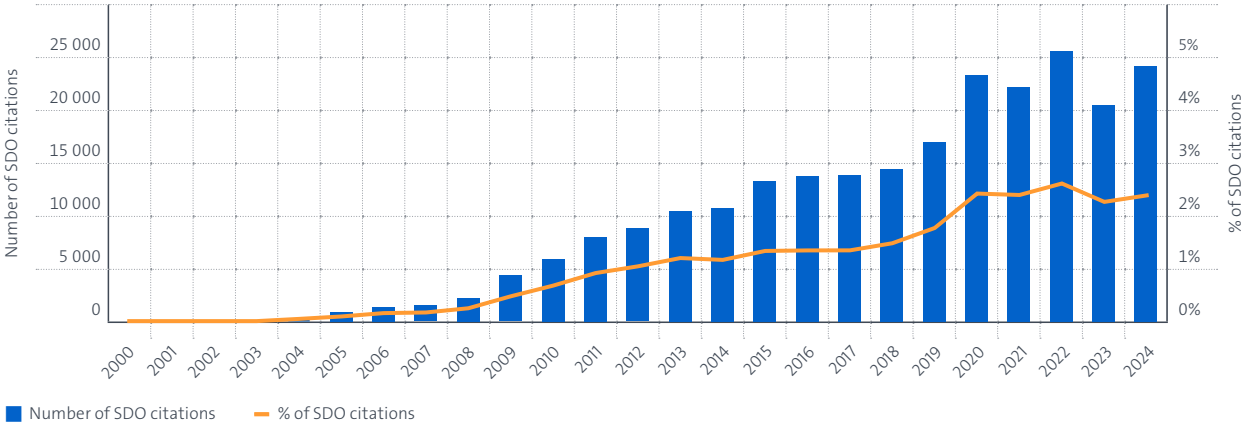
Number and percentage of SDO search reports by year



Note: The graph shows the number and percentage of SDO search reports by year of search report completion.
A SDO search report refers to a search report with at least one examiner citation to a document in the EPO SDO databases.

Figure 2.2.2

Number and percentage of SDO citations by year



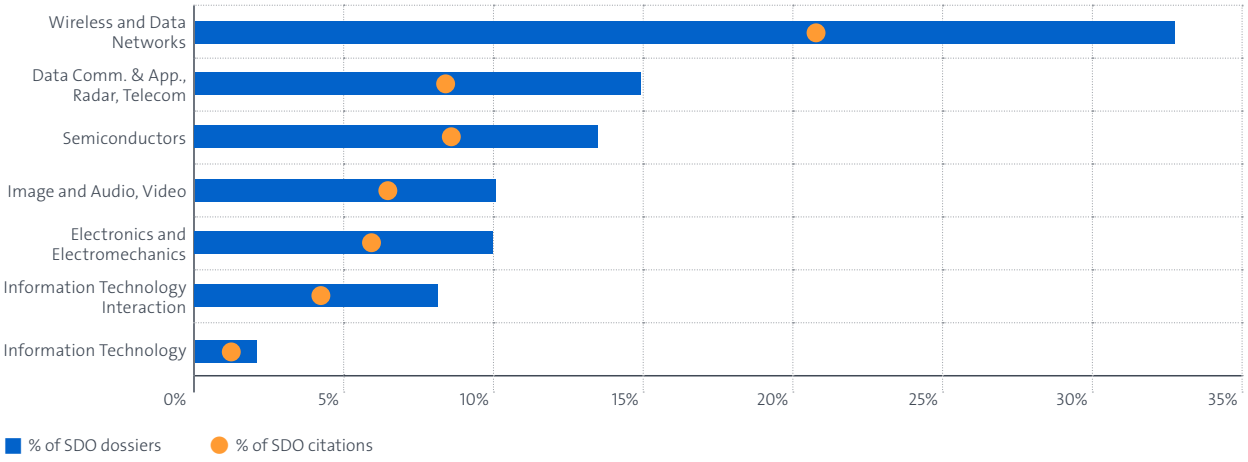
Note: The graph shows the number and percentage of SDO citations by year of search report completion.

2.2.1. Examiner units and technology classes where standards are central

Despite the upward trend in the number of SDO dossiers and citations, their relative weight across all EPO search reports remains relatively low because standardisation activity plays a limited role in many technological fields. However, when focusing on areas where standardisation activity is pervasive, the share of SDO dossiers increases significantly. Figure 2.2.3 provides a breakdown by examiner unit, showing that the percentage of SDO search reports and citations in Wireless and Data Networks exceeds 30% and 20% respectively. Other units such as Data Communication, Semiconductors, Audio-Video, and Electromechanics, also show notable shares.

Figure 2.2.3

Percentage of SDO search reports and SDO citations by examiner unit

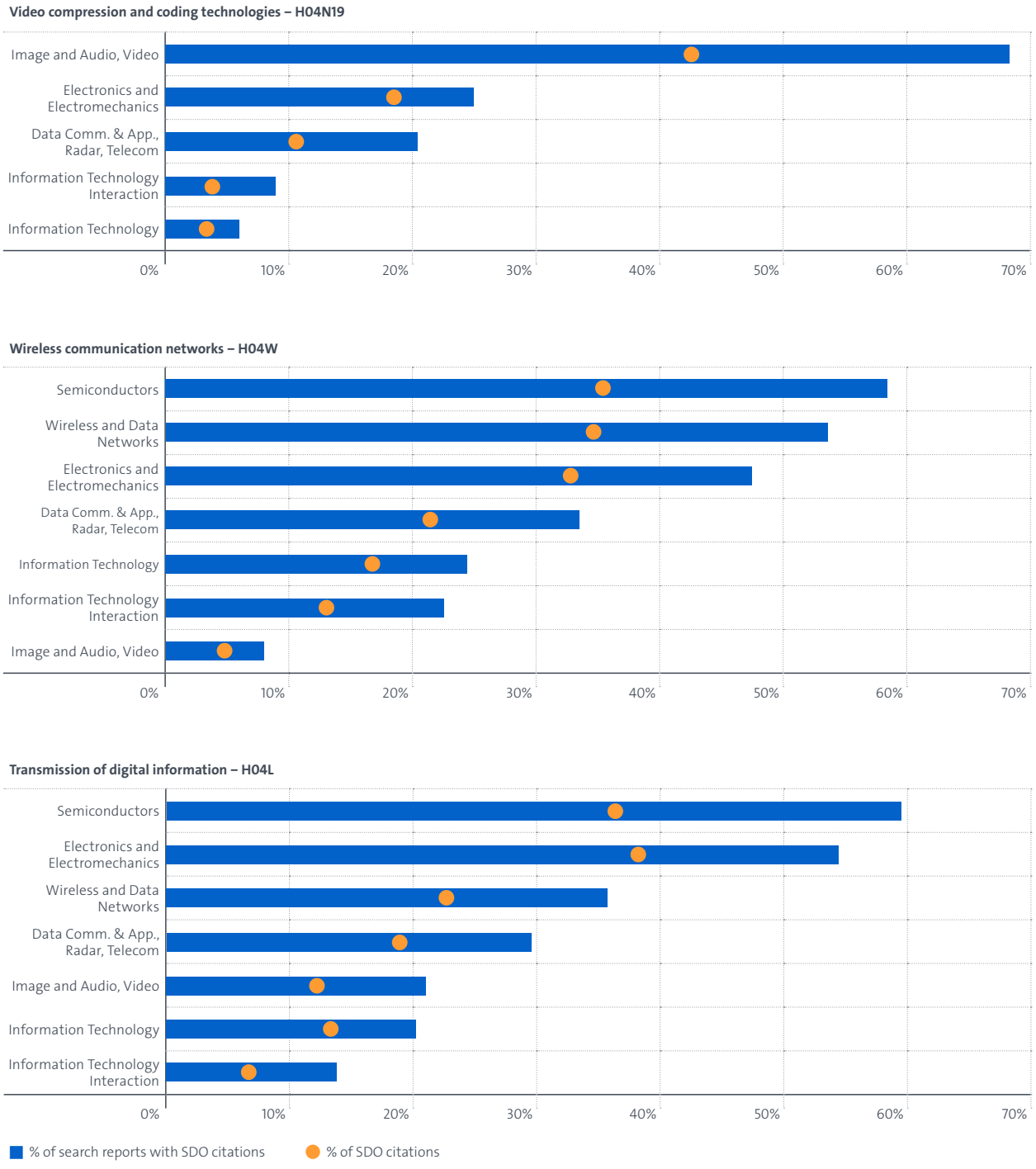


Note: The graph shows the percentage of SDO search reports (search reports that cite at least one document in the EPO SDO databases) and SDO citations by examiner unit. The sample covers examiner units handling applications where standard-related invention is more frequent and is restricted to search reports completed between 2015 and 2024.

Figure 2.2.4 shows that the percentage of search reports containing SDO citations exceeds 50% in specific examiner units and technology class combinations where technical standards are critical. For example, for patent applications in video compression and coding technologies (H04N19), handled by the Image and Audio, Video examiner unit, the percentage of SDO dossiers is close to 70%. Applications handled by the Semiconductors examiner unit in wireless communication networks (H04W) and "transmission of digital information (H04L) have a percentage of SDO dossiers close to 60%.

Figure 2.2.4

Percentage of SDO search reports and SDO citations by examiner unit and technology class



Note: The graph shows the percentage of SDO search reports (search reports that cite at least one document in the EPO SDO databases) and SDO citations by examiner unit (row label) and broad IPC technology classes (graph heading). The sample covers examiner units handling applications where standard-related invention is more frequent and is restricts to search reports completed between 2015 and 2024.

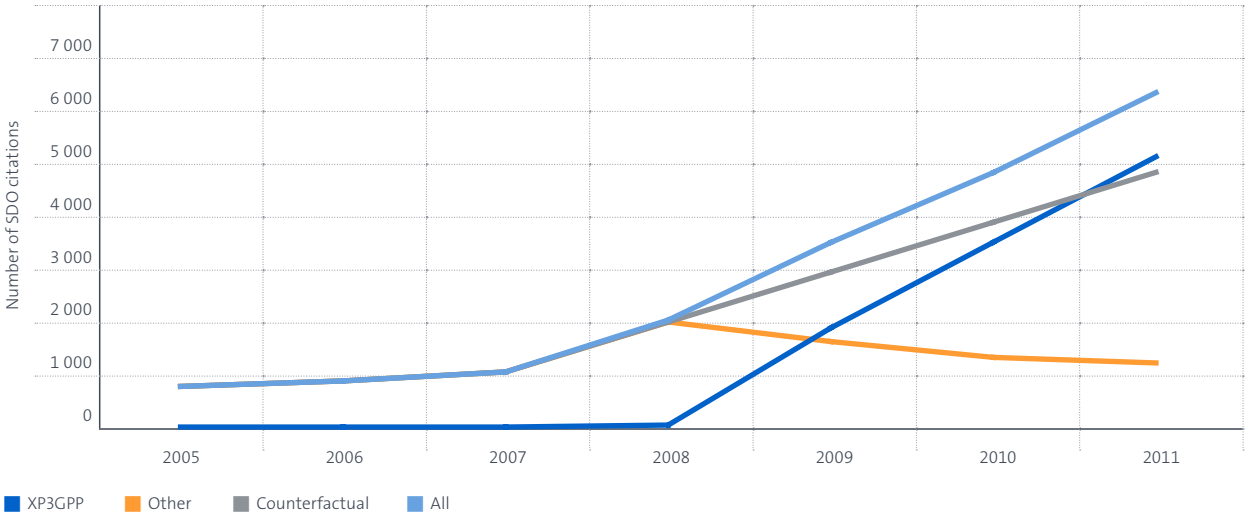
2.2.2. Net effects of the SDO databases: evidence from 3GPP

Before the creation of these databases, examiners already cited relevant prior art identified through available sources, including electronic and printed SDO publications. Unlike documents in the SDO databases, these are not classified within predefined XP ranges and cannot be easily identified. As a result, measuring the net increase in SDO citations resulting from the creation of the SDO databases over and above these citations from less systematic sources is challenging. In Figure 2.2.5 we attempt to do so for 3GPP citations. We identify citations from other sources as documents without XP numbers in the ranges assigned to the XP3GPP but mentioning 3GPP in the NPL text. There is an immediate shift in citations from other sources (the green line) to citations from the XP3GPP database (the dark blue line) immediately after its introduction in 2008.

To measure net effects of the introduction of the 3GPP database we have to make assumptions about how the citations from other sources would have evolved had the XP3GPP database not been introduced. We create such counterfactuals by assuming that citations from other sources would have grown a constant growth rate equal to that of 2008 and 2007 (the light green line). Under this assumption, in 2011 the XP3GPP database led to a net increase of 1 520 citations in 3GPP documents (the difference between the orange line and the light green line), representing a 31% rise in the total number of citations that year in addition to the 4 860 citations that would have taken place in the absence of the XP3GPP database (the light green line). This suggests that integrating the SDO databases into examiner workflows significantly improved their ability to identify relevant SDO-related prior art. Bekkers et al. (2020b) finds that the introduction of the first SDO databases led to higher-quality examinations and patent grants with narrower claims and reduced duplication.

Figure 2.2.5

Net effect of the introduction of the XP3GPP database



Note: The graph shows the number of SDO citations of 3GPP documents by citation source (XP3GPP database vs. other) and year of dossier completion for the window covering the three years before and after the introduction of the XP3GPP database in 2008. XP3GPP represents citations of an XP number in the range assigned to the XP3GPP database. Other represents citations with no XP numbers in the range assigned to the XP3GPP database, but where the cited NPL text includes the string 3GPP. Counterfactual represents a counterfactual for Other assuming that citations from other sources would have grown at a constant rate equal to that observed between 2008 and 2007 had the XP3GPP database not been introduced. All is the sum of the dossiers in XP3GPP database and other sources.

3. The EPO Cited SDO Documents Dataset

The integration of SDO databases into the PGP establishes a natural link between patents and standards generated by examiner searches. An advantage of this PGP-based linkage is that it offers a new window into the relationship between patents and standards, going beyond traditional datasets based on self-reported SEP declarations. Box 3 presents a detailed description of the dataset. The remainder of this section examines its key features. Subsection 3.1 characterises the cited SDO documents. Subsection 3.2 analyses citation patterns. Subsection 3.3 explores the relationship between the intensity of patent citations to SDO documents and patent essentiality.

Box 3: EPO Cited SDO Documents Dataset

This dataset identifies and characterises cited documents in the EPO SDO databases and can be downloaded from epo.org/standards.

The documents are extracted from the PATSTAT (2024b edition) table TLS214_NPL_PUBLN, which records NPL cited in patent publications. While this table is shared via PATSTAT, it is not readily suitable for studying standard-related topics because it does not distinguish SDO documents from other NPL sources. Moreover, it provides fields that are generic to all NPL and do not capture key information specific to standard documents. We address both points as follows:

— First, we identify cited SDO documents in the table using the XP number ranges that identify documents in the SDO databases. To facilitate independent identification and extraction of standards-related citations, the XP ranges corresponding to the SDO databases are provided in Table A1.1 of Annex 1.

— Second, we extract fields of interest from the system for the cited SDO documents. This is possible thanks to the pre-processing of SDO documents into EPO search tools and standardised examination procedures, both of which generate highly structured data.

The final extraction includes 168 620 distinct XP numbers from the SDO databases (level of observation of the dataset).

These numbers are referenced in 417 951 distinct citations by 190 116 distinct patent applications. The cited XP numbers represent 3% of all XP numbers in the SDO databases, underscoring the substantial investment needed to build comprehensive prior art databases, even though only a small fraction ultimately proves relevant in patent examination.

Most of these citations originate from search reports carried out at the EPO, and to a lesser extent examinations and other office actions. However, some citations originate from search reports by other offices, which is possible because the EPO holds agreements with certain patent offices (China, Japan, South Korea) that give them access to some of the EPO SDO databases. Some XP numbers are cited directly by applicants who reuse citations from EPO search reports for related applications within the same family. More details are provided in Table A1.3 of Annex 1.

Table 3.1.1 provides definitions of variables. Not all the variables are applicable to every database, owing to differences in how data are supplied by the respective SDOs. The applicability of the variables to each SDO database is described in Table A1.4 of Annex 1. The variables xpnr and stdn are of particular importance as they can be used to link the dataset to additional patent and standards data. **xpnr** provides a link to PATSTAT through table TLS214_NPL_PUBLN while **stdn** connects the data to standard documents and any information contained in them.

Table 3.0.1

Definition of variables

Name	Definition
src	SDO database (XP3GPP, XP3GPP2, XPCRYPT, etc.).
docn	XP number (XP0 prefix followed by 8-digit number). Unique identifier assigned by the EPO to non-patent prior art that has been cited in patent examination.
xpnr	XP number (just 8-digit number) formatted as in variable XP_NR of PATSTAT table TLS214_NPL_PUBLN. Linking variable to PATSTAT table TLS214_NPL_PUBLN.
stdn	Standard document number as provided by the corresponding SDO where document is generated. Linking variable to standard documents from external SDO databases.
pd	Publication date of the standard document. Earliest date when document is first disclosed. It usually coincides with the date when the document was uploaded onto the internet (onlined).
orefd	Official reference date. Generally same date as pd. For 0.5% of observations it differs from pd, having an earlier date by a few days.
onlined	Date when the document was uploaded to the internet.
author	Author (or authors) as indicated in the standard document. Only contributions and drafts have an author. Specifications or standards do not have an author as such.
sdotype	Categories describing the type of document in the standardisation process. The most frequent are contribution (typically work in progress inputs, some of which are then included in formal technical specifications) or specification (finalised technical specification approved as a standard).
doctype	Categories describing the status or formal document classification within the SDO. The most frequent are draft (which has a great degree of overlap with contribution in the variable sdotype) and standard (which has a great degree of overlap with specification in the variable sdotype).
tien	Document title
nofpages	Number of pages in document
pages	Page range of the document
idxwords	Keywords or indexed terms that identify the main technologies of a specification or standard. This information is generally available for documents with sdotype equal to specification.
pubdata	Text providing information on document numbers, publication dates, issuing SDO organisations and their locations (for XP3GPP, XPCRYPT, XPDVB, XPETSI, XPI3ES, XPIETF, XPITU and XPOMA); or information on conferences (for XPJPEG and XPVIDEO). Much of the information in this field is already parsed into the other variables in the dataset.
sdosimilaritykey	Text providing combined information such as SDO name, document number, workgroup or title.
meetingnum	Meeting identification number (only for XPVIDEO).
conference	Information on conference where contribution is presented. Mostly available for documents where sdotype is equal to contribution. XP3GPP, XPCRYPT and XPM2M.
confend	Conference end date.
confstart	Conference start date.
url	URL to meeting (if meetingnum or conference are not null).
workgroup	Categorises technical working group responsible for developing a cited standards document. Only applicable to XP3GPP, XP3GPP2, XPCRYPT, XPETSI, XPI3ES and XPM2M.
sdotechcategory	Technological category of the document or group working on the document. In most cases this duplicates the values found in the workgroup variable (XP3GPP, XP3GPP3, XPI3ES, and XPM2M) or provides information similar to the workgroup (XPETSI, XPIETF, XPITU), suggesting a difference in variable labelling rather than content. It only seems to provide genuine technological category information for XOCRYPT, XPDVB and XPOMA.
mpeggroup	Working groups within MPEG responsible for video and audio compression standards. Only available for XPVIDEO and XPDVB.
mpegsec	Specific sections or subgroups within MPEG focusing on particular aspects of video coding, streaming and multimedia technologies. Only available for XPVIDEO.

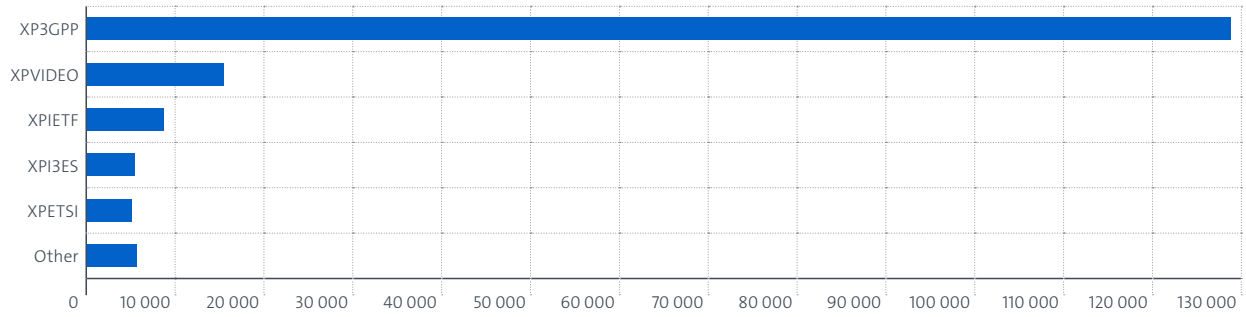
3.1. Descriptive evidence on examiner-cited SDO documents

This subsection describes the EPO Cited SDO Documents Dataset. It identifies the most common source SDO databases, the types of documents referenced, and their main authors. It also highlights the working groups responsible for their development and examines the distribution of publication dates.

Figure 3.1.1 shows the number of distinct standard documents cited by examiners in patent publications, categorised by SDO library. The XP3GPP database accounts for the vast majority of cited documents, indicating that its high volume of SDO documents is closely linked to substantial patenting activity building on these documents. XPVIDEO, XPIETF, XPI3ES, and XPETSI follow, with significantly fewer cited documents, while the Other category aggregates the remaining SDO libraries with lower representation. Interestingly, while the XPVIDEO and XPIETF databases rank seventh and eighth respectively in number of SDO documents, these documents are fairly frequently cited in published applications, suggesting strong patenting activity in their fields and heavy reliance on SDO production.

Figure 3.1.1

Number of cited standard documents in published applications, by SDO database

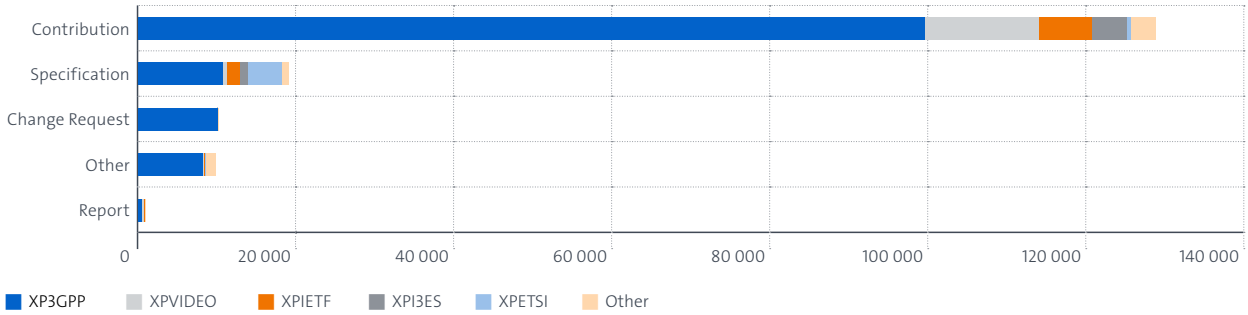


Note: The graph shows the number of distinct standard documents cited in patent publications, by SDO library.

Figure 3.1.2 shows the number of distinct SDO documents cited in published patent applications, categorised by document type. The majority of documents correspond to contributions, which are early-stage inputs in the standardisation process, followed by specifications, which represent finalised technical standards. Change requests, which represent changes proposed to a specification, reports, which include technical studies and reports submitted to working groups for informational purposes, and other document types account for a much smaller share of documents. This suggests that patent citations predominantly build on pre-standardisation contributions, reflecting the importance of early-stage technical discussions.

Figure 3.1.2

Number of standard documents cited in published applications by type of document and SDO database

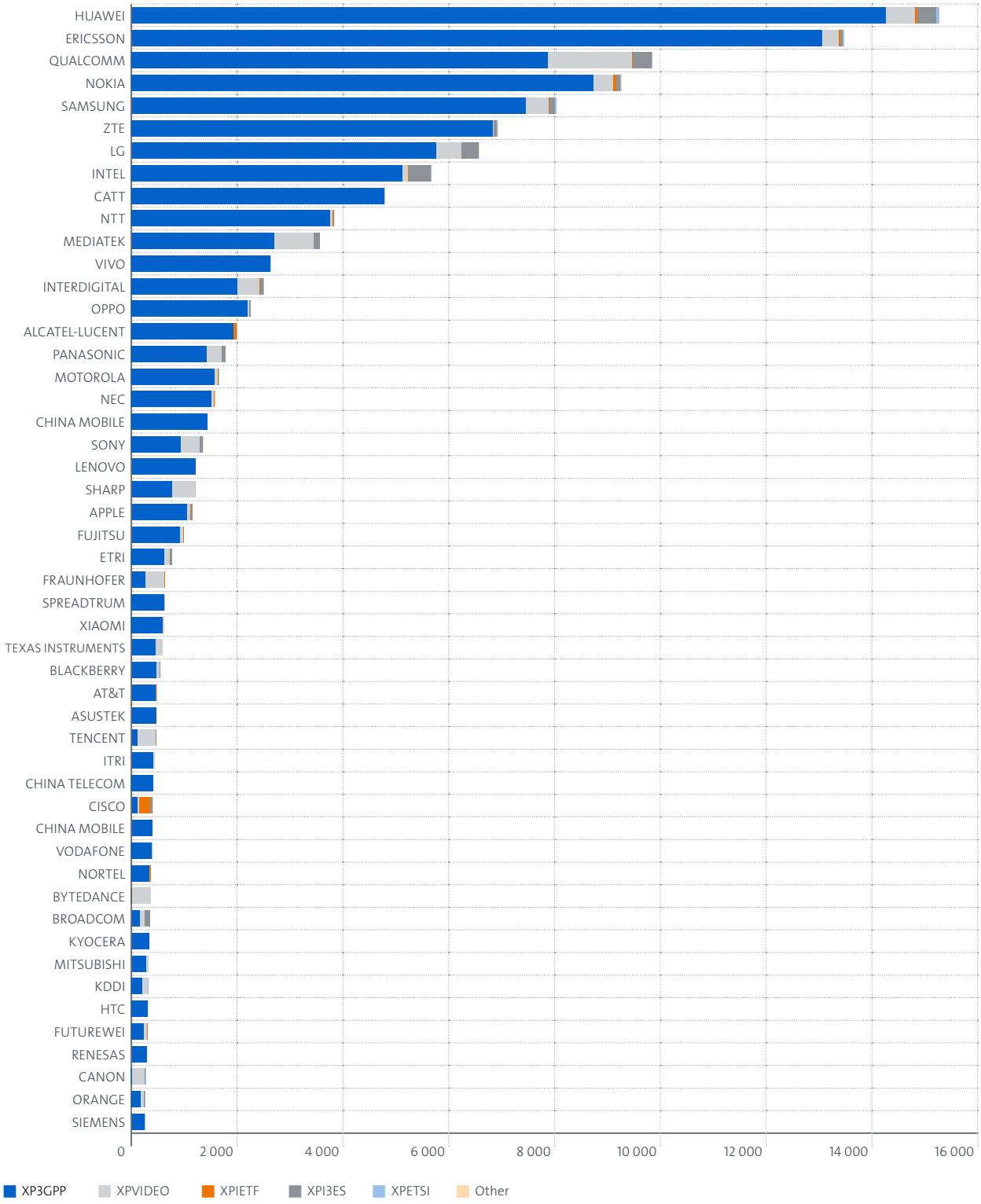


Note: The graph shows the number of distinct standard documents cited by published applications, by type of standard document. The categorisation is based on a cleaned grouping of the categories included in the variable sdotype (see Box 3). Contributions are inputs submitted by members in the standardisation process that bring new technical material to a working group; specifications are the normative text of the technical standard approved through the SDO's ballot or consensus process; change requests specify detailed changes that are proposed to a specification; reports include feasibility studies, technical studies and reports submitted to working groups for informational purposes; other includes minutes, liaisons, white papers, unknown document types and other document types.

Figure 3.1.3 shows the top 50 authors of standard documents cited in published patent applications, along with the number of distinct documents they have authored that have been cited. Only contributions have an author and are counted, since specifications do not have an author as such. Huawei, Ericsson and Qualcomm lead the ranking, followed by Nokia and Samsung, reflecting their strong involvement in standardisation activities. The presence of a diverse set of firms, including chip manufacturers (Intel, Mediatek), telecom operators (NTT, China Mobile), and consumer electronics companies (Sony, Apple, LG), underscores broad industrial participation in the standardisation process and its direct connection to patent filings.

Figure 3.1.3

Top 50 authors of standard documents cited in published patent applications, by SDO database

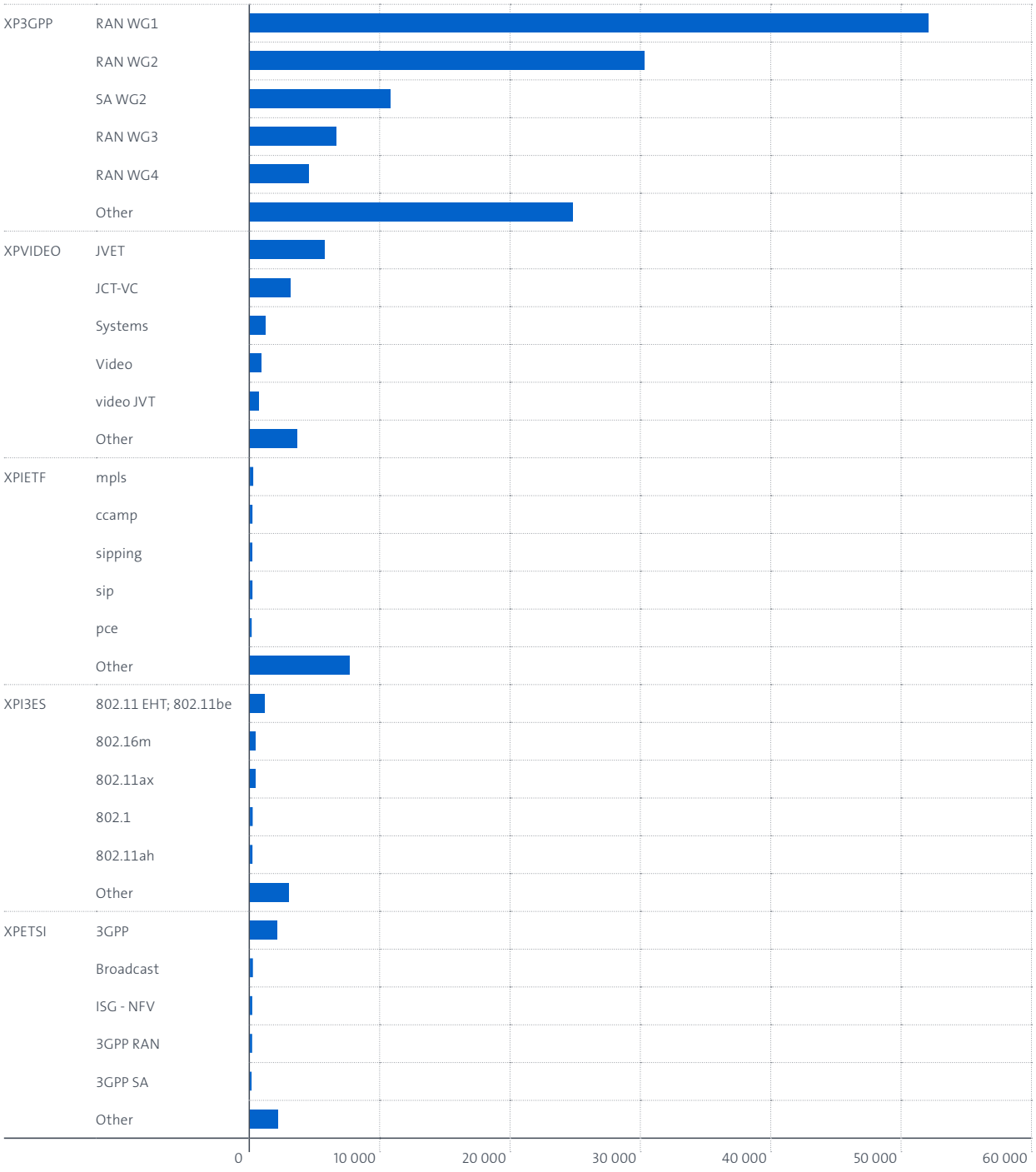


Note: The graph shows the top 50 authors of standard documents cited in published applications, along with the number of distinct standard documents they have authored that have been cited in these applications.

Overall, the patenting activity in cancer-related Figure 3.1.4 shows the number of documents cited in published patent applications by SDO workgroup. The XP3GPP database dominates, with the most cited documents originating from RAN WG1, RAN WG2 and SA WG2, reflecting the strong influence of 3GPP's radio access and system architecture workgroups on patent filings. XPVIDEO follows, with the JVET workgroup leading in number of cited documents, highlighting the impact of video coding standards. Within XPIETF the most cited workgroups include mpls and ccamp, indicating a focus on networking and routing technologies. In XPI3ES citations are concentrated in IEEE 802 standards, particularly 802.11 (Wi-Fi standards). XPETSI includes citations from workgroups related to 3GPP, broadcast and network virtualisation (NFV). The figure underscores the diverse contributions of different SDO workgroups to patented technologies, with telecommunications and video coding standards being the most influential in patent filings.

Figure 3.1.4

Number of cited standard documents by work group and SDO database

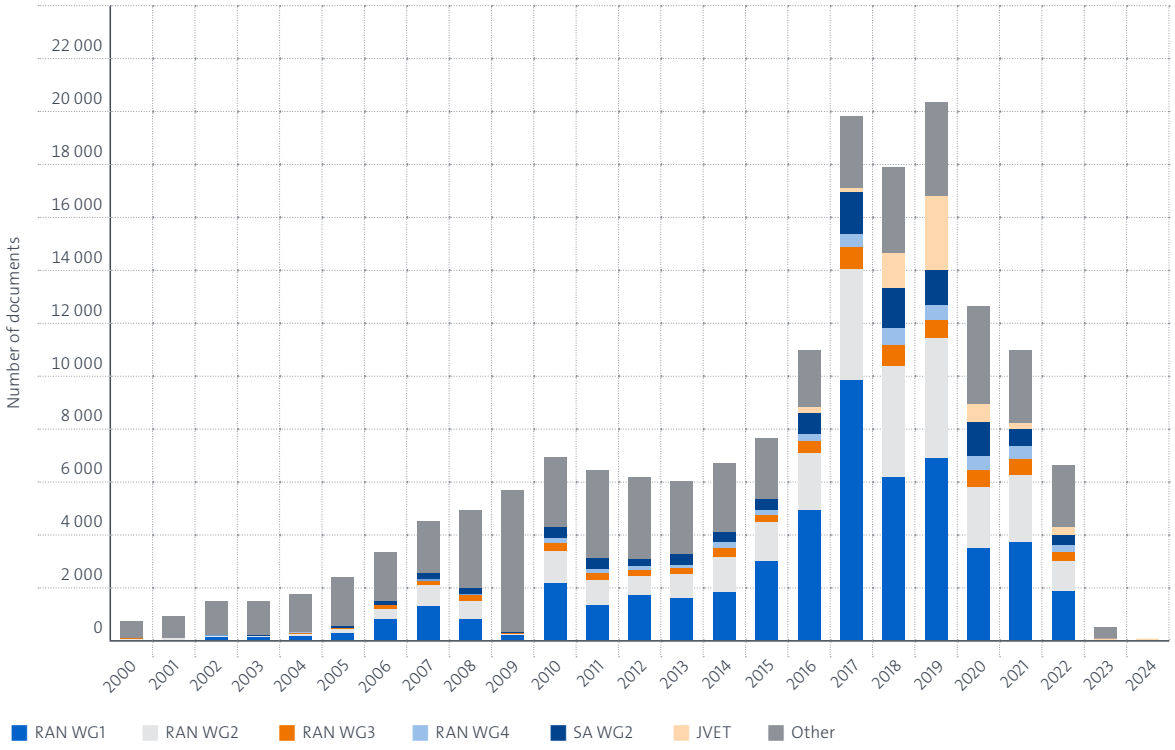


Note: The graph shows the number of examiner-cited SDO documents by SDO workgroup. It includes only the five SDOs with the highest number of cited documents and, within each SDO, the top five work groups with the most cited documents; the remaining ones are combined into Other.

Figure 3.1.5 shows the number of cited SDO documents by publication year and main SDO workgroups, which are useful to capture technology trends. Also, publication dates are important for establishing priority and hence patentability. The publication of cited documents steadily increased from 2000 to 2015, followed by a sharp rise peaking in 2017-2019, likely reflecting the impact of 5G standardisation efforts. RAN WG1 and RAN WG2 (from 3GPP) account for the largest share of documents, highlighting their central role in wireless communication standards. JVET, which focuses on video compression, appears in later years, indicating its growing influence. The subsequent decline is primarily due to the typical truncation in citation data, as more recent documents have had less time to accumulate citations.

Figure 3.1.5

Number of cited standard documents by work group and publication year



Note: The graph shows the number of examiner-cited SDO documents by publication year and SDO workgroup.
It includes only the five workgroups with the highest number of cited documents; the remaining ones are combined into Other.

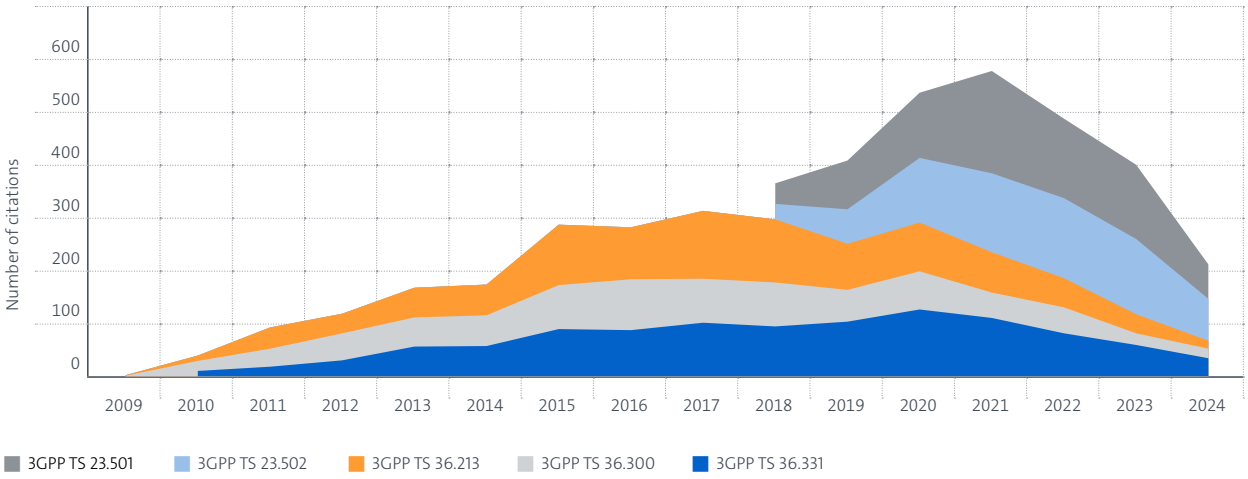
3.2. Citation patterns

This subsection presents evidence based on citations from published patent applications to SDO documents. Citation data enable multiple analyses, such as identifying the most frequently cited standard documents, the patent technology fields referencing them, and the precise reasons why examiners referenced these documents. It also allows the examination of citation lags from the publication of the standard document to the filing of the citing patent application and facilitates identification of the companies most actively citing standards. These insights can help uncover citation-based links between firms and better understand the role of standards in technological development.

Figure 3.2.1 reports the yearly number of citations to the top-5 most cited documents, all of which are 3GPP technical specifications (TS). Early growth in citations of TS 36.213, TS 36.300, and TS 36.331 reflects the rise and maturation of 4G technologies during the 2010s. Around 2018, a noticeable shift occurs with a surge in citations of TS 23.501 and TS 23.502, core architecture specifications for 5G, indicating a transition in innovation focus from 4G to 5G. The peak around 2021 corresponds to heightened patenting activity during the rollout of commercial 5G systems. The subsequent decline is primarily due to the typical truncation in citation data, as more recent documents have had less time to accumulate citations. The figure describes the evolution in mobile communication technologies over the last years and highlights the potential of the dataset to track technological progress in standards-related fields.

Figure 3.2.1

Top 5 most cited SDO documents

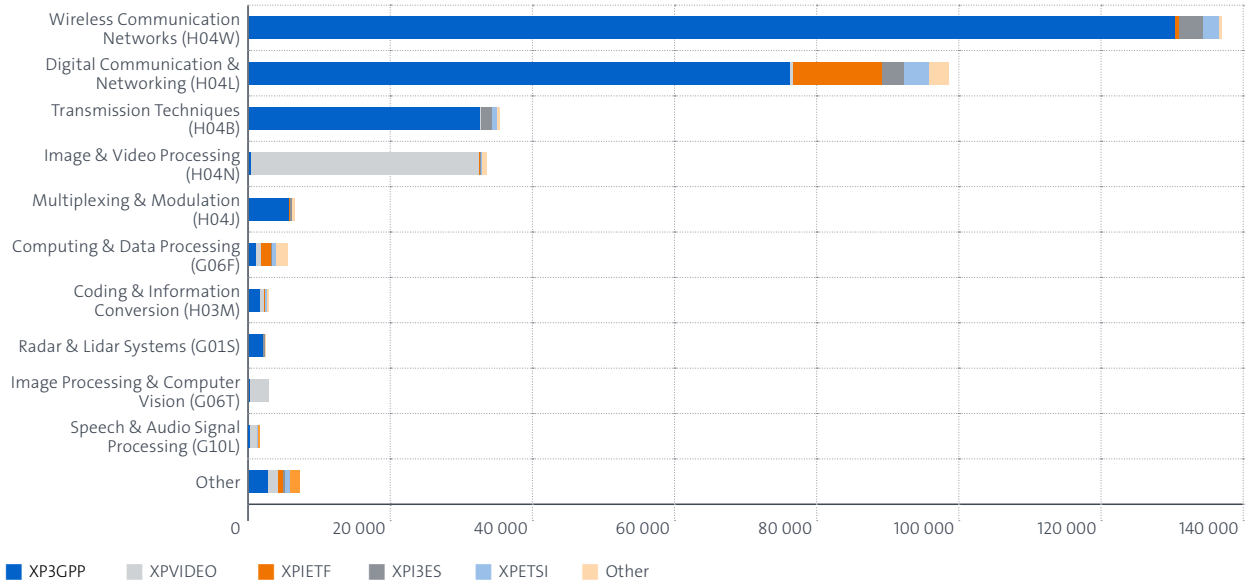


Note: The graph reports the number of citations to the five most cited SDO documents by publication year. These documents are 3GPP technical specifications with the following titles: 3GPP TS 23.501 - Technical Specification Group Services and System Aspects; System Architecture for the 5G System; Stage 2 (Release 15); 3GPP TS 23.502: Technical Specification Group Services and System Aspects; Procedures for the 5G System; Stage 2 (Release 15); 3GPP TS 36.213: Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures, (Release 13); 3GPP TS 36.330: Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2 (Release 14); 3GPP TS 36.331: Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification (Release 14).

Figure 3.2.2 shows that the primary technology classes of patent applications citing SDO documents align with the technology classes where declared SEPs are concentrated (Bekkers et al., 2020b). SDO citing applications are predominantly concentrated in wireless communication (H04W), digital communication & networking (H04L) and Transmission techniques (H04B). Patent applications in these classes primarily cite XP3GPP, due to its importance for LTE and 5G, and XPIETF, due to its importance for networking protocols. Image & video processing (H04N) also stands out as a key area, with XPVIDEO playing a major role in video compression standards.

Figure 3.2.2

Number of standard citations by technology class of citing patent and SDO Database of cited document

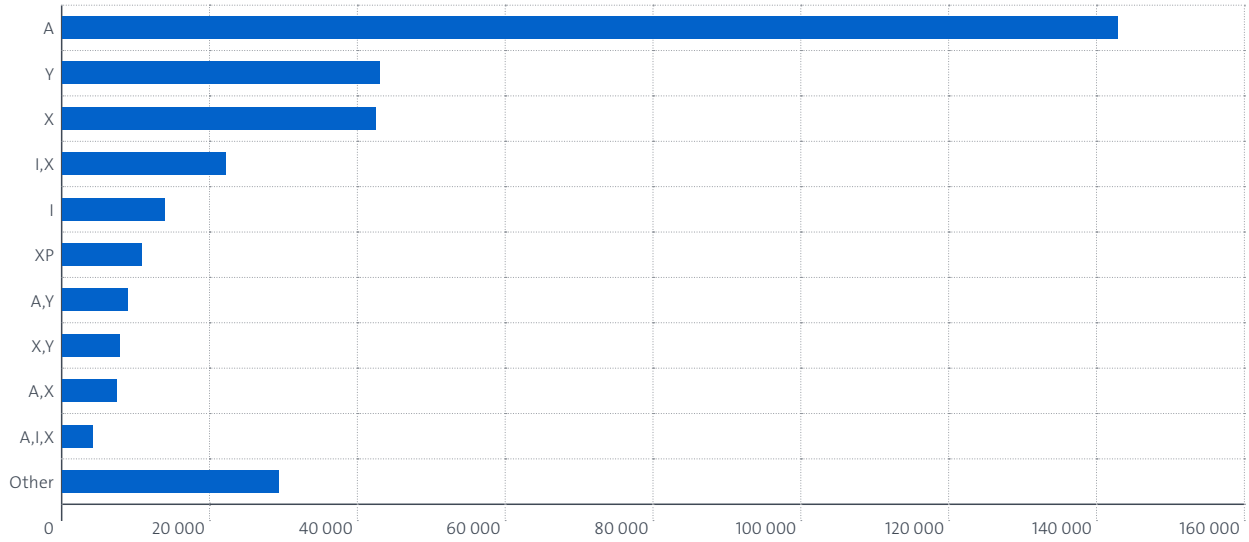


Note: The graph displays the number of citations to SDO documents by IPC technology group of citing application and SDO Database of cited document.

Figure 3.2.3 shows the number of citations to SDO documents by citation category (see the documentation in the European Patent Register or the EPC Guidelines B-X,9.2), primarily from search reports. Type A citations representing background technological knowledge are most frequent, indicating that SDO documents are widely used to establish technical context. Y, X and I citations, which signal potential conflicts with inventive step or novelty (see figure note for a description of each category), are also frequent, highlighting their importance in prior art assessments. This distribution indicates a dual role of SDO documents in both offering technical background and posing patentability challenges for applicants. Both emerge naturally due to the dynamic nature of standard creation through recurrent meetings spanning multiple contributions.

Figure 3.2.3

Number of citations by citation category

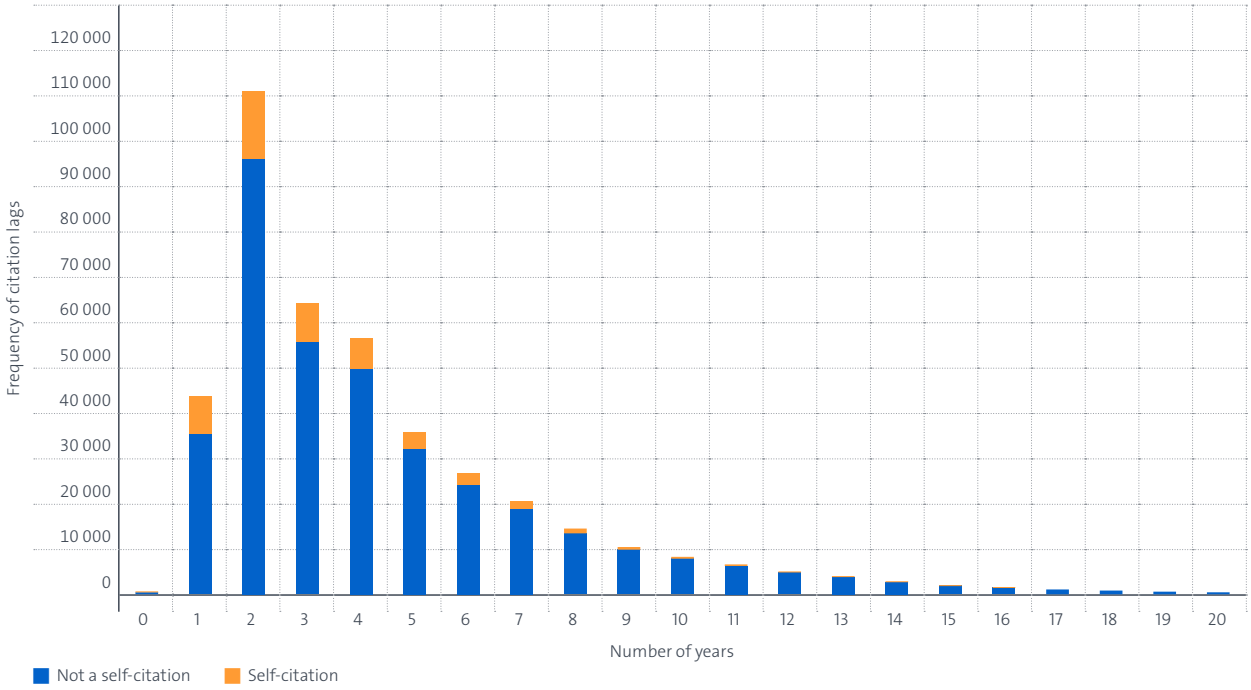


Note: The graph displays the number of examiner citations to SDO documents by citation category. These categories are available mainly for citations where the origin is a search report and occasionally for other origin categories. Categories with letters separated by a comma indicate that both types of categories are included in the citation. Instead, joint letters without commas indicate categories formed by combinations of factors. The letter "A" refers to cited documents defining the state of the art and not prejudicing novelty or inventive step. The letter "X" refers to a cited document that is particularly relevant if taken alone, prejudicing the novelty or inventive step of the claimed invention (prior to April 2011) or just its novelty (after April 2011). The letter "I" refers to a cited document that is particularly relevant if taken alone, prejudicing the inventive step of the claimed invention (introduced in April 2011 as a refinement of "X"). The letter "P" denotes intermediate documents published between the priority date claimed in the searched application and its filing date and is always accompanied by one of the letters "X", "I", "Y" or "A" to indicate its level of relevance.

Figure 3.2.4 illustrates the diffusion of SDO documents into patents by analysing the distribution of citation lags. The histogram shows that most citations occur within 2 to 5 years after the standard's publication, indicating a fairly rapid integration of standard-related knowledge into patent filings. Self-citations, where the citing entity is also the author of the cited standard, represent a smaller share but follow a similar temporal pattern. The frequency of citations declines steadily beyond 6 years, suggesting that older standards become less relevant for patent filings over time. This trend underscores the strong temporal link between standardization and patenting activity, with patents primarily citing recent standards.

Figure 3.2.4

Citation lags between publication dates of citing patent and cited standard

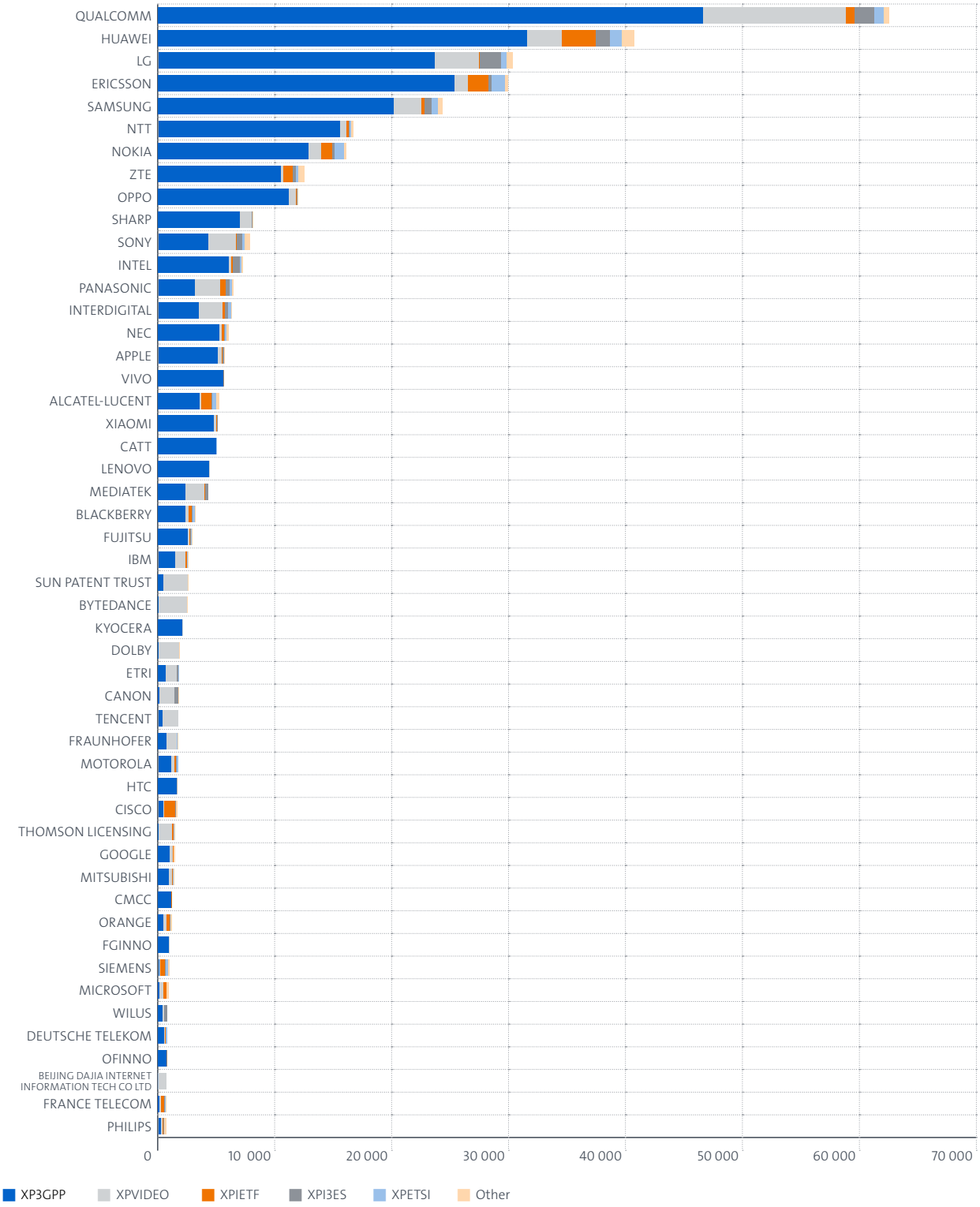


Note: The graph displays the frequency of citation lags in years between the publication date of the citing patent or application and the cited standard document. The histogram bins represent full years. Any lag less than a full year (e.g. 6 months) is classified in the first bin equal to 0, any lag between 1 and less than 2 years falls in the bin equal to 1, and so on.

Figure 3.2.5 reports the list of top 50 SDO citing companies by number of citations. Qualcomm has the highest number of citations, followed by Huawei, Ericsson, and LG, with the majority of citations stemming from the XP3GPP database. Most top citing companies are also listed as top SDO contributors in Figure 3.1.3, indicating that patents are of primary importance to these companies that create standards and advance standard-related technologies.

Figure 3.2.5

Number of SDO citations made by the top 50 citing companies



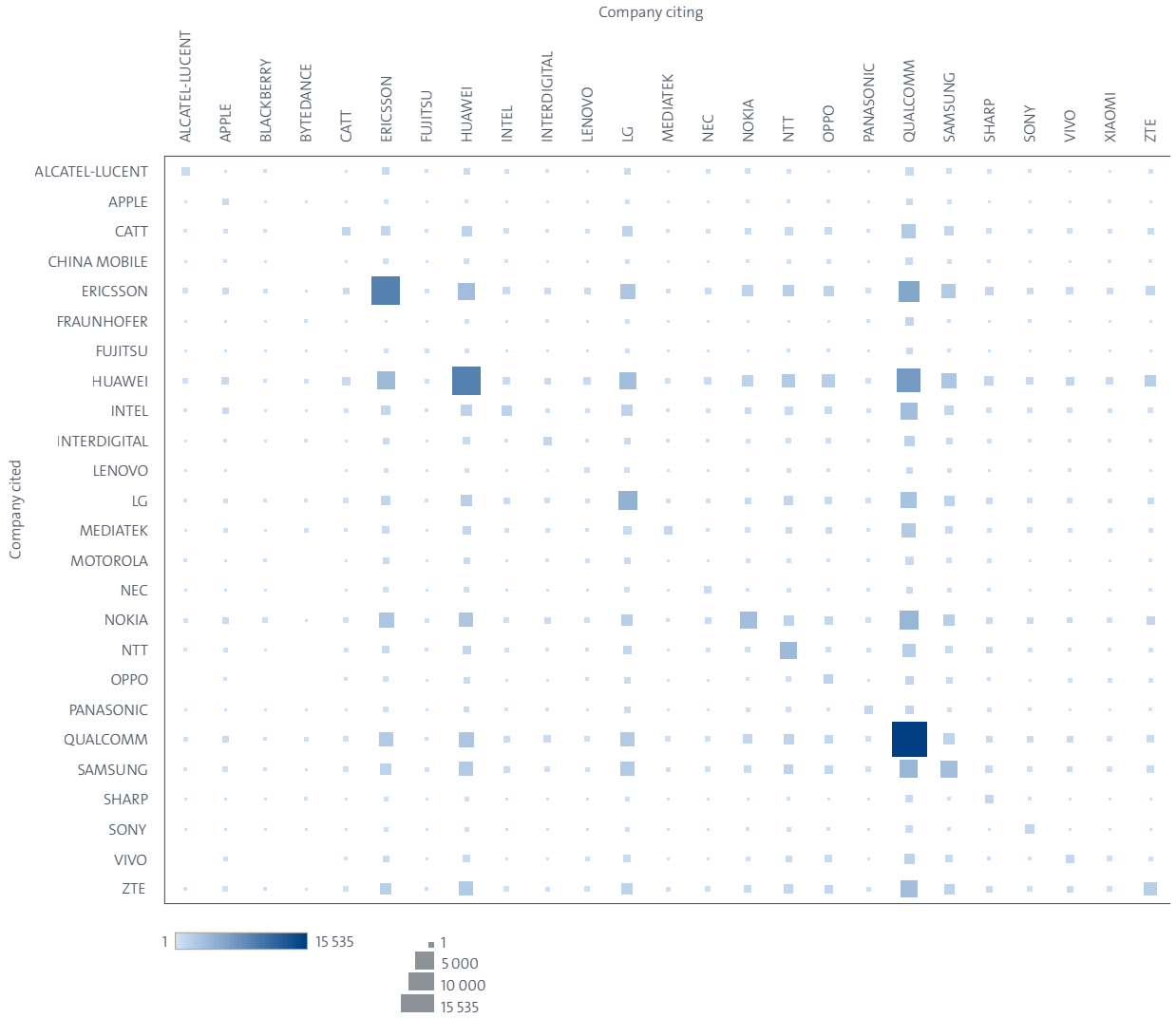
Note: The graph shows the number of citations of documents in the SDO databases by citing company and SDO database of the cited document for the 50 companies with the highest number of citations of SDO documents.

Figure 3.2.6 shows a diffusion heatmap from the top 25 cited companies developing SDO documents to the top 25 citing companies integrating these documents into patent applications. The cross-diagonal is particularly salient, indicating that firms draw on their own contributions when patenting.

The vertical and horizontal patterns also reveal intense cross-citations among leading firms, reflecting technological interdependence. This highlights the key role certain companies play in both contributing to and building upon standardisation efforts.

Figure 3.2.6

Citation heatmap between top 25 citing and cited companies



Note: The companies in in the y-axis are the top 25 cited companies by number of citations received.
The companies in the x-axis are the top 25 citing companies by number of citations made. The size and colour intensity of the squares represent the number of citations from citing company to cited company.

3.3. The relationship between SDO citations and SEP declarations

SDOs do not normally review the declarations of potential SEPs they receive from their members. Evidence indicates that self-declarations of potential SEPs to SDOs include patents that are not actually essential. Bekkers et al. (2020a) estimate that only between 20% and 47% of all 2G, 3G and 4G patents declared to the ETSI were assessed to be essential by experts and judges in two SEP litigation cases (Unwired Planet v Huawei and TCL v Ericsson). However, note that over-declaration is inevitable since ETSI IPR Policy requires early declaration, while applications are still pending and before the relevant standard specification is finalised.

In response to this, and with a view to increasing transparency on the essentiality of patents to standards for the benefit of implementers and patent holders, some have proposed the development and implementation of a system of essentiality checks by an independent third party (Bekkers et al., 2020a). Some researchers have proposed AI-based tools to reduce the costs of these, but they do not yet perform at high enough levels of accuracy (Brachtendorf et al., 2023; Baron and Pohlman, 2021; Rangan and Yonamine, 2021). The EPO SDO databases provide a potential infrastructure for assessing the essentiality of a given patent against the documents in the databases. The **EPO Cited SDO Documents Dataset** could also help in this regard, since patents citing SDO documents are likely to hold a particular relationship with the cited standards.

This subsection offers descriptive evidence on the relationship between SDO citations and SEP declarations. The analysis aims to explore whether the presence and amount of citations of standard-setting documents in patent filings can serve as an indicator of a patent's potential essentiality to a standard as captured by essentiality declarations to the SDOs. However, it is important to bear in mind that not all SDOs require their participants to declare potential SEPs (see Box 4). As a consequence, the overlap between SDO-citing patents and potential SEPs may be even higher in reality than reported in our analysis.

Box 4: Essentiality and the obligation to declare potential SEPs

Some SDOs require their members to identify and declare to the SDO in a timely manner patents, and in some cases published patent applications, that they believe in good faith to be essential to the standard. SDOs with extensive declaration requirements include, for example, the ETSI and the IETF. In some SDOs this obligation is formulated negatively, i.e. individual patents are identified and declared only if they are to be explicitly excluded from a general licensing undertaking. Other SDOs, by contrast, do not provide for any declaration obligation at all. For example, the ANSI, which is the accrediting body for SDOs in the USA, does not require its accredited organisations to include such requirements in their rules.

Information about declared patents, and often also about the associated FRAND undertaking, is usually published in databases or tabular lists of the respective SDOs. To increase transparency, the ETSI and ITU-T databases are linked to Espacenet, the EPO's patent information database of over 140 million patent documents from around the world. This means the patent specification and a wide range of relevant patent information, legal events and information on any other members of the patent family can be accessed quickly and easily via the ETSI and ITU-T IPR databases. Furthermore, the powerful patent information available at the EPO is also used by ETSI to constitute patent family information, which makes it possible for ETSI to require only the declaration of one member in a patent family while at the same time expanding the effect of a FRAND undertaking to all the members of a patent family for which one patent has been declared. This greatly enhances the legal certainty of the FRAND undertaking, while at the same time reducing the burden for companies to declare potential SEPs in the course of the standard development process.

Purpose, timing and scope of the declaration obligation

The obligation to identify and declare patents that are believed in good faith to be essential to a standard has several objectives. One key purpose is to increase transparency about potential SEPs for the standard development process and subsequent licensing. Participants in standardisation should be able to make informed decisions about the inclusion of particular technologies in a standard, based on their technical merit, potential implementation costs and the availability of licences. The information can be used to choose between different technical alternatives or increase efforts to develop a particular technology. Another objective is for the SDO to invite the patent holder to make a FRAND undertaking on the basis of the identified SEPs, or to identify which potential SEPs a FRAND licensing undertaking is not available. Finally, the declaration also provides information to potential users of the standard to enable them to assess the scope of protection of the declared potential SEP and identify the patent holder.

There are also differences between SDOs in terms of timing. While early declaration may be desirable to provide relevant information to standardisation participants as early as possible, choosing a date that is too early may compromise the quality of the declaration. Until the relevant specifications of the standard have been finalised and the patent granted, it may be difficult to anticipate what may ultimately be essential. A common approach is that identification and declaration can occur at any point in the standardisation process. Occasionally this is qualified to mean in a timely manner. This is usually assumed to be the case when participants can reasonably be expected to know that they, or the companies for which they work, may hold patents or patent applications that could be considered essential under the current

draft standard in development. Another approach is to expect a declaration at specific times, e.g. 30 to 60 days after the date of publication of a particular draft.

The scope of the obligation to declare potential SEPs also varies from one SDO to another. In some cases, the definition of essentiality used requires that patents and published patent applications be identified and declared (e.g. ETSI). Some SDOs also specify that the declaration requirement applies only to essential patent claims and not to the patent or patent application, which can include patent claims that are not required for the implementation of the standard. The latter is then of course particularly important for determining the scope of the FRAND undertaking and avoids potential misinterpretation by explicitly clarifying that the FRAND undertaking does not extend to claims of a declared patent that are not essential to the standard.

Occasionally, SDO members are also encouraged to identify potential third-party SEPs of which they are aware. However, there is usually no obligation to conduct a patent search; it is usually considered sufficient for the patent holder to have made reasonable efforts to identify and declare any potential SEPs.

Definition of essentiality

Essentiality is a key concept, as it determines not only the obligation to declare potential SEPs, but also the scope of the FRAND undertaking. Whether a patent is standard-essential is determined by the definition of the SDO, which may vary from oneto another. Significant differences can arise depending on whether standard essentiality is understood to "technical essentiality" or "commercial essentiality".

Technical essentiality is usually presumed when it is not possible to implement the standard and perform the acts reserved to the patentee without infringing the patent. However, some SDOs also take commercial and economic factors into account when defining essentiality, recognising that although there may be other technical ways of implementing the standard, in practice these may be so difficult, unsatisfactory or costly that they do not represent a commercially viable alternative. A patent is therefore considered commercially essential if the protected teaching is the only economically viable way of implementing the standard, taking into account factors such as manufacturing costs, efficiency, reliability, etc.

The implications of these different approaches can be far-reaching. Using a definition based on technical essentiality has the effect of limiting the number of patents covered by the SDO's reporting and licensing requirements. Conversely, the use of commercial essentiality can lead to difficult questions of demarcation and a higher degree of legal uncertainty.

Differences in the definition of essentiality may also arise from the question of whether essentiality refers only to mandatory parts of the standard that must be applied, or whether it also includes optional parts of the standard or alternatives for implementing it. In some cases it is explicitly stated that essentiality extends to alternative or optional parts of the standard.

Over-declaration

SDOs do not normally review or validate the declarations of potential SEPs they receive from their members. This means that the determination of whether a particular patent is indeed essential to a standard is initially left to the patent holder's own judgement. This, together with the uncertainties arising from the early timing of the declaration, has led to what is often referred to as over-declaration, i.e. many more patents being declared essential than are actually essential.

It cannot be ruled out that individual patent holders may, for opportunistic reasons, declare more patents from their portfolio to be essential than they actually believe in good faith to be so. In most cases, however, there are likely to be legitimate external and internal factors that lead patent holders to declare a patent essential that ultimately turns out not to be. On the one hand, there is the declaration obligation of the SDO itself, which creates an incentive to declare a patent as possibly essential rather than expose oneself to the accusation of a breach of the obligation to declare potential SPEs. This is all the more so as the consequences of a violation of this obligation can be far-reaching and may imply antitrust liability, while the legal consequences of declaring too many patents are more limited. Another reason is that it can be difficult, even for experienced experts, to assess the essentiality of a patent with absolute certainty. The standard may contain complex technologies and terminology that requires interpretation, as do the patent claims. In addition, both the standard development process and the patent granting process are dynamic. Accordingly, the timing of the declaration requirement also has a significant impact on potential over-declaration. The earlier in the standardisation process the obligation to declare potential SEPs is introduced, the higher the probability of over-declaration (at the same time, this ensures early availability of the FRAND commitment, benefiting the standardisation process). However, even after publication of a standard, it may change over time, just as granted patents may change after grant.

Box 5: Sample SEP analysis

To analyse the relationship between SDO citations and SEP declarations, we integrate SEP declaration data from Orbis IP, sourced from major SDOs also covered in the EPO SDO databases. Orbis IP includes 332 951 distinct patent publications flagged as SEP declarations (as of the download date: 10 March 2025). We merge patent publications that cite SDO documents to SEP ceclarations from Orbis IP using patent publication numbers as the linking variable.

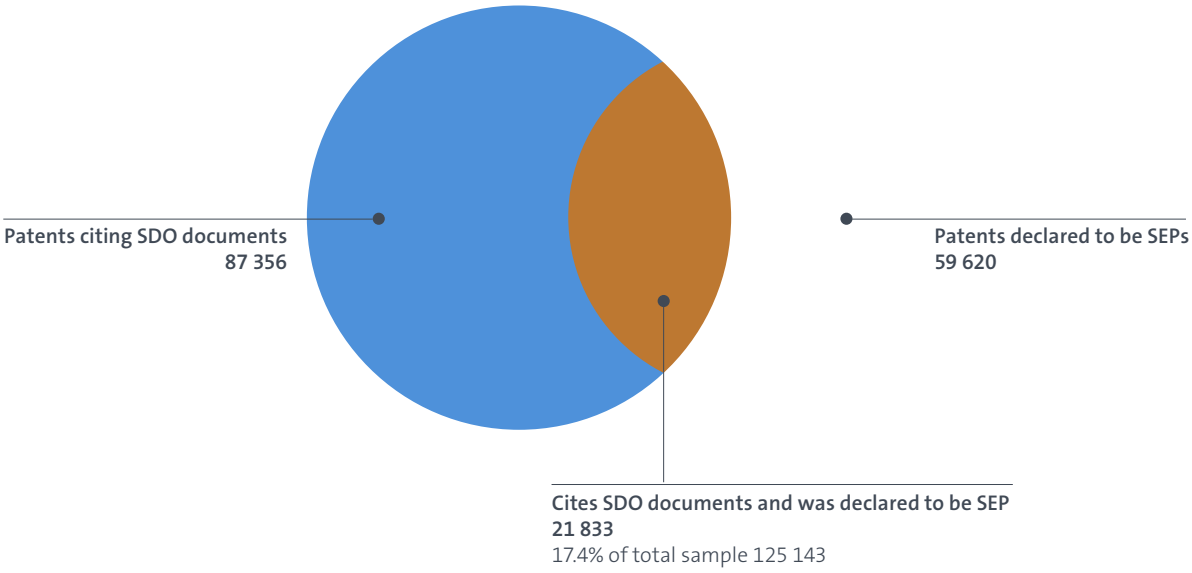
We apply two filters to ensure comparable coverage across both datasets. First, we retain published patent applications where the publication authority is either the EPO (EP in PATSTAT) or the WIPO (WO in PATSTAT), as WIPO applications may include SDO citations if examined by the EPO (or by other offices with access to the EPO SDO databases) as the international searching authority. Second, we restrict the sample to patents published between 2010 and 2019, a period during which the two datasets offer a comparable coverage. The final dataset comprises 125 143 patent publications, which serve as the basis for our analysis.

Figure 3.3.1 describes the intersection between SDO-citing patents and declared SEPs. Drawing on the sample described in Box 5, for which we can more reliably measure SEP declarations, we find that 52.4% of the patents cite SDO literature but are not declared SEPs, 30.2% are declared SEPs but do not cite SDO literature, and 17.4% fall into both categories, citing SDO documents and being declared SEPs. Focusing on the subset of SDO-citing patents, 25% of them are declared SEPs.

Alternatively, focusing on declared SEPs, 37% of these cite at least one SDO document. The results indicate that, although important, SEPs are only a subset of patents related to standards. Other patented inventions generated during the standard-setting process may not be essential because there are alternative ways to implement a standard or because they protect contributions not included in the final technical specification.

Figure 3.3.1

Overlap between SDO-citing published applications and SEP declarations

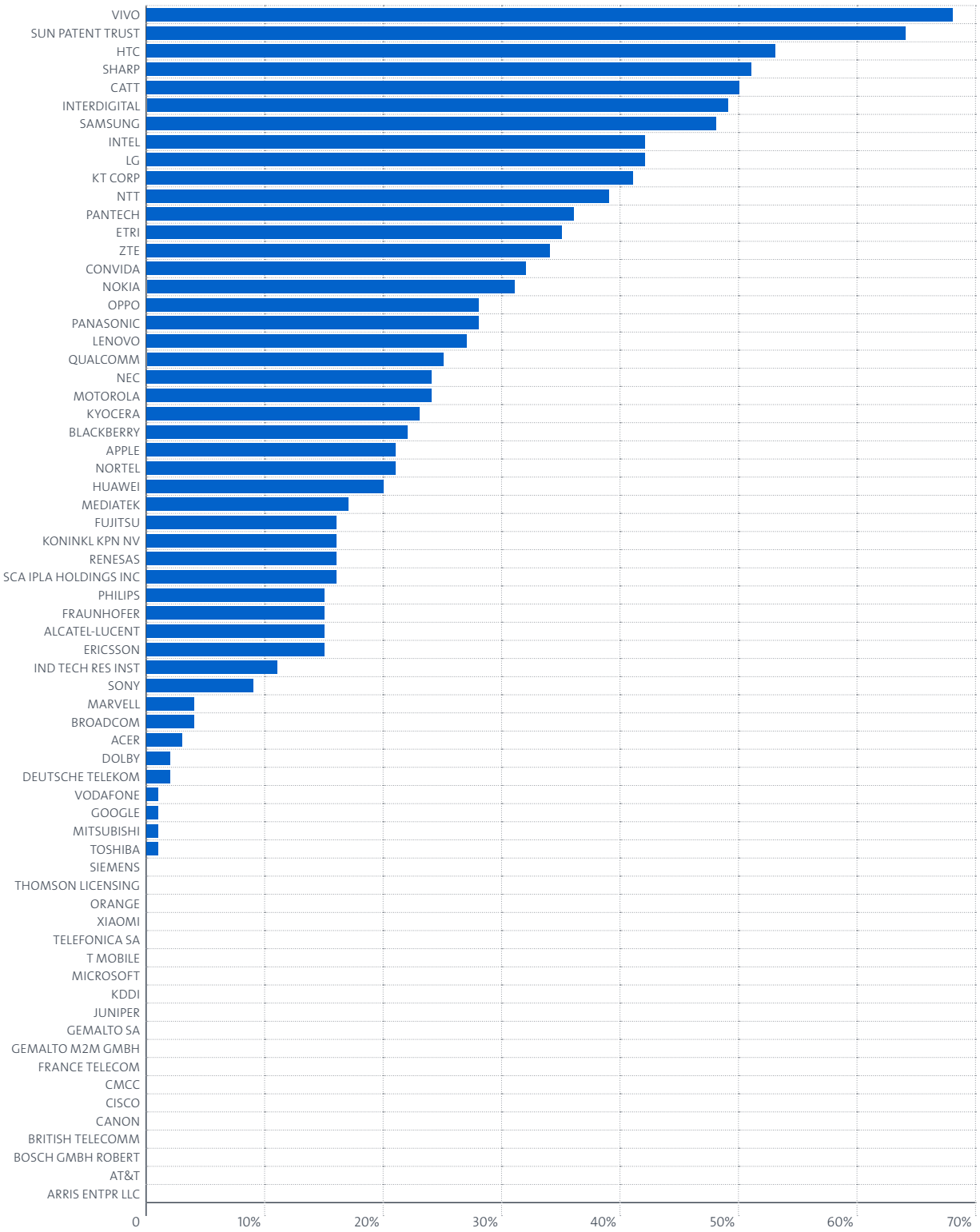


Note: The graph is based on a sample of 125 143 published patent applications resulting from the union of the following two samples: a) PATSTAT applications that cite documents in the EPO SDO databases and b) patent Orbis IP applications that are declared SEPs. Only applications published by the EPO or WIPO between 2010 and 2019, years in which both sources are comparable, are included.

Figure 3.3.2 ranks companies based on their percentage of SDO-citing published patent applications declared SEPs. Many of the companies holding SDO-citing patent portfolios have a substantial share of declared SEPs, with Vivo and Sun Patent Trust leading the ranking. Other firms, including HTC, Sharp, and InterDigital, also have a large percentage. Interestingly, well-known SEP holders such as Qualcomm, Ericsson, Nokia and Huawei who dominate standards authorship (see Figure 3.1.3) and own large portfolios of patents citing SDO documents (see Figure 3.2.5), do not exhibit the highest shares of declared SEPs. This suggests that these firms take a selective approach to declaring patents SEPs, possibly declaring only patents they regard as truly essential. The companies ranked last, with SDO citations but low SEP declaration rates, such as Bosch, Deutsche Telekom and Xiaomi, are predominantly implementers.

Figure 3.3.2

Percentage of SDO-citing published applications declared SEPs

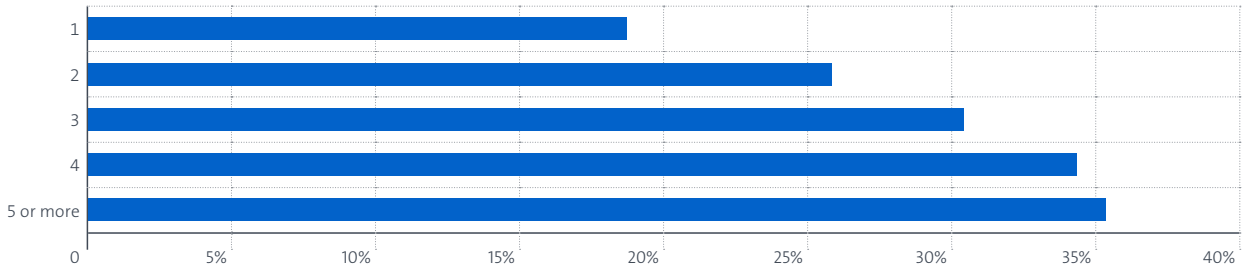


Note: The graph shows the percentage of SDO-citing applications declared SEPs for firms with more than 70 patent applications.
The analysis is restricted to the sample described in Box 4.

Figure 3.3.3 further explores the relationship between patent citations of SDO documents and the likelihood of these applications being declared SEPs, revealing a positive correlation between both. Applications with a single SDO citation exhibit the lowest SEP declaration rate, while those citing four or more SDO documents demonstrate a significantly higher probability of being classified as SEPs. This trend suggests that patents with extensive engagement with SDO literature are more likely to be declared SEPs.

Figure 3.3.3

Percentage of SDO-citing published applications declared SEPs, by number of SDO citations



Note: The graph shows the percentage of SDO-citing published applications declared SEPs, by number of citations of SDO documents in the published applications. The sample is restricted to published applications that cite SDO documents where the publication authority is the EPO or the WIPO published between 2010 and 2019 where coverage in Orbis IP and SDO citations data are similar.

Table 3.3.1 studies this relationship more formally, controlling for other observable patent, citation and company characteristics in a logistic regression setting. The variables used in the specifications presented in columns 1 to 4 are defined in the table's note. Across specifications, the number of SDO citations exhibits a positive and statistically significant effect on SEP declarations, with marginal effects ranging between 0.028 and 0.035. Characteristics of the relationship between the citing and cited parties, the cited document or the type of citation also help predict the likelihood of SEP declarations:

— Self-citations of SDO documents: this variable has a positive coefficient in the most demanding specification (column 4), even though there are mixed effects across specifications. Self-citations could indicate instances where the applicant intends to patent its own contributions to the standard. In principle, it would seem rational for applicants to withhold the disclosure of their contributions until filing date to avoid compromising the patentability of their own contribution. However, there could be unintended disclosures before establishing the priority date. Also, some disclosures between priority and publication dates could be incorporated into the published application or patent.

— Number of SDO citations to technical specifications (TSs): the type of SDO document cited matters, with patents citing technical specifications (TSs) being less likely to be declared SEPs than patents citing contributions. This result likely captures two effects. First, TSs represent completed standards released collectively by the responsible SDOs and whose essentiality cannot be claimed in a patent as they are not owned by individual companies as such. Contributions, however, have well identified authors with incentives to claim ownership if the contribution becomes essential to a given standard. Second, TSs are much more important for technological progress than contributions and are more likely to capture follow-on innovation by implementers adopting the standard or by companies developing the next generation of the standard.

— Citation category X: patent applications that include X citations of SDO documents are more likely to be declared SEPs in most specifications. These citations indicate that some of the content in the claims are closely related to the content of the cited standard, to a point where it interferes with novelty. As a result, examiners might deem it appropriate to narrow or eliminate some of these claims. However, the remaining parts of the affected claims or other unaffected claims in the application could retain a close connection to the cited standard, increasing the likelihood of the patent being declared an SEP.

Table 3.3.1

Likelihood of SEP declarations as a function of SDO citations

	(1)	(2)	(3)	(4)
Number of SDO citations	0.035*** (0.001)	0.033*** (0.001)	0.032*** (0.001)	0.028*** (0.001)
Number of SDO self-citations	0.007*** (0.002)	-0.007*** (0.002)	-0.005** (0.002)	0.015*** (0.002)
Number of SDO citations to TSs	-0.045*** (0.002)	-0.043*** (0.002)	-0.043*** (0.002)	-0.029*** (0.002)
Patent portfolio citing company		0.035*** (0.001)	0.036*** (0.001)	0.044*** (0.002)
International search report			0.007 (0.009)	0.001 (0.008)
Search report			0.036*** (0.009)	0.015* (0.008)
Citation category X			0.011*** (0.004)	0.006* (0.004)
Citation category Y			0.019*** (0.004)	-0.008** (0.004)
Citation category A			-0.000 (0.003)	-0.020*** (0.003)
Publication year FE	Yes	Yes	Yes	Yes
Technology class FE				Yes
Company FE				Yes
Observations	87 356	87 356	87 356	87 356
Pseudo R2	0.036	0.054	0.055	0.166
Log likelihood	-47 334	-46 479	-46 413	-40 953

Note: The reported coefficients are marginal effects from logit estimates. Robust standard errors in parentheses. *** p<0.01, ** p<0.05 and * p<0.1 denote statistical significance at the 1, 5 and 10 percent levels respectively. The regressions are estimated on a subsample of the data described in Box 4 consisting of patents that cite SDO documents (i.e. patents only in Orbis IP data which do not cite SDO documents are excluded from the analysis). The dependent variable is a binary variable with value one if the patent is a declared SEP. The controls are the number of citations in published applications to SDO documents, the number of self-citations in published applications of SDO documents where the authors in the two documents are identified as the same companies, the number of SDO citations in published applications to technical specifications, the log of the number of patent publications citing SDO documents in the company's portfolio of published patent applications, two binary variables indicating that the origin of the citation is an international search report or a national (or regional) search report (the base category for these two variables are other origins such as examinations), three variables indicating the citation category (X, Y or A) and a full set of publication year fixed effects (FEs). The last column also includes IPC technology class fixed effects and company fixed effects.

4. An overview of SEP litigation in Europe

Most SEP licensing agreements between SEP holders and implementers are reached without litigation. However, on occasions, views may diverge on technical issues such as the determination of essentiality, validity or infringement of asserted SEPs, or because the parties may disagree on what constitutes FRAND terms and conditions. As a result, the licensing of SEPs can be contentious and may lead to litigation as a last resort if bilateral negotiations fail. According to Baron et al. (2023), the prevalence of SEP litigation is low, with fewer than 5 litigations per 100 licenses involving major SEP licensors and patent pools.

The Unified Patent Court (UPC) addresses the long-standing fragmentation of enforcement in Europe by establishing a specialised patent court with exclusive jurisdiction for litigation relating to Unitary Patents and "classic" European patents. It harmonises among the 18 participating Member States the scope and limitations of the rights conferred by a patent and the available remedies – beyond those provided by the EU Enforcement Directive (2004/48/EC) – thereby enhancing legal certainty, reducing the risk of conflicting national decisions, and harmonising case law.

In the EU, litigation has largely focused on requests for injunctions, guided by the competition law framework established in the 2015 CJEU decision in *Huawei v ZTE*[4] (see below Box 7) and further developed through over 100 national court rulings, many of them from German courts. In contrast, UK courts have approached SEP disputes as contractual matters, interpreting SDO IPR policies under national law to determine FRAND licensing terms.

This chapter examines SEP litigation in Europe from 2015 to 2025, with a focus on the emergence of the UPC as a key forum for resolving such disputes. Subsection 4.1 describes the rising role of the UPC in disputes involving SEPs. Subsection 4.2 highlights the share of SEP-related cases in the workload of the UPC. Subsection 4.3 outlines the role of the UPC in reducing jurisdictional fragmentation in the EU. Subsection 4.4 contrasts evolving caselaw in the EU and the UK regarding FRAND licensing and enforcement. Lastly, Subsection 4.5 indicates alternative dispute resolution mechanisms and the role of the UPC's Patent Mediation and Arbitration Centre (PMAC).

Box 6: FRAND undertaking

Many SDOs have patent policies that aim to ensure patented technology may only become part of the standard if the patent holder makes an irrevocable undertaking to be willing to license on FRAND terms and conditions. In most SDOs, this FRAND undertaking is voluntary, ensuring patented technology is not included in the standard against the patent holder's will. The irrevocable FRAND undertaking is the safeguard to ensure that licenses will be available and acts as a quid pro quo for the inclusion of the proprietary technology in the standard and the associated restriction of competition at the technological level. The FRAND undertaking counteracts this restriction of competition in the technology market and promotes competition in the downstream market by preventing the patent holder from excluding its competitors or any other company from the production of standard-compliant products and thus foreclosing the downstream market.

The scope and content of a FRAND undertaking can vary considerably from SDO to SDO. For example, the undertaking may apply only to granted patents or patent claims but can also involve published patent applications. Also, in a number of SDOs, the FRAND undertaking is not made on an individual basis, but rather in such a way that members agree, either upon joining the SDO or by making a so-called "blanket declaration", to license on FRAND terms all of their patents necessary for the application of a specific standard, a set of standards, or all standards of the SDO, or for the manufacture of a specific category of standard-compliant products.

The scope of the FRAND terms and conditions ultimately to be granted may also vary depending on the nature of the undertaking made to the SDO. These may range from simple primary access obligations (e.g., non-assertion, royalty-free, RAND or FRAND licensing) to voluntary disclosure on royalties or specific secondary obligations in this direction (e.g. caps, maximum royalties, specific method of calculating royalties) or other specific licensing terms (e.g. restrictions on injunctive relief or on the transfer of patents to patent assertion entities).

The FRAND declaration gives rise to a legitimate expectation on the part of third parties that the SEP holder will grant them licences on those terms. In the EU, refusal by a SEP holder to grant a licence on those terms may then under certain conditions constitute an abuse within the meaning of Article 102 TFEU. For an injunction or recall action not to be considered abusive, the patent holder must comply with conditions designed to ensure a fair balance of the interests at stake. Whether the FRAND undertaking has a more restrictive meaning than the obligation under antitrust law is controversial and is assessed differently in the various European jurisdictions.

[4] CJEU, ECLI:EU:C:2015:477 - Huawei v ZTE.

Box 7: Enforcement of SEPs and resolution of FRAND disputes

There are some peculiarities in the enforcement of SEPs, as a defendant sued for patent infringement may claim that the patent holder is obliged to grant him a licence for the subject-matter of the patent(s) in dispute under antitrust law or under the contractual obligation of the FRAND undertaking.

The Court of Justice of the European Union (CJEU) clarified in a 2015 landmark decision (CJEU, ECLI:EU:C:2015:477 - Huawei v ZTE) the circumstances in which a SEP holder that has made a FRAND declaration is entitled to enforce an injunction against an implementer of a standard without infringing competition law.

Principles established by the CJEU in Huawei v ZTE

In Huawei v ZTE, the CJEU had to clarify the controversial issue whether a user of an SEP for which its proprietor has made a FRAND undertaking should be able to avoid an injunction by merely declaring its "willingness" to negotiate a FRAND licence, or whether injunctions should be granted unless the user of the patented technology makes a binding offer to the SEP holder on terms that the latter cannot refuse without infringing competition law.

The CJEU has created a legal framework that emphasises the good faith behaviour of the parties and strikes a balance that prevents both the SEP holder from engaging in patent hold-up and the implementer of the standard in hold-out behaviour. This framework sets out obligations for both sides:

- Before seeking injunctive relief or recall, the SEP holder must notify the alleged infringer of the alleged patent infringement, identifying the patent and specifying how it is alleged to have been infringed.
- The alleged infringer must express a willingness to enter into a licence agreement on FRAND terms.
- The SEP holder must make a specific written offer of a licence on FRAND terms to the alleged infringer, specifying in particular the royalty and the way in which it is to be calculated.
- The alleged infringer is obliged to respond to this offer with due diligence, in accordance with good commercial practice in the field, and in good faith, as determined on the basis of objective factors, including the absence of delaying tactics.
- If the alleged infringer does not accept the offer made to him, he can only invoke the abusive nature of an injunction or recall action if he makes a specific counter-offer in writing to the SEP holder within a short period of time and on FRAND terms.
- If the alleged infringer has been using the SEP prior to the conclusion of a licence agreement, the alleged infringer must also provide adequate security in accordance with accepted business practices in the relevant field from the date of rejection of the counteroffer, e.g., by providing a bank guarantee or depositing the necessary sums. The calculation of this security must take into account, inter alia, the number of prior acts of use of the SEP for which the alleged infringer must provide a record.

In addition, if no agreement on the details of the FRAND terms has been reached following the alleged infringer's counteroffer, the parties may jointly request that the licence terms be determined by an independent third party, which will decide within a short period of time.

If the alleged infringer does not comply with his obligations, the SEP holder can enforce his injunction without restriction. If the SEP holder fails to comply with his obligations, the alleged infringer may successfully invoke his antitrust compulsory licence defence with the result that the infringement action is dismissed.

With this judgment, the CJEU has succeeded in striking a balance of obligations for both parties that ensures the availability of the patent injunction in appropriate cases while protecting the ability to defend against abusive conduct. Since the CJEU's decision, national courts have gradually examined the scope of the obligations established by the CJEU and some differences amongst the jurisdictions can be observed.

Contractual licence defence

The English and, to some extent, also French courts do not base the alleged infringer's objection to the SEP holder's claim for an injunction on antitrust law, but view FRAND primarily as a matter of contract law. Normally, in the UK, a patentee would be able to obtain an injunction against an infringer, but if the patent is subject to a FRAND undertaking, the implementer may be able to rely on that contractual undertaking to avoid the injunction by compelling the patentee to offer a FRAND licence. In this context, the person held liable for patent infringement is considered a third party beneficiary of that contractual obligation as a user of the standard.

4.1. The rising role of the UPC

Over the past decade, SEP litigation in Europe was predominantly handled by national courts in Germany and the UK. However, with the inception of the UPC in June 2023 a new venue has emerged, offering a uniform, specialised and efficient framework for patent litigation at a European level. This sections details how the UPC is reshaping the European patent litigation landscape. The analysis must be interpreted with caution, however, since the UPC is still in its early days and there is a transitional period.

For the participating Member States, the UPC has exclusive jurisdiction over European patents with unitary effect (Unitary Patents) and "classic" European patents. The exclusive jurisdiction regarding "classic" European patents is, however, shared with competent national courts and authorities during a transitional period of at least seven years. Furthermore, "classic" European patents can be opted out entirely from the UPC's jurisdiction.[5] This is not possible for Unitary Patents. In practice, however, only 26% of "classic" European patents have been opted out of the UPC jurisdiction with opt-out rates remaining similar for declared SEPs and other patents (29% vs 26%). The majority of "classic" European patents now fall under the jurisdiction of the UPC, with 74% of eligible patents (and 71% of declared SEPs) remaining within its scope.

Box 8: The Unified Patent Court

The Unified Patent Court is a court common to currently eighteen EU Member States, in which the Agreement on a Unified Patent Court (UPCA) is in force. The remaining nine EU Member States could still join the UPCA at a later stage. The agreement is only open to EU Member States and thus not to all EPC Contracting States.

The UPC offers a uniform, specialised, and efficient framework for patent litigation at a European level. It hears both infringement and revocation actions.

The Court has exclusive jurisdiction in respect of classical European patents and European patents with unitary effect (Unitary Patents). The exclusive jurisdiction regarding "classic" European patents is, however, shared with competent national courts or authorities during a transitional period of at least seven years. Furthermore, patent holders can opt out their "classic" European patents from the UPC's jurisdiction.

The UPC is composed of judges from all 18 participating states. The panels sit in a multinational composition and usually comprise both legally and technically qualified judges with great expertise in patent litigation.

The UPC comprises a Court of First Instance, a Court of Appeal, and a Registry. In addition a Patent Mediation and Arbitration Centre (PMAC) is currently established to foster settlements.

— The Court of First Instance operates through a decentralized structure that includes a Central Division – itself divided into a location at the seat of the Central Division and two sections – thirteen Local Divisions and a Regional Division, situated all across Europe. This ensures proximity to the users. The Court of First Instance has jurisdiction over various types of actions, as listed in Article 32 UPCA.

— The Court of Appeal is centralised and has its seat in Luxembourg. Its purpose is to review on appeal orders and decisions of the Court of First Instance and to ensure a uniform interpretation of the law.

— The Registry of the UPC is located at the seat of the Court of Appeal in Luxembourg. The Registry is lead by the Registrar and comprises all the administrative functions of the Court (e.g., the Secretariat, the Human Resources, Finance, Translation and IT Departments, etc.) and also provides secretarial services to the different Committees of the Court (Administrative Committee, Budget Committee and Advisory Committee) for the performance of their duties under the UPC.

[5] The patent "opt-out" option became available during the so-called "sunrise period", which started on March 1, 2023, and covered the three months leading up to the start of the UPC. According to the UPCA, the transitional period will initially last seven years but may be prolonged with an additional seven years by the Administrative Committee. See: https://www.unified-patent-court.org/en/faq/opt-out.

Box 9: Litigation data

The data sample comprises a total of 101 SEP-related disputes, based on the definition of dispute provided below in this box, across Europe between 2015 and 2025. This sample includes disputes for which decisions are publicly available, supplemented by 17 pending or settled disputes filed at the UPC. These additional disputes have been included to offer insights into emerging trends at the UPC, given its recent establishment. While this constitutes the largest dataset of European SEP disputes described in the literature to date, it does not cover the full universe of SEP litigation in Europe, due to the absence of comprehensive databases for patent litigation and declared SEPs beyond ETSI declarations.

The majority of SEP disputes (59) relate to mobile telecommunications such as 4G, 5G, or speech codecs used in these standards. Another large number of disputes (29) relate to video coding technologies (AVC and/or HEVC). Much smaller numbers of disputes are related, for instance, to WiFi and Qi Wireless Charging.

The sample includes SEP-related disputes in national courts from existing literature, media reports, and datasets of SEP-related court judgments.[6] In the case of the UPC, the analyses consider the full list of patent infringement cases filed with the UPC, considering whether any of the patents in dispute have been declared potentially essential to ETSI or are included in a patent pool that licenses SEPs. The analyses also identify potentially SEP-related disputes at the UPC using media reports and the identity of the parties; and (where available) consult the court's decision(s) in the case to confirm that the disputes are indeed SEP-related. While this identification strategy may induce certain biases, it nonetheless enables the identification of a large and meaningful number of disputes likely associated with SEPs. Notably, all dispute data within the sample is publicly available. The Annex provides full details into the sampling strategy and a detailed overview of the disputes within the sample, including the respective docket numbers by country and the UPC (see Table A2.1).

Disputes as the unit of analysis: Comparing numbers of decisions across different jurisdictions and systems is challenging, as different aspects of a dispute may be combined into a single judgment in one system, but lead to multiple decisions in another. Also, different jurisdictions have different propensities to publish decisions, in particular those that are not the final judgment in a dispute. Therefore, the approach relies on identifying and counting unique "disputes", collapsing different decisions relating to the same set of parties into one "dispute" observation.

The definition of a dispute: A patent infringement dispute between two parties may be defined as two parties litigating over the alleged infringement or revocation of a specific patent. Following this definition, parallel litigation denotes a situation in which parties litigate the same accused infringement or revocation of the same patent in different courts. For the purpose of this study, the authors adopt a broader, commercial perspective: the same parties may be involved in different infringement proceedings over different sets of patents in different courts, either within the same country, across countries, or both. However, all these actions are related to the same commercial disagreements over the terms of a single (global) licensing agreement. To capture this broader notion, the study considers different patent litigations to be part of the same commercial dispute if they involve the same parties, and take place at approximately the same time. Litgations may be related to the same dispute even if the parties are not exactly the same, e.g. because multiple parties are participating in one action, but only a subset in another, or because different companies that form part of the same corporate group are parties in different litigations. For example, parallel to the proceedings between Ericsson and Lenovo in the UK, Motorola Mobility, a subsidiary of Lenovo, brought proceedings against Ericsson before the UPC. In such cases, the study consolidates disputes into one.

This definition can be especially useful in situations where parties litigate over potential patent infringement relating to standardised technologies. Typically, standardised technologies build upon large patent portfolios that include dozens, hundreds or even thousands of patents. Parties often seek to conclude overall portfolio licenses for all patents implementers must license to allow them to make and sell standard-compliant products.

Our definition of dispute involves an element of judgment (assisted by contextual information, such as press coverage); but we are confident we have grouped together litigations that are commercially related. In our opinion, the litigations identified as being part of the same dispute involve the same commercial facts and are capable of being jointly resolved through a single licensing agreement.

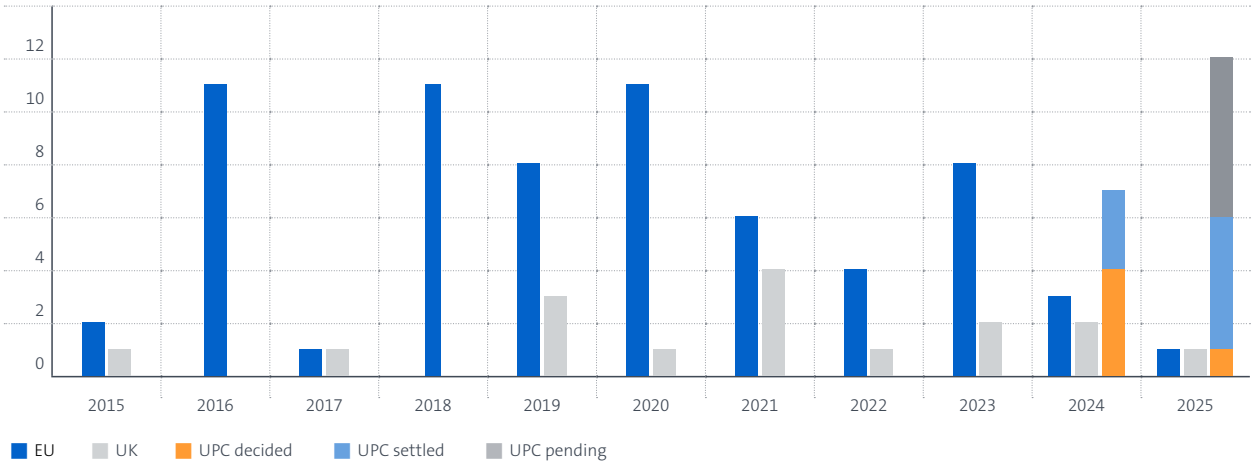
[6] In particular, the study uses the datasets provided by WIPO (https://www.wipo.int/wipolex/en/collections/profile/sep_caselaw), the 4ip Council (https://caselaw.4ipcouncil.com/), Bristows (https://www.bristows.com/expertise/litigation-disputeresolution/sep-frand-disputes/), and Kather Augenstein (https://www.katheraugenstein.com/en/latest-news/frand-database/).

Figure 4.1.1 indicates that the UPC is rapidly establishing itself as a key forum for resolving SEP-related patent disputes in the EU. As of 14 March 2025 the UPC had been the venue for 23 SEP-related disputes, averaging more than 13 such disputes per year since launch in mid-2023. Many of these are still pending; and some were settled before the UPC reached any decision. The number of disputes at the UPC is thus not directly comparable with historical numbers of disputes in national jurisdictions, where the dataset does not include cases that are currently still pending or were settled before any court decision. There are three cases in which the UPC has reached a substantive decision in a dispute involving SEPs *(Huawei v Netgear, Panasonic v Oppo, and Philips v Belkin)*.

Given that the UPC only started operating less than two years ago, these are notable figures. In light of the large number of currently pending cases involving (declared) SEPs, it is likely that the UPC will become a leading venue for SEP-related judgments in the near future; with a number of cases comparable to the levels historically recorded in courts of EU Member States and UK national courts. While litigation data are subject to publication lags, and the dataset may not reflect the full extent of recent SEP litigation in national courts, the number of SEP-related decisions issued by national courts in the EU appears to have decreased in 2024 and be hovering substantially below the levels observed between 2019 and 2021. The UPC thus appears to have absorbed a significant share of disputes that would previously have been brought before courts of EU Member States.

Figure 4.1.1

Number of SEP disputes by jurisdiction and decision year



Note: This figure shows the number of disputes (as defined in Box 9) involving declared SEPs by European jurisdiction and decision year. Where a dispute spans several jurisdictions, it is assigned to the jurisdiction and year of the earliest decision. Under this rule of thumb, 4 UPC-related disputes which spanned multiple jurisdictions are assigned to other jurisdictions with earlier decisions.. In the case of the UPC, settled and pending cases are included, dated by their earliest filing year, to reflect harmonisation effects and consider the number of cases where decisions will likely be taken in 2025, while this is not done for other jurisdictions.

4.2. Share of SEP-related cases in the workload of the UPC

As mentioned, 23 SEP-related disputes have reached the UPC. To put the SEP-related caseload of the UPC in context, the study turns to the UPC's own statistics. According to its annual report for 2024, 635 cases had been filed with the UPC up to the end of 2024, including 239 infringement actions. By the end of the first quarter of 2025, the number of cases had increased to 798, including 289 infringement actions.

Our study relies on 271 infringement actions filed until 14 March, 2025, which are related to 194 disputes (as defined above, see Box 9). Of these, 23 are SEP-related, i.e. approximately 12% of the disputes at the UPC involve declared SEPs. These cover 73 infringement actions. Thus, declared SEPs account for 27% of the infringement actions at the UPC. Non-SEP-related infringement actions at the UPC relate to 171 different disputes.

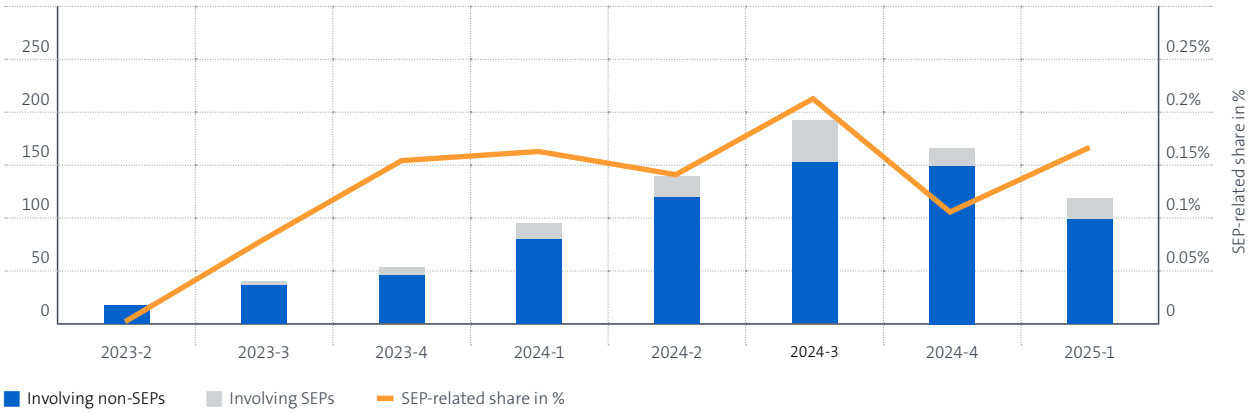
Box 10: Orders and decisions at the UPC

The study identifies different UPC cases related to disputes, using the UPC identification number assigned to each infringement action. Multiple infringement actions for a single dispute are common; SEP holders often assert multiple patents against the same implementer. One infringement action at the UPC may cause at least one order or decision. However, disputes may give rise to multiple orders and decisions. Orders and decisions can be allocated to SEP and non-SEP disputes in order to estimate their complexity and the resulting workload. The study approximates the complexity of a dispute at the UPC by extracting orders and decisions and estimating the average number of these for SEP and non-SEP disputes.

Judging from the mere number of orders and decisions, SEP-related disputes also appear to be more "complex" than other disputes at the UPC, on average. Overall, the study extracts 894 orders and decisions up to 14 March 2025, from the UPC case management system. The 23 SEP-related disputes gave rise to 123 orders and decisions (see Figure 4.2.1), whereas the 171 non-SEP related disputes resulted in 771 orders and decisions. Consequently, SEP-related disputes account for approximately 14% of the UPC's 894 orders and decisions, and cause 5.35 orders and decisions on average, compared to 4.51 for non-SEP related disputes.

Figure 4.2.1

UPC orders and decisions related to potential SEPs versus other orders and decisions, by quarter



Note: This figure reports the number and percentage of orders and decisions at the UPC by quarter, distinguishing between those related to declared SEPs and those unrelated. The left y-axis illustrates absolute numbers while the right y-axis displays the share of SEP-related orders and decisions at the UPC. The figure relies on the time of each order and decision to allocate it to the respective quarter.

Box 11: Methodology for selecting the population of European patents

The study makes the following assumptions to identify the population of European patents under the UPC jurisdiction. First, it identifies 1 703 807 European patents in the time frame 2015 to 2024, out of which 1 268 911 were not opted out from the UPC. Further, it identifies 29 221 EPs that were declared potentially essential to ETSI, with 20 776 not being opted out from the UPC. Consequently, the share of declared SEPs at ETSI that were not opted out equals 71%. Besides this, there are 7 409 European patents that were included in one of the patent pools for AVC or HEVC video coding technology. Assuming the opt-out share of ETSI patents applies to other European patents too, we derive a figure of 5 261 European patents in video codec patent pools under the UPC jurisdiction. Similarly, we derive that 1 242 874 non-SEPs are under the UPC jurisdiction. We use these numbers to compare assertion likelihoods at the UPC for ETSI-declared SEPs, European patents relating to video codecs, and non-SEPs.

The study identifies 233 individual European patents that were asserted in at least one of the 271 infringement actions at the UPC. This includes 20 individual European patents declared potentially essential to ETSI and asserted in 33 infringement actions, as well as 6 individual European patents included in one of the patent pools for AVC or HEVC video coding technology and asserted in 8 infringement actions. Moreover, the authors manually identify 35 additional infringement actions covering 26 individual European patents that are likely also SEPs but were not declared to ETSI or included in the two video codec pools. This SEP group may cover other standardised technologies such as WiFi where it is generally challenging to identify the population of SEPs since there are no specific declarations. Thus, 181 individual non-SEPs have been asserted through infringement actions.

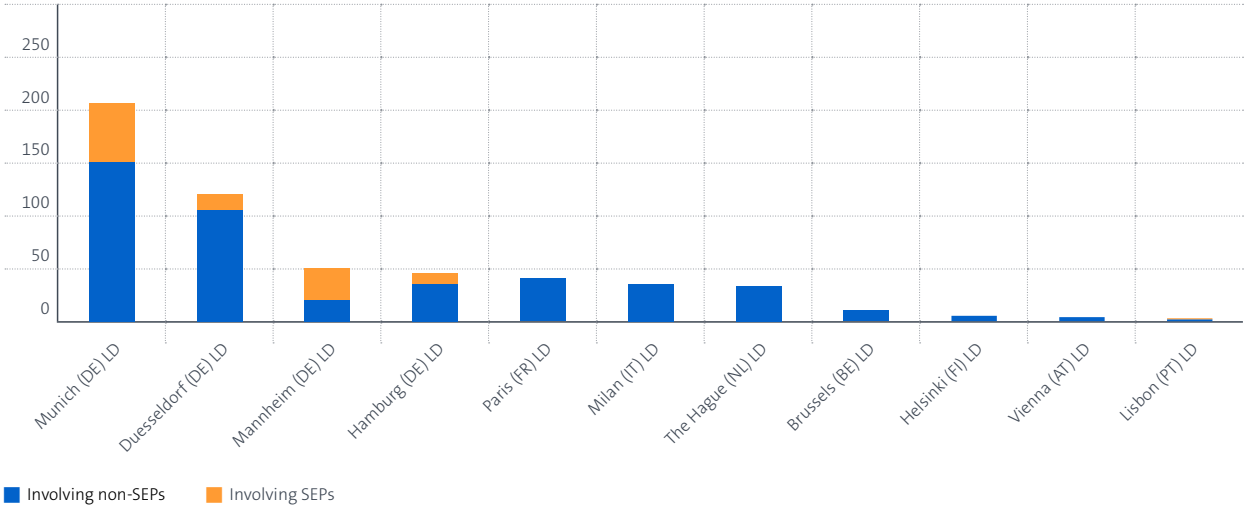
Based on the previous assumptions in Box 11, ETSI-declared SEPs account for 8.6% of the asserted patents in infringement actions (20 out of 233), video codec patents for 2.6% (6 out of 233), other potential SEPs for 11.2% (26 out of 233), and non-SEPs for 77.6% (181 out of 233).

However, ETSI-declared SEPs that were also asserted at the UPC account for 0.096% out of all ETSI-declared European patents eligible to be asserted (i.e., 20 out of 20 776 ETSI-declared SEPs not opted out); while 0.081% (6 out of 7.409) of the European patents included in one of the AVC or HEVC video codec patent pool were asserted. By comparison, the 207 other asserted European patents (181 non-SEPs and 26 likely SEPs other than the two groups of SEPs mentioned above) account for a share of 0.017% of their reference population (181 out of 1 242 874). ETSI-declared SEPs are therefore approximately 5.5 times more likely to be asserted in an infringement action at the UPC than other European patents, and video codec patents licensed through a patent pool are 4.7 times more likely to be asserted at the UPC than other patents.

These differences between declared SEPs and other patents reflect the importance and high commercial value of the declared SEPs. At the same time, they also indicate that the UPC has established itself as a particularly important venue for SEP litigation.

Figure 4.2.2

UPC orders and decisions related to potential SEPs versus other orders and decisions, by Local Division



Note: This figure shows the number of orders and decisions at the UPC by local division, distinguishing between those related to declared SEPs and those unrelated.

Figure 4.2.2 shows that the distribution of UPC orders and decisions concentrates in Germany-based local divisions, particularly for SEP-related matters. The Munich Local Division issues by far the highest number of orders and decisions, both in general and for SEP-related disputes. Collectively, German Local Divisions account for over 95% of all SEP-related orders and decisions and approximately 50% of the non-SEP-related ones. This highlights the central role of Germany-based Local Divisions within the UPC's early SEP litigation landscape.

4.3. The UPC's role in reducing fragmentation of SEP litigation across Europe

Section 4.1 shows that the UPC is rapidly establishing itself as a key forum for resolving SEP-related patent disputes in the EU, absorbing a share of disputes that would previously have been brought before courts of EU Member States. Another margin through which the UPC could be harmonising SEP litigation is by reducing the extent of "parallel litigation", as measured by the number of SEP disputes spanning multiple European jurisdictions or the jurisdictional combinations observed in such disputes.[7] Again, the analysis should be interpreted with caution, as the system is still in its early days and remains in a transitional period.

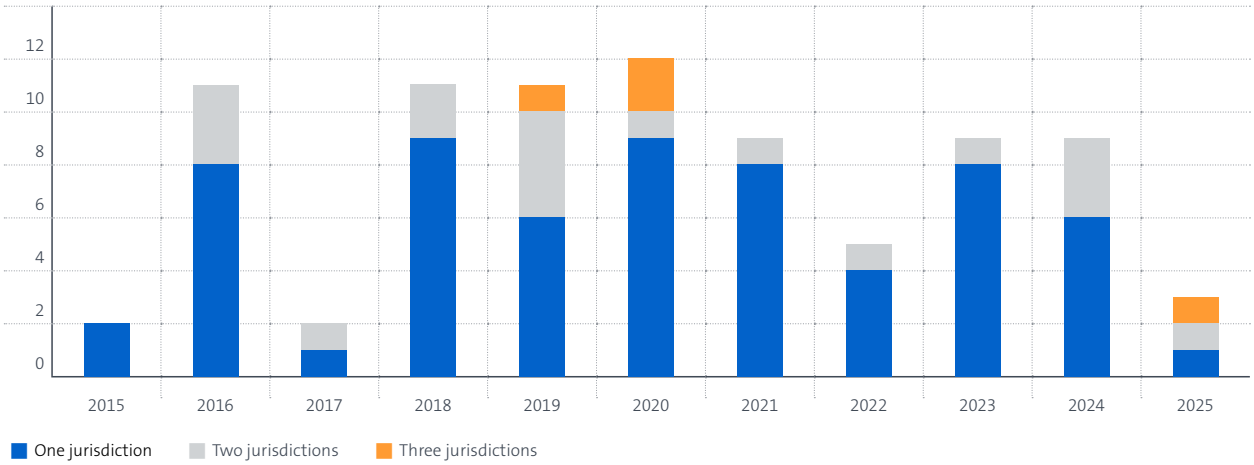
Figure 4.3.1 displays the number of disputes decided by European courts by year. The incidence of parallel litigation is rather low, with only one fifth (22 out of 101) of SEP-related disputes involving decisions from courts in

[7] The working definition of "dispute" proposed in this study considers different actions between the same parties as one same dispute (see Box 9). This definition encompasses "parallel litigation", understood as infringement proceedings over different sets of patents in different courts, either within the same country, across countries, or both. Accordingly, disputes can involve different actions between the same parties across multiple jurisdictions (e.g. parties may litigate in France and Germany or UK and the UPC).

multiple European jurisdictions, most involving just two jurisdictions.[8] In terms of trends, both the overall number of disputes and the number of disputes involving court decisions in multiple European jurisdictions have been approximately constant over the past years, including those following the establishment of the UPC. It is still too early to observe whether the UPC may be leading to a decrease in the number of disputes with decisions from different courts in different jurisdictions.

Figure 4.3.1

Number of SEP disputes by decision year and number of European jurisdictions involved



Note: This figure shows the number of SEP disputes by number of European jurisdictions with a court decision related to the dispute, and year of the earliest decision date related to this dispute in the data. The figure excludes disputes that do not result in court decisions (e.g. settled or pending cases). The figure includes 22 disputes spanning more than one jurisdiction.

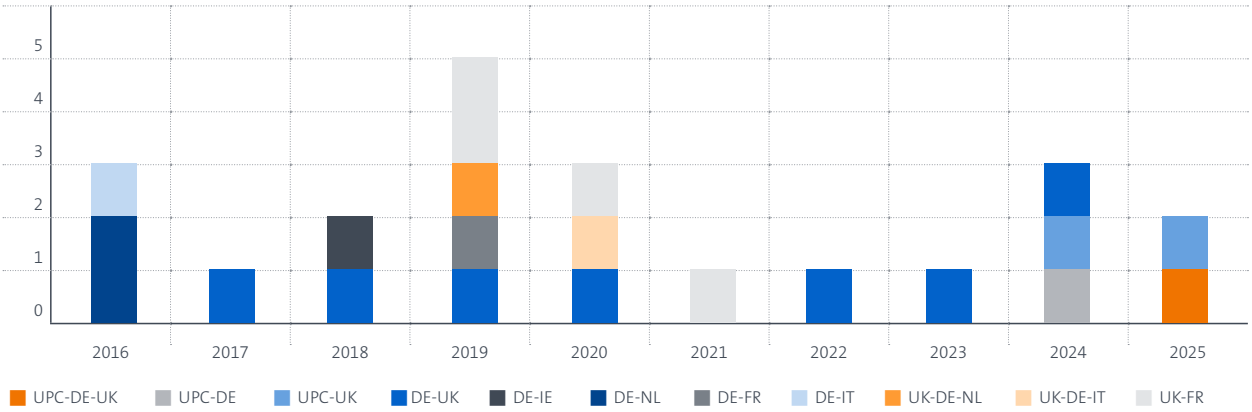
Figure 4.3.2 shows, however, that the combination of jurisdictions in such disputes changed after the establishment of the UPC. Since 2020, disputes with decisions from different courts in different jurisdictions consistently involved decisions from courts in both the UK and the EU. As the UK does not participate in the UPC, this potential for cross-border disputes remains. Nevertheless, the UPC has been involved in all the recent cross-border disputes, taking the place of national courts in the States which have ratified the UPC Agreement (in particular Germany, France and the Netherlands).[9] This suggests that, while enforcement remains internationally fragmented in about one fifth of SEP-related disputes, the UPC nevertheless marks an important step toward more unified and predictable patent enforcement in the EU. Whether the momentum continues will likely depend largely on forthcoming case law, which will play an important role in determining how extensively the UPC replaces national courts for "classic" European patents under its jurisdiction.

[8] This could be a lower bound since the method for measuring parallel litigations is based on court decisions and not all parallel litigations initiated in different jurisdictions proceed to decisions (e.g. the method does not identify instances where one of the disputes is settled before a first decision on the merit as parallel disputes).

[9] Note that the coexistence of litigation at the UPC and national courts of EU Member States is possible because some SEP portfolios include a combination of European patents that have been opted out of the UPC and others that have not, with the former being litigated in courts of EU Member States and the latter at the UPC. Such instances will gradually fade away as the UPC reaches the end of the transitional period and the European patents that have been opted out lapse.

Figure 4.3.2

Number of SEP disputes spanning multiple European jurisdictions, by combinations of jurisdictions involved



Note: This figure shows the number of SEP disputes spanning multiple European jurisdictions by jurisdiction combination and year of decision date related to this dispute in the data. The figure excludes disputes that do not result in court decisions (e.g. settled or pending cases). The figure includes 22 disputes spanning more than one jurisdiction.

4.4. Litigation outcomes by jurisdiction

The incidence of parallel litigation between courts in the EU (including the UPC and national courts of EU Member States) and the UK courts is partly explained by the substantive differences in the court approaches to SEP case law in these different jurisdictions. This subsection studies how these different approaches affect the outcomes of SEP disputes. The analysis covers key EU jurisdictions where SEP litigation is primarily based on EU competition law and the framework established by the CJEU in *Huawei v ZTE*, including the UPC, Germany, France, the Netherlands, Ireland, and Italy. It also includes the UK, where courts treat SEP disputes as contractual matters and interpret SDO IPR policies under national law to determine FRAND licensing terms. The analysis focuses on FRAND disputes, excluding essentiality and validity challenges.

Box 12: Definition of outcomes categories and methodological handling of multiple jurisdictional outcomes in a single dispute

The coding of the authors distinguishes seven mutually exclusive outcome categories:

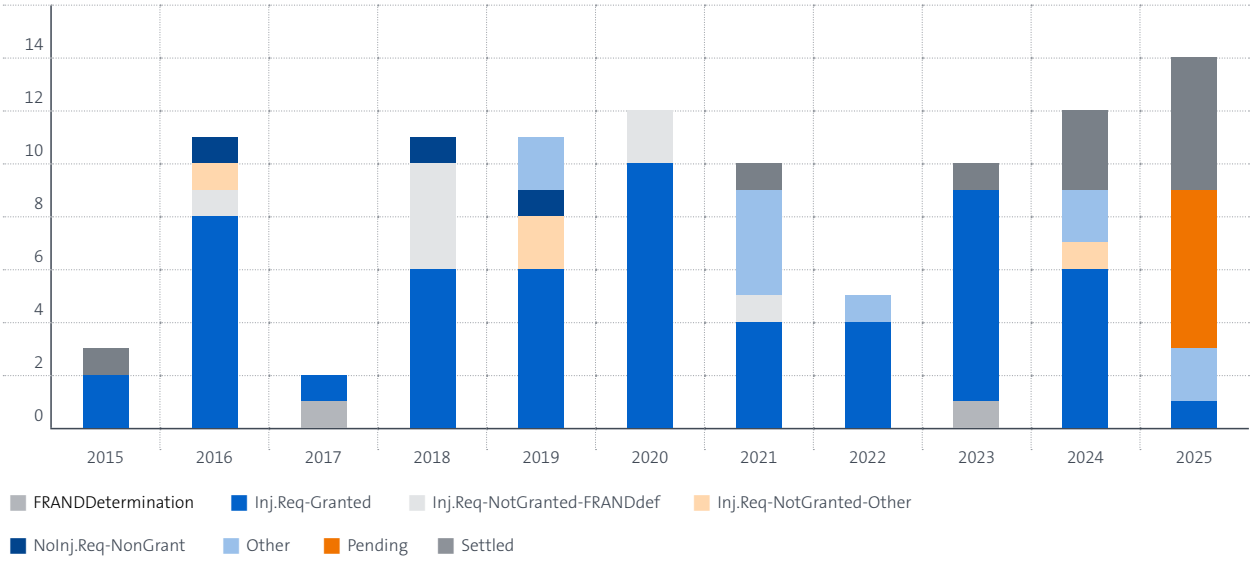
- *"Inj.Req-Granted"* denotes disputes in which at least one injunction (preliminary or permanent) was sought and granted by any court.
- *"Inj.Req-NotGranted-FRANDdef"* covers cases where an injunction was sought but refused on FRAND-defensive grounds.
- *"Inj.Req-NotGranted-Other"* refers to injunction requests denied for reasons other than a FRAND defence under the EU competition law (e.g. due to proportionality reasons, exhaustion, non-infringement, and time-related reasons).
- *"NoInj.Req-NonGrant"* applies to infringement actions in which the plaintiff (patent owner) did not request an injunction (e.g. actions for damages and rendering accounts).
- *"FRAND determination"* refers to cases in which a court has determined the FRAND rate.
- *"Other"* encompasses remaining outcomes such as declaratory judgements, interim licenses, and anti-suit or anti-anti-suit injunctions.
- *"Settled"* indicates disputes that have been resolved by mutual agreement before any decision in the above categories has been reached.
- *"Pending"* refers to UPC disputes for which no final decision has yet been rendered.

When a dispute gives rise to more than one decision, the authors retain only the outcome with the greatest "market" effect. FRAND determination take top priority, followed by grants of injunctions, then come denials of injunctions, cases in which no injunction was formally requested despite being discussed, other rulings such as anti-suit or anti-anti-suit injunctions, settlements, and, finally, pending decisions. Whenever two outcomes share the same rank, the dispute is assigned to the year of the earlier decision.

4.4.1. Outcomes of FRAND disputes

Figure 4.4.1

Overall number of SEP disputes by outcome and decision year



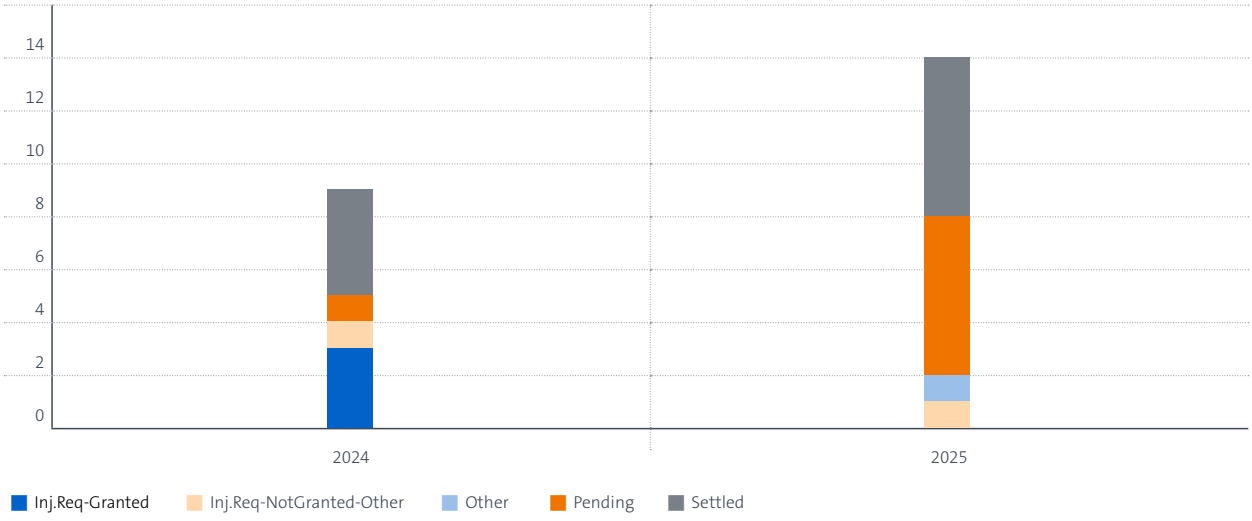
Note: See Box 12 for definitions of outcomes.

Figure 4.4.1 aggregates annual FRAND dispute outcomes in the dataset across all seven jurisdictions. The data suggest SEP holders request an injunction in at least one jurisdiction in the majority of SEP disputes, and that the grant of an injunction is the most frequent outcome of SEP litigation in Europe (largely driven by the large number of cases in Germany).

4.4.2. Unified Patent Court

Figure 4.4.2

Number of SEP disputes by outcome and decision year at the UPC



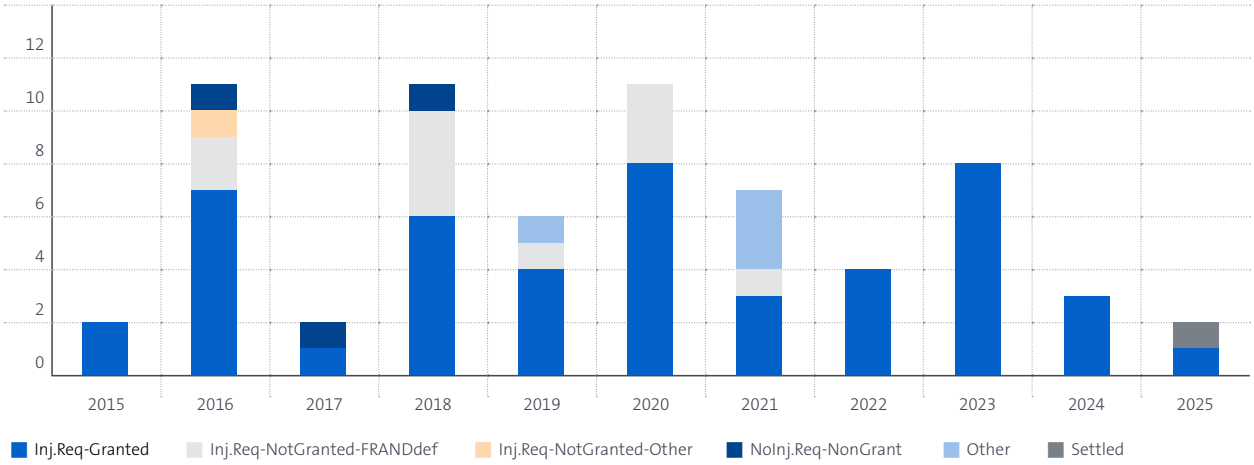
Note: See Box 12 for definitions of outcomes.

Figure 4.4.2 shows that, since its inception, the UPC has awarded three injunctions in SEP cases, and denied SEP holders' injunction requests in two other cases. In both of these, injunctions were denied for reasons other than a FRAND defence (one involved a preliminary injunction request being denied for lack of urgency; in the other, an application to amend was rejected). The UPC also awarded one anti-anti-suit injunction. Various other cases were settled before a decision on the merit, and six cases were pending at the end of the observation period.

4.4.3. Germany

Figure 4.4.3

Number of SEP disputes in Germany by outcome and year of decision



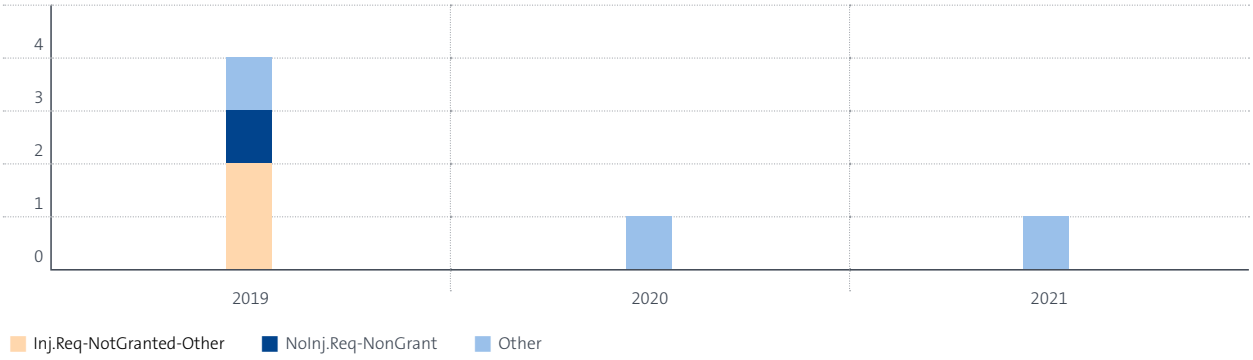
Note: See Box 12 for definitions of outcomes.

Figure 4.4.3 shows the distribution of German regional court decisions in the dataset. In Germany, SEP litigation is primarily related to the application of EU competition law and the application of the framework established by the CJEU in Huawei v ZTE. The dataset suggests that the vast majority of SEP litigations involve requests for an injunction. Since mid-2018, the vast majority of injunction requests have been granted. These findings add to the earlier results showing that Germany has a central role for patent owners and patent enforcement.

4.4.4. France

Figure 4.4.4

Number of SEP disputes in France by outcome and decision year



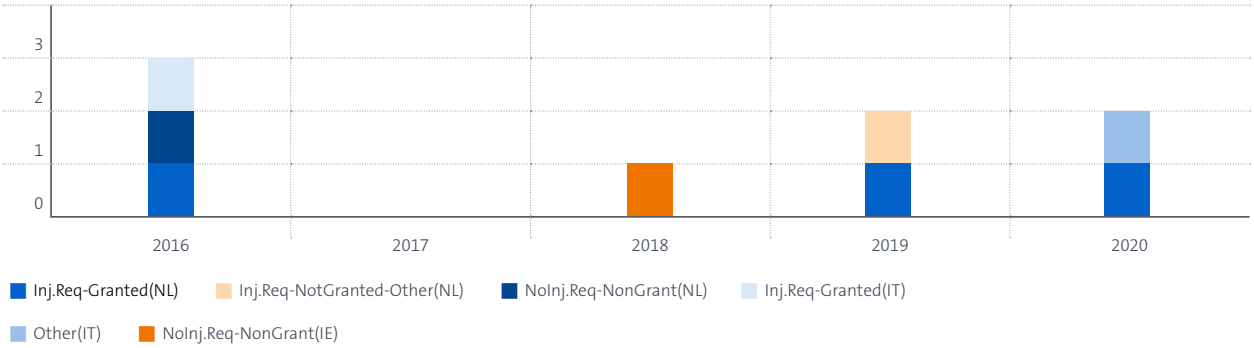
Note: See Box 12 for definitions of outcomes.

Figure 4.4.4 suggests that France has attracted a smaller number of disputes than Germany, the UK, or the UPC. The only requests for an injunction in the dataset involved preliminary injunction requests, with none being granted. One such case was settled, in one case the court found that the asserted patents were not essential, and in the remaining one the injunction was denied on proportionality considerations. In addition, there has been a larger number of cases brought by standards implementers; including cases in which implementers sought a court determination of FRAND rates. Nevertheless, unlike the situation in the UK, no French court has ever awarded FRAND rates for an SEP license.

4.4.5. The Netherlands, Italy and Ireland

Figure 4.4.5

Number of SEP disputes in the Netherlands, Italy, and Ireland by outcome and decision year



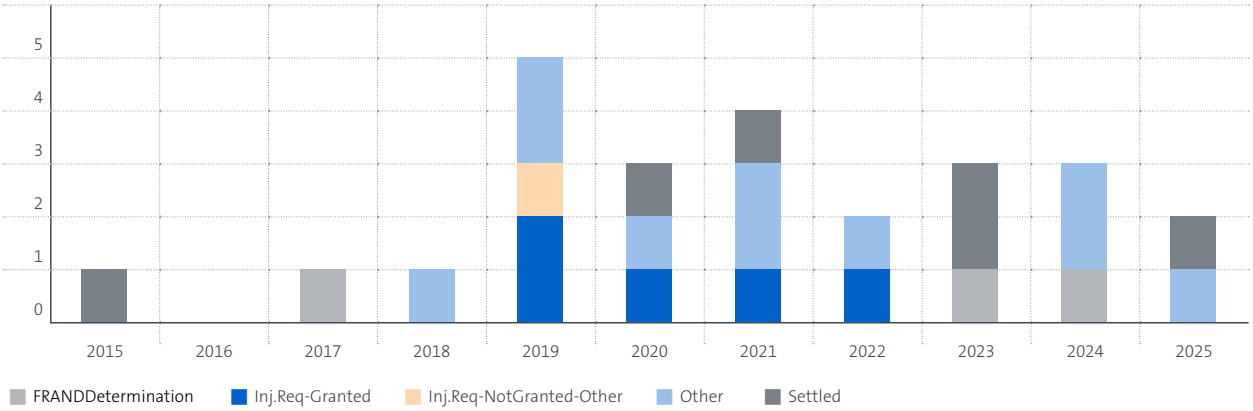
Note: See Box 12 for definitions of outcomes.

Figure 4.4.5 shows the outcomes of disputes in three other national jurisdictions in the EU, namely the Netherlands, Italy, and Ireland (please note that the colour coding for the decision is still the same as for the other figures, but using patterns to distinguish between the respective jurisdictions). Across the three, there is a small number of decisions, but a significant diversity of types and outcomes. SEP holders' requests for injunctions account for the majority of cases, in particular in the Netherlands, and in the majority of such cases injunctions were granted.

4.4.6. United Kingdom

Figure 4.4.6

Number of SEP disputes in the UK by outcome and decision year



Note: See Box 12 for definitions of outcomes.

Figure 4.4.6 shows a more diverse distribution of outcomes for the UK compared to other jurisdictions. The UK is for the time being the only European jurisdiction in which courts have determined FRAND rates for SEP licenses, with three such decisions in the dataset (Unwired Planet v Huawei, Interdigital v Lenovo and Apple v Optis). There were also a number of cases in which an injunction was granted, as well as "other" cases, e.g. involving anti-anti-suit injunctions or interim licenses.

4.5. The UPC's Patent Mediation and Arbitration Centre and alternative dispute resolution

One possible solution to the jurisdictional dilemma in resolving global FRAND disputes may lie in the use of alternative dispute resolution (ADR). This is not bound by the same territorial jurisdictional limitations as courts and offers additional flexibility and efficiency. Various forms of dispute resolution are available to parties other than litigation, in particular mediation and arbitration. ADR is supported by administrative and judicial bodies and institutions, not least the Unified Patent Court's Patent Mediation and Arbitration Centre.

Box 13: The UPC's Patent Mediation and Arbitration Centre (PMAC) and its potential for SEP dispute settlement

There is a substantial potential for ADR in SEP disputes, which currently seems to be underexploited.[10] It offers certain advantages that are particularly beneficial for settling SEP disputes. First, specialised neutrals can be selected which might have experience and profound knowledge of FRAND licensing. The process itself can be designed flexibly to meet the needs of the parties, e.g. by only focusing on certain claims and defences, or conducting proceedings in several stages. ADR procedures usually offer full confidentiality to protect sensitive information that is needed to reach a settlement, e.g. comparable licenses to determine a FRAND rate. Moreover, a typical global FRAND dispute can be settled in a single procedure, avoiding potentially divergent national judgements. ADR proceedings can thus save time and cost. If requested by the parties, the UPC can confirm by decision the terms of any settlement or arbitral award by consent. In addition, arbitral awards are internationally enforceable under the New York Convention. Finally, by subjecting themselves to a FRAND determination in ADR, parties can demonstrate their willingness to grant/take a FRAND licence in accordance with the legal framework set out by the CJEU in Huawei v ZTE.

In addition to these advantages that are associated with ADR in general, the PMAC will present a unique forum for settling FRAND disputes through mediation and arbitration as it will be operating under the umbrella of the UPC. Its judges will be encouraged to suggest parties to refer their dispute or parts thereof to the court's very own ADR Centre, where they deem mediation or arbitration to be a suitable means for resolving the dispute. The court could for example deal with questions of validity and infringement, while carving out the determination of FRAND licensing terms and conditions and referring this to mediation.

ADR proceedings could also use court orders issued by the UPC, for example introducing a strict confidentiality regime during the FRAND determination as regards third-party information such as comparable licenses.

The recently appointed director of the PMAC has announced the drafting of FRAND-specific procedural framework to be included in the Centre's Arbitration and Mediation Rules with a view to realising this potential for settling such disputes. The envisaged tailor-made rules could serve to even better accommodate the particularities of these disputes and is sending a clear signal that the PMAC is ready to handle SEP disputes.

[10] *Contreras/Newman*, Alternative Dispute Resolution and FRAND Disputes, The Cambridge Handbook of Technical Standardization Law (2018), p. 351 f.

5. Concluding remarks

Technology standards help drive innovation and growth by promoting the widespread adoption of interoperable and secure solutions. In turn, the patent system supports the development of technology standards by incentivising research and knowledge sharing. A transparent and balanced relationship between patent and standardisation systems, aligning incentives for optimal technical solutions with broad dissemination, is essential to strengthening Europe's competitiveness.

This study seeks to improve transparency in the relationship between standards and the European patent system. The extensive scope of the EPO's standard-related libraries naturally creates links between patents and standards, offering valuable opportunities for empirical analysis. Additionally, the establishment of the Unified Patent Court introduces a new efficient framework for resolving SEP-related disputes that merits attention, particularly considering also the potential of the UPC's Patent Mediation and Arbitration Centre.

The study leverages the EPO's unique collection of over 5.5 million standards-related documents collected from SDOs. Expert examiners rely on these databases to ensure that patents in standardisation-intensive fields are only granted for inventions which are novel and involve an inventive step, referencing SDO documents in a considerable number of search reports – as high as 30% in standardisation-intensive fields. Such examiner citations create a natural link between patents and standards that the EPO has compiled into a new dataset: the EPO Cited SDO Documents Dataset. The study offers new empirical evidence drawing on this new resource.

The dataset, which is publicly shared and available from epo.org/standards, has practical value for both SEP holders and implementers, who can use it to explore potential commercial or technological links between standard authors and patent applicants. In addition, it opens up new avenues for academic research on the interplay between standardisation and innovation. The dataset also provides a foundation for developing methods to predict essentiality based on observable patent-standard characteristics.

The study further presents new empirical insights into SEP litigation in Europe, highlighting the emerging role of the UPC. This is emerging as a central forum for resolving SEP disputes in Europe, absorbing much of the litigation previously handled by national courts in the EU Member States. Its early impact points to its potential for increased harmonisation. Looking ahead, the forthcoming launch of the Patent Mediation and Arbitration Centre in late 2025 is expected to further streamline dispute resolution, offering specialised alternative mechanisms for addressing SEP -related disputes.

Taken together, the findings highlight the strong potential of the EPO, the UPC and its forthcoming PMAC to enhance transparency and predictability in Europe's patent and standardisation landscape. The EPO can contribute by leveraging its internal infrastructure and procedures within the PGP to shed light on the link between patents and standards. Meanwhile, the UPC and the PMAC represent a move toward a more harmonised and effective framework for resolving SEP-related disputes.

The EPO Observatory on Patents and Technology (epo.org/observatory) supports the European innovation ecosystem by providing studies, data and tools. As part of its growing focus on the interplay between patents and standards, this study marks the EPO's first contribution to the topic. The EPO Cited SDO Documents Dataset will be regularly updated with new data releases. To further increase transparency, the EPO is developing a search tool that will enable users to determine connections between patents and standards. This will help licensees to help clarify if specific patents are linked to the standards they implement, and authors of standard contributions to ascertain whether their documents are cited by particular patents. In addition, a new section on the EPO's website now brings together all related resources on patents and standards (epo.org/standards).

ANNEX 1: EPO SDO data: sample descriptions

EPO search reports (Box 2)
The data are de-duplicated, preserving distinct citations per dossier. Duplicate citations arise mostly due to replenishments in PCT applications where citations in international application are reused in national (or regional) counterparts. They also occur due to applications spanning more than one publication (e.g. A1 publication of application with search report, followed by B1 publication of granted patent) and, to a lesser extent, publications that cite the same XP number more than once.

XP number ranges assigned to the SDO databases (Box 3)
Table A1.1 provides the XP number ranges assigned to the different SDO databases. These can be used to identify citations of documents in these databases from PATSTAT table TLS214_NPL_PUBLN.

Table A1.1

XP number ranges assigned to the SDO databases

SDO database	XP number range
XP3GPP2	[XP062000000- XP063999999]
XP3GPP	[XP050000000- XP052999999]
XPCRYPT	[XP061000000- XP061199999]
XPDVB	[XP017800000- XP017999999]
XPETSI	[XP014000000- XP014999999]
XPI3ES	[XP017600000- XP017799999] and [XP068000000- XP068999999]
XPIEC	[XP082000000- XP083999999]
XPIETF	[XP015000000- XP015999999]
XPITU	[XP017400000- XP017599999] and [XP044000000- XP046999999]
XPJPEG	[XP017200000- XP017399999]
XPM2M	[XP084000000- XP084999999]
XPOMA	[XP064000000- XP064999999]
XPVIDEO	[XP030000000- XP030999999]

Linking the EPO Cited SDO Documents Dataset to PATSTAT
The main data product created in this study is the **EPO Cited SDO Documents Dataset** described in Box 3, which includes 168 620 unique XP numbers assigned to documents in the SDO Databases cited in TLS214_NPL_PUBLN (PATSTAT table of cited non-patent literature).

To study citation patterns we create a second dataset, which we refer to as the **SDO Citations Dataset**, which contains citations to the documents included in the EPO Cited SDO Documents Dataset. The linking variable between the two datasets is the XP number identifier **xpnr**. Note that this second dataset is not original per se as it is possible for users to obtain it by directly linking the EPO Cited SDO Documents Dataset to PATSTAT.

This second dataset is created by combining several PATSTAT tables including the ones reported in Table A1.2 and a few more: we include information on the examiner citation categories (X, Y, etc.) mentioned in each publication from TLS215_CITN_CATEG (we collapse the information at the publication level if multiple categories are cited by a given publication); we add in information on the first applicant for each publication from TLS227_PERS_PUBLN and TLS206_PERSON; we add in information on the

main technology class per application from the tables TLS209_APPLN_IPC, TLS230_APPLN_TECHN_FIELD and TLS901_TECHN_FIELD_IPC.

After removing duplicates (the de-duplication process is described below), the final data in the SDO Citations Dataset includes 417 951 citations by 192 489 distinct publications (190 116 distinct patent applications, since some applications have multiple publications citing different XP numbers, which we do not treat as duplicates) to 168 620 distinct XP numbers in the SDO Databases. The unit of observation is at the CITN_ID - PAT_PUBLN_ID pair level, which identifies distinct citations.

Note that the **SDO Citations Dataset** differs from the dataset described in Box 2 (used in the analysis conducted in Subsection 2.2) in two main aspects. First, the sample described in Box 2 includes search reports by the EPO whereas the PATSTAT data also includes citations originating from other sources (other offices on top of EPO and other actions on top of search reports). Second, the data described in Box 2 is based on completed search reports by the end of 2024, some of which might not have resulted in published applications or granted patents yet. Instead, the **SDO Citations Dataset** includes only published documents (published applications or granted patents).

Table A1.2

Citations to XP-numbers in SDO Database by originating office and action

EPO Cited SDO Documents Dataset	**SDO Citations Dataset**			
src	TLS214_NPL_PUBLN	TLS212_CITATION	TLS211_PAT_PUBLN	TLS201_APPLN
docn (XP_NR)	**NPL_PUBLN_ID**	**PAT_PUBLN_ID**	**PAT_PUBLN_ID**	**APPLN_ID**
xpnr	**XP_NR**	CITN_REFTYPE	PUBLN_AUTH	APPLN_AUTH
stdn	NPL_TYPE	CITN_ID	PUBLN_NR	APPLN_NR
pd	NPL_BIBLIO	CITN_ORIGIN	PUBLN_NR_ORIGINAL	APPLN_KIND
orefd	NPL_AUTHOR	CITED_PAT_PUBLN_ID	PUBLN_KIND	APPLN_FILING_DATE
onlined	NPL_TITLE1	CITED_APPLN_ID	**APPLN_ID**	APPLN_FILING_YEAR
author	NPL_TITLE2	PAT_CITN_SEQ_NR	PUBLN_DATE	IPR_TYPE
sdotype	NPL_EDITOR	**CITED_NPL_PUBLN_ID**	PUBLN_LG	RECEIVING_OFFICE
doctype	NPL_VOLUME	NPL_CITN_SEQ_NR	PUBLN_FIRST_GRANT	EARLIEST_FILING_DATE
tien	NPL_ISSUE	CITN_GENER_AUTH	PUBLN_CLAIMS	EARLIEST_FILING_YEAR
nofpages	NPL_PUBLN_DATE			EARLIEST_PUBLN_YEAR
pages	NPL_PUBLN_END_DATE			GRANTED
idxwords	NPL_PUBLISHER			DOCDB_FAMILY_ID
pubdata	NPL_PAGE_FIRST			INPADOC_FAMILY_ID
sdosimilaritykey	NPL_PAGE_LAST			
meetingnum	NPL_ABSTRACT_NR			
conference	NPL_DOI			
confend	NPL_ISBN			
confstart	NPL_ISSN			
url	ONLINE_AVAILABILITY			
workgroup	ONLINE_CLASSIFICATION			
sdotechcategory	ONLINE_SEARCH_DATE			
mpeggroup				
mpegsec				

Removing duplicate citations (Box 3)

To obtain the **SDO Citations Dataset** we remove some duplicate citations in the data resulting from merging the different PATSTAT tables. The original data includes 533 548 observations by 223 456 citing applications to 168 620 cited SDO documents through 273 648 unique NPL references. However, some of these citations include duplicates (understood as same documents citing the same XP number). We de-duplicate the data based on three steps:

Step 1: Drop replenished citations (PCT Applications with dual publications)

The first step in the de-duplication process targets replenished citations, which arise in the context of PCT (Patent Cooperation Treaty) applications. Specifically, these are citations where the same invention is published both as a WO (international publication) and later at national or regional levels (e.g., EP, US). These records are typically identified by a citation origin marked as ISR (International Search Report). Since the same prior art is cited in both the international and national/regional publications, retaining both records introduces redundancy without adding new information. Therefore, only the citation from the original publication (usually the WO document) is kept, and all corresponding national or regional duplicates are dropped. Importantly, this step does not remove XP numbers themselves or merge distinct citations. However, it eliminates duplicate records that refer to the same XP number but through different appln_id or pat_publn_id identifiers (and hence eliminates a few distinct appln_id and pat_publn_id identified as duplicates). As a result, 112 725 duplicate citations are removed in this phase.

Step 2: Consolidate XP numbers with multiple cited_npl_publn_id identifiers

Despite the initial clean-up, some duplication still exists at the level of publication and XP number pairing. In these cases, the same XP number (used to identify non-patent literature, often from standards or technical documents) appears to be linked to different values of cited_npl_publn_id, suggesting that the same document is erroneously stored under multiple identifiers. These duplications occur primarily in citations originating from APP (applicant filings) or ISR sources. Since these entries point to the same underlying document, only the first citation to a given XP number is retained, and any subsequent ones (from different reports or publication versions) are discarded. This helps streamline the dataset and ensures a one-to-one mapping between each XP number and its associated NPL identifier. This step removes an additional 2 074 duplicate citations.

Step 3: Remove redundant XP citations across multiple publications of the same application

The final stage addresses situations where a single patent application has multiple publications, and these publications redundantly cite the same XP number. While having multiple publications per application is common (e.g., A1, B1, etc.), citing the same XP number across these publications can result in unnecessary repetition. This step specifically targets such redundancies within the same application, ensuring that each XP number is cited only once. To perform this filtering, publications are sorted by appln_id, xp_nr, and publn_kind, and only the first publication kind citing the XP number is retained. Importantly, if different XP numbers are cited across the publications of a single application, these are not removed (only the duplicates are removed). This final clean-up eliminates 798 duplicates.

Citations of XP numbers in SDO database by originating office and action (Box 3)

Table A1.3 provides some detail on the origin of the 417 951 de-duplicated citations to XP numbers in the EPO Cited SDO Documents Dataset. Note that not all the citations to XP numbers originate from EPO. Some originate from other offices, which is possible because the EPO shares access to some SDO databases with other major patent offices, notably the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), and the China National Intellectual Property Administration (CNIPA). Some citations are made directly by applicants, in applications where the application authority is the US, who reuse XP numbers previously cited by examiners. The originating citing sources are reported in Table A1.3. Most documents are cited by search reports, and other office actions, from the EPO. However, a significant number of citations originate from search reports and other actions from other offices or by applicants reusing XP numbers.

Table A1.3

Citations of XP numbers in SDO database by originating office and action

Originating action	EPO	Other offices	Applicants
National or regional search report (SEA)	138 258	2 567	
International search report (ISR)	89 454	104 293	
Examination (EXA)	9 277	73	
Other	687	280	
Total	**237 684**	**180 267**	**73 062**

Note: The table reports the number of citations by originating office and action, building on the deduplicated dataset including 417 951 distinct citations. A subset of citations are made directly by applicants, all from applications where the application authority is the US, even though they originate from search reports that cite NPL in EPO libraries (and hence have an associated XP number) but are then used by applicants.

Applicability of variables in the EPO Cited SDO Documents Dataset (Box 3)

Table A1.4

Applicability of variables in the EPO Cited SDO Documents Dataset by SDO database

	stdn	sdotype	doctype	pages	idxwords	sdosimilaritykey	meetingnum	conference	confend	confstart	url	workgroup	sdotechcategory	mpeggroup	mpegsec
XP3GPP	x	x	x	x	x	x		x			x	x	x		
XP3GPP2	x	x	x	x		x						x	x		
XPCRYPT		x	x	x	x	x		x			x	x	x		
XPDVB	x	x			x	x					x		x	x	
XPETSI	x	x	x	x	x	x					x	x	x		
XPI3ES	x	x	x	x	x	x					x	x	x		
XPIEC			x	x							x				
XPIETF	x	x	x	x	x	x					x		x		
XPITU	x	x	x	x		x					x		x		
XPJPEG	x		x												
XPM2M	x	x	x	x	x	x		x			x	x	x		
XPOMA	x	x	x	x		x					x		x		
XPVIDEO	x	x				x	x		x	x	x		x	x	x

ANNEX 2: Litigation data

SEP data

The study identifies data on potential SEPs from two sources: first, ETSI's Special Report SR 000 314 V2.35.1 (2024-04), representing a snapshot of ETSI's database and all potential SEPs disclosed to ETSI up to April 2024; second, pool patent lists for AVC and HEVC from the websites of the pool licensing administrators (Access Advance and Via LA). In both cases, the study extracts all patent numbers with any of the following application authority codes: EP, DE, NL, FR, IT and GB; as well as US (for general comparison). In total, the study identifies 54 568 patent or application publication numbers; including 45 557 from ETSI and 9 011 from patent pools.[11] In the following, the study will simply refer to potential SEPs, which is meant to encompass both declared SEPs from ETSI disclosure data and pool patents from the pool licensing administrators' websites.

In other cases, the study manually identifies SEP disputes from patent litigation data. The data on SEP litigation at the UPC as well as national courts in Europe thus also include (some) SEP litigation related to other standards, such as WiFi and Qi Wireless Charging. The number of observations related to these "other" potential SEPs is small, giving us some reassurance that the data on ETSI/3GPP cellular communications technology and AVC/HEVC video coding technology indeed account for the vast majority of SEP litigation in Europe over the observation period from 2015 to 2025. Consequently, the study largely excludes SEPs outside of ETSI/3GPP and the AVC/HEVC video codec patent pools. To make the data more directly comparable, the study thus also produces data on SEP-related orders and decisions at the UPC that exclude "other" SEPs from the sample.

Patent litigation data

With respect to patent litigation data for the period 2015 to 2025, the study relies on a dataset of potential SEP litigations covering the following jurisdictions and types of proceedings:

- **UPC:**
- All orders and decisions published on the UPC website.[12]
- "Opt-outs" of EPs from UPC jurisdiction[13]

The study uses the full list of published UPC orders and decisions from the UPC website (last consulted on March 14, 2025), including 894 orders and decisions. The data sampling included manually searching this data for SEP litigations. The study identifies a decision as being related to SEP litigation using information on the name of the parties together with press coverage of the UPC caselaw, which additionally was confirmed by searching the decisions for information about this being a SEP litigation dispute. The study identifies 123 orders and decisions as being related to SEP litigation.

For the opt-out analyses, the study relies on the approach of Gamarra (2024) and uses data from the Docket Navigator Research Database.[14] It relies on all opt-outs until June 2024, retrieving 612 890 opt-outs. Next, it matches these patent numbers to PATSTAT, as well as ETSI's Special Report. The final opt-out dataset contains 1 904 000 EPs, including 30,857 EPs declared potentially essential at ETSI.

– National courts of France, Germany, Ireland, Italy, the Netherlands, and the UK.

National litigation data covers patent litigation in civil courts, including first instance, court of appeal, and Supreme Court decisions.

For the UK disputes, the data were collected from Bristows[15] and Baili.[16] It covers a total of 105 cases, including dispute references, judgment dates, links to the judgment documents, names of the parties involved and the types of judgments. Subsequently, the study identifies SEP-related disputes.

[11] The number of patent numbers in the dataset is distinct from the number of unique patents. The study has included both application and patent publication numbers.

[12] See: https://www.unified-patent-court.org/en/registry/cases.

[13] See: https://www.unified-patent-court.org/en/registry/opt-out.

[14] See: Hopkins Bruce Publishers Corporation. Docket Navigator Research Database, 2024. URL: https://search.docketnavigator.com/upc/opt-outs.

[15] See : https://www.bristows.com/expertise/litigation-dispute-resolution/sep-frand-disputes/.

[16] See: https://www.bailii.org/.

SEP litigation (and patent litigation more generally) in national courts in the EU is difficult to study as there is no comprehensive dataset of asserted patents and not all court decisions in patent litigation disputes are published. In general, the study identifies SEP litigation disputes in Germany, the Netherlands, France, Italy and Ireland using a combination of literature review, snowball sampling, media coverage (including FOSS Patents, IP fray, Juve Patent and IAM), and the SEP case law overviews offered by the 4ip Council, the Japanese Patent Office, and law firms such as Kather Augenstein and Bristows.
Next, sampling included searching for the text of the decision in the official legal databases of the national courts. If unsuccessful, an online search was conducted to find a copy of the decision from any other publicly available source.

For SEP litigation disputes in Germany, the study used and extended the dataset described in Baron et al. (2024), which includes 80 decisions of German regional courts in injunction disputes. It updated and extended this dataset to also include other types of SEP-related litigation (including, e.g., disputes involving anti-suit injunctions or injunction disputes that did not reach a FRAND defence analysis because the patent was found not to have been infringed). It also added Higher Regional Court and Federal Court of Justice decisions. For other EU Member States we built a new dataset based on the (limited) data available in the aforementioned sources. For the UK it followed the same process as for the EU Member States, but identified most of the observations in the dataset from Bristows.

In total, the study collected 101 SEP disputes across different countries and jurisdictions. The respective data is broken down in Table A2.1, covering all respective disputes numbers by country and the UPC.

Table A2.1

Litigation data including the respective docket numbers by country and the UPC

Cases	UPC	DE	UK	FR	NL	IT	IE
Advanced Standard Communication v Xiaomi	ACT_57903/2024*						
Apple v Qualcomm		7 O 14461/17; 7 O 14456/17	[2018] EWHC 1188 (Pat); [2018] EWHC 2711 (Ch)				
Atlas Global v TP Link	ACT_41356/2024; ACT_41396/2024*	7 O 4832/23					
Avago v Netflix		7 O 12200/21; 7 O 1971/22					
Avago v Stellantis	ACT_52765/2024*						
Avago v Tesla	ACT_462984/2023; ACT_463258/2023; ACT_24735/2024	21 O 1020/23; 21 O 2030/23; 7 O 23/23					
Conversant Wireless Licensing v Daimler et al.		21 O 11384/19					
Conversant Wireless Licensing v Huawei, ZTE		4b O 30/18	[2018] EWHC 808 (Pat); [2018] EWHC 3549 (Ch); [2018] EWHC 1216 (Ch); [2018] EWHC 2549 (Ch); [2019] EWCA Civ 38; [2019] EWHC 1687 (Pat); [2019] EWHC 3471 (Pat); [2020] EWHC 728 (Pat); [2020] EWHC 741 (Pat); [2020] UKSC 37-2				
Conversant Wireless Licensing, Nokia v ZTE		4b O 6/19					

Cases	UPC	DE	UK	FR	NL	IT	IE
Core Wireless Licensing v LG Electronics				RG 15/17037			
Datang v Samsung		21 O 16085/22					
Dolby v ASUSTek	ACT_590109/2023						
Dolby v HP	ACT_590145/2023						
Dolby v Mas Elektronik		4c O 44/18					
Dolby v Optoma	ACT_26489/2024						
Dolby v Roku	ACT_27821/2024*						
Dolby v TCT Mobile		4b O 23/20; 4b O 49/20					
Ericsson v ASUSTek	ACT_35574/2024; ACT_35575/2024; ACT_63643/2024						
Ericsson v Lenovo	ACT_5326/2024; ACT_5324/2024; ACT_47298/2024		[2023] EWHC 3222 (Pat); [2024] EWHC 846 (Ch); [2024] EWCA Civ 1100; [2024] EWHC 2941 (Pat); [2024] EWHC 1267 (Ch)				
France Brevets v Ingram Micro Mobility Germany		4b O 16/16					
Fraunhofer v ZTE		4a O 15/17					
GE Video Compression et al. v Novatek, Vestel		4c O 42/20					
GE Video Compression v Mas Elektronik		4c O 56/18					
GE Video Compression v TCL		21 O 4140/21					
GE Video Compression, Boston Scientific v Xiaomi		4c O 73/20					
Huawei v Amazon		7 O 10988/22					
Huawei v AVM		21 O 2576/22					
Huawei v Netgear	ACT_459771/2023; ACT_18917/2024						
Intellectual Ventures II v Deutsche Telekom		4c O 72/17					
Intellectual Ventures II v Telefónica Germany		4c O 77/17					
Intellectual Ventures II v Vodafone		4c O 81/17					2016 5102P, [2017] IEHC 160
InterDigital v Lenovo, Motorola		7 O 12029/23; 7 O 91/22	[2020] EWHC 1318 (Pat); [2021] EWHC 89 (Pat); [2021] EWHC 3192 (Pat); [2021] EWHC 3401 (Pat); [2023] EWHC 539 (Pat); [2023] EWHC 1577 (Pat); [2023] EWHC 1578 (Pat); [2023] EWHC 3212 (Pat); [2024] EWHC 742 (Pat); [2024] EWCA Civ 743				
InterDigital v OnePlus, Oppo		7 O 17302/21	[2022] EWCA Civ 166; HP-2021-000047				
InterDigital v Xiaomi Communications		7 O 14276/20					
InterDigital, Avanci v Tesla			[2024] EWHC 1815 (Ch)				
Invensas v Broadcom		7 O 98/16					
IP Bridge 1 v HTC		7 O 165/16					

Cases	UPC	DE	UK	FR	NL	IT	IE
IP Bridge 1 v Huawei		4c O 3/17; 4b O 4/17; 7 O 36/21	[2021] EWHC 1261(Pat); [2021] EWHC 2826 (Pat); [2022] EWHC 1766 (Pat)				
IP Bridge 1 v TCT Mobile, Anonymous		2 O 136/18; 2 O 98/16					
IP Bridge 1 v ZTE		4b O 5/17; 7 O 13016/21					
IPcom v HTC		7 O 38/14	[2020] EWHC 2941 (Pat)			60228/2010 R.G.// it-mil-60228-10	
IPcom v Lenovo, Motorola			[2019] EWHC 3030 (Pat); [2019] EWHC 3030 (Pat)	RG 19/59311; RG 19/21426; RG 19/60318			
IPcom v Vodafone			[2019] EWHC 1255 (Pat); [2021] EWCA Civ 205				
IPcom v Xiaomi			[2019] EWHC 3074 (Pat)	RG 19/60317			
Kigen v Thales			[2022] EWHC 2846 (Pat); [2023] EWHC 313 (Pat)				
KPN v Oppo	ACT_53784/2024; ACT_49150/2024*						
LG v Anonymous		2 O 131/19					
Mitsubishi v Huawei		4c O 12/17					
Mitsubishi, Sisvel v Archos et al.		4c O 75/20	[2019] EWHC 3477 (Pat); [2020] EWHC 2177 (Ch (Pat); [2020] EWHC 2641 (Pat); [2020] EWHC 2641 (Pat); [2021] EWHC 493 (Pat); [2021] EWHC 889 (Pat); [2021] EWHC 1541 (Pat)				
NEC v TCL	ACT_595922/2023; ACT_596658/2023; ACT_16417/2024						
Nokia v Amazon	ACT_584119/2023	4c O 50/23; 4c O 49/23	[2024] EWHC 1921(Pat); [2024] EWHC 2339 (Pat); [2025] EWCA Civ 43				
Nokia v Continental		21 O 9333/19					
Nokia v Daimler et al.		2 O 34/19; 21 O 3891/19; 4c O 17/19; 7 O 3890/19					
Nokia v HP	ACT_588466/2023						
Nokia v Lenovo		21 O 13026/19					
Nokia v Oppo et al.		2 O 75/21; 21 O 11522/21; 21 O 8879/21; 21 O 8891/21; 2 O 95/21; 2 O 107/21; 2 O 74/21	[2021] EWHC 2952 (Pat); [2022] EWHC 293 (Pat); [2022] EWHC 1745 (Pat); [2022] EWCA Civ 947; [2022] EWHC 3395 (Pat); [2023] EWHC 23 (Pat); [2023] EWHC 1912 (Pat); [2023] EWHC 2250 (Pat); [2023] EWHC 2871 (Pat)				
Nokia v Reflection Investment		21 O 8890/21; 2 O 113/21; 2 O 96/21					
Nokia v Sunmi	ACT_7300/2025						
Nokia v Verifone	ACT_13475/2024; ACT_13491/2024						

Cases	UPC	DE	UK	FR	NL	IT	IE
Nokia v Vivo		2 O 36/22; 2 O 37/22; 2 O 65/22					
NTT Docomo v HTC		7 O 66/15					
Optis v Apple			[2019] EWHC 1742 (Pat); [2019] EWHC 3538 (Pat); [2020] EWHC 214 (Pat); [2020] EWHC 2033 (Pat); [2020] EWHC 2425 (Pat); [2021] EWHC 1739 (Pat); [2021] EWHC 2080 (Pat); [2021] EWHC 2564 (Pat); [2022] EWHC 422 (Pat); [2022] EWCA Civ 1411;HP-2019-000006;[2024] EWHC 197 (Ch)				
Panasonic v Huawei		4b O 15/17					
Panasonic v Oppo	ACT_545535/2023; ACT_545551/2023; ACT_545604/2023; ACT_545620/2023; ACT_546122/2023; ACT_545770/2023						
Panasonic v Xiaomi	ACT_545562/2023; ACT_545606/2023; ACT_545615/2023; ACT_545619/2023; ACT_546092/2023; ACT_36390/2024; ACT_36396/2024; ACT_36403/2024; ACT_36410/2024; ACT_545817/2023; ACT_36412/2024; ACT_36422/2024		[2023] EWHC 2249 (Pat); [2024] EWHC 1733 (Pat); [2024] EWCA Civ 1143				
Panasonic v ZTE		4b O 16/17					
Philips v Archos		7 O 19/16; 7 O 209/15			C/09/505587/ HA ZA 16-206		
Philips v Asus, HTC		7 O 31/16; 4c O 12/16; 7 O 238/15; 7 O 29/16	[2018] EWHC 1224 (Pat); [2020] EWHC 29 (Ch)		C 09 512839/ HA ZA 16-712		
Philips v Belkin	ACT_459762/2023; ACT_583273/2023; ACT_9332/2025; ACT_463961/2023						
Philips v Harman		4a O 23/17					
Philips v Mas Elektronik		4c O 69/18					
Philips v Oppo			[2022] EWHC 1703 (Pat)				
Philips v TCL		4b O 83/19	[2020] EWHC 2553 (Ch)	RG 19/02085			
Philips v Wiko		7 O 18/17; 7 O 43/16; 7 O 44/16; 7 O 212/15; 2 O 229/15			19/04503; C/09/511922/ HA ZA 16-623; 200.219.487/01		
Philips v Xiaomi			[2021] EWHC 2170 (Pat)	RG 20/12558			
Pioneer v Acer		7 O 96/14					
Pioneer v Asus		7 O 28/16; 7 O 97/14					
Polaris Innovations v Anonymous, Nvidia		4b O 144/16					
Qualcomm v Transsion	ACT_39916/2024; ACT_40035/2024; ACT_40121/2024; ACT_41607/2024; ACT_39943/2024						

Cases	UPC	DE	UK	FR	NL	IT	IE
Saint Lawrence Communications v Deutsche Telekom		2 O 106/14					
Saint Lawrence Communications v HTC, Vodafone		4a O 126/14; 4a O 73/14					
Sharp v Daimler		7 O 8818/19					
Sisvel v Haier		4a O 144/14; 4a O 93/14					
Sisvel v Sun Cupid					C/09/582418/ HA ZA 19-1123		
Sisvel v Wiko		7 O 115/16		RG 2016F01637			
Sisvel v Xiaomi					C/09/573969/ KG ZA 19-462; C/09/574487/ KG ZA 19-487		
Sisvel v ZTE		4a O 16/16; 4a O 35/16; 4a O 27/16; 4a O 154/15				30308/20215 R.G.// it-tor-30308-15; 2695/2016 R.G.// it-tor-02695-16	
Sony v Acer		7 O 24/14					
Sony v Asus		7 O 26/14					
Sun Patent Trust v Roku	ACT_36560/2024; ACT_29956/2024*						
Tagivan II v Huawei		4a O 17/17; 4a O 63/17					
Tagivan II v ZTE		4a O 16/17					
TQ Delta LLC v Zyxel Communications			[2018] EWHC 1515(Ch); [2018] EWHC 3651 (Pat); [2019] EWHC 353 (Pat); [2019] EWHC 562 (Pat); [2019] EWHC 745 (Pat); [2019] EWHC 1089 (Pat); [2019] EWHC 1089 (Pat)				
Unwired Planet v Huawei		4b O 52/14; 4b O 49/14; 4b O 51/14	[2015] EWHC 3366 (Pat); [2016] EWHC 94 (Pat); [2016] EWHC 576 (Pat); [2018] EWCA Civ 2344; [2020] UKSC 37				
Unwired Planet, Ericsson v LG Electronics		4b O 157/14; 4b O 156/14; 4b O 154/14					
Vestel v Access Advance, Philips			[2019] EWHC 2766 (Ch); [2021] EWCA Civ 440				
Voiceage EVS v HMD Global		7 O 15350/19; 7 O 14091/19					
Voiceage EVS v Honor		21 O 5693/22; 21 O 15301/22					
Voiceage EVS v OPPO		21 O 1910/22; 21 O 1890/22					
VRINGO Infrastructure v ZTE			[2014] EWHC 3924 (Pat); [2015] EWHC 214 (Pat); [2015] EWHC 1704 (Pat)				
ZTE v Samsung	ACT_68656/2024; ACT_68534/2024*						

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