Methodologies for FRAND determination: evidence from global case law

A survey of court cases around the world involving the determination and assessment of fair, reasonable and non-discriminatory (FRAND) terms and conditions for the licensing of standard-essential patents

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Foreword

Technology standards are drivers of the digital economy and economic progress. The patent system plays a key role in standardisation by incentivising the research and development needed to bring the best technical solutions into standards. A balanced framework for licensing standard-essential patents (SEPs), one that rewards investment in high-quality technical solutions while ensuring that implementers can access standards on fair terms, is essential to strengthening Europe's competitiveness.

Fair, reasonable and non-discriminatory (FRAND) licensing commitments are designed to preserve this balance. However, FRAND commitments do not prescribe a fixed royalty rate, and most SDOs deliberately refrain from providing a more specific definition. This flexibility has the advantage of allowing licensing terms to reflect the circumstances of each case, but it can also give rise to disagreements over what constitutes FRAND terms and conditions. Such disagreements may prolong negotiations and, in some cases, lead to litigation. Greater clarity regarding how FRAND rates are determined is therefore valuable for SEP holders, implementers, courts, competition authorities and policymakers.

The Patents and standards programme at the EPO Observatory on Patents and Technology, aims to improve transparency and predictability in the relationship between patents and standards. Following the publication of "Standards and the European patent system" and the launch of the Patents Standard Explorer, the present study turns to the licensing of standard-essential patents. It examines how courts around the world determine FRAND terms based on the most comprehensive global corpus of judicial FRAND determinations compiled to date. This study, prepared in collaboration with BRELA, sets out to make that information more accessible to the broader community. It does not advocate for any particular methodology; rather, it seeks to describe how courts have approached FRAND determinations in practice.

The study shows that, despite differences in legal frameworks, courts share a common understanding of FRAND as a mechanism to balance fair compensation for patent owners with broad access to standards for implementers. It also shows that FRAND case law is moving from defining licensing conditions in the abstract to applying them through concrete methodologies. Comparable licences have emerged as the main method relied on by courts, while the top-down approach is used less frequently and often as a cross-check. Both approaches raise implementation challenges, from selecting and adjusting complex agreements to determining aggregate royalty rates and apportioning them to the relevant portfolio. Patent data is central to both methodologies, although several indicators remain contested. Future work under the Patents and standards programme will continue to support users of the system by improving access to relevant information and analytical tools.

This project was carried out in collaboration with 17 national patent offices across Europe: Austria, Belgium, Bulgaria, Croatia, Czech Republic, Finland, France, Germany, Italy, Latvia, Luxembourg, the Netherlands, Portugal, Spain, Sweden, Türkiye and the United Kingdom. We look forward to continuing this fruitful co-operation as we expand our efforts to improve knowledge and tools at the intersection of patents, standards and innovation.

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List of abbreviations

ADR	Alternative dispute resolution
ARR	Aggregate royalty rate
ASP	Average selling price
AVC	Advanced Video Coding
CCI	Competition Commission of India
CDMA	Code-division multiple access
CJEU	Court of Justice of the European Union
DPU	Dollar-per-unit
DSL	Digital Subscriber Line
DVD	Digital versatile disc
ECPR	Efficient component-pricing rule
EDGE	Enhanced Data rates for GSM Evolution
EMVR	Entire market value rule
EPO	European Patent Office
ETSI	European Telecommunications Standards Institute
EU	European Union
EVC	Essential Video Coding
EVS	Enhanced Voice Services
FRAND	Fair, reasonable and non-discriminatory
FTC	Federal Trade Commission (United States)
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
HEVC	High Efficiency Video Coding
HPA	Huawei patent analysis
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IPR	Intellectual property rights
ISO	International Organization for Standardization
ITC	International Trade Commission (United States)
ITU	International Telecommunication Union
IVR	Incremental value rule
JEDEC	Joint Electron Device Engineering Council
JPO	Japanese Patent Office
LTE	Long-Term Evolution
MNPA	Modified numeric proportionality approach
MPEG	Moving Picture Experts Group
ND	Non-discriminatory
NDRC	National Development and Reform Commission (China)
NPV	Net present value
NSP	Net selling price
PLA	Patent licence agreement
PMAC	Patent Mediation and Arbitration Centre
PSR	Portfolio strength ratio
R&D	Research and development
RAND	Reasonable and non-discriminatory
SDO	Standards development organisation
SEP	Standard-essential patent
SPC	Supreme People's Court (China)
SSO	Standards-setting organisation
SSPPU	Smallest saleable patent-practising unit
TDoc	Technical document (3GPP standardisation contribution)
TFEU	Treaty on the Functioning of the European Union
UMTS	Universal Mobile Telecommunications System
UPC	Unified Patent Court
UPCA	Unified Patent Court Agreement
USITC	United States International Trade Commission
VVC	Versatile Video Coding
WACC	Weighted average cost of capital
WAPI	WLAN Authentication and Privacy Infrastructure
WCDMA	Wideband Code-Division Multiple Access
WIPO	World Intellectual Property Organization
WLAN	Wireless local area network
WTO	World Trade Organization

List of countries

CN	China
DE	Germany
FR	France
IN	India
IT	Italy
JP	Japan
NL	Netherlands
UK	United Kingdom
US	United States

Executive summary

Technology standards underpin much of the modern digital economy, enabling interoperability across connectivity and multimedia technologies such as 5G, Wi-Fi and the major video codecs. These standards routinely incorporate patented inventions since patents provide the incentive to invest in the research and development on which standards depend. This creates an inherent tension between rewarding that innovation and ensuring the widest possible access to the resulting standard. To preserve this balance, standards development organisations (SDOs) require participants to commit to licensing their standard-essential patents (SEPs) on fair, reasonable and non-discriminatory (FRAND) terms.

The FRAND commitment, however, does not prescribe a single fixed royalty rate, and most SDO policies deliberately refrain from providing a more specific interpretation of FRAND. The lack of a specific definition of FRAND allows for a range of permissible outcomes depending on the circumstances of the case. Because the content of FRAND is left undetermined, SEP holders and implementers disagree on occasion over what terms a given licence should carry. Such disagreement raises the cost of licensing by prolonging negotiations and, when bilateral negotiation fails, it can escalate into litigation. Greater clarity on how FRAND terms are determined may therefore be of considerable benefit to all parties by reducing both the duration and the cost of reaching agreement.

The meaning of FRAND has been concretised over time through court decisions, scholarship and policy guidance. A substantial body of literature has reviewed these contributions, explaining why FRAND matters and identifying the methods courts tend to favour. Nevertheless, important gaps remain. Existing reviews often cover selected decisions rather than a comprehensive and consistently assembled corpus of case law. Therefore, there is a lack of evidence showing how consistently methods are applied across decisions and how robust the underlying data and indicators are. Furthermore, existing reviews rarely examine how patent data is used to apportion value, scale between portfolios and unpack existing licences. Such uses of patents data (which are not limited to any specific methodology for the determination of FRAND rates) have important implications for the reliability of FRAND determinations.

This study intends to fill these gaps. It assembles the most comprehensive global corpus of judicial FRAND determinations to date and covers 65 court documents across seven jurisdictions. It analyses this corpus systematically to identify the methodologies that courts use, the principles and frameworks within which they operate, and the points of convergence and divergence across jurisdictions. It pays particular attention to how these methodologies are applied in practice and to the role of patent data within them. The study examines how essentiality, validity and patent valuation are used in apportionment, scaling and the unpacking of comparable licences. The goal of the study is empirical and descriptive – it presents the methodologies that courts have adopted in different cases and analyses the challenges and issues of different approaches, but it does not seek to draw legal conclusions on the current status of the case law of any individual jurisdiction.

The study forms part of the EPO's "Patents and standards" programme run under its Observatory on Patents and Technology, which aims to improve transparency regarding the relationship between patents and standards. The programme pursues dialogue with a broad range of stakeholders, including SEP implementers, SEP holders, licensing pools and standard development organisations. This study arises from that context and has benefited from that exchange. Prior initiatives within the programme include the 2025 study "Standards and the European patent system" and the Patent standards explorer.

Key findings

1 The study assembles the most comprehensive global corpus of judicial FRAND determinations to date, spanning 65 court decisions across seven jurisdictions.

To map how courts worldwide determine FRAND terms, the study collates 65 court decisions, including different types of court orders and guidelines, across seven jurisdictions into three categories. The first category comprises cases in which a court itself sets a FRAND rate. This category includes 20 cases and 33 reasoned decisions, counting first-instance and appeal decisions separately when the rate-setting analysis appears at both stages. For this category, the collection aims to be exhaustive, with a cut-off date of March 2026. The second category, which accounts for 19 decisions, covers FRAND rate assessments, i.e. decisions on whether a given rate or offer is FRAND. The third contains 13 documents on the admissibility of specific methods, mainly US court decisions on *Daubert motions*, as well as court guidelines from other jurisdictions. The second and third categories represent a non-comprehensive sample of decisions that is intended to illustrate a broad range of methodological aspects of FRAND rate determinations and assessments, but does not purport to be representative of the overall population.

Over the past thirteen years, the number of FRAND rate determinations per year has fluctuated between zero and six, with no clear trend in volume. The geographic composition, however, has shifted markedly: the United States and Japan led rate-setting between 2013 and 2015, whereas China, the United Kingdom and, more recently, India have become the leading venues over the last decade. The decline in US determinations after 2017 partly reflects the prevalence of jury trials in the US, which fall outside the corpus but is captured in the larger set of US *Daubert motions* in the third category. FRAND rate assessments are heavily concentrated in the European Union, and particularly Germany, which has emerged as the principal forum for assessing the FRAND character of licensing offers in the context of SEP injunction litigation under EU competition law, joined in the most recent years by the UPC.

Table E1

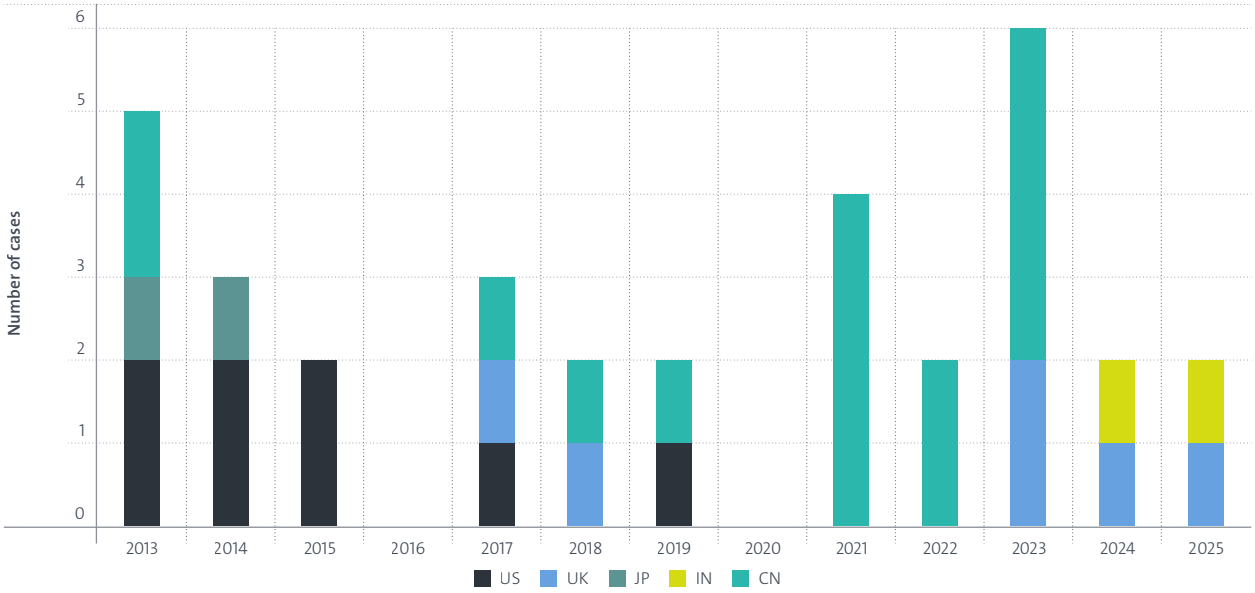
Composition of the corpus of court documents on FRAND

Category	What the court does	Cases	Decisions/ documents
FRAND rate determinations	Sets a FRAND rate	20	33 decisions
FRAND rate assessments	Decides whether a given rate is FRAND or within a FRAND range	16	19 decisions
Admissibility of FRAND determination methods	Rules on whether a method may be used to determine a FRAND rate	n/a	13 decisions
Total			**65 decisions**

Notes: the corpus combines three distinct categories of court decisions. A "case" refers to a distinct dispute between identified parties and "decision" refers to a court ruling within that case (first instance or appeal). The collection of FRAND rate determinations is intended to be exhaustive, with a cut-off date of March 2026. The collections of FRAND rate assessments and admissibility decisions are not exhaustive but are intended to be representative of the breadth of relevant scenarios. The category of admissibility decisions combines US Daubert rulings with a smaller, heterogeneous set of court orders and guidelines from other jurisdictions. Selection criteria, including the sampling filters applied, are set out in Box 1.

Figure E1

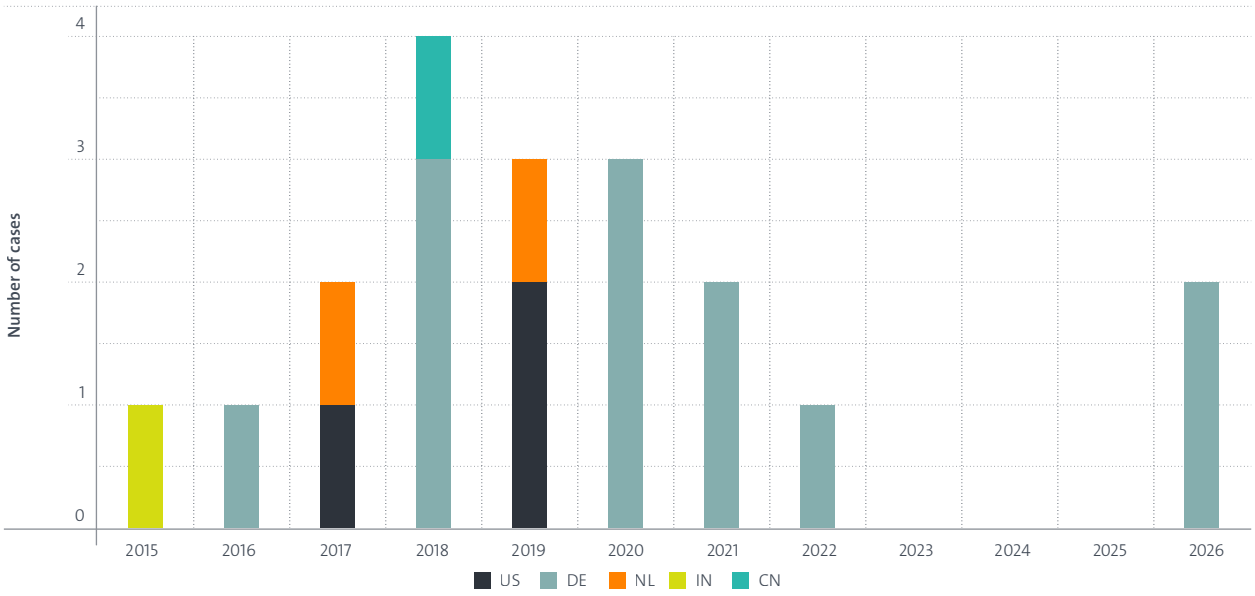
Yearly distribution of FRAND determination decisions by jurisdiction



Note: Based on the sample of 33 FRAND rate determination decisions listed in Table 2, which aim to represent the entire available corpus up to March 2026.

Figure E2

Yearly distribution of FRAND assessment decisions by jurisdiction



Note: Based on the sample of 19 FRAND rate assessment decisions listed in Table 3. This sample is non-exhaustive and does not represent all the case law on FRAND rate assessments.

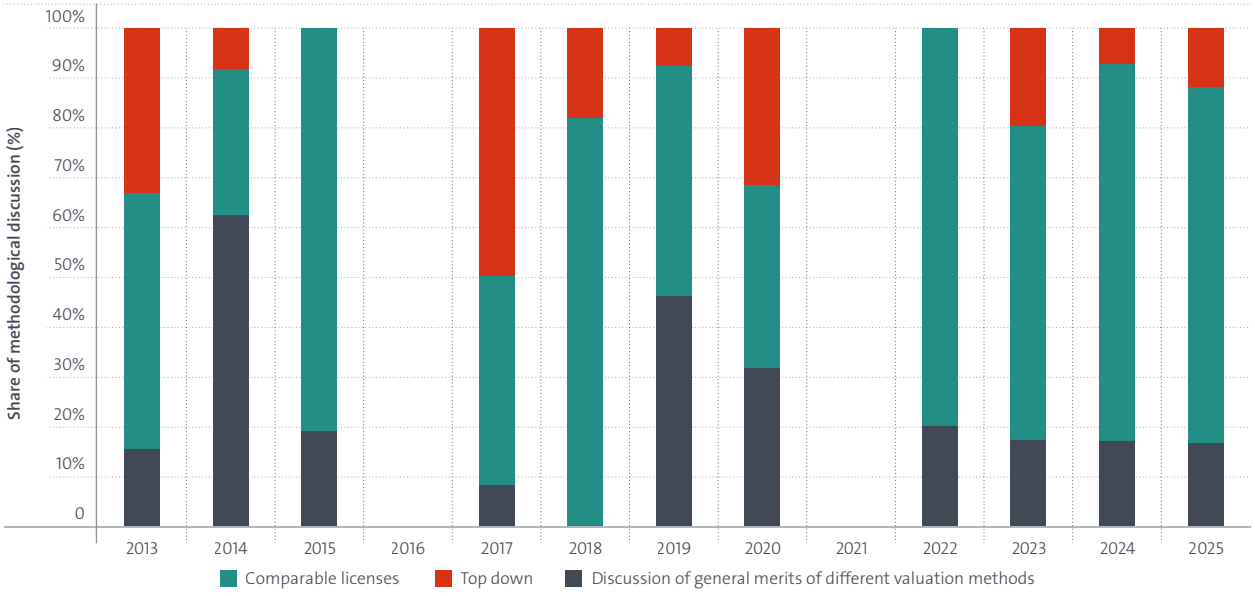
2 Despite operating under different legal frameworks, courts across jurisdictions have converged on a common purpose for FRAND and a shared conceptual framework, and the focus has shifted from defining FRAND to applying it.

Under contract law in the US and UK, competition law in the EU, and a mix of contract and antitrust grounds in China, courts articulate the same underlying purpose: FRAND must allow for a fair reward for the patent owner while ensuring the widest possible adoption of the standard. This balance appears in materially equivalent terms in *Huawei v. ZTE* (CJEU), *Unwired Planet v. Huawei* and *InterDigital v. Lenovo* (UK), *Microsoft v. Motorola* (US), *Huawei v. InterDigital* (China) and *Ericsson v. Lava* (India). Courts in the US have also converged on the hypothetical-negotiation construct, which is adapted to FRAND through the modified *Georgia-Pacific* analysis in *Microsoft v. Motorola* and *In re Innovatio,* and expressed in the analytically equivalent willing-licensor / willing-licensee test in the UK. A further point of alignment is the rejection of a *most-favoured-licensee* reading of the non-discrimination prong of FRAND in the United Kingdom, the United States and Germany.

The framing has also evolved over time. The earliest determinations treated FRAND principally as a safeguard against hold-up and royalty stacking, thus anchoring the rate in the patented technology's ex ante value. Later US decisions qualified this, holding that hold-up cannot be presumed and must be evidenced (*Ericsson v. D-Link*, *CSIRO v. Cisco*), while the CJEU and subsequent decisions from national courts in the EU, as well as UK courts placed hold-up and hold-out on the same footing as co-equal "mischiefs" (*Unwired Planet v. Huawei,* Supreme Court). Reflecting this, the centre of gravity in the case law has moved from a definitional phase – dominated in 2013–2015 by discussions of FRAND principles – to a methodological phase in which the application of FRAND through comparable-licence analysis (and, to a lesser extent, top-down) dominates from 2022 onward.

Figure E3

Changing focus of FRAND valuation analysis over time



Note: Share of snippets that focus on a given methodological discussion (comparable licences, top-down, and general discussion of valuation methods) by year. Based on 1 095 snippets containing information on methodological discussions, collected from 19 FRAND rate-determination decisions across 14 cases. The six FRAND determinations from China are excluded from the analysis because no publicly available documents providing the necessary information could be identified.

3 Two methodologies dominate FRAND rate determinations – comparable licences and the top-down approach – with comparable licences emerging as the primary method in most cases and top-down used mainly as a cross-check.

Of the 19 decisions for which the primary methodology can be classified, comparable licences are the primary methodology in 13, the top-down approach in five, and in one case both have been applied in parallel (*Oppo v. Nokia*). The comparable-licences approach derives the FRAND rate from real-world agreements concluded between similarly situated parties on the rationale that such agreements reflect how the market actually prices the patents.

The top-down approach is used as a secondary cross-check or as the primary method mostly where suitable comparables were unavailable or unreliable (*Huawei v. Conversant*; *In re Innovatio*; *Samsung v. Apple*; *Siemens v. Xiaomi*); in *TCL v. Ericsson*, the court applied top-down for the "fair and reasonable" prong while relying on comparable licences for non-discrimination. The top-down approach proceeds in two stages: first, it fixes an aggregate royalty rate for all SEPs reading on the standard, and then it apportions a share of that aggregate to the patentee's portfolio.

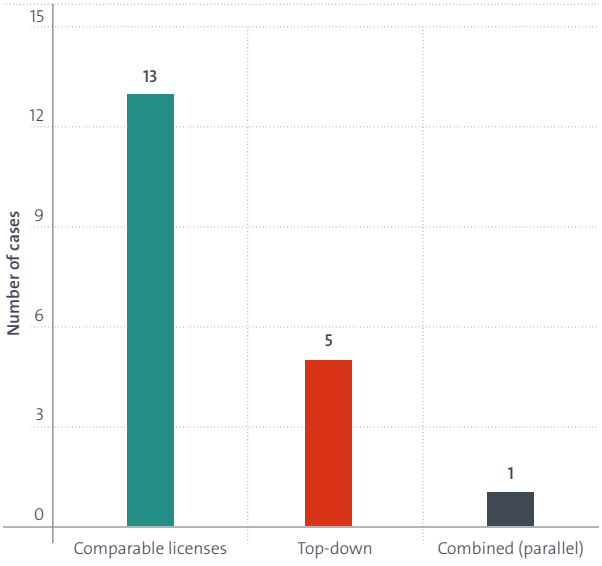
A few decisions combine the two, either as a mutual check (*Unwired Planet v. Huawei*; *TCL v. Ericsson*) or in parallel for different parts of the dispute (*Oppo v. Nokia*: top-down for the 5G single-mode rate, comparables for 4G).

Other methods discussed in the literature – bottom-up and cost-based approaches and theoretical benchmarks such as the Shapley value – have gained no traction in the case law and have at times been explicitly rejected as unsuitable.

Similar to FRAND rate determinations, FRAND rate assessments also primarily rely on comparables with top-down being the second most often used method, with 9 cases relying on comparables as the primary methodology and only four on top-down.

Figure E4

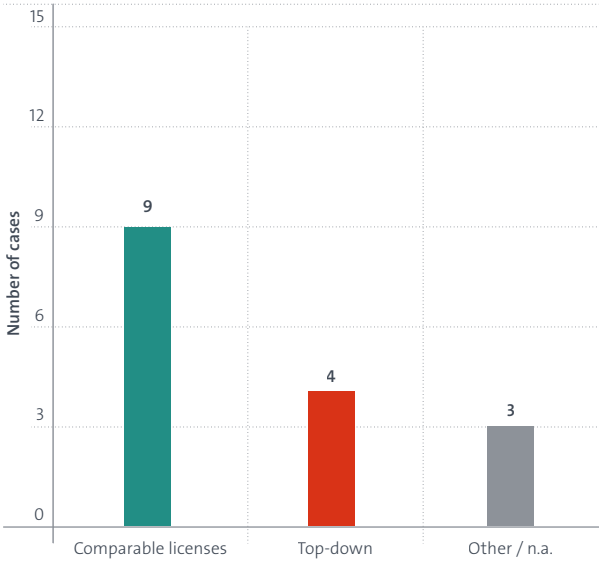
Primary methodology for FRAND rate determinations



Note: Based on the 19 FRAND rate determination cases in which the decision explicitly sets out the methodology applied. *Oppo v. Nokia* applies both methods in parallel, using a top-down approach for the 5G single-mode rate and comparable licences for 4G. Spreadtrum v. ASR is excluded because the available information does not specify how the damages or rate were calculated, although it identifies the case as one concerning patent infringement damages. In a few decisions, courts rely on comparable licences as the primary method and use a top-down approach as a cross-check, or vice versa

Figure E5

Primary methodology in FRAND rate assessments



Note: Based on the 16 FRAND rate assessment cases. *Wilus v. AsusTek* is classified as top-down because that approach was used to assess the SEP holder's offer, which was the primary subject of the assessment while comparable licences were considered separately to evaluate the implementer's counteroffer. The "Other/n.a." category includes Intellectual Ventures v. Telefónica and GE/Access Advance v. Vestel, both of which were decided on the basis of specific substantive defects in the licensing offers rather than a rate methodology, as well as Nokia v. Daimler, which settled before any FRAND methodology was applied.

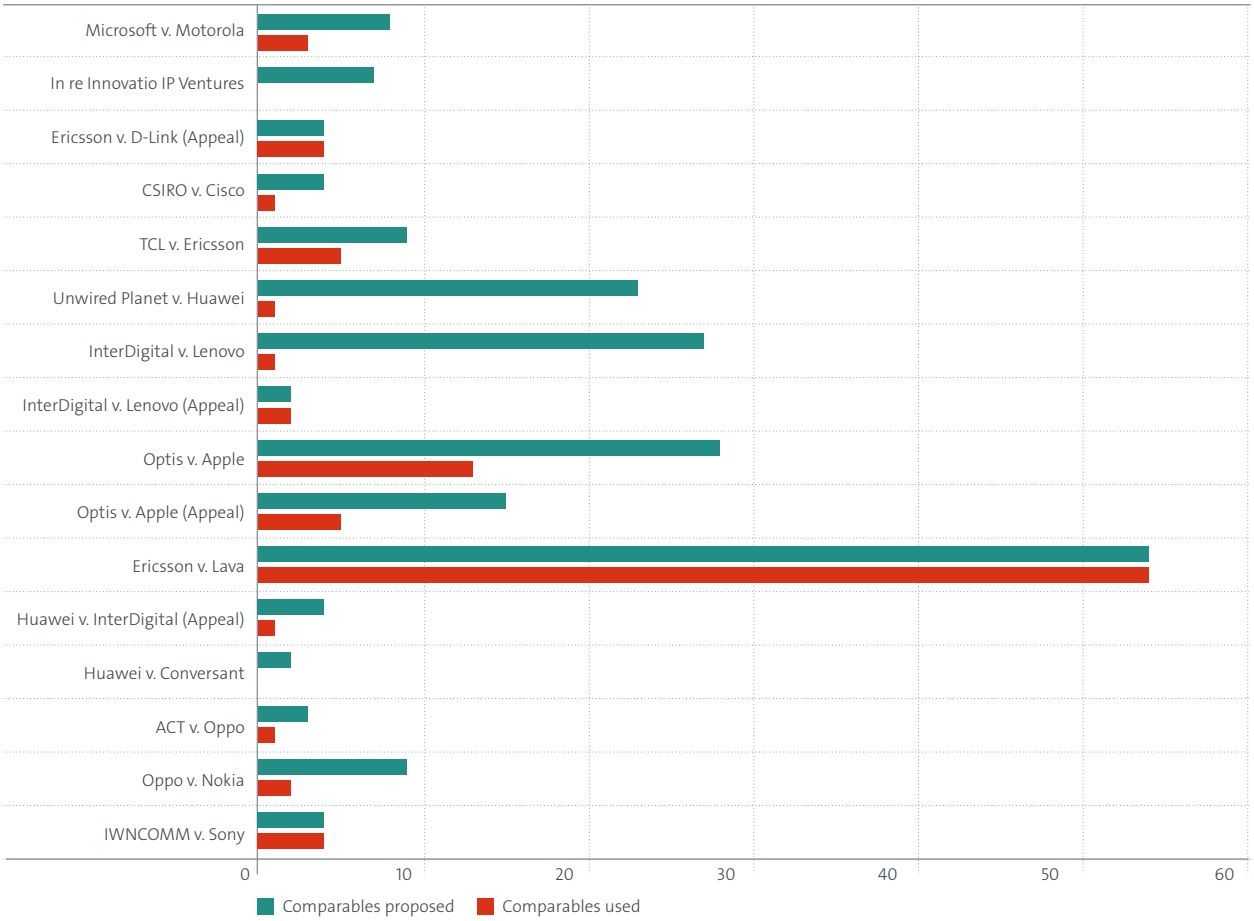
4 Case law has gradually refined the methodology for the main steps of the comparable licences approach: selection, unpacking and adjustments.

While comparable licences are the most commonly used starting point for FRAND rate determinations, courts are presented with many more proposed comparables than they ultimately accept as truly comparable. Across the surveyed cases, the number of proposed comparables ranges from 2 to 54, and three sets of challenges recur. The first is selection: courts must assess whether a proposed licence covers sufficiently similar technology, parties, scope and time period and whether it is itself untainted by hold-up or hold-out. Second is unpacking: when the comparable is a lump-sum agreement, a cross-licence, or a licence to a larger portfolio, the effective rate is not directly observed and must be recovered through net-present-value calculations, portfolio-strength ratios and apportionment across standards. Courts have generally held that the fact that a licence requires unpacking does not mean that the licence must or can be excluded from a comparable licences analysis. The third is adjustments: when only comparables involving different portfolios exist, courts must adjust for differences in relative portfolio value; when the only existing comparable licences are affected by non-FRAND factors, these factors must be accounted for in order to derive a FRAND rate.

Each step rests on significant assumptions that are a frequent source of disagreement between expert witnesses and between first-instance and appeal courts.

Figure E6

Number of licences proposed and accepted as comparables



Note: Based on 16 FRAND rate determination decisions for which the full document is publicly available and thus provides data about the comparable licences proposed and used.

5 The top-down approach combines the determination of an aggregate royalty rate with an apportionment that usually relies on patent counting. Patent counting is subject to known limitations, which new datasets may help address.

The top-down approach derives a FRAND rate in two steps: first, it establishes an aggregate royalty rate (ARR) representing the total royalty burden for all SEPs reading on the standard; second, it apportions a share of that aggregate to the portfolio at issue. Both steps are methodologically contested.

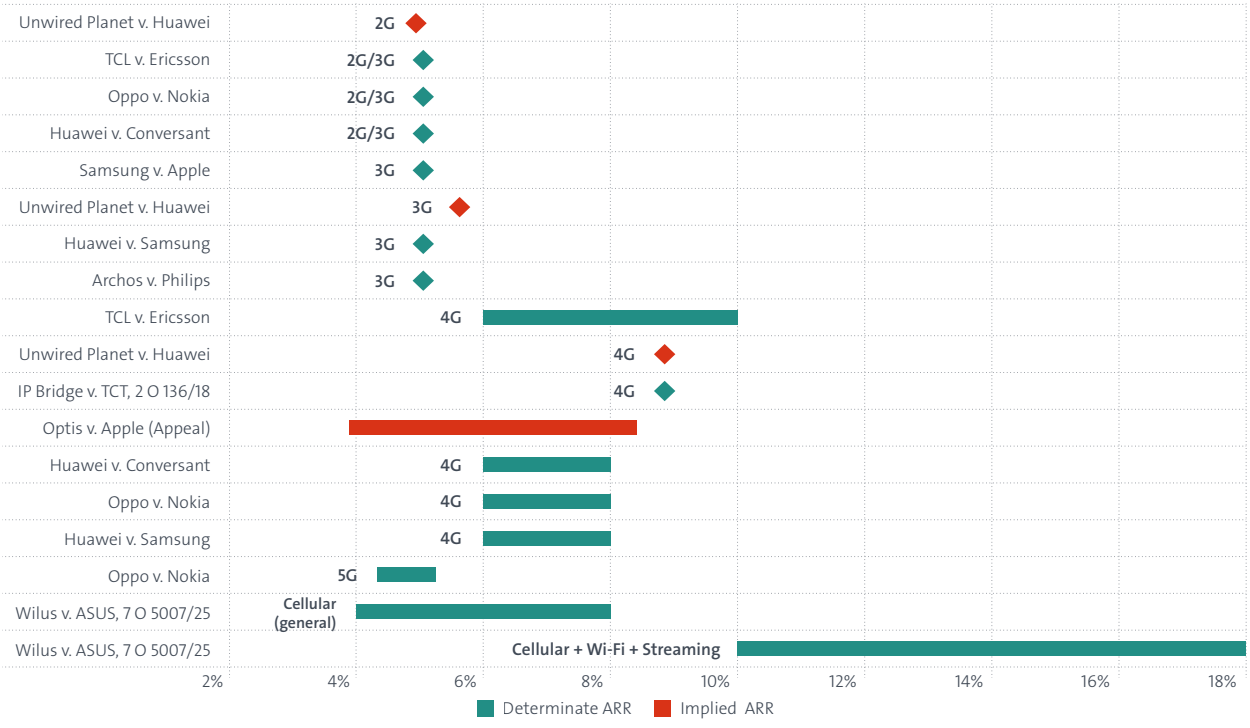
For the ARR, courts have relied on four main sources: public statements by SEP holders; rates accepted in earlier court decisions; calculations based on the available profit margin in the smallest saleable patent-practising unit (SSPPU); and hedonic regression models estimating the standard's incremental contribution to device value. No single approach governs. The 5% figure for 3G and the 6–10% range for 4G that recur across US, UK, Chinese and German decisions owe their persistence largely to cross-referencing of earlier decisions rather than independent re-derivation, raising questions about the robustness of the apparent convergence.

Apportionment is the more contested of the two steps. It relies primarily on patent counting, and courts have consistently cautioned that *"mere patent counting and dividing is not enough."* The specific challenges that patent counting raises in this and other contexts are addressed in the next key finding.

The top-down approach also lacks a uniform methodological status across jurisdictions. US and Chinese courts have used it as a primary rate-setting method, while UK and German courts have generally confined it to a cross-check role. Across all jurisdictions, courts broadly acknowledge that top-down analysis can be informative while also recognising its methodological vulnerabilities.

Figure E7

ARRs set in each court decision across the different technologies



Note: The figure is based on the 19 ARRs found across the case law and listed in Table 8. *In re Innovatio* is excluded for visualisation purposes because it is the only decision in the sample that reports a per-unit royalty.

6 Patent data plays a central but contested role in FRAND determinations; the limitations of current patent-counting approaches represent an open methodological gap that improved datasets can help address.

Patent portfolio strength assessments pervade FRAND determinations. They arise not only in the apportionment step of the top-down approach but also in the scaling of comparable licences across portfolios, in the unpacking of cross-licences using portfolio strength ratios, and in adjustments to account for portfolio changes over time. These use cases cut across both main methodologies and share common methodological challenges.

Courts have generally favoured patent counts over contribution counts, on the grounds that patent data tracks actual legal rights and can reflect portfolio changes resulting from transfers, expirations and acquisitions. However, courts have also consistently cautioned that *"mere patent counting and dividing is not enough."* The principal challenges that recur are: the gap between declared and truly essential SEPs, which can be large and non-uniform across licensors; the treatment of pending applications and expired patents, on which case law diverges; and the absence of a universally accepted method for incorporating validity considerations into portfolio assessments.

Beyond these specific issues, the case law illustrates that patent counts are widely used because they are objective and manageable, not because courts consider them fully satisfactory. A spectrum of approaches exists, from purely quantitative declared-patent counts to more refined exercises incorporating essentiality screening, validity adjustments, family deduplication and technical evaluation. Indicators of individual patent value — forward citations, family size, timing and technical evaluation — have been explored but none has been accepted as a comprehensive or universal measure. This methodological gap is widely recognised but largely unresolved in existing case law.

1. Introduction

1.1 Purpose and rationale of FRAND commitments

Technical standards are one of the fundamental elements of modern technology sectors. By establishing common specifications, they enable interoperability between products and services, reduce transaction costs, and allow manufacturers, network operators and consumers to interact on a shared technological platform. This is particularly evident in the telecommunications sector, where standards such as GSM, UMTS and LTE, and now 5G and 6G, are fundamental to global mobile connectivity and adjacent domains, including Wi-Fi, audio and video compression, and the Internet of Things.

The inclusion of patented technologies in technical standards creates a structural tension that lies at the heart of the FRAND framework. Patents grant their holders exclusive rights to prevent third parties from using protected technology without a licence. Standards, by contrast, aim for the widest possible adoption. A standard that market participants cannot implement defeats its own purpose. When a patent is essential to the implementation of a standard – meaning that compliance with the standard is impossible without practising the relevant patent claims – the patent holder can under certain circumstances acquire a position of economic power. Once the standard has been adopted and implementation investments have been made, switching to an alternative technology may no longer be readily possible.

Standards development organisations (SDOs) address this tension through their intellectual property rights (IPR) policies. These are contractual self-regulatory mechanisms embedded in the by-laws, membership agreements or rules of procedure of the SDO that are binding on every participant in the standard development process. While the policies of individual SDOs vary substantially in their details, most rest on two core pillars: first, an obligation for participants to identify and declare patents they believe, in good faith, to be essential to the standard being developed; and second, a requirement that any participant wishing to include patented technology in a standard make an irrevocable written commitment to license that technology to third parties according to fair, reasonable and non-discriminatory (FRAND) terms and conditions.

The FRAND commitment therefore serves as the quid pro quo for the inclusion of proprietary technology in a standard. Without this commitment, a patent holder cannot be forced to incorporate their technology into the standard. Conversely, once the commitment has been made, the SEP holder consents to a licensing obligation in exchange for their technology being included in the standard. This irrevocable commitment counteracts the restriction of competition in the technology market that the SEP holder's exclusive rights could otherwise cause, all while preserving the holder's right to receive fair and adequate compensation for their contribution. The FRAND commitment is a cornerstone of the standardisation system, and its operation is of direct relevance to all stakeholders – SEP holders, implementers, SDOs, courts and competition authorities alike.

SDOs' IPR policies and SEP holders' FRAND commitments, however, do not prescribe a specific fixed royalty rate, and most SDOs deliberately refrain from providing a more specific definition of FRAND terms. This approach has advantages since it allows FRAND to be concretised case by case, adapting to the technology, the parties and the market at issue, and it relieves SDOs of the need to fix commercial terms that are better left to bilateral negotiation.

At the same time, the lack of commonly accepted specific definitions of FRAND contributes to parties' disagreements on the terms and conditions that should apply to a specific SEP licence. These disagreements can increase costs on both sides of the negotiating table by prolonging negotiations and delaying the conclusion of licensing agreements. While most disagreements are resolved through bilateral negotiation, some have resulted in litigation, with courts in different jurisdictions being asked to determine or assess FRAND terms for SEP licences. Greater clarity on how FRAND terms are arrived at in practice could therefore help expedite negotiations and create significant value for all stakeholders.

1.2 Existing literature on the determination of FRAND rates

In the absence of a definition by SDOs, the meaning of FRAND has been concretised in different jurisdictions over time through court decisions, economic and legal scholarship, and policy guidance issued by competition authorities and patent offices. These contributions have sought to provide greater clarity at different levels of abstraction, from the general principles and conceptual frameworks that give content to FRAND and the valuation methodologies that are used to calculate or assess a FRAND rate to the patent data on which those methodologies increasingly rely. The paragraphs below briefly describe how the literature has addressed these questions, what it has established, and where it leaves gaps that the present study seeks to fill.

An initial body of work approached FRAND from the perspective of competition economics and cooperative game theory, seeking abstract benchmarks for a *"reasonable"* royalty grounded in the value a technology contributes before it is locked into a standard (Swanson and Baumol, 2005; Layne-Farrar et al., 2007), with later contributions formalising fairness- and efficiency-based frameworks for the same purpose (Hougaard, Ko and Zhang, 2023; Turner, 2024). These efforts established concepts that continue to inform the debate, such as ex ante competition, incremental value, and value apportionment; however, the specific structural frameworks they proposed have had limited interaction with how FRAND rates are actually determined and have remained largely in the background of the practice.

A second and more influential branch of the literature has sought to define FRAND terms and conditions on the basis of the rationale for the commitment itself. One prominent view casts the FRAND commitment as primarily a safeguard against the potential so-called patent hold-up and royalty stacking problems that standardisation can allegedly enable (Lemley and Shapiro, 2007; Shapiro, 2010; Carlton and Shampine, 2013). That framing has been contested by a substantial amount of counter-literature that questions the empirical weight of hold-up, points to the countervailing risk of the so-called implementer hold-out, and disputes the proposition that FRAND rates should be confined to the ex ante value of the technology to the exclusion of any value derived from standardisation (Geradin and Rato, 2007; Layne-Farrar et al., 2009; Sidak, 2013; Epstein and Noroozi, 2017; Siebrasse and Cotter, 2017a).

From the mid-2010s onwards, the literature turned from these conceptual debates toward the practice of judicial FRAND rate determination and the methodologies applied therein (Geradin, 2013; Sidak, 2013). A series of comparative reviews has since described and consolidated this practice across jurisdictions, documenting a broad convergence on a set of shared principles and a small number of methods – principally comparable licences and the top-down approach – while also charting the extension of the case law to new jurisdictions and the persistent difficulties that valuation continues to pose (Leonard and Lopez, 2014; Contreras and Gilbert, 2015; Layne-Farrar and Wong-Ervin, 2017; Pentheroudakis and Baron, 2017; Siebrasse and Cotter, 2017a, 2017b; Putnam, 2018; Dhenne, 2019; SEPs Expert Group, 2020; Tsilikas, 2020; Tyagi, 2022; Yiu and Ren, 2024; Effraimidis et al., 2024). This practice-oriented literature is the branch to which the present study most directly contributes, and it is also the source of the study's motivation.

For all its breadth, the existing work leaves important gaps. The body of comprehensive reviews of case law literature tends to cover selected decisions rather than a comprehensive and consistently assembled corpus of case law; moreover, it has not kept pace with the growing number of decisions, and some of the recent case law reviews have a more limited scope. Existing reviews also rarely examine the most operational layer of the analysis in detail, e.g. the specific steps of the comparable licences analysis (selection criteria, unpacking, etc.), and how patent data is used to apportion value and scale between portfolios and unpack existing cross-licences into two unidirectional licences. However, this is often the layer on which the reliability of a FRAND determination depends. In short, the existing literature explains why FRAND matters and identifies the methods that courts tend to favour. What remains less well understood is how those methods are specifically applied across the full body of decisions, how consistently they are applied, and how robust the underlying data and indicators are.

The present study is complementary to, but distinct in approach from, the recent WIPO (2026) publication on the same subject. The WIPO publication approaches the question from the standpoint of economic theory, explaining why structured valuation methods matter and setting out the principal methodologies in terms of their economic rationale and properties. The present study is grounded in a systematic empirical review of

how courts across seven jurisdictions have actually applied those methodologies in practice, identifying the specific choices, trade-offs and unresolved tensions that arise when economic principles meet the constraints of litigation.

1.3 A step beyond: defining FRAND through a review of court decisions

The present study takes stock of how courts worldwide have given practical content to FRAND. Since FRAND is concretised case by case, the accumulated body of judicial decisions is the most authoritative source on what FRAND means in practice. As noted, however, this case law is dispersed across jurisdictions, languages and legal traditions, and no existing source brings it together on a comprehensive basis with a focus on methodology.

The study assembles what is, to the authors' knowledge, the most comprehensive global corpus of judicial FRAND determinations compiled to date by covering 65 court documents across seven jurisdictions. This corpus is organised around three categories of decisions, namely those in which courts have themselves set a FRAND rate, those in which they have assessed whether a given rate or offer is FRAND, and those in which they have ruled on the admissibility of a particular method.

The study analyses this corpus through a primarily qualitative review process complemented by a quantitative coding to illustrate the extent of methodological discussions of different aspects contained in the decisions. The goal of this empirical study is to document and compare the judicial practice of FRAND rate determination and assessment in different jurisdictions. Decisions are selected and discussed with a focus on deriving globally relevant methodological insights, not in view of the decisions' legal authority within the case law of any individual jurisdiction. Consequently, we also include decisions that have been vacated or overturned in our review.

The report treats principles, methodologies and data as part of a connected chain linking the abstract purpose of FRAND to the data on which valuation methodologies ultimately depend. Within this chain, the study focuses on the two dominant methodologies – comparable licences and the top-down approach – and on their main challenges, including licence selection, licence unpacking and top-down apportionment. The study consistently focuses its attention on the most operational layer of the analysis, namely the criteria for selecting and unpacking comparable licences and the role and limitations of patent data, which the existing literature has largely left underexamined. It examines how patent data is used across methodologies and how the indicators upon which courts and parties rely can be operationalised more reliably. It also points to open questions and to areas where existing resources can support more robust FRAND determinations in future cases.

1.4 Structure of the report

The remainder of the study is organised as follows. Chapter 2 presents the collection of case law and the criteria used to assemble it. Chapter 3 sets out the frameworks and principles of FRAND determinations. It covers the underlying purpose of FRAND, the treatment of hold-up and hold-out, the hypothetical-negotiation construct, the different legal frameworks across jurisdictions, and the evidentiary guardrails that have developed around them. Chapter 4 turns to the two methodologies that dominate the case law, namely comparable licences and the top-down approach, and examines how each is applied. Chapter 5 considers how patent data is used within these methodologies, identifies the principal use cases and assesses the limitations of current approaches. The study concludes by providing guidance for the determination of FRAND terms and identifying the principal challenges that remain open for future work.

2. Collection of case law

This chapter introduces the corpus of court documents that underpins the substantive analysis presented in Chapters 3 to 5. The corpus, summarised in Table 1, comprises 65 court decisions from seven jurisdictions. It reflects three main approaches through which courts have engaged with FRAND rates across jurisdictions over the last 15 years: FRAND rate determinations, FRAND rate assessments, and assessments of the admissibility of FRAND rate determination methods. Box 1 sets out the selection criteria used to construct the corpus. Sections 2.1 to 2.3 describe each category in detail.

Table 1

Composition of the corpus of court documents on FRAND

Category	What the court does	Cases	Decisions/ documents
FRAND rate determinations	Sets a FRAND rate	20	33 decisions
FRAND rate assessments	Decides whether a given rate is FRAND or within a FRAND range	16	19 decisions
Admissibility of FRAND determination methods	Rules on whether a method may be used to determine a FRAND rate	n/a	13 decisions
Total			**65 decisions**

Note: the corpus combines three distinct categories of court decisions. A "case" refers to a distinct dispute between identified parties and "decision" refers to a court ruling within that case (first instance or appeal). The collection of FRAND rate determinations is intended to be exhaustive, with a cut-off date of March 2026. The collections of FRAND rate assessments and admissibility decisions are not exhaustive but are intended to be representative of the breadth of relevant scenarios. The category of admissibility decisions combines US Daubert rulings with a smaller, heterogeneous set of court orders and guidelines from other jurisdiction. Selection criteria, including the sampling filters applied, are set out in Box 1.

Box 1: Selection criteria for the corpus of court documents

Terminology. A "case" refers to a distinct dispute between identified parties, a "decision" refers to a court ruling within that case (first instance or appeal). The overall count of decisions is 65, also including different types of court orders and guidelines.

Exhaustiveness. The set of decisions that was reviewed by no means represents all the case law on FRAND and SEP licensing. While we believe that the decisions in the first category represent the entire corpus of available FRAND rate determinations up to March 2026, the second and third categories (FRAND rate assessments and admissibility of FRAND determination methods) represent a non-comprehensive sample of decisions that is, however, intended to illustrate a broad range of methodological aspects of FRAND rate determinations and assessments, but does not purport to be representative of the overall population of such decisions.

FRAND rate determinations – (20 cases / 33 decisions). The collection of FRAND rate determinations is intended to be exhaustive, with a cut-off date of March 2026.[1] Out of a total of 20 cases identified, 14 included an appeal decision. When only the first instance decision deals with the specific FRAND rate determination, only the first-instance decision is included. In some cases, only the appeal decision is included, e.g. because there is no written reasoning for the first instance decision. The 33 decisions are limited to rulings with written reasoning and therefore exclude jury determinations. In other cases, first instance decisions were not available, and thus only the appeal decision was included. In cases in which both instances addressed FRAND rate determination, and both decisions are available, both decisions are included.

1 For this reason, the decisions issued in the Samsung/ZTE dispute are not part of the determination corpus: the judgments of the English High Court (*Samsung v. ZTE* [2026] EWHC 999 (Pat)) and of the Chongqing First Intermediate People's Court (*ZTE v. Samsung*), both of 1 May 2026, and the judgments of the Munich I Regional Court of 30 April 2026, post-date the March 2026 cut-off (see Box 2); the assessment by the Regional Court of Frankfurt (judgment of 25 February 2026, 2-06 O 426/24) falls within the study period but is not included in the non-exhaustive assessment sample.

Coverage of Chinese decisions is constrained by limited public availability.[2] Only the full text of three Chinese FRAND rate determinations could be accessed for this study (the appeal court decision in *Huawei v. InterDigital, the Supreme Court decision in ACT v. Oppo, and the Chongqing Intermediate Court first instance decision in Oppo v. Nokia)*; and we used inofficial machine translations to English. For the remaining Chinese decisions, the analysis relies on secondary sources, and our discussion of these cases is accordingly much more limited.[3]

FRAND rate assessments – (16 cases / 19 decisions). This sample includes FRAND rate assessments of licensing offers and, to a lesser extent, existing licensing contracts. This collection is not exhaustive but is intended to shed light on the breadth of scenarios in which courts have assessed a FRAND rate. Most assessments occurred at first instance, except for two German cases in which the first-instance assessment was overturned on appeal. This sample also includes two recent German case (*Wilus v. AsusTek* and *Broadcom v. Renault*) decided in 2026 by the Regional Court of Munich, where the formal subject was whether a FRAND-compliant offer had been made, but where the court also provided an opinion on the FRAND rate.

Admissibility of FRAND determination methods – (13 documents). This collection comprises rulings of US district courts on the parties' *Daubert motions* concerning the admissibility of expert testimony, together with a more heterogeneous set of court guidelines and orders from different jurisdictions that contain methodological discussions of general applicability. As with the previous category, this collection is not intended to be exhaustive but rather illustrative of cases in which courts assessed the admissibility of an underlying FRAND determination methodology.

Sampling filters

Three categories of decisions were deliberately excluded from the corpus:

Decisions exclusively based on the parties' conduct. The study excludes a large number of cases in which FRAND disputes are decided on the basis of negotiating conduct rather than on the substance of FRAND terms and conditions, such as, for example, whether the SEP holder gave sufficient notice of infringement or whether the implementer unambiguously stated its willingness to take a FRAND licence.[4] Cases in which the court declined to assess the substance of an offer because the defendant's conduct indicated unwillingness (e.g. *Sisvel v. Haier*) are excluded on the same basis.

Decisions on jurisdiction. Decisions addressing whether courts have jurisdiction to set a FRAND rate, without actually determining one, are excluded. These, include the High Court and Court of Appeal decisions in *Tesla v. Avanci*, the *Oppo v. Sharp* decision of the Supreme People's Court of China, and the US District Court decisions in *Continental v. Avanci* and *Samsung v. ZTE*. The case law on cross-jurisdiction interactions, including anti-suit injunctions and interim licences, is likewise outside scope. While we are aware of at least one case in which a court has determined a rate for an interim licence, this rate determination is methodologically not comparable to a FRAND rate determination for an SEP licence, and thus also excluded from the sample.

Damages awards not anchored in a FRAND rate analysis. The corpus includes damages awards only when the quantum was determined on the basis of a FRAND rate analysis. Decisions in which a court awards patent infringement damages to a SEP owner without engaging in a FRAND rate determination fall outside the scope of this study.[5]

2 This has led the European Commission to initiate an international dispute at the World Trade Organization.

3 The cases for which we only used secondary sources are the following Chinese cases: *Huawei v. Conversant, Iwncomm v. Apple, Huawei v. InterDigital* (first instance), *Huawei v. Samsung, ACT v. Vivo, Oppo v. Sharp, Spreadtrum v. ASR,* and *Iwncomm v. Sony.* Secondary sources were also used for the Japanese decision in *Apple v. Samsung.* Among the secondary sources consulted, Liu (2024) and Yiu and Ren (2024) were the sources providing a comprehensive coverage of methodologies used in a larger number of decisions.

4 We do, however, include cases in which a court assesses willingness on the basis of the FRAND character of either party's licensing offer, irrespective of whether that assessment was decisive for the outcome of the case (*Nokia v. Daimler* in Germany). For these cases, we only focus on the aspect of the decision that assesses the FRAND character of the offer.

5 For example, in *G+ Communications v. Samsung* at the US District Court of the Eastern District of Texas, the parties disagreed whether FRAND considerations were applicable for determining patent damages because Samsung had been found in breach of its FRAND obligations to act as a willing licensee. Judge Gilstrap held that one party's obligation to negotiate toward a FRAND licence in good faith may be temporarily suspended in response to the other party's lack of good faith. Nevertheless, in a subsequent ruling, Judge Gilstrap clarified that *"that whether G+'s damages request is consistent with a FRAND royalty remains a live issue notwithstanding the jury's prior finding that G+ had not breached its FRAND obligation."* In the case *3G Licensing v. HTC*, 3G Licensing argued that *"HTC's refusal to voluntarily take a license meant that HTC was not entitled to receive a fair, reasonable and non-discriminatory (FRAND) discount."*

2.1 FRAND rate determinations

This section describes the 33 decisions drawn from 20 cases across five jurisdictions, in which courts themselves determined a FRAND rate. Box 2 discusses developments after this cut-off date. Table 2 lists these cases according to the type of proceeding, geographic scope and technology concerned, while Figures 1 and 2 illustrate their distribution across jurisdictions over time. Several patterns emerge from the table and the figures.

First, the cases arise under a variety of procedural and legal contexts, including breach of contract claims (e.g., *Microsoft v. Motorola* in the US), patent infringement damages proceedings (e.g. *Ericsson v. D-Link*, and *CSIRO v. Cisco* in the US), antitrust complaints (e.g. *Huawei v. InterDigital* in China) and declaratory judgment actions seeking a judicial determination of the applicable FRAND rate (e.g. *Unwired Planet v. Huawei, InterDigital v. Lenovo*). The aim is not to produce a detailed categorisation of the specific legal basis on which the FRAND rate was determined, as the available causes of action are highly dependent on the specific legal framework of each jurisdiction. Moreover, individual decisions often concern more than one legal claim, which may also evolve over the course of lengthy proceedings. However, distinction is made between damages awards and other types of FRAND rate determinations since this distinction can have direct implications for the methodology, as explained in detail in Box 3. The procedural and legal contexts differ across jurisdictions: US cases frequently emerge in litigation over patent infringement damages, UK courts (at least in recent years) have primarily conducted FRAND determinations through standalone proceedings aimed at establishing the terms of a portfolio licence, and Chinese courts have adopted a more heterogeneous mix of procedural mechanisms.[6]

Second, FRAND rate determinations remain concentrated in a limited number of jurisdictions, particularly the United States, the United Kingdom and China. While early landmark determinations between 2013 and 2015 were primarily issued in the United States and Japan, the centre of gravity has progressively shifted towards the United Kingdom and China, especially in relation to global portfolio licensing disputes. At the same time, the overall annual number of determinations has remained relatively stable, suggesting that the principal development has been geographical redistribution rather than a sustained increase in judicial FRAND rate-setting activity. Notably, no major FRAND determination has been issued in the United States since 2017.

Third, there are notable differences across jurisdictions in the geographic scope of FRAND determinations. UK courts have consistently affirmed their ability to set rates on a global level, an approach confirmed by the UK Supreme Court in *Unwired Planet v. Huawei*. By contrast, FRAND determinations in the United States have remained predominantly national in scope. Only two US cases involved the setting of global rates: *Microsoft v. Motorola*, and *TCL v. Ericsson*, where the global rate determination was later vacated on appeal after the appellate court held that the district court had improperly denied a party's right to a jury trial. Chinese courts likewise initially focused on national royalty determinations. This changed significantly following the Chinese Supreme People's Court decision in *Oppo v. Sharp*, which confirmed that Chinese courts may exercise jurisdiction over disputes involving the determination of global licensing terms, including when parallel proceedings are pending in other jurisdictions. More recent Chinese cases, such as *Oppo v. Nokia* and *ZTE v. Samsung*, have accordingly moved towards global FRAND rate-setting.

6 Hao (2026) states that *"[i]n current practice, there are three types of cases that involve judicial determination of FRAND license terms in China. First is in patent infringement cases: under Section 24 of The Interpretation of the SPC on Several Issues Concerning Application of Law in Trial of Patent Infringement Dispute Cases II (2016) (JI II), when a court considers the grant of an injunction, it needs to look into both parties' behavior during the licensing negotiation process and decide whether the parties were at fault, and part of this scrutiny is to decide substantively whether the SEP holder's offer and/or the implementer's counteroffer are "significantly deviant"* from the adjudicated FRAND benchmark. Additionally, a court may need to calculate the reasonable royalty of a FRAND license in determining the infringement damages. Second, is the anti-monopoly proceedings: in order to adjudicate the claim of *"unfairly high patent price"* as a form of abuse of the patentee's dominant market position, a court or anti-monopoly agency would likely estimate a FRAND benchmark as a comparison basis. The last type, arguably a controversial one, is a direct judicial FRAND rate-setting case, in which either party can directly request a court to adjudicate the FRAND rate for the SEP(s) in dispute, provided that no agreement had been reached despite *"adequate negotiations."*

Box 2: Developments after the cut-off date – the *Samsung v. ZTE* dispute

Shortly after the March 2026 cut-off, the parallel proceedings between Samsung and ZTE produced the first instance of competing global FRAND rate determinations in a single dispute. After the parties' 2021 cross-licence expired, Samsung applied to the English High Court for a global FRAND determination (December 2024) and ZTE applied to the Chongqing First Intermediate People's Court days later; infringement and related actions followed in Germany, before the Unified Patent Court, in the United States and elsewhere. Within the study period, the Regional Court of Frankfurt held ZTE's offer to be FRAND and Samsung's counter-offer too low (judgment of 25 February 2026, 2-06 O 426/24). After the cut-off, the Munich I Regional Court granted ZTE injunctions, declining to set a global rate but finding ZTE's offer within the FRAND corridor (judgments of 30 April 2026); on 1 May 2026 the English High Court determined a lump sum of USD 392 million for a five-year global cross-licence, relying on a comparables analysis anchored in the ZTE–Apple licence and rejecting a top-down cross-check as excessively sensitive to its assumptions (*Samsung v. ZTE* [2026] EWHC 999 (Pat)); and on the same day the Chongqing court held ZTE's offer of USD 731 million over six years to be FRAND (*ZTE v. Samsung*). These decisions reinforce several findings of this study – the dominance of the comparables methodology, the role of unpacking and adjustment choices as the main driver of divergent outcomes, and the unresolved tension over global rate-setting jurisdiction – and will need to be incorporated in any update of the corpus.

Box 3: Damages awards and FRAND rate determinations

A significant subset of the decisions in Table 2 concerns actions for patent infringement damages rather than standalone determinations of licensing terms. This distinction may have important methodological consequences.

In damages proceedings, courts often determine compensation only for the asserted patents-in-suit, even when those patents belong to a much larger SEP portfolio. By contrast, declaratory FRAND proceedings more commonly assess the value of an entire portfolio licence. In *Samsung v. Apple* in Japan, for example, damages were determined for a single SEP. Damages are typically also limited to infringing use within the court's jurisdiction, whereas FRAND rate determinations may be global or national.

As a result, damages determinations may require an additional layer of apportionment. Courts may first have to determine a FRAND rate for the SEP portfolio as a whole and subsequently apportion that value to the asserted patents.[7] In *Ericsson v. D-Link*, for example, Ericsson's expert determined that the patents-in-suit accounted for half of the value of the FRAND rate to Ericsson's Wi-Fi SEP portfolio. In other cases, however, courts effectively treated the asserted patents as representing most of the relevant portfolio value (e.g. *Iwncomm v. Apple*), or reasoned that the infringer would in any event have needed a portfolio licence to access the standardised technology (e.g. *Philips v. DVD* manufacturers).

In some cases, there may be more fundamental differences of methodology between the determination of damages and other FRAND rate determinations. On one hand, methods that are available for evaluating entire portfolios may not be suitable for the purpose of determining damages for individual patents-in-suit. For example, in *Realtek v. LSI*, the expert testimony was excluded since it assessed the value of the SEP holder's portfolio using a patent citation analysis. In the expert's opinion, this was a *"large numbers approach"* and they therefore applied this to the entire portfolio, failing to tie this to the patent-in-suit.[8] On the other hand, in damages cases such as *Cisco v. CSIRO* and *In re Innovatio*, courts relied on detailed assessments of the specific value contributions of the patents-in-suit for a determination of the FRAND rate. Such a technical assessment of the value contribution of individual patents would typically not be available in cases in which a FRAND rate is determined for an entire portfolio.

For these reasons, the present study distinguishes between damages awards and other forms of FRAND determinations where relevant.

7 Notably, in the court's decision on parties' Daubert's motions in the US case *WiLAN v. Alcatel* (at 7), an expert testimony was found inadmissible because it provided *"no apportionment to account for the differences between the worldwide portfolio licenses and a license to the patents-in-suit for U.S. sales of Defendants' accused products."*

8 *Realtek v. LSI*, Case C-12-03451, at 8.

Table 2

FRAND rate determinations – Type of proceeding and geographic scope

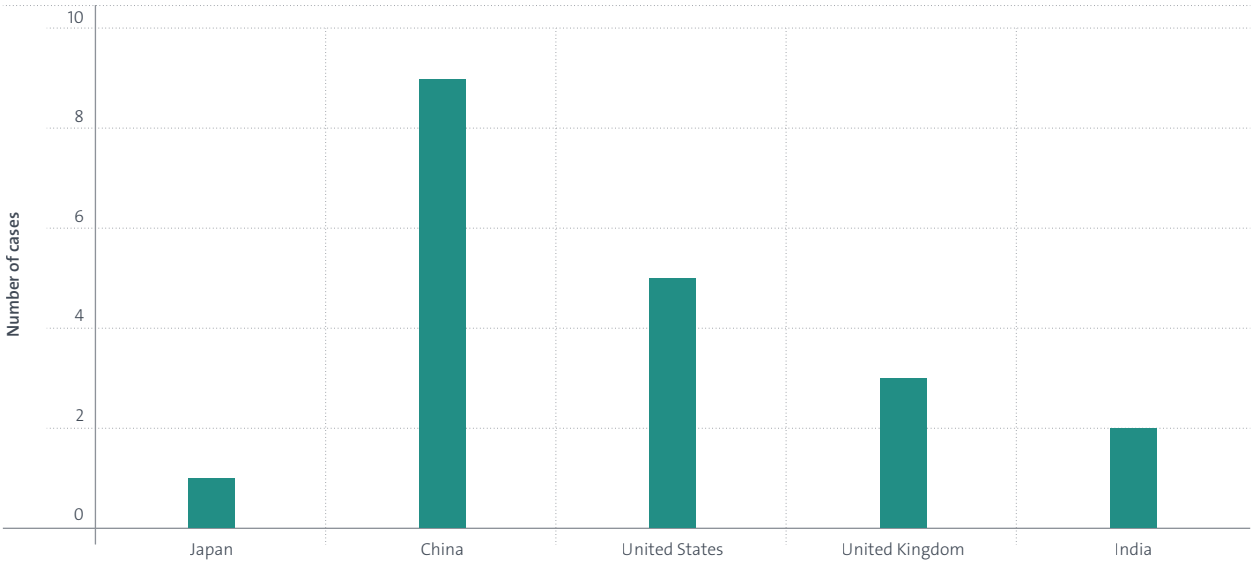
Case	Year	Number of decisions	Type of proceeding	Geographic scope	Technology
United States					
In re Innovatio IP Ventures, LLC Patent Litig. (Innovatio v. all cases)	2013	First instance	Patent infringement damages	National	Wi-Fi
Ericsson, Inc. v. D-Link Systems, Inc. (Ericsson v. D-Link)	2014	Appeal	Patent infringement damages	National	Wi-Fi
Microsoft Corp. v. Motorola, Inc. (Microsoft v. Motorola)	2013/ 2015	First instance + appeal	FRAND breach of contract	Global	Wi-Fi & Video Codec
CSIRO v. Cisco Systems, Inc. (CSIRO v. Cisco)	2014/ 2015	First instance + appeal	Patent infringement damages	National	Wi-Fi
TCL Communication Technology Holdings Ltd. v. Telefonaktiebolaget LM Ericsson (TCL v. Ericsson)	2017/ 2019	First instance + appeal	Declaratory / FRAND determination	Global	Cellular
United Kingdom					
Unwired Planet International Ltd v. Huawei Technologies Co. Ltd (Unwired Planet v. Huawei)	2017/ 2018	First instance + appeal	Declaratory / FRAND determination	Global	Cellular
InterDigital Technology Corporation v. Lenovo Group Ltd (InterDigital v. Lenovo)	2023/ 2024	First instance + appeal	Declaratory / FRAND determination	Global	Cellular
Optis Cellular Technology LLC v. Apple Retail UK Ltd (Optis v. Apple)	2023/ 2025	First instance + appeal	Declaratory / FRAND determination	Global	Cellular
China					
Huawei Technologies Co., Ltd v. InterDigital Communications, Inc. (Huawei v. InterDigital)	2013/2013	First instance + appeal	Antitrust / FRAND determination	National	Cellular
IWNCOMM Co., Ltd v. Sony Mobile Communications (China) Co., Ltd (Iwncomm v. Sony)	2017/ 2018	First instance + appeal	Patent infringement damages	National	WAPI
Huawei Technologies Co., Ltd v. Conversant Wireless Licensing Sàrl (Huawei v. Conversant)	2019	First instance	Declaratory / FRAND determination	National	Cellular
IWNCOMM Co., Ltd v. Apple Inc. (Iwncomm v. Apple)	2021/ 2022	First instance + appeal	Patent infringement damages	National	WAPI
Advanced Codec Technologies (ACT) v. Oppo Guangdong Mobile Telecommunications Co., Ltd (ACT v. Oppo)	2021/ 2023	First instance + appeal	Patent infringement damages	National	Audio Codec
Advanced Codec Technologies (ACT) v. Vivo Mobile Communication Co., Ltd (ACT v. Vivo)	2021/ 2023	First instance + appeal	Patent infringement damages	National	Audio Codec
Spreadtrum Communications (Shanghai) Co., Ltd v. ASR Microelectronics (Shanghai) Co., Ltd (Spreadtrum v. ASR)	2021/ 2023	First instance + appeal	Patent infringement damages	National	Wi-Fi

Siemens v. Xiaomi Communications Technology Co., Ltd. (Siemens v. Xiaomi)	2022	First instance	Patent infringement damages	National	Cellular
Oppo Chongqing Mobile Telecommunications Co., Ltd v. Nokia Technologies Oy (Oppo v. Nokia)	2023	First instance	Declaratory / FRAND determination	Global	Cellular
India					
Telefonaktiebolaget LM Ericsson v. Lava International Ltd (Ericsson v. Lava)	2024	First instance	Patent infringement damages	Global	Cellular
Koninklijke Philips N.V. v. Maj. (Retd.) Sukesh Behl & Anr	2025	First instance	Patent infringement damages	National	DVD
Japan					
Samsung Electronics Co., Ltd v. Apple Japan LLC (Samsung v. Apple)	2013/2014	First instance + appeal	Patent infringement damages	National	Cellular

Notes: For the full case reference list, see Table A1 in the Annex. WAPI refers to standards for WLAN Authentication and Privacy Infrastructure, a Chinese standard, often described as a Chinese alternative to Wi-Fi.

Figure 1

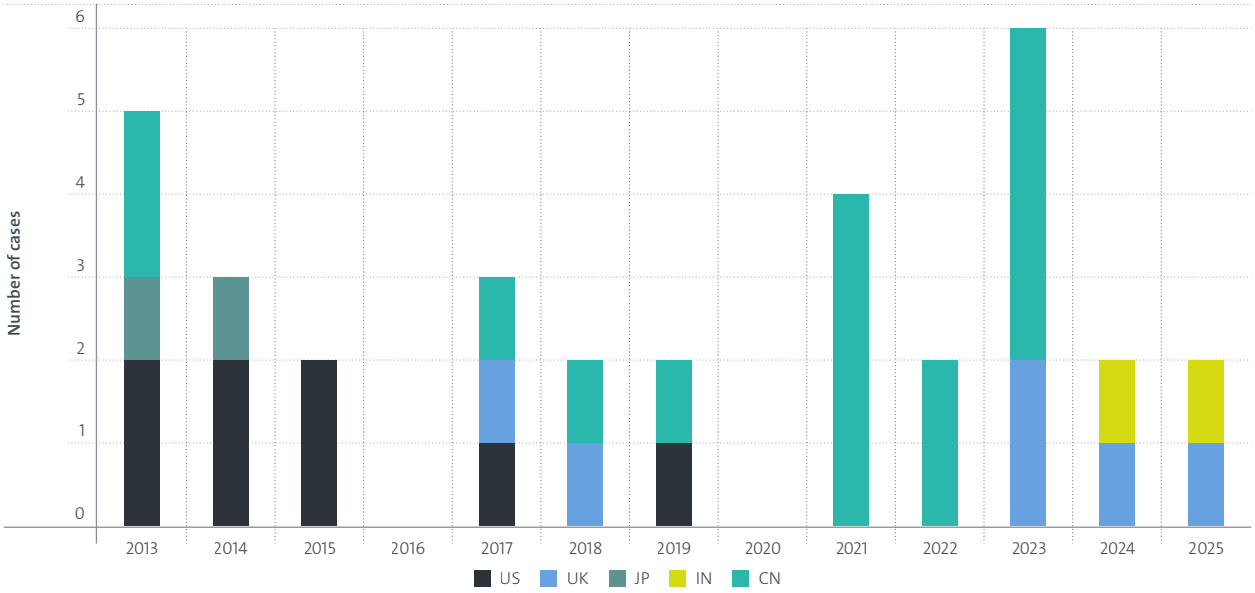
Distribution of FRAND determination cases across countries



Note: Based on the sample of 20 FRAND rate determination cases listed in Table 2, which aim to represent the entire available corpus up to March 2026.

Figure 2

Yearly distribution of FRAND determination decisions by jurisdiction



Note: Based on the sample of 33 FRAND rate determination decisions listed in Table 2, which aim to represent the entire available corpus up to March 2026.

2.2 FRAND rate assessments

This section reviews decisions in which courts assessed whether a particular rate is FRAND or falls within a FRAND range rather than determining a specific FRAND rate. These assessments may concern either the rates contained in existing licensing agreements or, more commonly, licensing offers made during negotiations between SEP holders and implementers. Box 4 describes the main differences between FRAND assessments and determinations. Table 3 summarises the identified cases spanning five jurisdictions by type of assessment and technology. Figures 3 and 4 illustrate their distribution across jurisdictions over time.

The most common context in which FRAND assessments arise is in the evaluation of whether a SEP holder's request for injunctive relief complies with Article 102 TFEU and, more generally, EU competition law. In *Huawei v. ZTE*, the Court of Justice of the European Union (CJEU) established a framework for assessing when a SEP holder's request for injunctive relief may constitute an abuse of dominance under Article 102 TFEU (for a detailed description of the framework and the case law built on it, see Subsection 3.3.1). Numerous decisions in the EU have subsequently applied this framework (e.g. *Sisvel v. Haier*, *VoiceAge v. HMD*, *Panasonic v. Oppo*), giving rise to significant disagreement regarding its proper application, particularly regarding the sequence in which its different steps should be assessed. This study does not claim to provide a comprehensive overview of all such decisions. Instead, it focuses on decisions within this line of case law, examining the substance of offers made by SEP holders and/or counter-offers made by implementers in relation to the FRAND nature of these offers. Not considered are the numerous decisions that deal exclusively with the respective parties' negotiating conduct. Apart from this relatively large body of EU decisions, the corpus also includes a smaller and more heterogeneous group of cases from other jurisdictions in which courts assessed whether SEP licensing offers or royalty rates complied with FRAND obligations.

Several patterns emerge from Table 3 and Figures 3 and 4. First, FRAND rate assessments are heavily concentrated in the European Union, particularly Germany, which has emerged as the principal forum for assessing the FRAND character of licensing offers in the context of SEP injunction litigation under EU competition law, joined in the most recent years by the UPC. By contrast, jurisdictions such as the United Kingdom and China, which play a major role in FRAND rate determinations,

have produced comparatively few FRAND assessment decisions. Second, the sample consists predominantly of first-instance decisions, which reflects the procedural nature of many FRAND assessment disputes. Third, the technological distribution of the cases is strongly concentrated in cellular and video codec technologies although the sample also includes disputes involving Wi-Fi, DSL, memory modules and audio codecs.

Box 4: Differences between FRAND rate determinations and FRAND rate assessments

FRAND rate determinations and FRAND rate assessments are both judicial responses to the question of what FRAND is, but they differ in two main respects.

First, many courts have recognised that there can be a range of FRAND rates (see Section 3.2.2.), but the approach to the determination of a FRAND range differs between the two types of decisions. In FRAND rate determinations, a FRAND range may be used as a starting point for the determination of a single rate. In the economic literature, there are various definitions of FRAND that define a FRAND range rather than a single FRAND rate (Sidak, 2013). A theoretical approach sees the FRAND rate as determined within a theoretical "bargaining" range. This approach has not been applied in any of the 20 FRAND determination cases that we observed, but it was proposed in the *InterDigital v. Lenovo* UK High Court case. Instead of using the FRAND range as a starting point to determine the FRAND rate, courts have sometimes determined a FRAND rate first and subsequently derived the bounds of the FRAND range (*Microsoft v. Motorola*).[9] Either way, in FRAND determinations, treating FRAND as a range rather than a single rate does not simplify the analysis. The court must still apply a principled process to arrive at a specific rate and sometimes additional price points as well. In FRAND rate assessments, however, a court may find that the rate is within the FRAND range without necessarily specifying a specific FRAND rate or the specific boundaries of the FRAND range. Conversely, a court may find that a rate is not FRAND without specifying what would be FRAND. In other cases, the circumstances of the case require a more specific assessment, e.g. when a court is asked to consider whether an implementer has made an offer that a SEP holder may not refuse without violating its FRAND obligations (*Orange-Book-Standard*[10]; *Samsung v. ZTE*[11] in Frankfurt). Here, the exercise is explicitly to compare a licensing offer with the upper bound of the FRAND range. Nevertheless, in such cases too, a court may find that an offered rate is or is not at or above the upper bound of the FRAND range without a need to specifically determine where that upper bound would be (see e.g. *Samsung v. ZTE*).

Second, the two types of decisions differ with respect to how they deal with uncertainty in the determination of a FRAND rate – i.e. not only whether there is a single FRAND rate or a range, but also the extent to which the FRAND rate (or range) can be determined from the available evidence. In FRAND rate determinations, the court needs to arrive at a specific rate. When a court considers that there is substantial uncertainty, it needs to use discretion to arrive at a single rate.[12] In FRAND rate assessments, in contrast, courts have often found that it can be difficult or impossible to determine a FRAND rate (or assess whether a rate is FRAND) (e.g. FCJ in *Sisvel v. Haier*). Courts may hold that a rate is "not manifestly non-FRAND" (i.e. there is not sufficient evidence to show that the rate is non-FRAND). Courts may also find that sufficient support has been provided for a rate being FRAND considering the depth of assessment that is required by the circumstances of the case (e.g. *Nokia v. Daimler*).

9 See *Microsoft v. Motorola*, Case C10-1823JLR, at 8.

10 Federal Court of Justice (Bundesgerichtshof/BGH), judgment of 6 May 2009, Case No. KZR 39/06 — Orange-Book-Standard, BGHZ 180, 312.

11 *Samsung v. ZTE*, Case 2-06 O 426/24.

12 For example, in the *Unwired Planet v. Huawei* case, as reported in Contreras (2026): *"The court held that while the FRAND rate is precise, the conditions under which it may be enforced are fuzzy"*. Similarly, in the *Optis v. Apple* appeal, [2025] EWCA Civ 552, [72], the judge noted how the calculation of comparable licences employed in the first instance included arbitrary adjustments that would *"make a statistician blush"*.

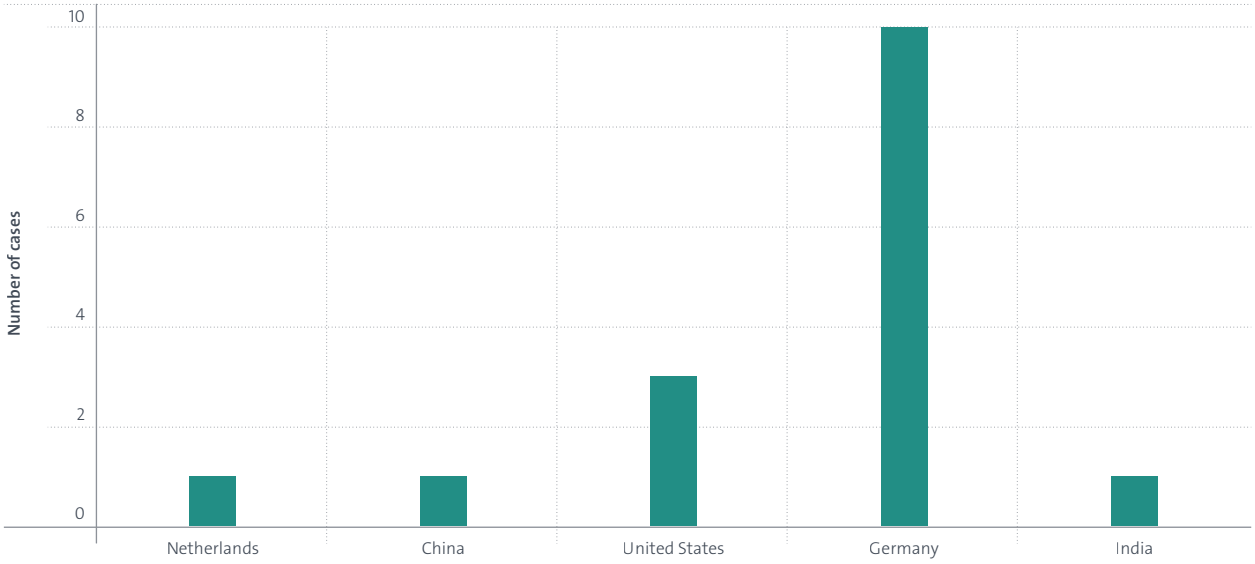
Table 3

FRAND rate assessments – Type of proceeding and geographic scope

Case	Year	Number of decisions	Subject of assessment	Technology
United States				
HTC Corp. v. Telefonaktiebolaget LM Ericsson (HTC v. Ericsson)	2019	First instance	SEP holder's offer	Cellular
Federal Trade Commission v. Qualcomm Inc. (FTC v. Qualcomm)	2019	First instance	SEP holder's rates	Cellular
In re Certain Memory Modules and Components Thereof (Netlist, Inc. v. SK Hynix Inc.)	2017	First instance	SEP holder's offer	Memory modules
Germany				
Saint Lawrence Communication GmbH v. Vodafone GmbH (Saint Lawrence v. Vodafone)	2016	First instance	SEP holder's offer; Licence seeker's counter-offer	Audio codec
Fraunhofer-Gesellschaft (MPEG-LA) v. ZTE Deutschland GmbH (Fraunhofer v. ZTE)	2018	First instance	SEP holder's offer; Licence seeker's counter-offer	Video codec
Tagivan GmbH (MPEG-LA) v. Huawei Technologies Deutschland GmbH (Tagivan v. Huawei)	2018	First instance	SEP holder's offer; Licence seeker's counter-offer	Video codec
Intellectual Ventures LLC v. Deutsche Telekom AG / Vodafone GmbH / Telefónica Germany GmbH (Intellectual Ventures v. German Mobile Operators)	2018	First instance	SEP holder's offer	DSL
LG Düsseldorf, 4b O 91/18 (officially anonymised; inferred parties: Siemens v. TCT)	2020	First instance	SEP holder's offer	Cellular
IP Bridge 1 GmbH & Co. KG v. TCT Mobile Europe SAS (IP Bridge v. TCT)	2020/ 2022	First instance + appeal	SEP holder's offer; Licence seeker's counter-offer	Cellular
Nokia Technologies Oy v. Daimler AG (Nokia v. Daimler)	2020/ 2021	First instance + appeal	SEP holder's offer; Licence seeker's counter-offer	Cellular
GE/Access Advance LLC v. Vestel Elektronik Sanayi ve Ticaret A.Ş. (GE/Access Advance v. Vestel)	2021	First instance	SEP holder's offer	Video codec
Avago (Broadcom) v. Renault	2026	First instance	SEP holder's offer	IEEE Ethernet
Wilus Institute of Standards and Technology Inc. v. ASUSTeK Computer Inc. (Wilus v. AsusTek)	2026	First instance	SEP holder's offer; Licence seeker's counter-offer	Wi-Fi
Netherlands				
Koninklijke Philips NV v. ASUSTeK Computer Inc. (Philips v. ASUSTeK)	2017/ 2019	First instance + appeal	SEP holder's offer	Cellular
China				
Huawei Technologies Co., Ltd v. Samsung Electronics Co., Ltd (Huawei v. Samsung)	2018	First instance	SEP holder's offer	Cellular
India				
Telefonaktiebolaget LM Ericsson v. Intex Technologies (India) Ltd (Ericsson v. Intex)	2015	First instance	SEP holder's offer	Cellular

Figure 3

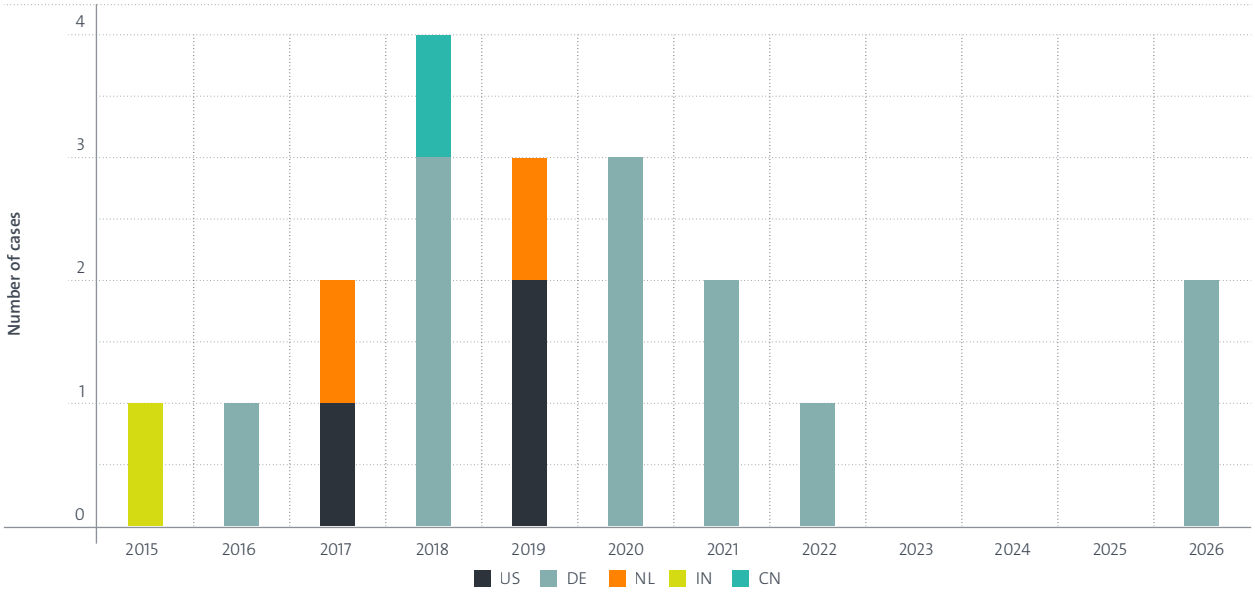
Distribution of FRAND assessment cases across countries



Note: Based on the sample of 19 FRAND rate assessment decisions listed in Table 3. This sample is non-exhaustive and does not represent all the case law on FRAND rate assessments.

Figure 4

Yearly distribution of FRAND assessment decisions by jurisdiction



Note: Based on the sample of 19 FRAND rate assessment decisions listed in Table 3. This sample is non-exhaustive and does not represent all the case law on FRAND rate assessments.

2.3 Admissibility of FRAND determination methods

This section describes 13 court decisions, orders and guidelines that discuss methodologies that may be used to determine FRAND rates even when the court does not itself determine or assess a specific FRAND rate. These documents are summarised in Table 4. Most of them are decisions on *Daubert motions* in the US, which are explained in more detail in Box 5. These decisions concern the admissibility of expert testimony on FRAND methodologies and are particularly relevant because they often contain detailed discussion of whether a proposed method is sufficiently reliable and relevant to support a FRAND rate analysis. The corpus also includes a smaller and more heterogeneous set of court guidelines and orders from other jurisdictions. The legal status of these documents differs, but they all provide relatively extensive methodological discussions that are intended to be of general applicability and therefore informative and relevant for our review.

Box 5: *Daubert motions* and methodological admissibility

In US litigation, before jury trials, parties may seek to exclude expert testimony that they consider unreliable or unsuitable for presentation to a jury. Such motions to exclude inadmissible evidence are known as *Daubert motions*. In assessing them, the trial judge acts *"as a gatekeeper to exclude junk science that does not meet Federal Rule of Evidence 702's reliability standards"*.[13, 14] In evaluating a Daubert motion, a court assesses whether *"an expert's testimony both rests on a reliable foundation and is relevant to the task at hand"*. [15]

A ruling on admissibility should not be confused with a ruling on the correctness of the expert's conclusions.[16] An opinion that is held admissible may still be challenged at trial. Nevertheless, Daubert rulings often contain detailed discussions of the reliability of FRAND valuation methods and are therefore relevant to this study.

13 *Estate of Barabin v. AstenJohnson, Inc.*, Case 740 F.3d 457, 463 (9th Cir. 2014), quoting *Ellis v. Costco Wholesale Corp.*, Case 657 F.3d 970, 982 (9th Cir. 2011).

14 Federal Rule of Evidence 702 provides that an expert witness may testify in the form of an opinion if *"the testimony is the product of reliable principles and methods"*. URL: https://www.law.cornell.edu/rules/fre/rule_702.

15 *Daubert v. Merrell Dow Pharm.*, Case 509 US 579, 597.

16 *"The Court's duty is to evaluate the soundness of the expert's methodology, not the correctness of the expert's conclusions." Primiano v. Cook*, Case 598 F.3d 558, 564.

Table 4

Overview of documents discussing the admissibility of FRAND determination methods

Case	Year	Jurisdiction
Decisions on *Daubert motions*		
WiLAN v. Alcatel Lucent	2013	US
Ericsson v. D-Link	2013	US
Realtek v. LSI	2014	US
GBT v. Apple	2014	US
Core Wireless v. Apple	2016	US
Network-1 Techs v. Alcatel	2017	US

Case	Year	Jurisdiction
Saint Lawrence Communications v. ZTE	2017	US
In re Qualcomm Antitrust litigation	2018	US
Huawei v. Samsung	2018	US
Qualcomm v. Apple	2019	US
Other court orders and guidelines on FRAND determination methodology		
Guidelines of the Munich Regional Court	2020	DE
Guidelines of the IP Divisions of the Tokyo District Court	2026	JP
Court order in ZTE v. Samsung, Munich Regional Court	2026	DE

3. Frameworks and principles of FRAND determinations

This chapter sets out the legal, conceptual and evidentiary framework within which courts determine or assess FRAND rates. It does not yet examine the valuation methods themselves, such as comparable licences or top-down analysis, which are addressed in Chapters 4 and 5. Instead, it identifies the principles, legal frameworks and evidentiary constraints that shape how courts select, adapt and evaluate those methods. A glossary of relevant concepts used throughout the chapter is provided in Box 6.

The approach taken is a qualitative comparative case law synthesis complemented by the related legal and economic literature. It extracts recurring concepts from the court documents reviewed in Chapter 2 – such as hold-up, royalty stacking, ex ante value, hold-out, fair balance, the hypothetical negotiation or the rate-versus-range distinction – and organises them according to their methodological function. The chapter traces how each concept has been articulated, qualified and refined across decisions and jurisdictions over time to shape core principles and frameworks.

The chapter proceeds as follows. Section 3.1 reviews the main principles guiding FRAND analysis, such as the avoidance of hold-up and royalty stacking, the prevention of hold-out, and the need to strike a fair balance between compensation for innovation and access to standards. Section 3.2 examines the conceptual frameworks used by courts to structure the inquiry, such as the hypothetical-negotiation construct, the debate over whether FRAND is a single rate or a range, and the interpretation of the individual components of the FRAND acronym. These principles and frameworks operate within jurisdiction-specific legal frameworks reviewed in Section 3.3, in particular the *Huawei v. ZTE* framework in EU competition law and the *Georgia-Pacific* framework in US patent damages law. Section 3.4 covers evidentiary guardrails applied by courts that constrain the choice of royalty base. Section 3.5 summarises the chapter's main findings.

Box 6: Glossary of concepts used in Chapter 3

Patent hold-up. In the SEP context, this can occur when an SEP holder exploits the standard essential character of its patents to demand excessive royalties from implementers who have already made irreversible investments in the development of standard-compliant products. Such a lock-in situation can arise when compliance with the standard is indispensable to compete in the relevant product market and there is no practicable alternative, with the consequence that the SEP holder could therefore exclude an implementer from making standard-compliant products by enforcing an injunction. This can give the SEP holder leverage to extract royalty rates in excess of the incremental value of its invention and its contribution to the standard, simply by exploiting the lock-in created by the standardisation process.

Patent hold-out. This is the mirror risk to patent hold-up, whereby an implementer has started using the patented invention but has no intention of obtaining a licence. Instead, they exploit procedural and legal delays to avoid or minimise royalty payments, forcing the patent holder to either incur substantial legal costs in pursuing enforcement across multiple jurisdictions or simply abandon the matter because the cost of enforcement exceeds the expected financial recovery.

Royalty stacking. This refers to situations in which a single product potentially infringes many patents and thus bears multiple royalty burdens. From the perspective of the firm manufacturing the product in question, it reflects the fact that all the different royalty claims must be added together, or "stacked", to determine the total royalty burden if the firm is to sell the product free of patent litigation. According to this theory, the total of the individual royalty rates may result in an excessive aggregate royalty burden, which can affect the implementer's ability to market commercially viable products.

Hypothetical negotiation. A framework used by courts, originating in US patent damages law and adapted to FRAND, which asks what royalty a willing licensor and a willing licensee would have agreed in an arm's-length negotiation before the standard was adopted, with neither party engaging in hold-up or hold-out. UK courts express a similar idea through the willing licensor and willing licensee framework.

Incremental value rule. The principle that the royalty for a SEP should reflect only the incremental technical contribution of the patented technology, i.e. its value over the next-best alternative available when the standard was set. The rule seeks to exclude value created by standardisation itself, rather than by the invention.

SSPPU (Smallest Saleable Patent-Practising Unit). An evidentiary rule, developed mainly in US litigation, under which expert damages analysis is anchored to the smallest saleable component that practises the patent, rather than to the end-product price, to avoid anchoring juries to an inflated royalty base. SSPPU is distinct from apportionment. Courts have held that it is an evidentiary safeguard, not a standalone valuation method or an obligation arising from FRAND commitments.

EMVR (Entire Market Value Rule). A substantive constraint under US patent damages law. A patent holder may rely on the entire market value of the end product only where the patented feature drives consumer demand for the product as a whole. In FRAND cases, courts have treated EMVR and SSPPU not as competing methods, but as expressions of the broader apportionment requirement. The royalty must ultimately be calibrated to the value of the patented technology, regardless of the royalty base used.

3.1 Core principles guiding FRAND analysis

This section reviews the overarching conceptual principles that courts have invoked when determining FRAND terms. These principles shape how the inquiry is structured, which factors may be considered, and whether a methodology is suitable to determine a FRAND rate, but they do not by themselves yield a number.

A single decision will typically consider several principles in order to assess and select the valuation methods used for determining a FRAND rate. The discussion below traces how courts in the United States, the United Kingdom, the European Union, China, Japan and India have articulated and refined these guiding principles and frameworks over time.

3.1.1 Hold-up, royalty stacking, and the ex ante, incremental value of the patent

Siebrasse and Cotter (2016) state a list of principles emerging from the FRAND determinations in the early US case law, which represented a large share of the earlier decisions in the global landscape of FRAND determinations:

> "(1) The royalty should prevent SEP owners from exercising patent 'hold-up'.[17] (2) Courts should minimize the risk of 'royalty stacking', in which a seller incurs an excessive royalty burden as a result of marketing a product incorporating multiple, separately owned patents (Cotter, 2009; FTC, 2003, Lemley & Shapiro, 2007).[18] (3) A FRAND royalty should reflect the incremental ex ante value of the technology in comparison with alternatives.[19] (4) The royalty should be proportionate to the technology's importance to the standard and to users of the standard (the 'proportionality' principle).[20] (5) The royalty should not reflect 'any value added by the

17 See *Microsoft v. Motorola*, Case C10-1823JLR, [72]; *Microsoft v. Motorola*, Case 14-35393, at 53; *In re Innovatio*, Case 11 C 9308, at 14; cf. *Ericsson v. D-Link*, Case 773 F.3d 1201, at 14.

18 See *Microsoft v. Motorola*, Case C10-1823JLR, [538]; at *9–10; cf. *Ericsson v. D-Link*, Case 773 F.3d 1201, at 8.

19 See *In re Innovatio*, Case 11 C 9308, at 36; *Microsoft v. Motorola*, Case C10-1823JLR, [77].

20 See *Microsoft v. Motorola*, Case C10-1823JLR, at 7; *In re Innovatio*, Case 11 C 9308, at 13; *Ericsson v. D-Link*, Case 773 F.3d 1201, at 52.

> standardization of that technology', that is, 'by the standard's adoption of the patented technology'[21] – or, as another court put it, simply, 'the value of the standard'.[22] (6) The royalty should be adequate to preserve the patent incentive (the 'incentive to invent' principle) (FTC, 2011).[23] (7) The royalty should provide an adequate incentive to participate in the standard-setting process (the 'incentive to participate' principle) (Layne-Farrar et al., 2014)".[24]

The first five of these principles reflect a view of FRAND as a safeguard against excessive royalties which may result from unilateral abusive conduct (hold-up) and uncoordinated royalty requests by different SEP holders (royalty stacking), a view prominently expressed by Lemley and Shapiro (2007). In particular, averting the risk of hold-up has sometimes been considered as an important guiding principle for determining FRAND rates.[25] Some economists consider that guarding against hold-up entails anchoring the FRAND rate in the ex ante value of the technology, in comparison with possible alternatives, and being careful not to include in the evaluation any value that the patented technology may derive from being included in the standard (see e.g. Leonard and Lopez, 2014). The notions of hold-up, ex ante value and the patented technology's intrinsic value (the value not attributable to standardisation) are thus conceptually related.

Preventing hold-up and royalty stacking is listed as an important guiding consideration in the foundational decisions in *Microsoft v. Motorola*[26] and *In re Innovatio*.[27] In both decisions, courts have emphasised the importance of anchoring the FRAND royalty in the ex ante value of the patented technology established prior to technological lock-in and therefore independent of any added value attributable to standardisation.[28] This emphasis on the potential risks of hold-up and royalty stacking has been qualified in subsequent US court decisions: in *Ericsson v. D-Link,* the Federal Circuit cautioned that hold-up and royalty stacking cannot be presumed; they must be evidenced before the jury is instructed on them.[29] Furthermore, in *CSIRO v. Cisco,* the Federal Circuit cautioned that *"abstract recitations of royalty stacking theory, and qualitative testimony that an invention is valuable – without being anchored to a quantitative market valuation – are insufficiently reliable".*[30]

Subsequently, these cautions against abstract references to hold-up and royalty stacking – in the absence of any evidence of actual hold-up and stacking – have been extended from the context of jury instructions to the context of assessing admissibility of expert evidence. In *Core Wireless v. Apple*, Core Wireless objected to the admission of expert evidence opining on royalty stacking. However, in that case, the court held that the opinion was admissible because Apple had presented evidence on royalty demands from multiple SEP holders that, if paid, would result in royalty stacking and because the record indicated that Apple considered royalty stacking concerns in real-world negotiations.[31] In *Network-1 Techs v. Alcatel*,

21 See *Ericsson v. D-Link*, Case 773 F.3d 1201, at 50; *CSIRO v. Cisco*, Case 809 F.3d 1295, at 16 (quoting *Ericsson v. D-Link*, Case 773 F.3d 1201).

22 See *Microsoft v. Motorola*, Case 14-35393, at 55; *Microsoft v. Motorola*, Case C10-1823JLR, [55].

23 See *Microsoft v. Motorola*, Case C10-1823JLR, [502].

24 See *Microsoft v. Motorola*, Case C10-1823JLR, [73].

25 *"The court concludes that patent hold-up is a substantial problem that RAND is designed to prevent. The court's RAND rate therefore must, to the extent possible, reflect only the value of the underlying technology and not the hold-up value of standardization."* (In re Innovatio, Case 11 C 9308, at 16).

26 *"As discussed with relation to SSO policy, RAND is informed by two prevailing concerns: preventing stacking and eliminating hold-up. The court finds that, among these two goals, the anti-stacking principle is the primary constraint on the upper bound of RAND".* (*Microsoft v. Motorola*, Case C10-1823JLR, [538]); *"In the context of a dispute concerning whether or not a given royalty is RAND, a proper methodology used to determine a RAND royalty should therefore recognize and seek to mitigate the risk of patent hold-up that RAND commitments are intended to avoid".* (*Microsoft v. Motorola*, Case C10-1823JLR, [71]).

27 *"The court concludes that patent hold-up is a substantial problem that RAND is designed to prevent. The court's RAND rate therefore must, to the extent possible, reflect only the value of the underlying technology and not the hold-up value of standardization".* (In re Innovatio, Case 11 C 9308, at 16).

28 *"Although Microsoft's approach suffers from several flaws, ex ante examination of the incremental contribution of the patented technology to the standard can be helpful in determining a RAND rate in the context of a dispute over a RAND royalty rate".* (*Microsoft v. Motorola*, Case C10-1823JLR, [76]).

29 *"A jury, moreover, need not be instructed regarding royalty stacking unless there is actual evidence of stacking. The mere fact that thousands of patents are declared to be essential to a standard does not mean that a standard-compliant company will necessarily have to pay a royalty to each SEP holder."* (*Ericsson v. D-Link*, Case 773 F.3d 1201, at 55); *"We also conclude that, if an accused infringer wants an instruction on patent hold-up and royalty stacking, it must provide evidence on the record of patent hold-up and royalty stacking in relation to both the RAND commitment at issue and the specific technology referenced therein".* (*Ericsson v. D-Link*, Case 773 F.3d 1201, at 56).

30 *CSIRO v. Cisco*, Case 809 F.3d 1295, at 11.

31 *Core Wireless v. Apple*, Case 15-cv-05008 NC, at 4-5.

however, an expert opinion referencing hold-up and royalty stacking concerns was held inadmissible because the defendant *"has identified no evidence that it has received requests for multiple royalties, or that it considers royalty stacking in real-world licensing negotiations"*,[32] and *"offered no evidence that patent hold up, is indeed an issue that exists in this case"*.[33]

In spite of these qualifications on the role of hold-up and royalty stacking risks for the interpretation of FRAND, US courts have continued to emphasise the need to distinguish between the intrinsic value of the patented technology and the value that must be attributed to the technology's inclusion into a standard.[34]

Similarly, some German courts have described the FRAND commitment as a limitation on the SEP holder's ability to exploit the dominant position created through the lock-in effect of standardisation. In this context, courts have stated that fair and reasonable rates are those that would have emerged in a hypothetical competitive market in which implementers' technology choice is not constrained by standardisation.[35] This case law furthermore recognises the need to avert the risk of royalty stacking as one additional guiding consideration for interpreting the fair and reasonable prong of the FRAND commitment.[36]

3.1.2 Hold-out as a co-equal concern

Where the *Microsoft v. Motorola* decision focuses on *"two prevailing concerns: preventing stacking and eliminating hold-up"*,[37] the Court of Justice of the European Union (CJEU) in *Huawei v. ZTE* and the more recent FRAND determination decisions of UK courts generally strike a different balance.

The central innovation of *Huawei v. ZTE* is that, although the dispute arose entirely under Article 102 TFEU, the CJEU declined to treat the SEP holder's dominance as the only possible source of opportunism. It constructed a reciprocal framework in which obligations run in both directions: the patentee must notify the implementer and make a specific, written FRAND offer, while the implementer must in turn demonstrate genuine willingness to license, respond diligently and in good faith *"without delaying tactics"*, submit a prompt FRAND counter-offer, and provide security for past use. By conditioning the availability of the abuse defence on the implementer's own conduct, the Court recognised that an unwilling licensee who refuses to engage can exploit the patentee just as a dominant SEP holder can exploit a locked-in implementer. Hold-out is thereby raised from a background worry to an operative criterion, co-equal with hold-up in determining when an injunction is — or is not — abusive.

32 *Network-1 Techs v. Alcatel*, Case 6:11-cv-492-RWS-KNM, Doc No. 810, at 6.

33 *Network-1 Techs v. Alcatel*, Case 6:11-cv-492-RWS-KNM, Doc No. 810, at 9.

34 The Federal Circuit stated the rule explicitly: *"We further hold that district courts must make clear to the jury that any royalty award must be based on the incremental value of the invention, not the value of the standard as a whole or any increased value the patented feature gains from its inclusion in the standard."* (*Ericsson v. D-Link*, Case 773 F.3d 1201, at 56); *"When dealing with SEPs, there are two special apportionment issues that arise. First, the patented feature must be apportioned from all of the unpatented features reflected in the standard. Second, the patentee's royalty must be premised on the value of the patented feature, not any value added by the standard's adoption of the patented technology."* (*Ericsson v. D-Link*, Case 773 F.3d 1201, at 50); *CSIRO v. Cisco* reinforced the same apportionment logic and tied it directly to the SEP context: *"This is not meant to imply that SEPs never claim valuable technological contributions. We merely hold that the royalty for SEPs should reflect the approximate value of that technological contribution, not the value of its widespread adoption due to standardization"*. (*CSIRO v. Cisco*, Case 809 F.3d 1295, at 16-17) *"Therefore, damages awards for SEPs must be premised on methodologies that attempt to capture the asserted patent's value resulting not from the value added by the standard's widespread adoption, but only from the technology's superiority."* (*CSIRO v. Cisco*, Case 809 F.3d 1295, at 17).

35 *"Ein Angebot des Lizenzgebers kann sich insbesondere dann als unfair/ unangemessen erweisen, wenn eine Lizenzgebühr verlangt wird, die den hypothetischen Preis, der sich bei wirksamem Wettbewerb auf dem beherrschten Markt gebildet hätte, erheblich überschreitet, es sei denn, es gibt eine wirtschaftliche Rechtfertigung für die Preisbildung (LG Düsseldorf, Teilurt. v. 31.03.2016, Az.: 4a O 73/14, Rn. 225, zitiert nach juris; Huttenlauch/ Lübbig, in: Loewenheim/ Meessen/ Riesenkampff/ Kerstin/ Meyer-Lindemann, Kartellrecht, Kommentar, 3. Auflage, 2016, Art. 102 AEUV, Rn. 182; Kühnen, ebd., Kap. E., Rn. 245)."* English translation: *"An offer by the licensor may prove to be unfair or unreasonable, in particular, if a licence fee is demanded that significantly exceeds the hypothetical price that would have been established in the dominated market under effective competition, unless there is an economic justification for the pricing (Regional Court of Düsseldorf, partial judgment of March 31, 2016, Case No.: 4a O 73/14, para. 225, cited from juris; Huttenlauch/ Lübbig, in: Loewenheim/ Meessen/ Riesenkampff/ Kerstin/ Meyer-Lindemann, Antitrust Law, Commentary, 3rd ed., 2016, Art. 102 TFEU, para. 182; Kühnen, ibid., Ch. E., para. 245)."* (*Fraunhofer v. ZTE*, Case 4a O 15/17, [391]).

36 *"Handelt es sich um ein standardgebundenes Schutzrecht, kann sich die Unangemessenheit ferner daraus ergeben, dass sich im Falle einer Lizenzforderung auch für die übrigen Standard-Schutzrechte eine kumulative Gesamtlizenzbelastung ergeben würde, die wirtschaftlich nicht tragbar ist (Kühnen, ebd., Kap. E., Rn. 246)"*. English translation: *"If the intellectual property right in question is a standard-essential right, the unreasonableness may also arise from the fact that, in the event of a licensing claim, a cumulative total licensing burden would result for the remaining standard-essential rights as well, which is economically unsustainable (Kühnen, ibid., Ch. E., para. 246)"*. (*Fraunhofer v. ZTE*, Case 4a O 15/17, [391]).

37 *Microsoft v. Motorola*, Case C10-1823JLR, [538].

Similarly, hold-out emerges in the UK case law as a concern that is co-equal to hold-up, as stated for instance by the Court of Appeal of England and Wales in *InterDigital v. Lenovo*, the UK courts identify *"two particular potential evils that must be avoided. Although terminology is not entirely consistent, these evils are generally known as 'hold up' and 'hold out' respectively."*[38]

Birss J's first-instance judgment in *Unwired Planet v. Huawei* was the first major decision to put hold-up and hold-out on the same footing: *"In my judgment what counts is that both hold up and hold out are possible and both concepts are relevant in analysing a given set of facts. Unscrupulous behaviour by either the patentee or the licensee can lead to unfairness. In order to arrive at fair, reasonable and non-discriminatory licence terms the patentee must not engage in hold up nor must the licensee engage in hold out."*[39]

The Court of Appeal endorsed and extended the symmetry, expressly recognising the risk of abusive conduct on either side: *"The owner of a SEP may still use the threat of an injunction to try to secure the payment of excessive licence fees and so engage in hold-up activities. Conversely, the infringer may refuse to engage constructively or behave unreasonably in the negotiation process and so avoid paying the licence fees to which the SEP owner is properly entitled, a process known as 'hold-out'."*[40]

More recent UK decisions have discussed the distinction between legitimate bargaining and hold-out. In *Optis v. Apple*, Marcus Smith J. criticized Optis' overly broad use of the hold-out concept, whereby *"[e]very effort by Apple to fight its own corner – an essential part of any market economy – was labelled Hold Out"*; and stated that it is necessary to *"consider the difference between legitimate and illegitimate Hold Out."*[41] This *"novel distinction between legitimate and illegitimate hold up or hold out"* (in the words of the Appeal Court)[42] formed an important aspect of the appeal. The Appeal Court rejected the notion of *"legitimate hold out"*, emphasising that the UK Supreme Court had labelled hold-out a *"mischief"*, and stated that *"both hold up and hold out are behaviours by one party, mischiefs, which the other party is to be protected from; and this underpins the FRAND system itself."*[43] The Appeal Court nevertheless establishes a distinction between unlawful hold-out and hold-out that is lawful, but contrary to FRAND principles: *"A finding that a degree of hold up or hold out was involved in a given real negotiation is not a finding that either party has acted in an unlawful manner. It is simply a finding that that outcome cannot be taken as the FRAND rate"*.[44]

Chinese courts similarly consider implementer hold-out a factor in SEP damages awards. Yiu and Ren (2024) report that for the first instance ruling of *Iwncomm v. Apple* "*The award of triple royalty is linked to the implementer's fault in negotiation … The ruling is consistent with the parallel judgment of Iwncomm v. Sony Mobile."*[45] They also report that for the appeal *"[t]he SPC upheld the finding that the implementer has obvious fault in negotiation"*[46] and awarded damages to Iwncomm as compensation and deterrence against wilful infringement.

3.1.3 Striking a fair balance between compensation and access

Despite the varying emphasis placed on different potential risks inherent in SEP licensing, courts in different jurisdictions state a similar goal of striking a balance between providing for a fair reward for patent owners' inventions on the one hand and encouraging widespread adoption of the standard on the other.

In the UK, this position is exemplified by the High Court decision in *Unwired Planet v. Huawei,* which states that *"While the inventor must be entitled to a fair return for the use of their invention, in order for the standard to permit interoperability the inventor must not be able to prevent others from using the patented invention incorporated in the standard as long as implementers take an appropriate licence and pay a fair royalty. In this way a balance is struck, in the public interest, between the inventor and*

38 *Interdigital v. Lenovo*, Case EWCA Civ 743, [8].
39 *Unwired Planet v. Huawei,* Case EWHC 711, [96].
40 *Unwired Planet v. Huawei,* Case EWCA Civ 2344, [5].
41 *Optis v. Apple*, Case EWHC 1095, [481-(ii)].
42 *Optis v. Apple*, Case EWCA Civ 552, [47].
43 *Optis v. Apple*, Case EWCA Civ 552, [118].
44 *Optis v. Apple*, Case EWCA Civ 552, [119].
45 Yiu and Ren (2024), at 8.
46 Ibid.

the implementers."[47] The court further states that *"The underlying purpose of the FRAND undertaking is to secure a proper reward for innovation whilst avoiding 'hold up'... The idea is to strike a fair balance. This way of describing the purpose of FRAND is not in dispute and can be seen in numerous sources."*[48] The Court of Appeal in *InterDigital v. Lenovo* similarly describes the purpose of FRAND as striking a balance: *"Patentees are ensured a fair reward for the use of their inventions, and implementers are guaranteed access to those inventions at a fair price. This balance is in the public interest, because it encourages patentees to permit their inventions to be incorporated into standards and it encourages implementers to implement those standards."*[49]

US courts have expressed the same idea that FRAND rates should establish a balance that promotes the public interest: this balance must leave enough on the table to keep innovators contributing to standards while incentivising standards adoption. For example, this is clearly stated in two places in the *Microsoft v. Motorola* decision: *"The purpose of the RAND commitment is to encourage widespread adoption of the standard"*[50] and *"At the same time, a RAND royalty should be set with the understanding that SSOs include technology intended to create valuable standards. To induce the creation of valuable standards, the RAND commitment must guarantee that holders of valuable intellectual property will receive reasonable royalties on that property."*[51]

A very similar emphasis on striking a balance can be observed in Chinese and Indian case law. The Guangdong High People's Court in *Huawei v. InterDigital* explained that *"[i]mplementing the principles of fairness, reasonableness, and non-discrimination requires balancing the interests of the parties involved in standard-essential patents. This ensures that patent holders can obtain sufficient returns from technological innovation while preventing standard-essential patent holders from using their dominant position to demand high licensing fees or impose unreasonable conditions."*[52]

A similar view is stated by the Indian court in *Ericsson v. Lava*: *"The aforesaid FRAND protocol was laid down in order to balance equities along with the legitimate interests of the patent owner and the licensee concerned and to ensure that the parties to FRAND negotiation do not have unjust bargaining powers."*[53]

3.2 Conceptual frameworks used by courts

3.2.1 Hypothetical negotiation

In both the literature and case law, different frameworks exist to analyse FRAND rates. As discussed in Section 1.2, academic economists have proposed conceptual frameworks that could be used for the purpose of determining FRAND rates, and which involve concepts such as the Shapley Value and the ECPR. These suggested frameworks have (so far) been of purely academic relevance.

In the case law, however, a commonly applied framework is the hypothetical negotiation construct (for a critical review, see Jarosz and Chapman, 2012). In the US, this hypothetical negotiation concept is not limited to just FRAND determinations; rather, it is also commonly used for the determination of reasonable royalties as damages for patent infringement. While not a concept that is specific to FRAND, US courts have found in cases such as *Microsoft v. Motorola* and *In re Innovatio* that the hypothetical negotiation framework is applicable to FRAND determinations.

In *Microsoft v. Motorola*, the court stated that *"[j]udicial simulation of a hypothetical, bilateral negotiation under the RAND obligation logically will lead to a royalty rate that both parties would have found to be reasonable"*.[54] The *In re Innovatio* court further explained that *"[t]he purpose of conducting such a hypothetical negotiation is 'to ascertain the royalty upon which the parties would have agreed had they successfully negotiated an agreement just before infringement began'. ... the court must try, as best as possible, to recreate the ex ante licensing negotiation scenario and to describe the resulting agreement"*.[55]

47 *Unwired Planet v. Huawei*, Case EWHC 711, [83].
48 *Unwired Planet v. Huawei*, Case EWHC 711, [92].
49 *Interdigital v. Lenovo*, Case EWCA Civ 743, [7].
50 *Microsoft v. Motorola*, Case C10-1823JLR, [51].
51 *Microsoft v. Motorola*, Case C10-1823JLR, [73].
52 *Huawei v. InterDigital*, Case Yue Gao Fa Min San Zhong Zi No. 305, at 19-20.
53 Ericsson v. Lava, Case CS(COMM) 65/2016, [647].
54 *Microsoft v. Motorola*, Case C10-1823JLR, [91].
55 *In re Innovatio*, Case 1:11-cv-09308, at 8-9.

However, the application of the hypothetical negotiation framework may lead to ancillary disputes. For instance, factor 15 from *Georgia-Pacific* directs courts to set the hypothetical negotiation at *"the time the infringement began"*.[56] This may lead to complex methodological challenges such as determining the information that would have been available to the parties of such a hypothetical negotiation. On appeal in the *Microsoft v. Motorola* case, Motorola contended that Judge Robart had misapplied the hypothetical negotiation framework by using hindsight information, i.e. relying on data that would not have been available to the parties of a hypothetical negotiation at the time infringement began: *"Motorola's central RAND-rate merits contention is that Judge Robart's analysis failed to meet Georgia-Pacific's factor fifteen criterion, as interpreted and applied by the Federal Circuit, and so constituted error. Several portions of the court's findings of fact and conclusions of law do indicate that the court did to an extent take into account the present-day value to Microsoft of Motorola's patents"*.[57] The Appeal Court nevertheless ruled that the hypothetical negotiation framework needs to be applied in a flexible manner and that the district court had applied the framework correctly: *"In sum, given the need for flexibility in determining a royalty rate for a RAND-encumbered patent, see Ericsson, 771 F.3d at 1230–31, and given that Motorola has not shown that the court's consideration of the companies' circumstances at the time of the bench trial prejudiced it, see Brown & Williamson Tobacco Corp., 229 F.3d at 1131, the district court's RAND order properly applied the hypothetical agreement approach."*[58]

UK courts use the willing-licensor / willing-licensee construction as the analytical equivalent to the hypothetical negotiation framework. The framework is operationalised by asking what willing licensors and licensees, which are those parties that do not engage in either hold-up or hold-out, would agree:

> "The question is what would be fair, reasonable and non-discriminatory. Asking what a willing licensor and a willing licensee in the relevant circumstances acting without holding out or holding up would agree upon is likely to help decide that question."[59]

> "It is common ground that FRAND terms are those that would be agreed by a willing licensor of a portfolio of SEPs and a willing licensee of that portfolio. The concepts of a willing licensor and a willing licensee are very well established in the field of intellectual property licensing, and it is unnecessary for present purposes to elaborate upon them. In the present context, for the reasons given above, a willing licensor is one not intent on hold up and a willing licensee is one not intent on hold out."[60]

In spite of its wide acceptance, the practical impact of the hypothetical negotiation framework (or the willing licensor / willing licensee concepts) is somewhat unclear. In practice, courts have generally looked at comparable (real) licences for guidance regarding the rates that may have emerged from a hypothetical negotiation between willing parties. As argued by Jarosz and Chapman (2012), comparable licences may also inform courts about the value of reasonable royalties independently of the construct of a hypothetical negotiation.

More specific implementations of the hypothetical negotiation framework have been suggested, but without gaining wide acceptance. As noted above, a rigid application of the hypothetical negotiation framework may require courts to disregard any evidence that would not have been available at the date of the hypothetical negotiation. Use of such information (posterior to the date at which infringement began) is, however, commonplace in FRAND determinations. Furthermore, an explicit implementation of the hypothetical negotiation framework may require the court to assess the bargaining positions of the different parties of that negotiation and use a bargaining theory framework to arrive at a rate. Such an approach was suggested but rejected by the court in *InterDigital v. Lenovo*. The split proposed by InterDigital's expert was grounded in bargaining theory: *"Under very general conditions,*

56 *Georgia-Pacific*, 318 F. Supp. at 1120.

57 *Microsoft v. Motorola*, Case 14-35393, at 31.

58 *Microsoft v. Motorola*, Case 14-35393, at 34.

59 *Unwired Planet v. Huawei*, Case EWHC 711, [170].

60 *Interdigital v. Lenovo*, Case EWCA Civ 743, [40].

economic equilibrium implies an equal division of the gains from trade if bargaining positions are symmetric… if these two groups bargained with each other, we might expect an equal division of the gains."[61] Then Mellor J.'s reasons for rejection included that the split was *"[c]ompletely arbitrary pointing out there was no evidence (nor any analysis) of how this split reflects risks, costs or profitability."*[62]

3.2.2 FRAND rate or range

There has been a long-standing debate in the literature and case law as to whether there is, for any given SEP licence, a single FRAND rate or a range of rates that may be FRAND. From the outset, it should be noted that the concept of a single FRAND rate or range of FRAND rates does not fully reflect commercial licensing practice, where royalties are negotiated together with other terms such as duration, geographic scope, releases for past sales, payment structure, cross-licences, reporting duties, audit rights or other contractual provisions. There can thus be many different packages of licensing terms providing similar value to licensors even if the payment elements of the licence may vary. When asking whether there is a single FRAND rate for any given SEP licence, one needs to hold all other licensing contract elements constant so that the question is specific to the FRAND rate (or range of FRAND rates) for that specific licensing contract.

Some decisions have emphasised the need to identify one FRAND rate, especially where the court must produce an operative outcome such as damages or a licence to be offered between the parties. Other decisions have accepted that FRAND may describe a range of permissible outcomes provided that the range remains sufficiently constrained by the fair, reasonable and non-discriminatory nature.

The debate should be understood as involving two distinct questions. The first question is substantive and asks whether there is, for any specific set of circumstances, only one single rate that is FRAND, so that any other rate should be considered non-FRAND. In negotiations, this would mean that when the SEP holder and implementer make different offers, at least one of them is not FRAND. By contrast, if FRAND is a range, several different rates may all comply with the FRAND undertaking. This approach thus raises a further question: if both parties' offers are within the FRAND range, how should the dispute be resolved?

The second question is evidentiary. It concerns whether a court is able to determine the FRAND rate with precision from the available evidence or whether the exercise necessarily involves approximation. In this sense, a FRAND range may not mean that all rates in the range are substantively FRAND. It may instead mean that, given imperfect comparables, uncertain adjustments, incomplete information on portfolio strength and the need to reconstruct a hypothetical negotiation, the evidence only supports an interval within which the FRAND rate is likely to lie.

Unwired Planet v. Huawei is among the cases supporting a single-rate approach. In the first instance, Birss J adopted the strict single-rate view: *"I find that for a given set of circumstances there will only be one set of FRAND terms and only one FRAND rate."*[63] This view of FRAND as a single rate is practical in situations in which the parties have failed to agree and ask the court to determine the terms of a licence. A broad range may be less useful if the purpose of the proceeding is to resolve the parties' disagreement.

A similar conclusion was reached with *In re Innovatio*, but for a more remedial reason. The court was setting damages for infringement, and damages require a determinate number: *"By contrast, the purpose of the RAND determination here is to set damages for infringement of the standard-essential patents. The court must therefore determine a single RAND rate for the purpose of calculating damages, rather than a range."*[64] This shows that procedural context matters since a court may need to determine a single rate when calculating damages even if several outcomes might have been FRAND in a commercial negotiation. In this sense, a "single rate" may sometimes reflect the institutional task of adjudication rather than a conclusion that FRAND has no substantive range.

Conversely, more examples in the case law can be found supporting the acceptance of a FRAND range. For example, the Court of Appeal in Unwired Planet

61 *Interdigital v. Lenovo*, Case EWHC 1583 (Pat), [861]. EWHC 1583 (Pat) is a revised public version of the judgment. An earlier, more redacted, public version was published as EWHC 539 (Pat).

62 *Interdigital v. Lenovo*, Case EWHC 1583 (Pat), [862-(i)].

63 *Unwired Planet v. Huawei*, Case [2017] EWHC 711 (Pat), [164].

64 *In re Innovatio* IP Ventures, LLC, Case 11 C 9308, at 11.

overturned Birss J's formulation while preserving the need for a practical judicial outcome.[65] The Court of Appeal explained: *"In our judgment this is more of a theoretical problem than a real one. If the SEP owner and prospective licensee cannot agree upon the terms and royalty rates of a FRAND licence and the question of what is FRAND falls to be decided by a tribunal, whether a court or an arbitrator, then the tribunal will normally declare one set of terms as FRAND and that will be the set of terms the SEP owner must offer to the prospective licensee. If, however, the outcome of the proceedings is that two different sets of terms are each found to be FRAND then in our judgment the SEP owner will satisfy its obligation to ETSI if it offers either one of them. It will in that way be offering an irrevocable licence of its SEPs on FRAND terms."*[66]

This formulation reconciles the two positions. More than one set of terms may be FRAND, but adjudication still requires an operative outcome. The court may therefore accept that FRAND is a range *"for all practical purposes"* while still declaring one set of terms to resolve the dispute.

The distinction between FRAND as a rate or a range was further developed in *InterDigital v. Lenovo* at the first instance. The court accepted that a range of rates may be FRAND but warned that the range cannot be so broad that it undermines the non-discrimination principle.[67] A FRAND range must leave room for legitimate bargaining variation and evidentiary uncertainty, but it cannot become a justification for arbitrary price dispersion among similarly situated licensees. If the range is too wide, it may itself become inconsistent with the non-discrimination limb of FRAND. The Court of Appeal later confirmed the same approach: *"Birss J had been wrong to hold that there would only be one set of FRAND terms for any given set of circumstances. To the contrary, a number of sets of terms might all be FRAND. If two (or more) different sets of terms were each FRAND, then the SEP owner would satisfy its obligation to ETSI if it offered the FRAND set of terms which was most favourable to itself: UPCA at [118]-[129]."* [68]

German courts have reached a similar conclusion in the context of assessing offers under the *Huawei v. ZTE* framework. In *IP Bridge v. TCT*, the Court of Appeal of Karlsruhe stated the point in general terms: *"Furthermore, there is generally not a single licence agreement that meets FRAND conditions, but rather a range of possible reasonable solutions."*[69]

The Düsseldorf Regional Court connects the existence of a FRAND range to the rejection of a *"mathematical derivation"* of the royalty.[70] The court holds that the SEP holder is not required to prove the FRAND character of its offer through a formula capable of producing a single precise number.[71] Instead, it asks whether the SEP holder has provided sufficient commercial and evidentiary support for its licensing offer, often through comparable licences and evidence of market acceptance, to comply with its FRAND obligations under EU competition law.[72]

The FRAND range for a specific SEP licence is related to, but distinct from the permissible range of royalty rate variations between different licensees. In the US

65 *"The economic evidence did not support such an inflexible approach, however. Dr Niels, UP's expert economist, explained in his second report that FRAND was a range for all practical purposes. Dr Neven, Huawei's expert economist, said that there are different combinations of contractual clauses including royalties that can be deemed to be FRAND, but that for a given set of contractual clauses there is only one level of royalty payments that will be agreed upon."*, see *Unwired Planet v. Huawei*, Case [2018] EWCA Civ 2344, [123].

66 *Unwired Planet v. Huawei*, Case [2018] EWCA Civ 2344, [125].

67 *"Whilst I agree, as it was made clear in UPCA that a range of rates may be FRAND, I regard the ranges set out in Mr Bezant's tables as far too wide to represent the FRAND range in this case. Taking 4G as the prime example, Mr Bezant's preferred range was $0.65-$3.00. Any endorsement of ranges of that type of width would, in my view, provide a licence for discrimination and would positively hinder the endeavour to converge on FRAND rates which the industry can use. Accordingly, in my view, the task of the Court is to arrive at a much more precise range or even a single rate. A separate point is whether the Court should arrive at a single rate blended across generations or a single rate per generation." Interdigital v. Lenovo*, Case [2023] EWHC 539 (Pat), [317].

68 *Interdigital v. Lenovo*, Case [2024] EWCA Civ 743, [33].

69 *"Zudem gibt es in aller Regel nicht den einen FRAND-Bedingungen genügenden Lizenzvertrag, sondern eine Bandbreite möglicher angemessener Lösungen."* OLG Karlsruhe, Case 6 U 149/20, [192] – *IP Bridge v. TCT.*

70 Saint *Lawrence v. Vodafone*, Case 4a O 73/14, *Fraunhofer v. ZTE*, Case 4a O 15/17, and unknown parties, Case 4b O 91/18.

71 Saint *Lawrence v. Vodafone*, Case 4a O 73/14, [320]: *"Der SEP-Inhaber muss keine mathematische Herleitung der von ihm verlangten Lizenzgebühren vorlegen, insbesondere, da es in der Regel keine einzelne Lizenzgebühr gibt, die alleine FRAND ist, sondern eine Bandbreite von Werten fair, angemessen und nicht-diskriminierend sein wird."* English translation: *"The SEP holder is not required to provide a mathematical derivation of the licence fees it demands, particularly since there is generally no single licence fee that is FRAND on its own, but rather a range of values that will be fair, reasonable, and non-discriminatory."*

72 Saint *Lawrence v. Vodafone*, Case 4a O 73/14, *Fraunhofer v. ZTE*, Case 4a O 15/17, and unknown parties, Case 4b O 91/18.

TCL v. Ericsson case, for example, the court accepted that there is no single FRAND rate and that the FRAND character may allow for the variation of rates between licensees. The court stated that: *"there is no single rate that is necessarily FRAND, and different rates offered to different licensees may well be FRAND given the economics of the specific license. [...] the drafters did not intend non-discriminatory to ensure the exact same treatment or identical license terms for all licensees to the same portfolio of essential patents."*[73] Overall, the FRAND range for any specific SEP licence must not be confused with the observed range across the overall licences.[74]

3.2.3 F, R and ND: The different components of FRAND

FRAND can be interpreted as either a single combined obligation or as a bundle of separate elements and courts across jurisdictions have not adopted a uniform approach. The term refers to the licensing commitment required by SDOs such as the European Telecommunications Standards Institute from holders of declared SEPs. European SDOs generally require "FRAND" licensing commitments from their participants, while US SDOs more often require willingness from their participants to license on "RAND" terms and conditions. However, the literature largely treats both terms as interchangeable indicating that no major legal differences exist between them (Geradin, 2013; Contreras, 2015; Baron & Spulber, 2018).[75]

Within the acronym, most interpretive debate focuses on the relationship between "fair and reasonable" (FR) and "non-discriminatory" (ND), and in particular whether non-discrimination is a separate requirement or part of fairness and reasonableness. This issue has significant implications for FRAND analysis: under a unitary interpretation, an assessment of whether a licence offer is fair and reasonable cannot be separated from the assessment of the offer on non-discrimination grounds; under a bifurcated interpretation, non-discrimination operates as an independent criterion that may invalidate an offer that is otherwise considered "fair and reasonable" (and vice versa). The following subsection considers three approaches in comparative case law: (1) a unitary approach in the United Kingdom, (2) a focus on the non-discrimination component in Germany, and (3) a bifurcated approach in at least one decision in the United States.

English case law discussing FR and ND starts with the question of whether ND has any independent role beyond FR. In *Unwired Planet v. Huawei,* Birss J stated that *"most of the time the concepts of non-discrimination, reasonableness and fairness relate to one another"* and that there is little value in separating something *"merely fair and reasonable"* from something *"fair, reasonable and non-discriminatory"*.[76] On this reading, FR and ND largely merge into a single obligation. At the same time, Birss J recognises the possibility that competition law introduces a separate "hard-edged" ND obligation that could operate independently *"to reduce a royalty rate [...] which would otherwise have been regarded as FRAND"*.[77] This "hard-edged" ND should be distinguished from "general ND", which is already part of the FR benchmark itself, since *"the FRAND rate ought to be generally non-discriminatory in that it is determined primarily by reference to the value of the patents being licensed"*.[78] Birss J finds that the FRAND commitment should not be interpreted as to include "hard-edged ND",[79] and cautions that the existence of a stronger and separate ND obligation should not be read into

73 *TCL v. Ericsson*, Case SACV 14-341 NS(DFMx), at 109.

74 See LG Düsseldorf, Case 4b O 91/18, [386]: *"[...] vermag die Kammer nicht ohne weiteres als einen im Sinne einer „FRAND-Bandbreite" bestehenden Korridor zu deuten. Vielmehr kann die Spanne ebenso ein Indiz dafür sein, dass die Referenzverträge ihrerseits nichtdiskriminierungsfrei zustande gekommen sind." (para [386]. English translation: "[...] the Chamber cannot automatically interpret this as a range within the meaning of a 'FRAND range'. Rather, the range may also be an indication that the reference contracts themselves were not concluded on a non-discriminatory basis."*

75 Geradin (2013) notes that *"the notions of FRAND and RAND are used interchangeably by most observers"* (at 10); Contreras (2015) refers to RAND and FRAND as *"two competing formulations that do not seem to have a meaningful difference"* (at 39, fn 3), and cites the US Dep't of Justice & US Patent & Trademark Office, Policy Statement on Remedies for Standards-Essential Patents Subject to Voluntary F/ RAND Commitments 1 n.2 (2013), www.justice.gov/atr/public/guidelines/290994.pdf (*"Commentators frequently use the terms [RAND and FRAND] interchangeably to denote the same substantive type of commitment."*) (ibd,). Baron and Spulber (2018) note that *"we are however not aware of any case in which a licensing term has been found to be reasonable, but unfair"* (fn 33, at 23).

76 *Unwired Planet v. Huawei,* Case EWHC 711, [177].

77 Ibid.

78 *Unwired Planet v. Huawei,* Case EWHC 711, [175].

79 *Unwired Planet v. Huawei,* Case EWHC 711, [501].

the ETSI FRAND undertaking.[80] There may still be a possibility that a "hard-edged ND" obligation may arise under competition law, but this can only be the case if licensing terms *"are sufficiently dissimilar to distort competition"*.[81]

The UK Supreme Court in *Unwired Planet v. Huawei* subsequently reinforced the interpretation of FRAND as a single combined obligation. The Court held that ND is "general" rather than "hard-edged" and stated that the FRAND undertaking "imports a single unitary obligation".[82] According to the Court, *"fair, reasonable and non-discriminatory"* must be read as a *"composite whole"* rather than as separate obligations.[83] ND was therefore understood as informing the meaning of FR as a whole, including the expectation *"that there is to be a single royalty price list available to all"*[84] rather than operating as an independent test. The Court also emphasised that differential pricing is common in IP licensing and that anti-competitive discrimination is addressed primarily through competition law rather than through an expanded interpretation of ND. As a result, FRAND is currently being analysed in the UK as a unitary obligation rather than a term broken down into its sub-components.

German FRAND case law has developed differently from the English approach by treating fairness/reasonableness and non-discrimination more separately within a competition law framework. One reason is that discriminatory treatment constitutes an independent form of abuse under Article 102(c) TFEU, which has led German courts to place greater emphasis on comparisons with existing licences and the equal treatment of similarly situated implementers. A good illustration is the Regional Court Düsseldorf's decision in *Fraunhofer-Gesellschaft v. ZTE* Deutschland (4a O 15/17), where the court assessed whether the licensing terms were exploitative in light of the patentee's dominant position and then considered whether similarly situated licensees had been treated equally, absent objective justification.[85] The decision also required SEP holders to disclose relevant licensing information when unequal treatment was alleged. Compared to the UK approach, German courts place stronger weight on non-discrimination as an independent element of FRAND analysis.

German courts have also applied non-discrimination beyond royalty rates alone. For instance, in *Tagivan v. Huawei* (4a O 17/17), the Regional Court Düsseldorf extended the ND assessment to selective patent enforcement, holding that unequal treatment may also arise when SEP holders enforce patents against some competitors while tolerating infringement by others. In *GE / Access Advance v. Vestel* (4c O 42/20), the Düsseldorf court further held that deviations from an established licensing practice may require objective justification. German courts have therefore applied non-discrimination not only to pricing, but also to enforcement conduct and broader licensing behaviour.

At the same time, more recent German decisions have increasingly emphasised an overall FRAND assessment rather than a strict separation of FR versus ND. For instance, in *IP Bridge v. TCT Mobile Europe* (6 U 149/20), the court stressed that the decisive question was whether the resulting licence terms were FRAND overall. A similar approach appeared in the recent *Wilus v. AsusTek* decision (7 O 5007/25). Overall, the German position continues to treat FR and ND more separately than the UK approach while increasingly integrating both into an overall assessment of the licence agreement.

In the United States, Judge Selna in *TCL v. Ericsson* adopts a more explicitly bifurcated structure in which FR and ND are treated as separate requirements that must both be satisfied. This differs from the UK approach, where ND is absorbed into a unitary FRAND assessment, and from the German approach, where ND is treated as a distinct and comparatively central element within the competition law analysis. The court separates the analysis into a FR stage and an independent ND stage: At first, the FR stage derives a royalty level using a top-down approach. Second, the ND stage assesses whether similarly situated licensees receive comparable terms. The case further highlights that the FR analysis, even when based on a top-down methodology, does not resolve questions of discrimination and therefore cannot substitute for a comparator-based assessment in the ND stage. The ND stage, in turn, does not determine the level of the royalty itself but focuses on whether similarly situated licensees receive comparable terms.

80 *Unwired Planet v. Huawei*, Case EWHC 711, [502].
81 *Unwired Planet v. Huawei*, Case EWHC 711, [501].
82 *Unwired Planet v. Huawei*, Case [2020] UKSC 37, [112-113].
83 *Unwired Planet v. Huawei*, Case [2020] UKSC 37, [113].
84 *Unwired Planet v. Huawei*, Case [2020] UKSC 37, [114].
85 *Fraunhofer v. ZTE*, Case 4a O 15/17, [391-392].

The overall structure therefore confirms a dual-track approach: FR and ND are analysed with different tools, and compliance requires satisfaction of both.

Taken together, the three jurisdictions reflect three different ways of structuring the FR/ND relationship. In the UK, FRAND is treated as a unitary assessment in which the ND prong of FRAND is integrated into the overall analysis. By contrast, Germany treats the FR and ND aspects of FRAND as distinct elements under competition law and places significantly stronger focus on the non-discrimination as an independent element grounded in comparisons across licences. Meanwhile, the US considers the FR and ND elements of FRAND separately, meaning that failing either element is enough to be considered non-FRAND. As a result, these approaches form a spectrum that ranges from integration to separation in the treatment of the FR and ND prongs of FRAND.

3.3 Different legal frameworks for FRAND determinations

Courts around the world have interpreted FRAND in light of the language of the SDO's IPR policies or their bylaws complemented by the legal frameworks available in their respective jurisdictions (Contreras, 2015). In Europe, that complement has primarily been competition law, in particular Article 102 TFEU (Petit, 2015). In the United States, courts have also drawn on US antitrust laws (particularly Section 2 of the Sherman Act), but FRAND determinations in the US primarily arise in the context of proceedings for patent infringement damages, signifying that FRAND rates are also determined in light of the general law of patent infringement damages under 35 U.S.C. § 284 (Sidak, 2013). Over the past few decades, these different legal anchors have directly shaped the methodologies courts use to determine FRAND royalty rates. To provide context for this discussion, the study briefly reviews the main frameworks that have emerged from these systems.

Against this backdrop, two frameworks particularly illustrate how different legal contexts shape FRAND royalty determinations. The *Georgia-Pacific* factors, originating in *Georgia-Pacific Corp. v. United States Plywood Corp.*[86], have long provided an influential framework for reasonable royalty calculations in US courts, and they were adapted to the SEP context in *Microsoft v. Motorola* (2013) and *In re Innovatio* (2013) (Lemley & Shapiro, 2007; Contreras, 2017). Meanwhile, the *Huawei v. ZTE* framework set out by the CJEU in 2015 structures how European courts apply EU competition law to SEP licensing disputes through a sequenced negotiation procedure between SEP holders and implementers (Picht, 2017).

This study does not attempt a jurisdiction-by-jurisdiction comparison since that ground is already well covered elsewhere (Contreras, 2019). However, *Georgia-Pacific* and *Huawei v. ZTE* are addressed in detail given their structural influence on FRAND methodology.

3.3.1 EU Competition law: the *Huawei v. ZTE* framework

The decision of the Court of Justice of the European Union in *Huawei v. ZTE* clarified the controversial issue of whether a user of an SEP for which the proprietor has made a FRAND undertaking should be able to avoid an injunction by merely declaring their willingness to negotiate a FRAND licence, or whether injunctions be granted unless the user of the patented technology makes a binding offer to the SEP holder that they cannot refuse without infringing competition law. The court established a legal framework that governs the interaction between SEP owners and implementers before the SEP holder may seek injunctive relief and emphasises the good faith behaviour of the parties.[87] The judgment specifies a sequence of behavioural obligations that determine whether an SEP holder's request of injunctive relief amounts to an abuse of its dominant position under Article 102 TFEU, which may justify the denial of an injunction.

The *Huawei v. ZTE* framework consists of a number of steps. The SEP holder must to notify the alleged infringer of the infringement; the alleged infringer must express its willingness to conclude a FRAND licence; the SEP holder must submit a specific and written offer on FRAND terms. The alleged infringer must respond diligently, in accordance with good commercial practice, and in good faith determined by objective factors, including the absence of delaying tactics. If the alleged infringer does not accept the offer, he must make a specific counter-offer on FRAND terms in writing within a short period of time accepting the FRAND offer. At

86 *Georgia-Pacific Corp. v. United States Plywood Corp.*, Case 318 F. Supp. 1116.

87 Case C-170/13 *Huawei Technologies v. ZTE*, ECLI:EU:C:2015:477.

this step, the alleged infringer is also required to render accounts and provide adequate security for past use once a counter-offer has been rejected.[88]

National courts – Germany above all, with notable Dutch contributions – have produced extensive case law regarding each of these steps, but a comprehensive review of this case law is outside the scope of this study.[89] The present discussion focuses exclusively on the aspects of the *Huawei v. ZTE* framework that involve an assessment of what constitutes a FRAND rate.

Under the *Huawei v. ZTE* framework, courts may address both the FRAND-conformity of the SEP holder's offer and that of the implementer's counter-offer.[90] While the German case law has somewhat frequently assessed whether the SEP holder's offer complies with formal criteria, courts have only rarely carried out an assessment of whether the offered rate is FRAND. Those assessments that have been carried out differ markedly from a full FRAND rate determination. Instead, courts have assessed whether an implementer that raises a FRAND defence against a SEP holder's request for injunctive relief has successfully proven that the factual requirements for such a defence are met, specifically that the plaintiff's latest binding offer does not comply with antitrust principles (FRAND).[91] When the implementer has not submitted a counter-offer of its own, the threshold is higher still: It must demonstrate that the plaintiff's last binding offer is *"schlechterdings untragbar"*, i.e. plainly unacceptable from an antitrust perspective.[92]

Often, courts have found that a SEP holder's offer is within a FRAND range or at least not manifestly non-FRAND without stating a specific FRAND rate or identifying specific upper and lower boundaries of the FRAND range. In the few cases in which courts found that a SEP owner's offer was non-FRAND, this was due to specific defects in the licensing offer rather than the offered rate exceeding the boundaries of a court-determined FRAND range.

In the majority of decisions, however, courts have held that even such a limited review of the substance of the SEP owner's offer was unnecessary. In *Sisvel v. Haier* (FRAND-Einwand I and FRAND-Einwand II), the German Federal Court of Justice has stated that *"[s]ince appropriate conditions for a contractual relationship, in particular an appropriate price, are regularly not objectively determined, but can only be determined as the result of (possibly similar) negotiated market processes, the serious and goal-oriented participation of the company seeking a licence in the negotiation of appropriate contractual conditions is of decisive importance."*[93] Thus, where an implementer's conduct (at any stage of the process) displays a lack of willingness, the court is not required to evaluate the substance of the SEP holder's licensing offers. While the European Commission in an Amicus curia brief to the Higher Regional Court in Munich stated its view that the different steps of the *Huawei v. ZTE* framework must be assessed sequentially, the German Federal Court of Justice (Bundesgerichtshof) confirmed its previous approach in *VoiceAge EVS v. HMD*, holding that *"it is to be assumed without any reasonable doubt that EU law (article 102 of the TFEU) does not lay down any fixed sequence of procedural steps to which strict adherence is required in every case", and that the FRAND defence must be evaluated through "assessment of the defendant's overall conduct"*.[94]

In application of this conduct-focused interpretation of the *Huawei v. ZTE* framework, which was further complemented with additional guidance from the Munich regional court,[95] subsequent German court decisions

88 See for more details, European Patent Office, Standards and the European patent system, Box 7, p.57 et seq.

89 See Picht et al. (2024) for a comprehensive review of the German FRAND case law. For a more succinct review and overview of relevant cases, see 4iP Council, FRAND Licensing Guideline. URL: https://caselaw.4ipcouncil.com/frand-licensing-guideline.

90 For instance, see Saint *Lawrence v. Vodafone*, case 4a O 73/14; *IP Bridge v. TCT*, case 6 U 149/20; and *Nokia v. Daimler*, case 2 O 34/19.

91 Hinweise zur Handhabung des kartellrechtlichen Zwangslizenzeinwandes nach *Huawei v. ZTE* innerhalb des Münchner Verfahrens in Patentstreitsachen, 2020, at 4: *"Der Beklagte hat insbesondere den Zwangslizenzeinwand zu erheben sowie vorzutragen und zu beweisen, dass dessen tatbestandliche Voraussetzungen vorliegen, also insbesondere, dass und warum das letzte verbindliche Angebot des Klägers nicht kartellgemäß (FRAND) ist".* English translation: *"In particular, the defendant must raise the compulsory licence defence and must argue and prove that the factual requirements for such a defence are met, specifically that the plaintiff's latest binding offer does not comply with antitrust principles (FRAND) and why."*

92 Id., at 4: "*Soweit der Beklagte kein Gegenangebot vorgelegt hat, hat er darzulegen und zu beweisen, dass das letzte verbindliche Angebot des Klägers unter kartellrechtlichen Gesichtspunkten schlechterdings untragbar ist bzw. dass der Kläger gehalten gewesen wäre, die Zulieferer des Beklagten zu lizenzieren." English translation: "Insofar as the defendant has not submitted a counter-offer, it must demonstrate and prove that the plaintiff's final binding offer is simply untenable under antitrust law or that the plaintiff would have been required to licence the defendant's suppliers."*

93 *Sisvel v. Haier*, KZR 36/17, at 81.

94 BGH, Urteil vom 27. Januar 2026, KZR 10/25 – *VoiceAge EVS v. HMD*, Pressemitteilung Nr. 21/2026. URL: https://www.bundesgerichtshof.de/SharedDocs/Pressemitteilungen/EN/2026/2026021.html?nn=374008.

95 LG München I, FRAND-Hinweise ("Munich Guidelines"), Feb. 2020.

largely focused on defendants' conduct to the exclusion of assessing FRAND-conformity of offered licensing rates (and other terms). Nevertheless, there also exists case law that evaluated the licensing offers of the SEP holder and implementer as part of the overall assessment of conduct. In this assessment, the FRAND-conformity of an offer for the purposes of the *Huawei v. ZTE* framework is not the same enquiry as the FRAND-conformity of an actually concluded licence. For instance, an initial non-FRAND offer may still result in a FRAND agreement. An implementer may thus still have to respond to an offer that is *"evidently non-FRAND"*, and may legitimately ignore a licensing offer only if it is *"so contrary to FRAND that it is evident that it was not meant seriously"*.[96]

The UPC Local Division Mannheim built on this combined assessment of the negotiating conduct and substance of licensing offers in *Panasonic v. Oppo*. Working expressly within the framework of *Huawei v. ZTE*, which it labelled the Court of Justice's *"negotiation programme" ("Verhandlungsprogramm")*, the Mannheim Local Division held that the parties' conduct must be measured against the fundamental objective of that programme, i.e. the timely conclusion of a privately negotiated FRAND licence, rather than against a rigid sequence of discrete procedural steps.[97] Crucially, the UPC adds that *"the SEP holder's offer must always be checked for its FRAND compliance if there is sufficient initial willingness to license. This step must not be omitted or only carried out very cursorily."* The UPC states that the assessment cannot focus either only on the conduct of the parties (to the exclusion of the substance of the offers) or only on the substance of the offers (to the exclusion of the conduct). This is because the FRAND-conformity of any (counter) offer can only be assessed in light of the concrete negotiations and the reciprocal conduct of both sides since each party depends on information from the other to put forward a constructive offer.[98]

A more recent line of decisions from the Munich regional court has offered a new interpretation of the *Huawei v. ZTE* framework, which differs from the conduct-oriented focus of previous decisions of the Munich regional court. In three recent decisions (*Wilus v. AsusTek*, *Broadcom v. Renault*, and *Nokia v. Asus*), the Munich regional court has ruled on the applicability of implementers' FRAND defence by looking at the implementers' willingness as well as the FRAND-conformity of the SEP holder's offer itself. The court hereby defined specific frameworks for the consideration of comparable licences and top-down analyses.[99] In contrast to other German court decisions in which the courts had found SEP holders' licensing offers to be FRAND-conforming without specifying a FRAND rate or the boundaries of the FRAND range, the Munich regional court in *Broadcom v. Renault* describes a process wherein the FRAND range is determined as ranging from 50% below to 50% above the midpoint of the FRAND rate.[100] In *Wilus v. AsusTek*, the court further stated that a top-down cross-check is always a possibility provided that the SEP owner accounts for a sufficiently large share of the total number of SEPs for the standard (which, in the case of a large standard, would be 1% of the stack).[101] The Munich regional court's very specific provisions on the determination of a FRAND rate and FRAND range stand in contrast to earlier German case law, which has considered that the FRAND rate and range cannot be determined independently of the negotiation process.

96 OLG Karlsruhe, 6 U 149/20, Rn. 192-194.

97 UPC LD Mannheim, UPC_CFI_210/2023, *Panasonic v. Oppo*, 22. November 2024, at 131: *"Ihr Verhalten ist daher danach zu bewerten, ob es dem grundlegenden Ziel des Verhandlungsprogrammes des Unionsgerichtshofs ausreichend Rechnung trägt, in zielgerichteten Verhandlungen zum zeitnahen Abschluss eines auf vorrangig privatautonomer Basis geschlossenen FRAND-Lizenzvertrages zu gelangen."* English translation: *"Their conduct must therefore be assessed to determine whether it sufficiently takes into account the fundamental objective of the Court of Justice's negotiation programme – namely, to reach, through targeted negotiations, the timely conclusion of a FRAND licence agreement based primarily on private autonomy."*

98 UPC LD Mannheim, UPC_CFI_210/2023, *Panasonic v. Oppo*, 22. November 2024, at 131-132: *"Ob ein (Gegen-)Angebot FRAND-Kriterien entspricht, kann nicht autark, sondern nur allein auf der Grundlage der konkreten Verhandlungen und des Verhaltens der Parteien beurteilt werden. Ebenso wie der Patentverletzer ohne ausreichende Kenntnisse von ggf. Dritten gewährten Lizenzierungsbedingungen kein förderliches FRAND-Gegenangebot unterbreiten kann, kann der SEP-Inhaber kein förderliches Angebot unterbreiten, wenn der Patentverletzer ihn bewusst über das Ausmaß seiner Benutzungshandlungen und seine wirtschaftlichen Rahmenbedingungen […] im Dunkeln lässt […]"*. English translation: *"Whether a (counter-)offer meets FRAND criteria cannot be determined in isolation, but only on the basis of the concrete negotiations and the conduct of the parties. Just as the patent infringer cannot submit a constructive FRAND counter-offer without sufficient knowledge of the licensing terms granted by third parties, the SEP holder cannot submit a constructive offer if the patent infringer deliberately keeps him in the dark regarding the extent of his acts of use and his economic circumstances […]."*

99 *Wilus v. AsusTek*, 7 O 5007/25: Leitsatz 12: *"Eine Kontrollberechnung über eine Top-Down-Analyse ist zumindest immer dann möglich, wenn der Patentinhaber einen erheblichen Anteil am Standard hat."* English translation: Guideline 12: *"A verification calculation based on a top-down analysis is always possible, at least when the patent holder has a significant share in the standard. For the very extensive mobile communications standard, a one-percent share is sufficient to satisfy the Board. For smaller standards, a higher share may be required."*

100 *Broadcom v. Renault*, case 7 O 7655/25, [132].

101 *Wilus v. AsusTek*, case 7 O 5007/25, [135].

Box 7: The UPC and FRAND

The UPC's approach to FRAND remains at an early stage of development, but the Court is increasingly being called upon to address FRAND issues in disputes, including, in some cases, requests to determine FRAND rates and indicating already points to a willingness to take a potentially more active role in determining specific FRAND rates. Regarding FRAND determination, the UPC has thus far mostly applied the procedural framework established by the CJEU in *Huawei v. ZTE*, focusing in particular on the parties' compliance with that framework and their conduct throughout the negotiation process. FRAND is therefore assessed primarily through an overall evaluation of the parties' negotiation behaviour rather than through strict economic formulas or a formalistic application of CJEU guidance. At the same time, the UPC has so far refrained from endorsing a specific methodology for determining FRAND rates, although it has acknowledged the probative value of the comparable-licences approach.

An initial group of decisions has applied *Huawei v. ZTE* in line with the German conduct-based approach by focusing on negotiation behaviour rather than a detailed assessment of offer terms. In *Huawei v. Netgear*, the Munich Local Division rejected the FRAND defence based on delayed negotiations, missing sales data and the absence of both security and a valid counter-offer, instead relying on an overall assessment of conduct rather than a rigid sequencing of steps.[102] In *Philips v. Belkin*, the Munich Local Division granted the UPC's first SEP injunction, which was later largely upheld on appeal, after the FRAND defence failed due to insufficiently established market dominance.[103] In *Dolby v. Beko*, the Düsseldorf Local Division held that when the implementer does not show genuine willingness to license from the outset, there is no need to assess whether the SEP holder's offer is FRAND.[104]

A second line of reasoning, reflected in the Mannheim Local Division's decision in *Panasonic v. Oppo*, has pointed towards a more substantive engagement with FRAND. The chamber describes *Huawei v. ZTE* as a framework of reciprocal obligations aimed at obtaining a negotiated FRAND licence, with judicial intervention serving as only one possible element. In this view, implementer willingness cannot be assessed in isolation of the SEP holder's offer since this would risk reducing the review of that offer to a largely formal exercise.[105]

A third and more contested theme is whether the UPC should or will determine FRAND licence terms itself. Meier-Beck (2025) explicitly examines whether the UPC could and should adopt a broader role like English courts, which determine FRAND licence terms when parties fail to agree. However, early UPC decisions have not engaged in rate-setting, instead resolving disputes through the *Huawei v. ZTE* framework. At the same time, more recent procedural developments such as in *Sun Patent Trust v. Vivo*,[106] *Ericsson v. Transsion*,[107] and *Ericsson v. Verifone*[108] show that parties are increasingly asking the UPC to determine FRAND terms.

This makes FRAND rate determination one of the key open questions in UPC jurisprudence. However, the launch of the UPC's Patent Mediation and Arbitration Centre, with its FRAND-specific framework in its Arbitration, Mediation and Expert Determination Rules, offers a number of opportunities in proceedings at the UPC and can provide a unique combination between the court and ADR in resolving SEP disputes.

102 UPC Munich Local Division, Order of 18 December 2024, UPC_CFI_9/2023.

103 UPC Munich Local Division, Decision of 13 September 2024, UPC_CFI_390/2023; largely upheld in UPC Court of Appeal, Decision of 3 October 2025, UPC_CoA_534/2024.

104 UPC Düsseldorf Local Division, Decision of 18 March 2026, UPC_CFI_135/2024 and UPC_CFI_477/2024.

105 UPC Mannheim Local Division, Decision of 22 November 2024, UPC_CFI_210/2023.

106 UPC Paris Local Division, Actions of 23 April 2025, UPC_CFI_361/2025 and UPC_CFI_362/2025.

107 UPC The Hague Local Division, Actions of 13 and 29 November 2025, UPC_CFI_1568/2025, UPC_CFI_1791/2025, and UPC_CFI_1793/2025; UPC Mannheim Local Division, Action of 24 November 2025, UPC_CFI_1570/2025; UPC Paris Central Division, Action of 13 November 2025, UPC_CFI_1571/2025.

108 UPC Mannheim Local Division, Action of 20 February 2026, UPC_CFI_661/2026; UPC The Hague Local Division, Action of 20 February 2026, UPC_CFI_662/2026.

3.3.2 US patent damages law: the *Georgia-Pacific* factors

In the United States, the most common approach for calculating reasonable-royalty damages for patent infringement under 35 U.S.C. § 284 is the fifteen-factor framework set out by the Southern District of New York in *Georgia-Pacific Corp. v. United States Plywood Corp.*[109] The framework structures reasonable royalties around a hypothetical, ex ante negotiation between a willing licensor and a willing licensee conducted at the moment the infringement began (Lemley & Shapiro, 2007; Contreras, 2017).

The fifteen factors are the following:

- **Factor 1:** the royalties received by the patent owner for licensing the patent-in-suit, proving or tending to prove an established royalty.
- **Factor 2:** the rates paid by the licensee for the use of other patents comparable to the patent-in-suit.
- **Factor 3:** the nature and scope of the licence, including whether it is exclusive or non-exclusive, and any territorial or customer restrictions.
- **Factor 4:** the licensor's established policy and marketing programme of maintaining its patent monopoly by not licensing others or by granting licences only under conditions designed to preserve that monopoly.
- **Factor 5:** the commercial relationship between the licensor and the licensee, such as whether they are competitors in the same line of business or inventor and promoter.
- **Factor 6:** the effect of selling the patented specialty in promoting sales of other products of the licensee, the existing value of the invention to the licensor as a generator of sales of its non-patented items, and the extent of such derivative or "convoyed" sales.
- **Factor 7:** the duration of the patent and the term of the licence.
- **Factor 8:** the established profitability of the product made under the patent, its commercial success, and its current popularity.
- **Factor 9:** the utility and advantages of the patented property over old modes or devices that had been used for similar results.
- **Factor 10:** the nature of the patented invention, the character of the commercial embodiment of it as owned and produced by the licensor, and the benefits to those who have used it.
- **Factor 11:** the extent to which the infringer has made use of the invention and any evidence probative of the value of that use.
- **Factor 12:** the portion of the profit or selling price that may be customary in the particular business or in comparable businesses to allow for the use of the invention or analogous inventions.
- **Factor 13:** the portion of the realisable profit that should be credited to the invention as distinguished from non-patented elements, the manufacturing process, business risks, or significant features or improvements added by the infringer.
- **Factor 14:** the opinion testimony of qualified experts.
- **Factor 15:** the amount that a licensor and a licensee would have agreed upon (at the time the infringement began) if both had been reasonably and voluntarily trying to reach an agreement.

As Lemley and Shapiro (2007) have observed, the fifteen factors represent three core concerns: the significance of the patented invention to both the product and market demand; the royalty rates others have been willing to pay for the same or similar inventions in the industry; and expert testimony as to the overall value of the patent. Although *Georgia-Pacific* was developed for ordinary patent infringement disputes, its application to SEPs required substantial adaptation.

It is firstly worth noting that the factors are not a mandatory checklist. Federal Circuit case law has consistently held that *"[c]ourts have wide discretion to decide which of the Georgia-Pacific factors are relevant to a given case"* [110], and the Federal Circuit has emphasised that it has "never described the *Georgia-Pacific* factors as a talisman for royalty rate calculations".[111]

As the Federal Circuit summarised it in *LaserDynamics, Inc. v. Quanta Computer, Inc., "[t]his court has sanctioned the use of the Georgia-Pacific factors to frame the reasonable royalty inquiry. Those factors properly tie the reasonable royalty calculation to the facts of the hypothetical negotiation at issue."*[112] Although the

109 *Georgia-Pacific Corp. v. United States Plywood Corp.*, Case 318 F. Supp. 1116.

110 See *Microsoft v. Motorola*, Case No. C10-1823JLR, at 35-[98], citing *Minco, Inc. v. Combustion Eng'g, Inc.*, Case 95 F.3d 1109, 1119–20.

111 *Ericsson v. D-Link*, Case 773 F.3d 1201, at 29.

112 *LaserDynamics, Inc. v. Quanta Computer, Inc.*, Case 694 F.3d 51, at 60 n.2.

framework was developed in an ordinary (non-SEP) patent infringement case, it was adapted to the SEP context in *Microsoft v. Motorola* (2013) and *In re Innovatio* (2013), and its proper use in *"RAND-encumbered"* disputes was subsequently delimited by the Federal Circuit in *Ericsson v. D-Link*.[113]

The first systematic adaptations of the *Georgia-Pacific* framework to RAND-encumbered patents were undertaken almost simultaneously in *Microsoft v. Motorola* and *In re Innovatio*. Both courts adopted the hypothetical bilateral negotiation structure but modified specific factors to account for the RAND commitment and the policy imperative of preventing hold-up and royalty stacking.[114]

Several factors were rendered inapplicable altogether. Factor 4, which accounts for a licensor's established policy of not licensing others, was eliminated in both cases on the grounds that the RAND commitment contractually obliges the SEP holder to license all implementers – a monopoly-preservation strategy is simply incompatible with that obligation. Factor 5, the commercial relationship between the parties, including whether they are competitors, was likewise set aside because the non-discrimination prong of RAND requires the patentee to offer equivalent terms regardless of the licensee's competitive position. Factor 7, the duration of the patent and the term of the licence, was treated as largely irrelevant in the SEP context since, as both courts observed, the licence term would in practice correspond to the remaining life of the patent, thereby leaving the factor with little discriminating force.

Other factors were substantially reformulated to strip out the *"hold-up value"* that SEP status artificially confers. This adaptation concerns Factors 6, 8, 10 and 11, which in the traditional framework capture the value of the invention to the licensor's and licensee's commercial operations, including derived and convoyed sales. In the SEP context, *Microsoft v. Motorola* held that these factors must focus exclusively on both the patent's contribution to the technical capabilities of the standard and, to an even further degree, the standard's contribution to the implementer's products, expressly excluding any value attributable to the mere fact of standardisation. As the court explained, *"there is substantial value in the agreed standard itself apart from any contribution of the patented technology to the standard, and the RAND commitment exists so that SEP patent holders cannot demand more than they contribute."*[115] The same logic governed the reformulation of Factor 13 (apportionment of realisable profit), which must exclude any hold-up premium flowing from lock-in rather than from the intrinsic technical merit of the patent.

Factor 9 – utility and advantages over prior alternatives – was reoriented to an ex-ante perspective: the relevant comparators are not prior art devices in the abstract but alternative technologies that could have been written into the standard instead of the patented invention at the time of adoption. The presence of equally effective alternatives that the standard-setting body could have chosen exerts downward pressure on the royalty a patent holder could reasonably have demanded. *In re Innovatio* applied this modified factor directly, instructing that the court would *"consider the presence of alternatives that could have been adopted into the standard"* in evaluating the patents' contribution to the 802.11 standard.[116] Factors 1 and 2 concerning established royalties and comparable licences were adapted rather than eliminated.
Both courts held that only licences negotiated in circumstances genuinely comparable to a RAND licensing context are appropriate comparators; licences obtained through litigation pressure, patent pools that treat all patents as equally valuable regardless of technical merit, or agreements where the parties were unaware of RAND obligations carry reduced or no weight.

In *Ericsson v. D-Link*, the Federal Circuit confirmed and sharpened the approach taken by the two 2013 decisions while resisting any move towards a fixed alternative framework. The court held that instructing a jury on *Georgia-Pacific* factors that are irrelevant or affirmatively misleading in the RAND context constitutes reversible error. Factors 4, 5, 8, 9 and 10 were specifically identified as presumptively problematic for SEP cases since they risk inflating the royalty by incorporating value generated by the standard rather than by the technology itself.[117] At the same time, the Federal Circuit explicitly declined to

113 See *Microsoft v. Motorola*, Case no. C10-1823JLR, at 7; *In re Innovatio*, Case: 1:11-cv-09308, at 8–10 & 36; *Ericsson v. D-Link*, Case 773 F.3d 1201, at 46-50.

114 See *Microsoft v. Motorola*, Case no. C10-1823JLR, at 7; *In re Innovatio*, Case: 1:11-cv-09308, at 8–13.

115 *Microsoft v. Motorola*, Case 2:10-cv-01823-JLR, at 104; *In re Innovatio*, Case: 1:11-cv-09308, at 80.

116 *In re Innovatio*, Case: 1:11-cv-09308, at 36.

117 *Ericsson v. D-Link*, Case 773 F.3d 1201, at 47-50.

"create a new set of Georgia-Pacific-like factors for all cases involving RAND-encumbered patents",[118] thus reaffirming that courts must calibrate their instructions to the actual RAND commitment at issue and the evidence adduced at trial. The *CSIRO v. Cisco* appeal extended this principle beyond RAND-encumbered patents to SEPs in general, holding that any reasonable royalty for a standard-essential patent must exclude value flowing from the standard's adoption regardless of whether a formal RAND commitment exists.[119]

The framework has also featured prominently in Daubert proceedings challenging the reliability of damages experts in SEP disputes. In cases such as *CSIRO v. Cisco*, courts evaluated whether experts had applied the modified *Georgia-Pacific* factors in a methodologically sound manner.[120] Common grounds for challenge included the experts' failure to limit comparable licences to genuinely RAND-comparable transactions (Factor 1), impermissible conflation of the value of the patented technology with the value of the standard (Factors 8 to 10), and arbitrary numerical adjustments to the royalty rate without adequate factor-by-factor justification. Courts have consistently held that while experts need not deploy every factor, they must explain, with reference to the record, why and to what extent each factor they invoke affects the royalty calculation; conclusory recitation of factors without substantive analysis does not satisfy Daubert.

3.4 Evidentiary guardrails for FRAND determinations

In addition to offering specific legal frameworks such as the *Georgia-Pacific* factors for the determination of reasonable royalties in US patent infringement damages law and the *Huawei v. ZTE* framework in the application of EU competition law, different jurisdictions have evidentiary guardrails that may limit or shape the methodologies that can be used for the determination of FRAND royalties.

Courts in the US regularly assess whether proposed FRAND determination methodologies violate the *"SSPPU rule"*, an evidentiary rule developed in patent damages case law that requires that the reasonable royalty be based on the *smallest saleable patent practicing unit*.[121]

The choice of using the royalty base for a reasonable royalty determination is sometimes (incorrectly) presented as the choice between two options: the entire market value rule (EMVR) and SSPPU. In reality, the EMVR and SSPPU are two different complementary rules that operate at distinct conceptual levels (Kappos and Michel, 2017). The EMVR, which goes back to Supreme Court precedent from the 19th century, embodies the principle of apportionment – i.e. the principle that the reasonable royalty must be apportioned to the value of the patented technology itself, which needs to be distinguished from other factors that affect the value of the infringing product. In application of this principle, a patent owner may only request the entire market value of the infringing product if the patented invention has created the entire market value. If the patented technology only accounts for a portion of the value of the infringing product, the reasonable royalty damages award needs to be apportioned accordingly. In principle, this apportionment may be carried out in different ways, including through an economic analysis that uses the value of the infringing end product as a starting point. Nevertheless, US courts have expressed the concern that including the price of complex multicomponent end products in the damages analysis may mislead a jury by *"skewing the damages horizon"* (by creating an undue impression that a large damages award is reasonable by comparison to the much larger profits of the infringer).

The Federal Circuit in *Ericsson v. D-Link* articulated the substantive principle and the related evidentiary rule:

> "The essential requirement is that the ultimate reasonable royalty award must be based on the incremental value that the patented invention adds to the end product. Our cases have added to that governing legal rule an important evidentiary principle. The point of the evidentiary principle is to help our jury system reliably implement the substantive statutory requirement of apportionment of royalty damages to the invention's value. The principle, applicable specifically to the choice of a royalty base, is that, where a multi-component product is at issue and the patented feature is not the item which imbues the combination of the other features with value, care must be taken to avoid misleading the jury by placing

118 *Ericsson v. D-Link*, Case 773 F.3d 1201, at 50.

119 *CSIRO v. Cisco*, Case no. 6:11-cv-00343-LED, at 17.

120 See, for instance, *CSIRO v. Cisco*, Case no. 6:11-cv-00343-LED at 25.

121 See, for instance, *Cornell Univ. v. Hewlett-Packard Co.*, Case 609 F. Supp. 2d 279, 283; *Uniloc USA, Inc. v. Microsoft Corp.*, Case 632 F.3d 1292, 1320; *LaserDynamics, Inc. v. Quanta Comput., Inc.*, Case 694 F.3d 51.

> undue emphasis on the value of the entire product. It is not that an appropriately apportioned royalty award could never be fashioned by starting with the entire market value of a multi-component product – by, or instance, dramatically reducing the royalty rate to be applied in those cases – it is that reliance on the entire market value might mislead the jury, who may be less equipped to understand the extent to which the royalty rate would need to do the work in such instances."[122]

It is important to note that the use of the SSPPU as a royalty base alone does not necessarily fulfil the substantive requirement of apportionment – if the SSPPU itself is a multicomponent product, further apportionment may be required.[123]

While the SSPPU rule is not specific to SEPs or FRAND determinations, it has had a significant effect on the development of US case law on FRAND damages. *In re Innovatio*, the court held that *"the court must calculate royalties not on the entire product, but instead on the 'smallest saleable patent-practicing unit"*.[124] There was a dispute in that case between the manufacturers and the patent owner on whether the SSPPU for Innovatio's patents was the end product or the Wi-Fi chip. Nevertheless, the court found that *"Innovatio's application of its approach did not credibly apportion the value of the end-products down to the patented features. In light of that failure of proof, the court has no choice based on the record but to calculate a royalty based on the Wi-Fi chip"*.[125]

In another infringement damages case involving Wi-Fi SEPs, a different US district court, however, found that the Wi-Fi chip is not a suitable royalty base for the determination of a FRAND royalty:

> "Basing a royalty solely on chip price is like valuing a copyrighted book based only on the costs of the binding, paper, and ink needed to actually produce the physical product. While such a calculation captures the cost of the physical product, it provides no indication of its actual value".[126]

Over time, US case law has clarified that the use of the SSPPU as a royalty base is not a mandatory requirement in all circumstances. In particular, the SSPPU rule should not be applied to the exclusion of comparable licences that are expressed as a percentage of a larger royalty base.

> "As the testimony at trial established, licenses are generally negotiated without consideration of the EMVR, and this was specifically true with respect to the Ericsson licenses relating to the technology at issue".[127]

US district courts have furthermore held that the ETSI FRAND commitment does not, as a matter of contract interpretation, mandate an SSPPU base: *"as a matter of French law, the FRAND commitment embodied in the ETSI IPR policy does not require a FRAND license to be based on the SSPPU"*.[128]

The debate over the correct application of the SSPPU to FRAND damages determination has also impacted court decisions on the admissibility of expert evidence. In *WiLAN v. Alcatel*, an expert report was found inadmissible because the expert had failed to apply the SSPPU.[129] By contrast, in *Core Wireless v. Apple*, a Daubert motion to exclude an expert's testimony was

122 *Ericsson v. D-Link*, Case 773 F.3d 1201, at 40.

123 The Federal Circuit noted in *VirnetX, Inc. v. Cisco Systems, Inc. and Apple Inc.*, Case no. 2013-1489 that the SSPPU *"is simply a step toward meeting the requirement of apportionment."* Id.at 29. *"Where the smallest salable unit is, in fact, a multi-component product containing several non-infringing features with no relation to the patented feature (as VirnetX claims it was here), the patentee must do more to estimate what portion of the value of that product is attributable to the patented technology"*.

124 *In re Innovatio*, Case: 1:11-cv-09308, at 23; (quoting LaserDynamics, Case 694 F.3d at 67, which in turn quotes *Cornell Univ. v. Hewlett-Packard Co.*, Case 609 F. Supp. 2d 279, 283, 287-88.

125 *In re Innovatio*, Case: 1:11-cv-09308, at 26.

126 *CSIRO v. Cisco*, Case no. 6:11-cv-00343-LED, at. 7.

127 *Ericsson v. D-Link*, Case 773 F.3d 1201, at 42.

128 *HTC v. Ericsson*, Case no. 6:18-CV-00243-JRG, at 7.

129 The court found that to the extent that the expert's analysis *"relies on calculations involving the value of the entire base station, instead of the smallest saleable patent practicing unit, to arrive at the lump-sum damages amount, it is a violation of the Entire Market Value Rule." WiLAN v. Alcatel,* Case no. 6:10-cv-00521, at 6.

denied because the expert's opinion was based on comparable licences.[130] In line with the Federal Circuit's decision in *Ericsson v. D-Link*, the district court held that expert evidence based on comparable licences is exempt from the SSPPU rule.[131] In turn, in *GBT v. Apple*, the district court excluded an expert opinion based on end-product prices. It held that *"to escape the clutches of the EMVR requires evidence of industry practice"*[132] and found that the expert had failed to provide evidence that it is industry practice *"to pay an uncapped royalty based on a percentage of the entire market value of any iPhone or iPad"*.[133] Independently of whether the expert had violated the SSPPU rule, the expert's opinion was found inadmissible because it had failed to operate the necessary apportionment of the royalty award to the value of the patented technology.[134]

While the SSPPU is primarily a rule of US case law and is motivated by the heightened risk of cognitive bias in jury trials, there have been debates over the SSPPU in other jurisdictions as well. In particular, in the Chinese National Development and Reform Commission's (NDRC) Administrative Sanction of 9 February 2015 against Qualcomm, the NDRC highlighted Qualcomm's failure to apply the SSPPU as one of the indications of its pricing abuse:

> "Qualcomm imposed unfairly high royalties by refusing to provide the patent list, entering with the license agreement with terms of free cross-grant and portfolio license and charging the royalties based on net selling price of handset, which constitutes imposition of unfairly high royalty by abusing its market-dominant position in the cellular SEP licensing market; Qualcomm violates Article 17(1)1 of the AML."[135]

Therefore, the NDRC ordered that *"For the wireless communication devices sold for use within P.R.C., Qualcomm shall not use the full wholesale NSP as the base to calculate royalties for license of wireless SEPs while insisting on a relatively high royalty rate."*[136]

By contrast, courts in other jurisdictions have disregarded the SSPPU. The UK High Court has gone further, treating an SSPPU-only approach as analytically inadequate for SEP valuation:

> "Apple's SSPPU approach is to be rejected for this reason alone; but, much more fundamentally, focusing on the SSPPU in no way assists in deriving a price for the technology licence here in issue."[137]

130 *Core Wireless v. Apple*, Case No. 15-cv-05008 NC, at 4.

131 *"Thus, if the starting point of the analysis is comparable licenses, an expert may begin the hypothetical negotiation with evidence of comparable licenses and not the smallest salable patent-practicing unit as the base. After reviewing Dell's report, the Court agrees with Core Wireless that Dell's opinion relies on comparable licenses and negotiating positions, which appear to include a value greater than that of the smallest salable patent-practicing unit. Apple's motion is DENIED". Core Wireless v. Apple*, Case No. 15-cv-05008 NC at 6.

132 *GBT v. Apple*, Case No. 5:12-cv-04882-PSG, at 9.

133 *GBT v. Apple*, Case No. 5:12-cv-04882-PSG, at 11.

134 *"Even if the accused products were the smallest saleable unit, this court has previously explained that, under the Circuit's case law, relying on the smallest saleable unit does not relieve a patentee of the burden of apportioning the base." GBT v. Apple*, case No. 5:12-cv-04882-PSG". id. at 11-12.

135 Qualcomm and China's National Development and Reform Commission (NDRC) settlement, February 9, 2015.

136 Id.

137 *Optis v. Apple*, Case [2023] EWHC 1095 (Ch), at 119–120 [218–220].

3.5 Conclusions

Courts converge on the purpose of FRAND. Courts in the United States, United Kingdom, European Union, China, Japan and India have described the purpose of FRAND commitments in materially consistent terms. FRAND seeks to balance fair compensation for SEP holders with broad access to standards for implementers. This basic formulation recurs across jurisdictions, even where the legal basis for intervention differs.

The hypothetical negotiation is the dominant analytical framework. Courts have largely converged on a hypothetical negotiation between a willing licensor and a willing licensee, conducted ex ante before adoption of the standard, as the main framework for structuring FRAND analysis. The UK willing licensor and willing licensee construct and the US modified *Georgia-Pacific* framework are analytically similar expressions of this shared approach.

FRAND analysis now treats hold-up and hold-out as parallel risks. The framing of FRAND has moved from a primary focus on hold-up to a more balanced treatment of hold-up and hold-out. Early US decisions presented FRAND mainly as a safeguard against hold-up and royalty stacking, requiring rates to be anchored in the ex-ante incremental value of the patented technology. Later US decisions qualified this approach, holding that hold-up and royalty stacking cannot be presumed and must be supported by case-specific evidence. UK courts, starting with *Unwired Planet v. Huawei,* placed hold-up and hold-out explicitly on the same footing. Chinese courts have also treated implementer hold-out as relevant, including when awarding enhanced damages.

Different legal frameworks share a common analytical core. Jurisdiction-specific frameworks shape how FRAND principles are applied, but they do not displace the common analytical core. In the EU, *Huawei v. ZTE* establishes a sequential competition-law framework of offers and counter-offers as a precondition for injunctive relief. In the United States, FRAND determinations are sometimes conducted within a patent damages framework centred on a modified *Georgia-Pacific* analysis. Despite structural differences, both approaches ultimately ask what rate a willing licensor and a willing licensee would have agreed, applying principles of proportionality and non-discrimination.

Courts apply convergent guardrails to the royalty base. Courts have consistently held that the royalty, whatever calculation method is used, must be calibrated to the incremental value of the patented technology rather than to the value of the standard or the end product as a whole. Different rules have been applied to ensure that this apportionment is carried out in a reliable fashion. In the US case law, the Entire Market Value Rule (EMVR) and the principle of the Smallest Saleable Patent Practicing Unit (SSPPU) have shaped courts' approaches to FRAND rate determinations, and the evidence that parties may present. Rather than competing methodologies, these rules are expressions of the same apportionment requirement. Courts have also rejected the view that SSPPU is a per se obligation under FRAND commitments.

4. Methodologies for FRAND determinations

This chapter examines the valuation methodologies that courts have applied in practice when determining or assessing FRAND rates. Where Chapter 3 set out the principles, legal frameworks and evidentiary constraints that shape how courts approach the task, this chapter turns to the methods through which those principles are given numerical expression. It covers the two methodologies that dominate the case law, comparable licences and the top-down approach, and examines in detail how each is applied across the corpus of decisions reviewed in Chapter 2. A glossary of relevant concepts used throughout the chapter is provided in Box 8.

The approach taken is a qualitative empirical overview of the case law, complemented by a quantitative coding of the methodological discussions contained in the court documents. The coding tracks which methods are proposed and accepted in each case, how comparable licences are selected and adjusted, how lump-sum payments and cross-licences are unpacked, how aggregate royalty rates are established in the top-down approach, and how the resulting rate is apportioned to the portfolio at issue. This combination of qualitative and quantitative empirical analyses allows the study to map not only which methods courts prefer, but also how much weight is given to particular technical discussions. In keeping with the overall empirical and descriptive character of the report, the goal of the section is to describe the methods that courts in different jurisdictions have used (and summarise relevant methodological discussions); but we do not aim to characterise the case law of any individual jurisdiction from a substantive legal perspective. Therefore, we also include first instance decisions overturned or vacated on appeal in our review.

The chapter proceeds as follows. Section 4.1 provides a general overview of the methodologies used across the corpus. Section 4.2 examines comparable licences in detail, addressing the various criteria courts apply when selecting comparables and the techniques used to unpack existing licences into directly usable rate evidence. Section 4.3 turns to the top-down approach, covering its status across jurisdictions, the methods used to establish aggregate royalty rates and their apportionment to the portfolio in suit. Section 4.4 summarises the chapter's main findings.

Box 8: Glossary of concepts used in Chapter 4

Comparable licences. Existing licence agreements between SEP holders and implementers that courts use as evidence of FRAND rates. A comparable licence analysis derives a FRAND rate by reference to the rates, royalty bases and terms agreed in prior arm's-length negotiations. Courts have treated comparable licences as the preferred starting point, subject to adjustments for differences in portfolio, geography, timing and negotiation context.

- **Scaling.** The process of adjusting a rate derived from a comparable licence to account for differences in portfolio size, composition or geographic scope between the comparable licence and the licence being determined. Scaling is needed when the comparable licence covers a larger, smaller or different set of patents than the portfolio being valued. It typically relies on patent counting or contribution counting to estimate the relative share.
- **Unpacking.** The process of decomposing an existing licence agreement into its component economic terms so that it can be used as a comparable. Unpacking is needed because most licences are not directly comparable in form. They may involve lump-sum payments, which must be converted into per-unit rates, cross-licences, which must be decomposed into one-way rates and multi-standard or multi-technology licences, for which the value attributable to the relevant standard must be isolated, or payments that include a release for past infringement, which must be separated from the prospective rate.

Top-down approach. A valuation methodology that derives a FRAND rate in two steps. Firstly, it establishes an aggregate royalty rate (ARR), representing the total compensation owed collectively for all SEPs covering a standard. Secondly, it apportions that total to the portfolio at issue based on the patentee's relative share of the relevant SEPs.

- **Aggregate royalty rate (ARR).** The total royalty burden for licences to all SEP-holder portfolios covering a standard, taken together. It is expressed

most commonly as a percentage of the average selling price of a standard-compliant end device, although courts have on occasion expressed it on a per-unit basis or anchored it to the value of a component. The ARR is the first input in a top-down analysis. Courts have derived ARRs from a range of sources, including public statements by SEP holders, rates accepted in earlier decisions, hedonic regression analyses of the standard's contribution to device price, and scaling from established rates for prior generations of the same standard.

— **Apportionment.** The allocation of a share of an aggregate royalty rate to the patent portfolio at issue. In the top-down approach, apportionment is the second stage of the analysis. Once the ARR has been established, the patentee's share is derived, typically by measuring its share of all SEPs reading on the standard. Apportionment may also be required in comparable licence analyses in which the comparable covers a larger or different portfolio than the one being valued. In both contexts, patent counting and contribution counting are the main methods used to operationalise apportionment.

Bottom-up approach. A valuation methodology that shares the theoretical premise of the incremental value rule (IVR). Accordingly, it builds a FRAND rate from the ground up by assessing the individual technical and economic value of each patent in the portfolio, rather than apportioning from an aggregate rate or relying on comparable licences. Although discussed in the economic literature, bottom-up approaches have had limited use in the surveyed case law, where courts have generally preferred comparable licences or top-down as more practical and reliable methods.

4.1 General overview of FRAND determination methodologies

Throughout the case law, two general families of methods have been used: comparable licences and top-down analyses. In the literature, other methods have been proposed, e.g., cost-based[138] or bottom-up,[139] but these methods have not (so far) gained traction.

Different methods have sometimes been used in conjunction; e.g., as a cross-check. There are also approaches that may be characterised as hybrid approaches. For example, in *Optis v. Apple*, the first-instance court derived an aggregate royalty for the SEP stack from comparable licences and apportioned it top-down. However, the Court of Appeal rejected this approach in 2025, setting the rate directly from the best comparables and using the implied aggregate only as a cross-check (with a further appeal to the UK Supreme Court pending). In principle, different methods may also be used to determine the upper and lower bounds of the FRAND range (e.g., top-down can be used to determine upper bound and bottom-up to determine lower bound), and bargaining theory (e.g., Nash bargaining) can subsequently be adopted to derive a FRAND rate; but these methods have not gained traction to date either.

4.1.1 Methodologies used by courts in FRAND rate determinations

Figure 5 and Table 5 summarise the methods used in FRAND rate determinations. Out of the 20 cases outlined in section 2.1, 19 cases include a decision where a methodology is explicitly laid out.[140] Overall, comparables are the default method, while top-down is mostly used as the main alternative and often as a "cross-check" for comparables. Top-down was the primary methodology in only five of the 19 cases (*In re Innovatio, TCL v. Ericsson, Huawei v. Conversant,*

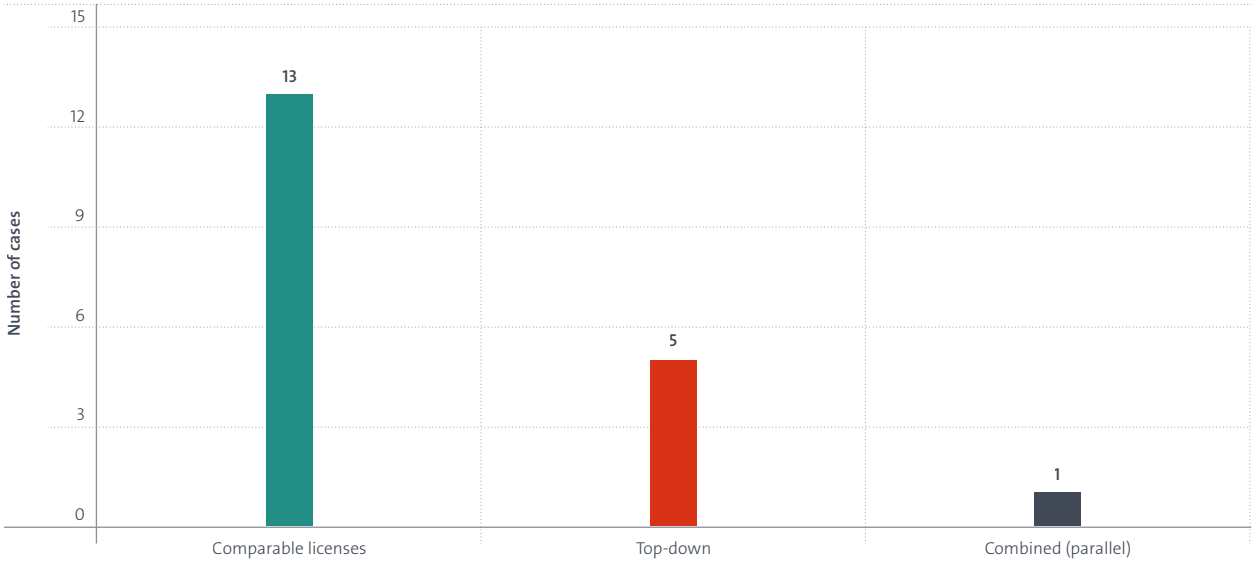
138 Friedl and Ann (2018).

139 Leonard and Lopez (2014).

140 The missing case is the Chinese case *Spreadtrum v. ASR*, for which the available material specifies that it was a case of patent infringement damages, but does not specify how the damages or the rate were calculated.

Figure 5

Primary methodology in FRAND rate determinations



Note: Based on the 19 FRAND rate determination cases in which the decision explicitly sets out the methodology applied. *Oppo v. Nokia* applies both methods in parallel, using a top-down approach for the 5G single-mode rate and comparable licences for 4G. Spreadtrum v. ASR is excluded because the available information does not specify how the damages or rate were calculated, although it identifies the case as one concerning patent infringement damages. In a few decisions, courts rely on comparable licences as the primary method and use a top-down approach as a cross-check, or vice versa.

Siemens v. Xiaomi, and *Samsung v. Apple*), and was used in combination with comparable licences in one other case (*Oppo v. Nokia*, where comparable-licence unpacking of the 2018 Oppo Agreement was used to derive the 4G multimode rate, and the 5G multimode rate was calculated by both top-down and a comparable methods[141]).

Beyond the choice between these two approaches, a central question in each case is how to execute the chosen approach. For the comparable licences approach, the key steps are selection, unpacking and adjustment, which together serve to normalise the available licences so that they can be used as reliable benchmarks. For the top-down approach, the key steps are the determination of the aggregate royalty rate and apportionment. In both cases, how these steps are carried out, and on what assumptions they rest, is often as consequential for the outcome as the initial choice of approach. The following subsections address these aspects.

141 *"Defendants argued that Plaintiffs' above calculation approach was a mixture of the comparable license approach and the top-down approach."* *Oppo v. Nokia*, case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 107.

Table 5

Overview of methodologies used in FRAND determinations

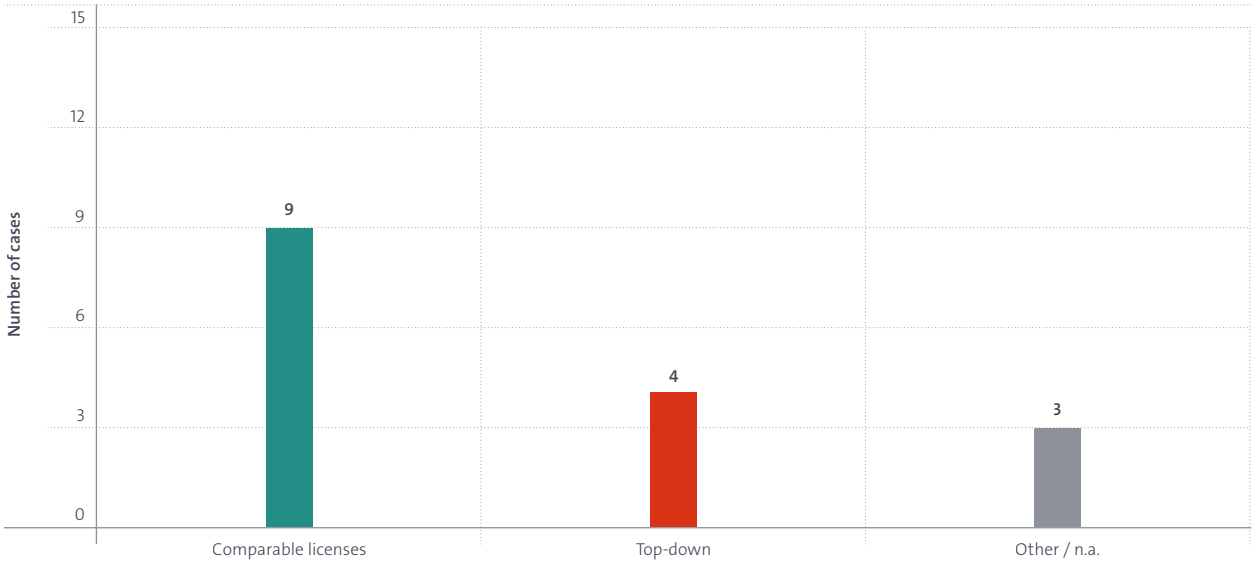
Case	Jurisdiction	Primary	Note
Innovatio v. all cases	US	**Top-down**	Top-down apportionment with the chip profit margin base, within a modified *Georgia-Pacific* framework.
Ericsson v. D-Link	US	**Comparable licences**	Federal Circuit affirms that comparable licence agreements may be used as evidence of reasonable royalty also where the royalty base of these agreements is not the SSPPU
Microsoft v. Motorola	US	**Comparable licences**	Comparable licences (patent pool rates used in the absence of bilateral comparable agreements but increased threefold to account for the fact that pool rates tend to be lower), within a modified
CSIRO v. Cisco	US	**Comparable licences**	Comparable licences (end-user device royalty base upheld by Federal Circuit).
TCL v. Ericsson	US	**Top-down**	Top-down as primary method, with comparable-licences cross-check.
Unwired Planet v. Huawei	UK	**Comparable licences**	Comparable licences as primary method; top-down used as cross-check only.
InterDigital v. Lenovo	UK	**Comparable licences**	Comparable licences as primary method, subject to economic adjustments to normalise past licence agreements to Lenovo's circumstances. InterDigital's top-down hedonic regression cross-check rejected.
Optis v. Apple	UK	**Comparable licences**	The High Court used comparable licences, but via an unusual aggregate-then-apportion route on the basis of the licensee's past licences. Decision overturned on appeal. The Court of Appeal relied on one of the licensor's own past licences, and selected licences of the licensee for adjustment
Huawei v. InterDigital	CN	**Comparable licences**	Unpacking of InterDigital–Apple lump-sum agreement; found to be a better comparable than InterDigital-Samsung.
Iwncomm v. Sony	CN	**Comparable licences**	Per-unit rate drawn directly from IWNCOMM's existing licence agreements.
Huawei v. Conversant	CN	**Top-down**	Aggregate royalty rate established; Conversant's share derived from essentiality analysis
Iwncomm v. Apple	CN	**Comparable licences**	Per-unit rate from IWNCOMM's existing licence agreements applied directly; 3× multiplier applied on account of implementer's fault in negotiation.
ACT v. Oppo	CN	**Comparable licences**	SPC unpacked a China-only lump-sum licence to derive per-unit rate
ACT v. Vivo	CN	**Comparable licences**	Same methodology as *ACT v. Oppo*, decided in parallel.
Siemens v. Xiaomi	CN	**Top-down**	Shanghai court applied a top-down approach to determine the royalty rate for the SEPs in suit and awarded Siemens damages of over RMB 12 million.
Oppo v. Nokia	CN	**Combined (comparable licences + top-**	Unpacking of the 2018 Oppo–Nokia agreement for the 4G rate, and top-down (using hedonic regression) for the 5G rate.
Ericsson v. Lava	IN	**Comparable licences**	Portfolio end-user device royalty base
Philips v. DVD	IN	**Comparable licences**	Inferred per-unit FRAND rates from Philips' existing 'Philips Only' DVD licensing program rather than performing an independent comparables analysis.
Samsung v. Apple	JP	**Top-down**	Aggregate royalty cap divided by essential patent count, apportioned by device contribution ratio.

4.1.2 Methodologies used by courts in FRAND rate assessments

Figure 6 and Table 6 summarise the methods used in court cases performing a FRAND rate assessment. Top-down features in four of the 16 cases (*Netlist v. SK Hynix*, *IP Bridge v. TCT*, *Wilus v. AsusTek*, and *Huawei v. Samsung*), either as the primary basis for the assessment or as a cross-check on comparables. Therefore, similar to FRAND rate determinations, FRAND rate assessments primarily rely on comparables with top-down being the second most often used method.

Figure 6

Primary methodology in FRAND rate assessments



Note: Based on the 16 FRAND rate assessment cases. *Wilus v. AsusTek* is classified as top-down because that approach was used to assess the SEP holder's offer, which was the primary subject of the assessment while comparable licences were considered separately to evaluate the implementer's counteroffer. The "Other/n.a." category includes Intellectual Ventures v. Telefónica and GE/Access Advance v. Vestel, both of which were decided on the basis of specific substantive defects in the licensing offers rather than a rate methodology, as well as Nokia v. Daimler, which settled before any FRAND methodology was applied.

Table 6

Overview of methodologies used in FRAND assessments

Case	Jurisdiction	Assessment	Basis of Assessment
HTC v. Ericsson	US	**SEP holder's offer held FRAND-compliant.** Offer supported by the relevant comparable licences.	**Comparable Licences:** Judge Gilstrap agreed that Ericsson's comparable agreements with others established that its offer to HTC was FRAND. The court also determined, that the ETSI FRAND commitment neither requires nor precludes an SSPPU-based royalty base.
FTC v. Qualcomm (District Court)	US	**SEP holder's royalty rates held non-FRAND (district court); reversed on appeal.** Ninth Circuit: reversed district court's FRAND findings insufficient to establish antitrust liability under Sherman Act.	**Comparable licences (scaling):** Qualcomm's rates held excessive by comparison to other licensors' rates
Netlist, Inc. v. SK Hynix Inc.	US	**SEP holder's licensing practice held FRAND-compliant.** ITC Administrative Law Judge rejected SK Hynix's FRAND-based defence.	**Top-down (Hedonic regression):** The Judge accepted Netlist expert's hedonic regression analysis as a valid basis and found that Netlist's rates were not discriminatory.
Saint Lawrence v. Vodafone	DE	**SEP holder's offer held FRAND-compliant.** Implementer's Germany-only counteroffer held non-FRAND.	**Comparable licences:** LG Düsseldorf found that SLC's royalty rates fell within the range of six existing comparable licences with mobile telecoms companies. Vodafone's Germany-only counteroffer was itself non-FRAND as it failed to reflect the industry practice of worldwide portfolio licensing.
Fraunhofer v. ZTE	DE	**SEP holder's offer held FRAND-compliant.** ZTE's counteroffer, which was limited to the defendant-in-suit, was not considered FRAND-compliant.	**Comparable licences:** The court held that no exact mathematical derivation of a FRAND-conform royalty rate is required. Court confirmed that a patent pool rate can serve as a FRAND-compliant offer where the pool is broadly representative, even though pool rates generally tend to be lower than bilaterally negotiated rates.
Tagivan v. Huawei	DE	**SEP holder's offer held FRAND-compliant.** Huawei's refusal to accept held to constitute unwilling-licensee conduct.	**Comparable licences:** Parallel to *Fraunhofer v. ZTE*. Same MPEG-LA pool licensing structure assessed under the same framework.
Intellectual Ventures v. German mobile operators	DE	**SEP holder's licensing offers held non-FRAND.** Court declined to issue injunction on substantive FRAND grounds.	**Specific defects:** LG Düsseldorf found the plaintiff's three licensing offers non-FRAND due to multiple substantive defects: selective enforcement against defendant but not its main competitors (discriminatory); refusal to license defendant's suppliers (discriminatory); clause placing burden of proof of double-licensing on defendant (unfair); inclusion of compensation for past infringement alongside ongoing parallel damages litigation (unfair); exclusion of wholesale business from licence scope (discriminatory).

Case	Jurisdiction	Assessment	Basis of Assessment
LG Düsseldorf, 4b O 91/18	DE	**SEP holder's licensing offer held non-FRAND.** Court denied injunction; offer found non-FRAND due to discriminatory and unfair comparable licence terms.	**Comparable licences:** LG Düsseldorf found that the plaintiff's licensing offer was non-FRAND due to discriminatory terms in relation to comparable licensees: the offer failed to provide a level playing field compared to other licensees, there were concerns regarding potential double dipping in licensing pools, and a detailed analysis of comparable licences indicated significant discrepancies that impacted fair competition.
IP Bridge v. TCT	DE	**1st Instance: SEP holder's licensing offer held non-FRAND.** Court denied injunction; plaintiff's offered rate found non-FRAND on royalty-base grounds. **Appeal: SEP holder's offer held FRAND-compliant. Implementer's counteroffer held non-FRAND.**	**Top-down:** Both parties relied on the top-down methodology but disagreed on the royalty base. The court agreed with the defendant that its product-specific ASP was the correct base. Applying this ASP, the plaintiff's rate implied an aggregate royalty 3.6 times higher than the 10% ceiling the plaintiff itself had declared to be reasonable. **On appeal,** IP Bridge's third offer was held FRAND. The Appeal Court accepted volume-discount differentiation between licensees and confirmed that an adjustment clause permitting royalty revision upon substantial changes in the licensed portfolio was FRAND. TCT was held to have been an unwilling licensee on an overall assessment.
Nokia v. Daimler	DE	**SEP holder's offer held FRAND-compliant.** No final FRAND determination, case settled June 2021 before adjudication.	
GE/Access Advance LLC v. Vestel	DE	**SEP holder's licensing offer held non-FRAND.** Court denied injunction; offer found non-FRAND due to discriminatory and unfair contract provisions.	**Specific defects:** treatment of implementers already licensed under the parallel MPEG LA pool (duplicate-royalty risk, with the burden of establishing overlap placed on the licensee) and unjustified deviation from the SEP holder's established licensing practice.
Wilus v. AsusTek	DE	**SEP holder's offer held FRAND-compliant. Implementer's counteroffer held non-FRAND.**	**Top-down:** Wilus's offers were both assessed as FRAND-compliant using a top-down analysis; proposed comparable licences were found not to provide sufficient information for a reliable analysis. **Comparable licences:** Asus's counteroffer was found to be well below the range of rates paid similar Wi-Fi 6 licences, and thus non-FRAND.
Broadcom v. Renault	DE	**SEP holder's offer held FRAND-compliant. The implementer lacked an "inner willingness to licence".**	**Comparable licences:** FRAND corridor applied with the range set at ±50% around a midpoint derived from previous Broadcom's agreements with comparable automotive manufacturers. Renault's proposed discounts rejected and its counter-offer resulted below-corridor.

Case	Jurisdiction	Assessment	Basis of Assessment
Philips v. ASUSTeK	NL	**SEP holder's offer held FRAND-compliant.** Asus held to be an unwilling licensee (non-FRAND conduct).	**Comparable licences:** Asus's negotiation conduct was found to fall short of the good-faith engagement required of a willing licensee. Philips had followed the required procedural steps, and its royalty rates were within the range supported by comparable licences.
Huawei v. Samsung	CN	**SEP holder's offer held FRAND-compliant. Implementer's offer held non-FRAND.**	**Top-down:** Portfolio strength assessed by: (i) approved contributions to LTE standards; (ii) essentiality of declared 3G/4G SEPs per third-party studies; (iii) invalidation rates of SEPs-in-suit. Samsung's forward citation analysis (US patents only) was rejected as not comprehensive. Samsung's sole licensing offer found outside the reasonable range supported by Huawei's portfolio strength.
Ericsson v. Intex	IN	**SEP holder's offer held FRAND-compliant.** Intex held to be an unwilling licensee.	**Comparable licences:** the court found that Ericsson's end-product royalty base was consistent with the approach endorsed in comparable jurisdictions. Intex's filing of a complaint before the CCI was treated as an admission of infringement and its refusal to engage on Ericsson's terms constituted unwilling-licensee conduct.

4.1.3 General observations on the prevalence of different approaches

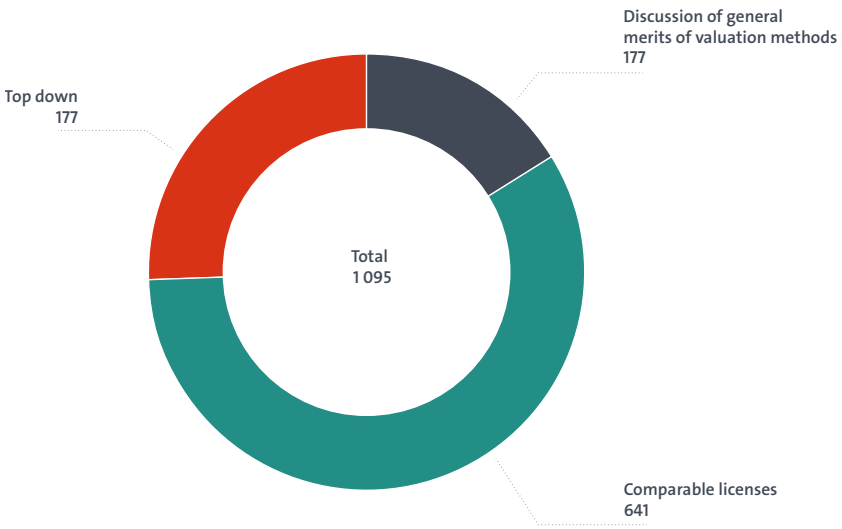
While the case-level classification in Figures 5 and 6 identifies the primary methodology in each determination, it does not capture the full weight that courts give to each approach in their reasoning. A court that uses comparable licences as its primary methodology may nonetheless devote substantial discussion to the top-down approach and vice versa. To capture this richer picture, relevant passages of text were extracted from the 19 available FRAND rate determination decisions and categorised into 1 095 snippets with information on the method discussed. The snippets were extracted by three co-authors in parallel and later cross-checked, with the objective of isolating text explicitly referring to either methodology. The extraction resulted in a categorisation between top-down, comparable licences and other general merits about valuation (Figures 7 and 8).

Figure 7 reports the distribution of the snippets collected across the three main categories. Comparable licences are the most frequently discussed methodology, accounting for 641 snippets (59%). Top-down is the second-most-discussed approach with 277 snippets (25%). A further 177 snippets (16%) are coded to the general discussion of the merits of different valuation methods, reflecting that courts often situate their choice of method within a broader assessment of the relative strengths and limitations of each approach.

Figure 8 shows how the weight of methodological discussion has evolved over time across the decisions reviewed, suggesting a shift in the methodological centre of gravity. Bottom-up elements feature prominently in several earlier decisions, including *CSIRO v. Cisco*[142], *In re Innovatio*[143], and *Microsoft v. Motorola*[144], where courts engaged with the value of individual patents or with hypothetical-negotiation constructs based on patent-specific reasoning.

Figure 7

Relative attention given to FRAND valuation methodologies in court decisions



Note: Based on the 1 095 snippets containing information on methodological discussions (comparable licences, top-down and general discussion of valuation methods). The snippets were collected from 19 FRAND rate-determination decisions across 14 cases. The six FRAND determinations from China are excluded from the analysis because no publicly available documents providing the necessary information could be identified.

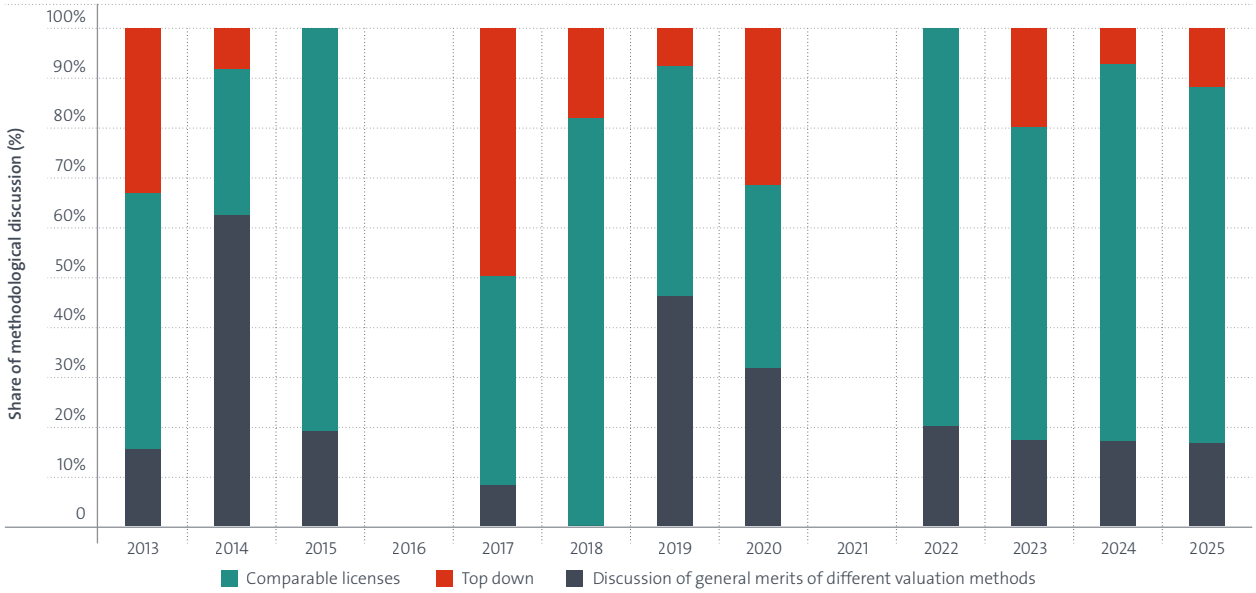
142 *CSIRO v. Cisco*, case 6:11-cv-00343-LED, at 10 and at 23-25.

143 *In re Innovatio*, case 1:11-cv-09308, at 72-73.

144 *Microsoft v. Motorola*, case C10-1823JLR, [75], [106] and [575].

Figure 8

Changing focus of FRAND valuation analysis over time



Note: Share of snippets that focus on a given methodological discussion (comparable licences, top-down, and general discussion of valuation methods) by year. Based on 1 095 snippets containing information on methodological discussions, collected from 19 FRAND rate-determination decisions across 14 cases. The six FRAND determinations from China are excluded from the analysis because no publicly available documents providing the necessary information could be identified.

In more recent decisions, such bottom-up elements appear less frequently, with the analysis organised around comparable licences and, where used, top-down cross-checks instead. Cost-based approaches have been explicitly rejected by courts in most jurisdictions that have addressed them, on the basis that the cost of developing a patented technology is not a reliable indicator of its value once incorporated into a standard.

4.2 Comparable licences

Courts across jurisdictions have recognised comparable-licence rates as a relevant FRAND benchmark, and several have characterised comparable-licences analysis as the most reliable approach.

In principle and ideally, a comparable licence is a licence executed between an SEP holder and an implementer, since such an agreement reflects what the SEP holder and the implementer themselves regarded as acceptable terms. When unavailable, the parties can propose and look to a broader range of evidence. This evidence includes the SEP holder's wider licensing programme, and, in some cases, the offers exchanged in the parties' own earlier negotiations. For instance, in the *CSIRO v. Cisco* case, the court rejected two licences, and instead built the royalty range from CSIRO's broader licensing programme that was offered to Cisco in the 2004 negotiations.[145] That served as the upper bound for the range, whereas the unofficial offer from the licensee was taken as the lower bound.[146]

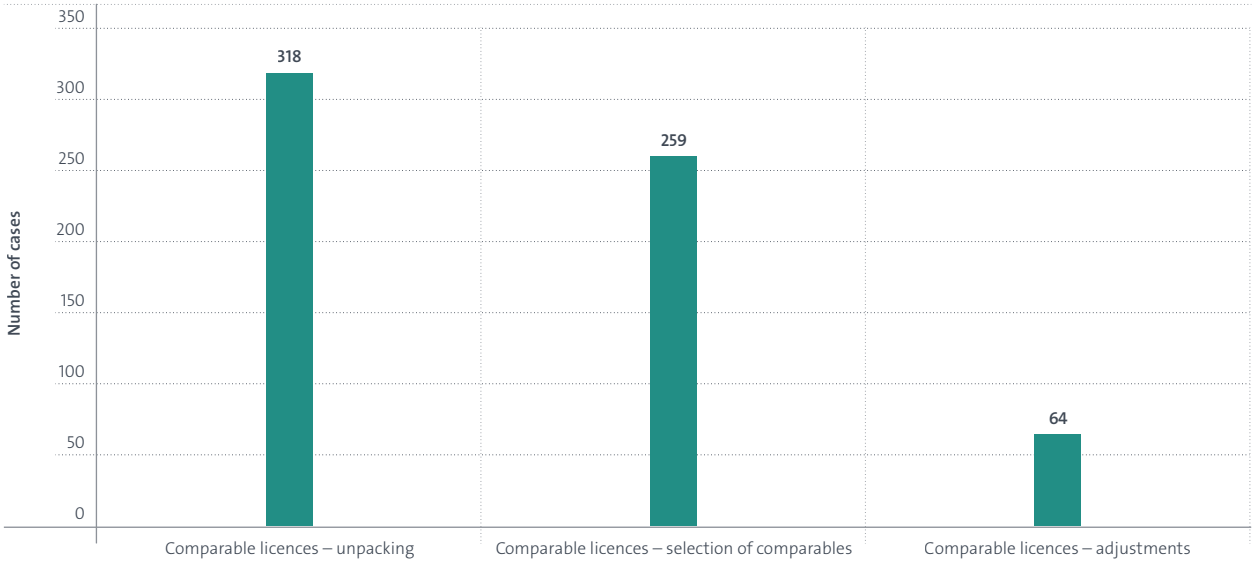
A comparable licence analysis generally proceeds through three steps: selection, unpacking and adjustments. Firstly, it requires the selection of existing licence agreements that are sufficiently similar to the licence under determination to serve as reliable benchmarks. Second, the selected licences must be unpacked, meaning their financial terms are decomposed into a form that can be directly compared with the rate at issue. Thirdly, adjustments are made to account for residual differences in portfolio scope, geography, or other relevant factors. Figure 9 shows that references to comparable licences mainly concern unpacking and selection, while

145 *CSIRO v. Cisco*, case 6:11-cv-00343-LED, at 24.

146 *CSIRO v. Cisco*, case 809 F.3d 1295, at 13.

Figure 9

Issues most frequently discussed in comparable licence analysis



Note: This figure reports the frequency of snippets covering the different relevant steps of comparable licences (i.e. selection, unpacking and adjustments). Based on 1,095 snippets containing information on methodological discussions, collected from 19 FRAND rate-determination decisions across 14 cases. The six FRAND determinations from China are excluded from the analysis because no publicly available documents providing the necessary information could be identified.

adjustments appear less frequently. This reflects the typical sequence where courts first identify usable comparables, proceed to examine their terms, and only then consider possible adjustments.

The following subsections offer detailed insights into the selection of comparable licences and how to unpack them. The analysis is based on 16 FRAND rate determination cases, out of the 19 cases identified, for which the full decisions were publicly available.

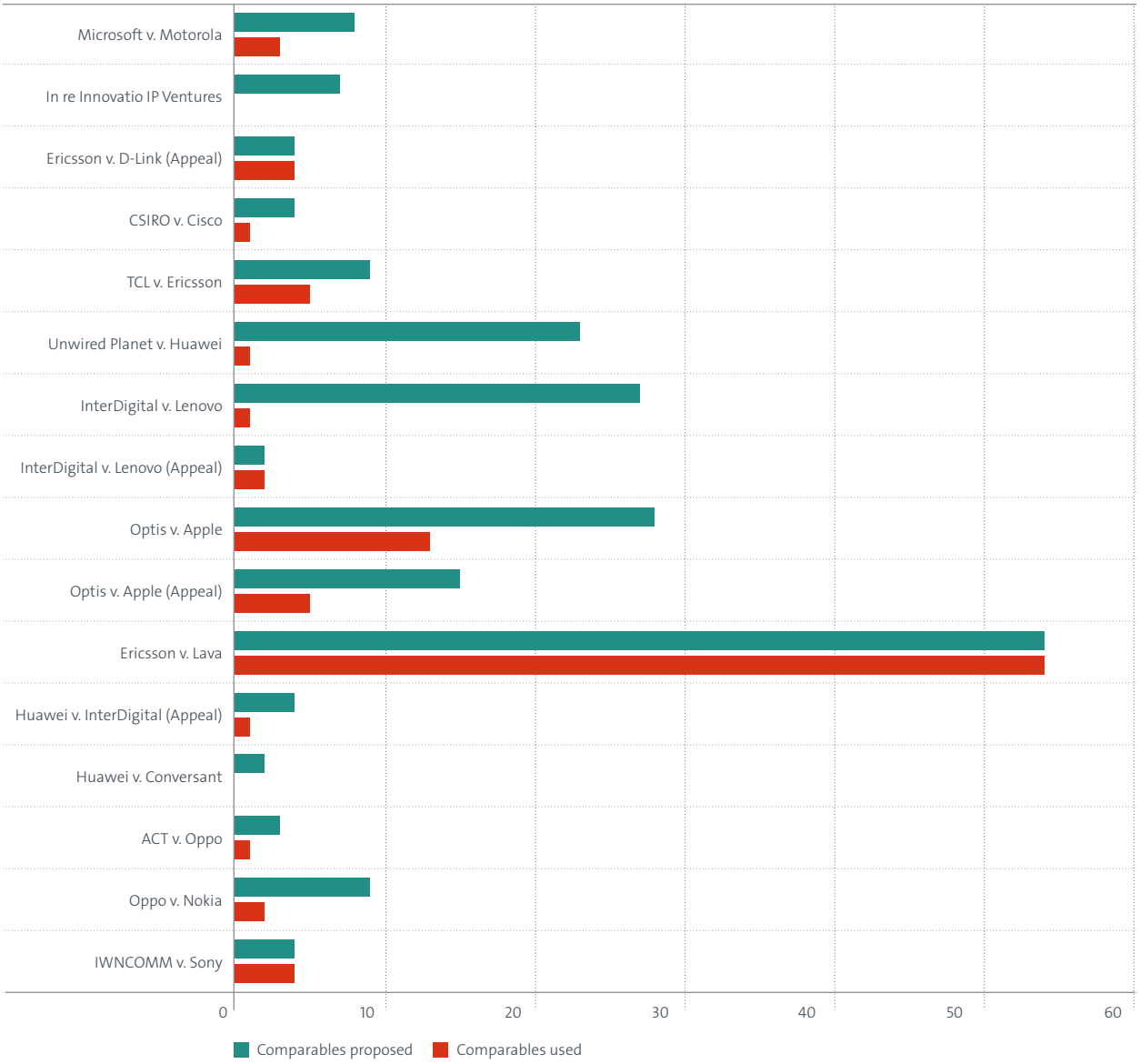
4.2.1 Selection of comparable licences

Courts are often presented with a substantially larger set of alleged comparable licences than they ultimately rely on, as shown in Figure 10. While some cases, such as *Ericsson v. Lava*, involve a close match between proposed and accepted comparables, most decisions reflect a selective approach in which courts filter the parties' proposed licences before using them in the FRAND analysis.

This subsection examines how courts select and assess comparable licences in FRAND determinations. It is structured around five issues, each of which developed in its own subsection: the different categories of licences proposed and accepted as comparables, the scope of the comparable licence analysis (i.e. the number of licences included in the analysis), and three different factors used to select the comparable licences: comparability, potential non-FRAND factors, and the reliability of the evidence that can be derived from a potential comparable license.

Figure 10

Number of licenses proposed and accepted as comparables



Note: This figure is based on 16 FRAND rate determination decisions for which the full document is publicly available and thus provides data about the comparable licences proposed and used.

4.2.1.1 Categories of comparable licences

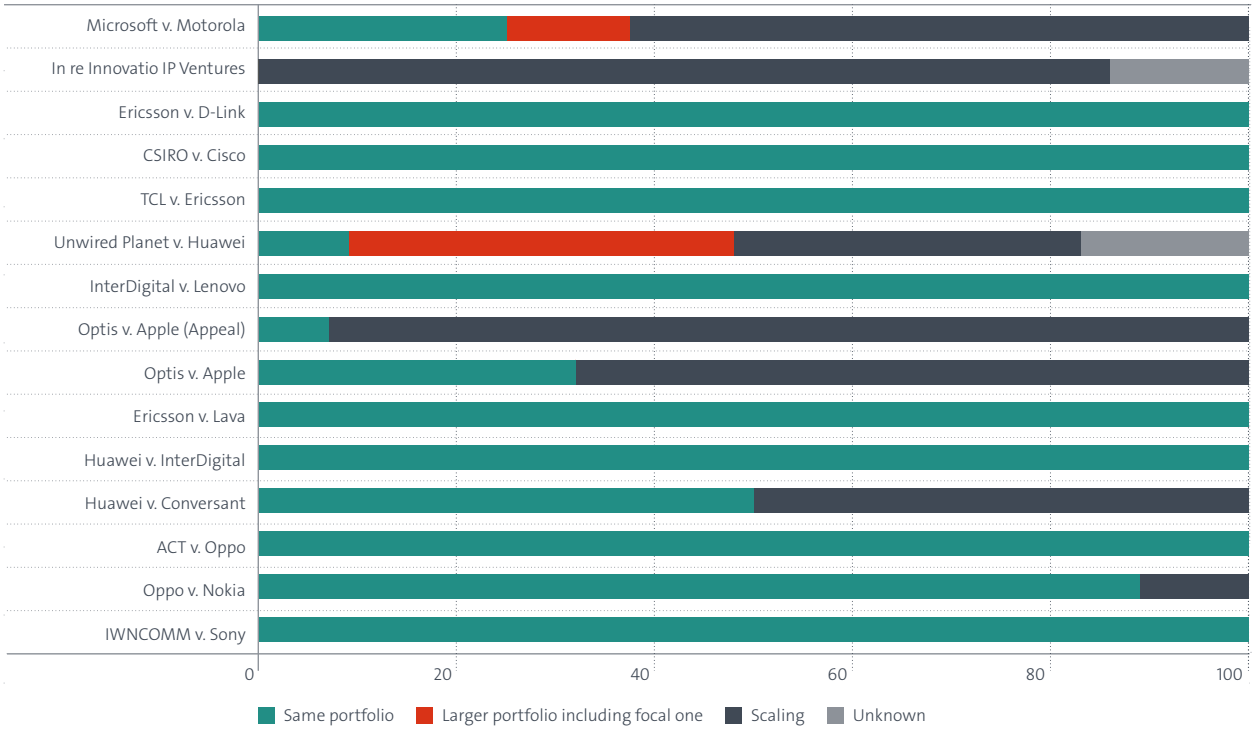
Comparable licences can be grouped into three broad categories: licences to the focal portfolio itself, licences to a larger portfolio that includes the focal portfolio and licences to a different portfolio used as a scaling benchmark.

Figure 11 shows the categories of comparable licences proposed by the parties in each case. The figure illustrates that parties often submit different types of comparables in the same dispute, including same-portfolio licences, licences to a larger portfolio and scaling benchmarks. Same-portfolio licences are the most recurring comparable, with several cases relying almost entirely on this category. In other disputes, parties also proposed scaled licences, especially where the available agreements did not match the portfolio at issue directly. Larger-portfolio licences were proposed less frequently, appearing mainly in a small number of cases such as *Unwired Planet v. Huawei* and *Microsoft v. Motorola*.

Figure 12 summarises the categories of comparable licences that courts ultimately accepted for use in their final FRAND determinations. Compared with the broader set of licences proposed in Figure 11, the figure shows a more selective picture: Courts most frequently relied on same-portfolio licences, while scaling was accepted in a smaller number of cases and licences to larger portfolios were used only occasionally. The comparison between proposed and accepted comparables therefore shows that courts do not treat all proposed licences alike. Instead, they assess which licences are sufficiently reliable to be used in their FRAND analysis.

Figure 11

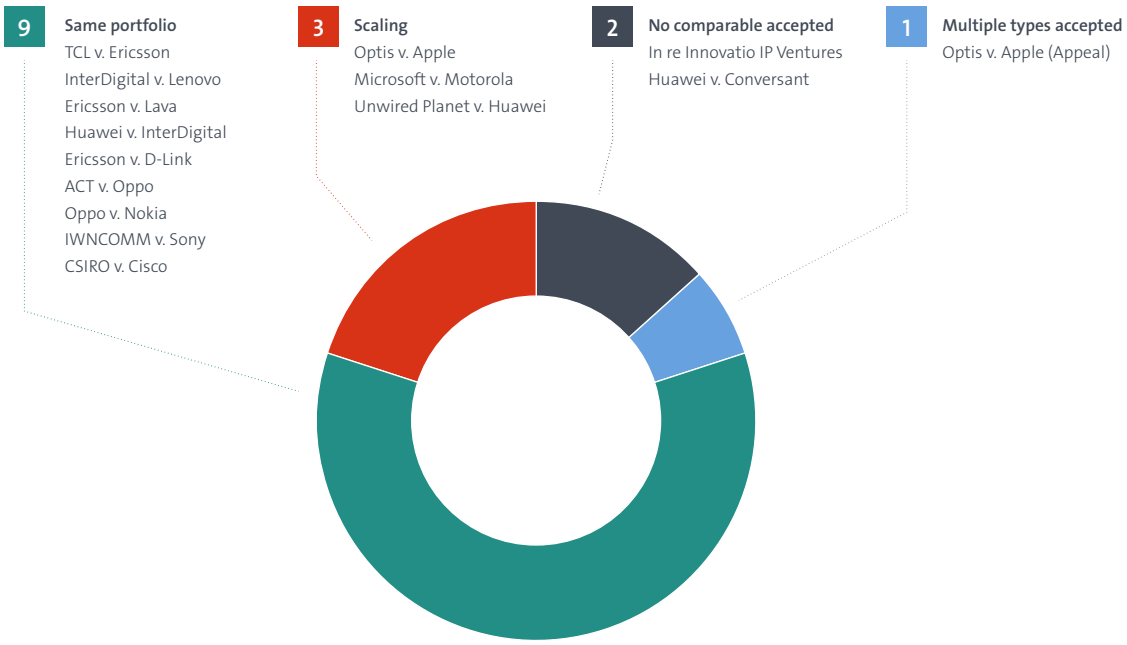
Composition of comparable license categories proposed in each case



Note: This figure is based on 16 FRAND rate determination decisions for which the full document is publicly available and thus provides data about the comparable licences proposed and used. The figure shows the percentage of comparable licence categories within each case. It includes only first-instance decisions where an appeal relied on the same type of comparable evidence, in order to avoid double-counting the same analytical approach. For this reason, *InterDigital v. Lenovo* is shown only once and not twice as in Figure 10, even though the appeal substantially narrowed the accepted set of comparables from 27 licences to 2 licences. *Optis v. Apple* is treated as an exception because the approach changed between instances: the first-instance decision relied on scaling, while the appeal accepted multiple types of comparables, including same-portfolio and scaling-based evidence.

Figure 12

Category of comparable licences accepted for use in final decisions



Note: Based on 16 FRAND rate determination decisions for which the full document is publicly available and thus provides data about the comparable licences proposed and used. The figure shows the type of comparable licence eventually accepted for each case. Same-portfolio licences was the type of comparable eventually accepted in nine cases, scaling was accepted in three cases and multiple types were accepted in one case (the appeal of *Optis v. Apple*). No comparables were accepted in two cases. The graph includes only first-instance decisions where an appeal relied on the same type of comparable evidence, in order to avoid double-counting the same analytical approach. For this reason, *InterDigital v. Lenovo* is shown only once and not twice as in Figure 10, even though the appeal substantially narrowed the accepted set of comparables from 27 licences to 2 licences. *Optis v. Apple* is treated as an exception because the approach changed between instances: the first-instance decision relied on scaling, while the appeal accepted multiple types of comparables, including same-portfolio and scaling-based evidence.

4.2.1.2 How many licences to include in the analysis – inclusive vs. selective approaches

A comparable licence analysis can be more or less *"inclusive"*; i.e., it can rely either on a small number of most directly comparable licences (often one), or a broader comparison extending to a larger number of licences (also including those licences that are less immediately comparable to the licence under dispute).

When there is a large number of licences for the same technology on identical (or nearly identical) terms, German courts have found that this large number of licences adds weight to the indicative value of the comparable licences.[147] Similarly, in *Iwncomm v. Sony* and *Iwncomm v. Apple*, the Chinese courts (the Beijing courts in the former, and the Shaanxi High People's Court, affirmed by the Supreme People's Court, in the latter) found that the fact that Iwncomm had

147 *"Je mehr abgeschlossene Lizenzverträge mit gleichartigen Lizenzbedingungen der SEP-Inhaber vorweisen kann, umso stärker spricht eine Vermutung dafür, dass die geforderten Lizenzgebühren FRAND sind"*. English translation: *"The more license agreements with similar terms the SEP holder can demonstrate, the stronger the presumption that the requested royalty rates are FRAND."* Saint *Lawrence v. Vodafone* (n 11) [273]; *Tagivan (MPEG-LA) v. Huawei* (n 12) [451]. Tsilikas (2020), at 886. Also: *"Vorrangig können Lizenzverträge heranzuziehen sein, um den angemessenen Charakter von einzelnen Vertragsbedingungen zu belegen. Dazu gilt im Grundsatz, je mehr Verträge geschlossen wurden, desto leichter können sie ein Indiz für die Angemessenheit bestimmter vertraglicher Regelungen sein. Denn eine ausreichende Anzahl von Lizenzverträgen kann eine Akzeptanz am Markt nachweisen und weitere Angaben zur Angemessenheit einer Vertragsklausel entbehrlich machen (LG Düsseldorf, Urt. v. 13. Juli 2017, 4a O 154/15, Rn. 311, zitiert nach juris; LG Düsseldorf, Urt. v. 11. Juli 2018, 4c O 77/17, BeckRS 2018, 25099, Rn. 137)."* GE/Access Advance LLC v. Vestel Elektronik Sanayi ve Ticaret A.Ş. (GE/Access Advance v. Vestel) 4c O 42/20: [391]. English translation: *"License agreements may primarily be relied upon to demonstrate the reasonableness of individual contractual terms. In principle, the more agreements that have been concluded, the more readily they can serve as an indication of the reasonableness of certain contractual provisions. This is because a sufficient number of license agreements can demonstrate market acceptance and render further information regarding the reasonableness of a contractual clause unnecessary"* (Regional Court of Düsseldorf, Judgment of July 13, 2017, 4a O 154/15, para. 311, cited from juris; LG Düsseldorf, judgment of July 11, 2018, 4c O 77/17, BeckRS 2018, 25099, para. 137).

achieved identical rates with multiple other licensees supported the finding that this rate was a FRAND rate.[148] Nevertheless, a licensing programme with many licensees is not necessarily a good comparable;[149] and a single licence between two companies can be sufficient for a comparable licence analysis. In fact, many comparable licence analyses in different jurisdictions have relied on a single comparable licence between two companies.[150]

The question of the scope (or *"inclusiveness"*) of the comparable licences analysis primarily arises in situations in which there is heterogeneity among existing licences. In such cases, some parties propose that the court should seek *"the closest possible parallel"*[151]; and additional licences should only be taken into consideration if there are only slight differences between licences.[152] Other parties suggest that including a larger number of licences in the analysis is preferable, as it increases the robustness.[153]

In the context of a comparable licences analysis that is based on the SEP owner's existing licences, the question of the inclusiveness of the analysis is also related to the scope of the non-discrimination obligation. A narrowly scoped comparable licences analysis (relying only on a smaller number of most directly comparable licences) allows for greater rate variation between licensees that are not directly similarly situated to each other. In this context, the US district court in *TCL v. Ericsson* found that a SEP owner defining *"similarly situated very narrowly by picking and choosing criteria with no relation to its SEPs or the FRAND commitment"* would effectively discriminate between different licensees; with the effect of granting lower rates to the largest firms in the market, thereby further contributing to their dominant position.[154] The Court concludes that for purposes of licence comparisons the analysis should include all firms reasonably well-established in the world market, which necessarily implies a wide spectrum.[155]

In the case *Optis v. Apple*, the High Court made a more general criticism of what it called the two parties' *"exclusionary"* approaches to the comparable licences analysis. While the two parties disagreed on which licences constituted the best comparables; they were in agreement that *"focus on fewer, better, comparables was to be preferred to a focus on more, less good, comparables"*.[156] In disagreement with both parties' positions, the court held that the *"comparables require analysis in light of the totality of the evidence"*.[157] In the court's assessment, this was a consequence of the weaknesses of the existing comparable licences; in particular the "subjectivities" involved in the necessary unpacking to derive effective rates from these licences. Therefore, the court developed an "inclusive" comparable licence analysis, involving averaging across values derived from 14 different agreements.

The Appeal Court in *Optis v. Apple* overturned the High Court's analysis and approach; stating that *"the right*

148 From Yiu and Ren (2024) In *Iwncomm v. Apple*, the *"Shan'xi High Court reviewed dozen(s) of Iwncomm's licence agreements (including some of agreements requested by Apple) and found that the per unit rate in Iwncomm's licence agreements for terminal products was consistently RMB */unit, which was the same as Iwncomm's offer to Apple."*

149 *"I concluded that the PLAs relied upon by InterDigital were not relevant comparable licences at all." Interdigital v. Lenovo*, case [2023] EWHC 1583 (Pat), [609].

150 See Figure 10.

151 *"The object of the comparability exercise, in this as in any other branch of the law, is to find the closest possible parallel. If there is an exact parallel, there is no point in looking any further. If there are slight differences, an allowance may be made. But once you have found your comparables, whether one or more, which enable you to arrive at the appropriate figure, it would surely be erroneous to modify that figure by reference to other cases which are not truly comparable at all, so as to bring the case into line with a predetermined range. This was, with great respect, the mistake which the hearing officer made."* Smith Kline & French Laboratories Ltd's (Cimetidine) Patents [1990] RPC 203.

152 *"In relation to comparables generally Huawei submit that the approach to be followed is that set out by Lloyd LJ in Smith Kline & French Laboratories Ltds (Cimetidine) Patents [1990] RPC 203 as follows: "The object of the comparability exercise, in this as in any other branch of the law, is to find the closest possible parallel. If there is an exact parallel, there is no point in looking any further. If there are slight differences, an allowance may be made. But once you have found your comparables, whether one or more, which enable you to arrive at the appropriate figure, it would surely be erroneous to modify that figure by reference to other cases which are not truly comparable at all, so as to bring the case into line with a predetermined range." (Unwired Planet v. Huawei* at 40; 172)

153 *"Due to the uncertainties in unpacking, InterDigital submitted that it is better to look across as broad a range of comparables as possible rather than focussing on a small subset of 'the best' comparables. They say doing so mitigates against the uncertainty inherent in any particular, single comparable licence skewing the analysis." Interdigital v. Lenovo*, case [2023] EWHC 1583 (Pat), [295].

154 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 57

155 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 56

156 *Optis v. Apple*, Case [2023] EWHC 1095 (Ch), [290].

157 *Optis v. Apple*, Case [2023] EWHC 1095 (Ch), [318].

approach was to adopt a comparables based approach (ground 2) in the sense of being one based on identifying the best comparable or comparables, excluding others and working from there."[158] In the Appeal Court's judgment, the main problem with the High Court's approach is that it gives weight to a large number of different agreements, even though these agreements point to very different rates. For the Appeal Court, "*[t]he obvious conclusion is that either this approach does not work or that these licences cannot all be useful comparables."*[159]

The Appeal Court's approach to the comparable licence analysis, as stated in *Optis v. Apple*, thus involves a selection of the best comparable(s) as a necessary and important first step. The emphasis on the need to select the closest possible comparable(s) is neither new nor specific to SEPs. The point was already clearly made by the UK Court of Appeal in 1990, in a passage repeatedly cited by the UK High Court and Court of Appeal in FRAND determination cases:

> "The object of the comparability exercise, in this as in any other branch of the law, is to find the closest possible parallel. If there is an exact parallel, there is no point in looking any further. If there are slight differences, an allowance may be made. But once you have found your comparables, whether one or more, which enable you to arrive at the appropriate figure, it would surely be erroneous to modify that figure by reference to other cases which are not truly comparable at all, so as to bring the case into line with a predetermined range."[160]

Courts in other jurisdictions have also adopted an "exclusionary" approach to comparable licences analyses, involving a selection of the most directly comparable license(s) as a necessary first step of the analysis. In *HTC v. Ericsson* in the US, Ericsson successfully *"pointed to licences with similarly situated companies to HTC that had terms that were remarkably similar to those offered to HTC"* to support both the valuation of its portfolio and the non-discriminatory character of its licensing offer to HTC.[161] While HTC argued that licences with companies such as Apple, Samsung and Huawei were much more favorable, Ericsson was successful with its argument that these companies were not similarly situated to HTC due to a variety of factors.[162]

The Regional Court of Munich in Germany also made it clear that SEP owners may be selective in the licences they rely upon. In *Wilus v. AsusTek*, the court stated that it is not necessary for SEP owners to disclose all existing licences; as this would lead the implementer to pick and choose the arguments most favorable to their cause in the various existing agreements.[163] Moreover, the court states that – according to its experience – disclosure of additional licensing agreements by the SEP owner almost always leads the implementer to request even further disclosures.[164]

Courts in China have also often used comparable licences analyses to determine FRAND rates. They consistently operated a selection of the relevant comparable licences as the first step of the analysis. In cases such as *Huawei v. InterDigital*, *Oppo v. Nokia*, and *ACT v. Oppo*, Chinese courts have relied on a single comparable license, to the exclusion of other, less comparable licences.[165] In other cases, in which multiple comparable licences were relied upon, these different comparable licences had identical rates.[166]

The majority of comparable licences analyses in the FRAND case law thus proceed on the basis of first selecting the most relevant comparable license(s); most commonly only using a single licence as a reference point for the FRAND rate determination. This does not, however, entail a bright line rule against considering a larger number of licences. In *Unwired Planet v. Huawei,* the UK High Court, e.g., stated

158 *Optis v. Apple*, Case [2025] EWCA Civ 552, [115].

159 *Optis v. Apple*, Case [2025] EWCA Civ 552, [108].

160 Smith Kline & French Laboratories Ltd's (Cimetidine) Patents [1990] RPC 203; cited by *Unwired Planet v. Huawei*, case [2017] EWHC 711 (Pat), [172]; and *Optis v. Apple*, case [2023] EWHC 1095 (Ch), [229]; [2025] EWCA Civ 552, [35].

161 *HTC v. Ericsson*, 12 F.4th 476 (5th Cir. 2021), at 16.

162 Ibd.

163 *Wilus v. AsusTek*, case No. 7 O 5007/25, [121].

164 Ibd.

165 See, for instance, *Oppo v. Nokia*, case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 91 & 111.

166 From Yiu and Ren (2024) In *Iwncomm v. Apple*, the *"Shan'xi High Court reviewed dozen(s) of Iwncomm's licence agreements (including some of agreements requested by Apple) and found that the per unit rate in Iwncomm's licence agreements for terminal products was consistently RMB */unit, which was the same as Iwncomm's offer to Apple."*

that *"if a group of comparables are at least potentially as relevant as each other and are not the same, it is not right to elevate a small subset above the others."*[167] The court further elaborates: *"If a group of good comparables corroborate one another then no doubt that is a factor to take into account but equally if apparently good comparables, when properly understood, contain different rates that is also relevant too."*[168]

Thus, in a situation in which there is not one licence that is clearly the most relevant comparable license, a comparable licence analysis can proceed on the basis of multiple comparables. An example of such an approach is the UK Appeal Court decision in *Optis v. Apple*, which gives weight to certain Apple licences with other licensors, and the *Optis v. Google* license, to arrive at a FRAND rate.[169] Nevertheless, this analysis still operates on the basis of a much more "exclusionary" approach than the High Court's decision in that case, which had included a far greater number of "comparable" licences.

Even where a court has identified one licence that is most comparable to the issue under dispute, it may still consider evidence from other licences to guide the necessary adjustments to account for the differences between the selected comparable licence and the focal licence under dispute. It may also turn to other licences as a cross-check, or as a source of additional support for a rate determined on the basis of a single, most comparable license.[170]

4.2.1.3 Comparability factors

The comparability of a proposed licence depends on several factors. Courts primarily assess whether the licence concerns the same or an analogous technology or portfolio, whether the licensee is similarly situated to the party seeking a license, and whether the license's timing, duration and geographic scope make it a reliable benchmark for the FRAND assessment.

Same or analogous technology

One important selection criterion for comparable licences is the similarity of the licensed patents, which encompasses two separate issues: first, the extent to which the licensed patents overlap between different agreements, and second, the extent to which different patents licensed in different licences are comparable with each other.[171]

There is a broad consensus in the case law across different jurisdictions that existing licences to the portfolio at issue are usually the most relevant type of comparable licences.[172] In particular, licences to the portfolio-in-suit are the only licences that are capable of *directly* reflecting the value of that portfolio (which is one of the guiding considerations of a FRAND rate determination).[173] Nevertheless, other licences may also be informative. In particular, licences between the licence seeker and other SEP owners are often proposed, and sometimes relied upon as comparable licences for FRAND rate determinations. Existing licences between the infringer and other patent owners are also a factor contemplated by the *Georgia-Pacific* framework for the determination of a reasonable royalty in patent infringement damages cases.[174]

These licences have the potential to contribute in two different ways to a FRAND rate determination. Firstly, while not capable of providing a direct measure of the value of the portfolio at issue, licences to other portfolios may shed light on other aspects that may be relevant to FRAND determinations, e.g. general market conditions and the licence seeker's bargaining power in SEP licensing negotiations. Secondly, such licences may

167 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [173].

168 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [174].

169 *Optis v. Apple,* case [2025] EWCA Civ 552, [145].

170 *Samsung Electronics Co. Ltd v. ZTE Corp.* [2026] EWHC 999 (Pat), judgment of 1 May 2026 (decided after the cut-off date of this study)

171 The Chinese Supreme Court in *ACT v. Oppo* lists four categories of selection criteria for comparable licenses, including *"[t]he similarity of the licensed patents, for example whether the patents that are the subject of the comparable agreement are the same as or at least encompass those in the disputed case, and whether they have the same or similar number and quality as the patents in the disputed case."* (*ACT v. Oppo*, p. 23 of inofficial English translation)

172 "The most directly comparable licences will be licences the patentee has already entered into for the portfolio in question." *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [179].

173 *"Actual licenses to the patented technology at issue are probative as to what constitutes a fair and reasonable royalty for those patent rights because such actual licenses reflect the economic value of the patented technology in the market place." TCL v. Ericsson* at 110, referencing CSIRO, 809 F.3d at 1303; *Ericsson v. D-Link*, 773 F.3d at 1227; *Apple v. Motorola*, 757 F.3d at 1315.

174 *Georgia-Pacific Corp. v. United States Plywood Corp.*, 318 F. Supp. 1116 (S.D.N.Y. 1970), factor 2.

provide an *indirect* measure of the value of the portfolio at issue.[175] Analyses that rely on comparable licences to other portfolios proceed "by analogy", i.e. they rely on a factual relationship or apparent similarity between two portfolios, so that licences to one portfolio can be used to determine the FRAND rate for a licence to the other portfolio. In a case of two "analogous" portfolios (i.e. two portfolios assessed or assumed to be of similar value), the rate at which one portfolio has been licensed may be informative of the FRAND rate for a licence to the other portfolio. Where the two portfolios are manifestly different, but one assesses that the differences between portfolios can be quantified (e.g. because the portfolios are thought to be of similar quality but differ in size), a necessary step is "scaling", i.e., adjusting the rate to account for the differences in portfolio size and/or value.

Courts have made it clear that licences to other portfolios are capable of providing useful comparables, but that an analogy between different portfolios requires a factual basis. In *Optis v. Apple*, the UK Court of Appeal highlighted that the place to start is looking at the SEP holder's own licences.[176] Nevertheless, where the SEP holder's licences are not useful (e.g., because they are tainted by hold-up or hold-out), the court explains that licences of the putative licensee *"are capable of being useful comparables, again subject to hold up and hold out, but using them also involves a further dimension which is why, although they may well be useful in the end, they are not the best place to start. Their comparability (not reliability) also depends on the relationship between the patent portfolio being licensed and the SEP holder's portfolio. Not only does one need a view about stack shares, the issue of portfolio quality arises. It is not enough to render them comparable to say that the SEP holder's portfolio is average. The other licensed portfolios also have to examined"*.[177]

In US FRAND case law, there are several examples of licences to other patent portfolios being proposed as comparable licences. Frequently, such licences have been rejected because the court found that there was insufficient evidence to support the analogy between the different patents (or patent portfolios). In *In re Innovatio*, both Innovatio and the implementers proposed comparable licences to other companies' patents. The court, however, found that none of these proposed licences was a useful comparable (and thus proceeded to determine a FRAND rate through a top-down approach).[178] Innovatio's proposal to use two licences between Symbol and LXE to determine a FRAND rate for a licence to Innovatio's 802.11 (i.e., Wi-Fi) SEPs was rejected because Innovatio's expert "*did not know how many of Symbol's patents were 802.11 standard-essential, and how many were non-standard-essential or related to other technologies, and he did not take those factors into account in determining that the Symbol-LXE agreements were comparable.*"[179] Similarly, Innovatio's proposal to rely on a licence between Qualcomm and Netgear was rejected because Qualcomm's large portfolio could not be readily compared with Innovatio's much smaller number of patents, and because the Qualcomm/Netgear licence involved a different wireless communication standard, and there was *"no evidence in the record regarding the comparative commercial value of 802.11 networks versus 802.16/20 networks"*.[180] Innovatio's proposal to rely on three CSIRO licences similarly failed for lack of evidence that the patents are comparable.[181] In addition, the implementers' proposal to use the Via LA 802.11 patent pool as a comparable was rejected because the court found that the pool did not include high-value patents, whereas it assessed Innovatio's patent portfolio to be of moderate to moderate-high importance to the 802.11 standard.[182]

Similarly, in *GBT v. Apple*, the district court found an expert opinion that relied on licences not involving the patents-in-suit to be inadmissible. The court held that *"[e]specially in the absence of any hard evidence the Delaware licences are comparable to the proposed licence*

175 *"The comparison with third party licences is indirect and the relationship between those licences and the value of the portfolio in issue will depend on the evidence." Unwired Planet v. Huawei*, case [2017] EWHC 711 (Pat), [180].

176 *Optis v. Apple*, Case [2023] EWHC 1095 (Ch), at 95

177 Ibd.

178 *In re Innovatio*, Case: 1:11-cv-09308, at 73.

179 *In re Innovatio*, Case: 1:11-cv-09308, at 66.

180 *In re Innovatio*, Case: 1:11-cv-09308, at 68.

181 *"In this context, however, Dr. Lynde presented only brief testimony about the patents and technology covered by the three CSIRO licenses and the ARM chip license. (Id. at 2175:23-2178:22.) That testimony, combined with other evidence in the record, is insufficient for the court to determine the relative merit of the patented technology in each of those licenses compared with the technology in Innovatio's patents."* In re Innovatio, Case: 1:11-cv-09308, at 71-72.

182 *In re Innovatio*, Case: 1:11-cv-09308, at 71.

in this case, their incorporation flies in the face of the Federal Circuit's explicit teaching that parties may not rely on licences that have 'no relationship to the claimed invention' or are not 'commensurate with' the accused products."[183] The court further held that it was a mistake to assume that the patent-in suit *"was no different than the value of each of the other WCDMA standard-essential patents considered."*[184] The court further stated that *"GBT identifies no case law supporting the notion that a claimed standard-essential patent gets a free pass on the fundamental notion that a patent damages methodology must be 'tied to the relevant facts and circumstances of the case at issue.' If anything, the case law is clear that mere patent counting and dividing is not enough."*[185]

There are, however, also examples of FRAND determinations in which a court has relied on comparable licences covering a patent portfolio that differs from the patent portfolio at issue. This includes cases of damages determinations on the basis of comparable licences to the larger portfolio, of which the patents-in-suit are often only a part. For example, in *Ericsson v. D-Link*, Ericsson's expert determined a FRAND rate for Ericsson's portfolio of Wi-Fi SEPs from comparable licences, and apportioned this rate to the patents-in-suit by dividing the portfolio rate by two (on the basis of an assessment that the portfolio-in-suit accounted for half of the value of Ericsson's Wi-Fi SEP portfolio).[186] In *Iwncomm v. Apple* and *Iwncomm v. Sony*, the Chinese court relied on comparable licences to derive the FRAND rate for Iwncomm's larger portfolio. It also awarded damages for Apple's infringement of the patent-in-suit on the basis of the full portfolio rate, reasoning that the patent-in-suit was the most important patent of Iwncomm's SEP portfolio.[187] By contrast, in the US, an expert witness opinion was ruled inadmissible in *Realtek v. LSI*. The expert had derived a FRAND rate for LSI's portfolio from the Via 802.11 pool as a comparable license, and scaled the pool rate to LSI's portfolio using a patent citation analysis. The expert then used patent counting to apportion the LSI portfolio rate to the two patents-in-suit.[188] The court found this approach to be "skewed and misleading", as the patents-in-suit would account for only 0.1% of the portfolio value in the expert's patent citation analysis (as the majority of citations to LSI's patents had been received by a patent that was not among the patents-in-suit).[189] These examples illustrate that scaling is a common approach for the purpose of determining damages awards for smaller numbers of patents-in-suit on the basis of comparable licences to the larger portfolio (of which the patents-in-suit are a part). Nevertheless, even this form of scaling requires an assessment of the relative value – beyond a mere count – of patents-in-suit and other patents in the portfolio.

Other cases in which scaling was used successfully to determine a FRAND rate include instances in which there was a clear factual relationship between the portfolio at issue, and the portfolio that was licensed in the proposed comparable license. An example of such an instance is Judge Robart's FRAND determination for Motorola's AVC patents in *Microsoft v. Motorola*. The MPEG LA AVC pool's rate was considered to provide a reasonable basis for determining a FRAND rate for Motorola's AVC patents.[190] While Motorola was not (and had never been) a member of the AVC pool, it had participated in the discussions for setting up the pool, and had approved of its rate structure.[191] This past relationship between Motorola and the AVC pool formed part of the factual basis for scaling from the pool rate to Motorola's portfolio.[192]

183 *ResQNet.com v. Lansa*, 594 F.3d 860, 870 (Fed. Cir. 2010); cited in *GBT v. Apple*, at 13

184 *GBT v. Apple*, at 13

185 *GBT v. Apple*, case No. 5:12-cv-04882-PSG, at 13-14, referencing *Microsoft Corp. v. Motorola, Inc.*, Case No, 10-cv-1823-JLR, 2013 WL 2111217, at *80 (W.D. Wash. Apr. 25, 2013); *In re Innovatio IP Ventures*, LLC Patent Litig., MDL 2303, 2013 WL 5593609, at *39 (N.D. Ill. Oct. 3, 2013).; and citing directly from Uniloc, 632 F.3d at 1315.

186 *Ericsson v. D-Link*, 773 F.3d at 1227, at 37-42.

187 From Yiu and Ren (2024) In *Iwncomm v. Apple*, the "SPC noted that the asserted patent is the first patent listed in the list of patents annexed to the (earlier) patent licence agreement between the parties. It is also an SEP. Therefore, that patent should be the key or core technical solution of the 51 patent assets in Iwncomm's portfolio, and should have a higher weight amongst the portfolio (though not the whole of the value)."

188 *Realtek v. LSI*, case C-12-03451 at 6-8.

189 Ibd.

190 *Microsoft Corp. v. Motorola, Inc.*, Case no. C10-1823JLR, at 151 ([468]) (MPEG LA H.264 pool as *"closest real-world comparable"*); *Microsoft Corp. v. Motorola, Inc.*, Case no. C10-1823JLR, at 153–156 ([470] – [481]).

191 *Microsoft Corp. v. Motorola, Inc.*, Case no. C10-1823JLR, at 153–156 ([470] – [481]) (Motorola's participation in pool formation and approval of rate structure); 157 (§ 487) (Motorola's ultimate decision not to join the pool).

192 *Microsoft Corp. v. Motorola, Inc.*, Case no. C10-1823JLR, at 165–167 ([510]).

In a different but somewhat comparable context, Judge Birss used a licence between Ericsson and Samsung as a comparable licence to determine a FRAND rate in *Unwired Planet v. Huawei*. Unwired Planet's portfolio was spun off from Ericsson's. While that transaction had occurred prior to the licensing agreement between Ericsson and Samsung, so that Unwired Planet's patents were not subject to that license, the fact that Unwired Planet's patents originated from the same portfolio as the patents that Ericsson licensed to Samsung again provides for a factual connection between the comparable licence and the issue at hand.[193]

In the absence of such a factual link between the different portfolios, scaling has also been carried out in cases in which the portfolio at issue and the portfolio underlying the comparable licence had been assessed to be of similar value. For instance, in *Microsoft v. Motorola*, Judge Robart relied on the Via LA 802.11 pool as a comparable licence for Motorola's 802.11 (Wi-Fi) SEPs; even though Motorola had never been a member of the Via LA pool and (unlike the situation with respect to MPEG LA's AVC pool) had not participated in the formation of the Via LA pool. Nevertheless, the judge found that scaling on a patent-by-patent basis between the pool and Motorola was unlikely to prejudice Motorola, because he assessed that Motorola's 802.11 SEPs provided minimal value to the 802.11 standard.[194] In turn, in *Realtek v. LSI*, Realtek's expert relied on Robart's determination as a secondary assessment for the determination of a FRAND rate for LSI's 802.11 SEPs. The district court held that the expert's opinion was admissible, even though it scaled from Motorola's 24 Wi-Fi SEPs to LSI's two patents-in-suit on the basis of patent counting, thus assuming equal contributions of the different patents.[195] The court found that this assessment was a reasonable comparison *as part of the expert's more comprehensive analysis;* also on the basis that (similar to Motorola's Wi-Fi SEPs) LSI's patents-in-suit were assessed to provide minimal *ex ante* value to the 802.11 standard.[196]

Similarly situated licensee

The "similarly situated" inquiry sits at the intersection of comparability and non-discrimination: selecting comparable licences on the basis of how comparable the licensees are amounts to asking whether it is permissible for the licensor to treat those licensees differently. Courts across jurisdictions have consistently rejected two extreme positions.

At one end, a definition that confines comparable licensees to a narrow "strategic group" insufficiently accounts for the SEP holder's non-discrimination obligation. In *TCL v. Ericsson*, Judge Selna rejected the strategic-group framework advanced by Ericsson's expert, holding that *"for purposes of license comparisons the analysis should include all firms reasonably well-established in the world market."*[197] The court reasoned that excluding the largest firms from the comparables would insulate those firms and contribute to their dominant market positions by imposing higher rates as a barrier to firms not at the top tier of the market; and that permitting a SEP holder to define "similarly situated" by *"picking and choosing criteria with no relation to its SEPs or the FRAND commitment"* would effectively allow it to read the non-discrimination obligation out of the FRAND commitment altogether. The practical implication is that the category of comparables must be drawn broadly enough to encompass the competitive set as a whole.

At the other end of the scale, the approach of treating every implementer of the technology as similarly situated and thus requiring identical rates for all manufacturers is equally untenable, and courts have repeatedly rejected it. The similarly situated inquiry is therefore best understood as calling for identification of the relevant peer group, namely firms that are comparable in terms of their position in the value chain, their sales volumes, and the character of their product portfolios, without either collapsing the category to a narrow strategic subset or expanding it to the entire universe of technology users.

193 *"Since the relevant Unwired Planet patents all came from Ericsson, the Ericsson licences at one time included all the SEPs in issue. That alone makes Ericsson licences relevant" Unwired Planet v. Huawei,* [2017] EWHC 711 (Pat), [181]; *"The Ericsson-Samsung 2014 licence is the best place to start but other Ericsson licences are relevant" Unwired Planet v. Huawei,* [2017] EWHC 711 (Pat), [807]; Ericsson–Samsung 2014 as *"solid evidence from which one can infer what a fair and reasonable value of the portfolio under licence might be" Unwired Planet v. Huawei,* [2017] EWHC 711 (Pat), [420]); *Unwired Planet v. Huawei,* [2017] EWHC 711 (Pat), [411].

194 *Microsoft Corp. v. Motorola, Inc.*, case No. C10-1823JLR, at 179–189 ([547–577]) (Via Licensing 802.11 pool as RAND indicator); *Microsoft Corp. v. Motorola, Inc.*, case No. C10-1823JLR, at 188–189 ([574–577]) (Motorola's SEPs provide *"very minimal technical contribution"* to the 802.11 Standard).

195 *Realtek v. LSI*, case C-12-03451, at 4.

196 Ibd.

197 *TCL v. Ericsson*, Case No. 8:14-cv-00341-JVS-DFM, at 56–57.

Other courts have applied the criterion more pragmatically. In *Ericsson v. Lava*, the High Court of Delhi accepted agreements with other Indian mobile phone manufacturers, most prominently Micromax. Their royalty rates had been determined by the same court in earlier proceedings, as the primary comparables for assessing whether the rates offered to Lava were within the FRAND range.[198] The court described Micromax as *"a similarly placed entity as Lava"* and confirmed FRAND compliance after verifying that Lava had been offered essentially identical terms to those paid by Ericsson's other Indian licensees, *"who are similarly situated to Lava in their patent position and product sales."* The analysis centred on size, product portfolio and competitive position within the Indian market as the primary indicators of comparability.

Chinese courts have incorporated a degree of geographic proximity into the similarly-situated analysis. In *Oppo v. Nokia*, the Chongqing First Intermediate People's Court found the Xiaomi–Nokia licence to be a comparable agreement for the proposed OPPO licence, noting that Xiaomi and Oppo are both Chinese mobile phone manufacturer, that both sell mobile communications products in major markets around the world, and that in terms of global market share and shipments in recent years, the overall mobile phone shipments of the two companies have been pretty close.[199] Chinese nationality and similar global market scale were both treated as factors supporting comparability. This does not, however, reflect a blanket rule against cross-national comparisons: in the earlier *Huawei v. InterDigital* proceedings, the Guangdong Higher People's Court relied on InterDigital's licences with Apple and Samsung as comparables for a licence to Huawei, adjusting for differences in sales volume and cross-licence considerations.

Licensing terms: time, duration and geographic scope

Apart from the characteristics of the licensee and the licensed patents, the comparability of a proposed licence also depends on the terms of the licence itself. The Supreme People's Court of China in *ACT v. Oppo* e.g. identifies *"the similarity of the licensing terms, including royalty calculation, scope of license, license term, form of license, manner of payment, etc."* as one of the four categories of selection criteria for comparable licences.[200] Some of these licence terms, particularly the *"manner of payment"*, concern the issue of unpacking, which is the process of translating different payment terms into an effective royalty rate. We address in Chapter 4.2.1.5. the issue of selecting comparable licences on the basis of the payment terms and the reliability of the required unpacking steps. Among the remaining characteristics of the licence, the following are of particular importance: when it was concluded, how long it runs, and what territory it covers. These three dimensions may interact with one another and with the similarly-situated analysis.

Time of contracting is significant because royalty rates reflect the market conditions, technology maturity and parties' expectations prevailing at the time of signing. A licence concluded at an early stage of a standard's deployment, when the technology's market value was uncertain and the licensor's bargaining position may have been materially different, is a less reliable guide to current FRAND terms than one negotiated after the standard has been widely adopted. German courts have given particular weight to recently concluded licences with similarly situated licensees. In *Wilus v. AsusTek*, the Regional Court of Munich stated that *"the preferred and most precise way to determine whether an offer of the patent holder lies within the FRAND corridor is comparison with already concluded licences of the patent holder"* and that *"recently concluded agreements with other licensees of approximately the same size and a comparable product portfolio carry a very strong indicative effect that the rate determined therein lies within the FRAND corridor."*[201] Temporal proximity and similarity of the contracting parties are thus mutually reinforcing factors: a recent licence with a structurally similar licensee carries the strongest probative weight.

Duration affects comparability because longer-term agreements typically carry different risk-allocation and pricing structures. A multi-year lump-sum licence fixes a single payment for the entire term; and removing the licensee's marginal royalty burden per unit and

198 *Ericsson v. Lava*, case CS(COMM) 65/2016, [663], [670], [785], [809–812].

199 *Oppo v. Nokia*, case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 82–83.

200 *ACT v. Oppo*, at 22 of the English translation.

201 "Nach Ansicht der Kammer ist die bevorzugte und genaueste Art und Weise, um zu bestimmen, ob ein Angebot des Patentinhabers im FRAND-Korridor liegt, der Vergleich mit bereits abgeschlossenen Lizenzen des Patentinhabers. Dabei gilt der Grundsatz, dass zeitnah geschlossenen Verträgen mit anderen Abnehmern, die in etwa eine gleiche Größe und ein vergleichbares Produktportfolio haben, eine sehr starke Indizwirkung zukommt, dass die dort festgelegte Rate innerhalb des FRAND-Korridors liegt." *Wilus v. AsusTek*, case 7 O 5007/25, [118].

transferring to the licensor the risk that actual sales volumes diverge from expectations. Deriving an effective per-unit rate from such an agreement requires a conversion that is sensitive to the assumed sales volumes over the term; the longer the term, the greater the scope for divergence between ex ante expectations and actual outcomes. This is not a reason to exclude long-term agreements from the analysis altogether, but it does mean that differences in duration between a proposed comparable and the focal licence require explicit treatment.

Geographic scope – whether a proposed comparable covers a single country, a group of countries, or the entire world – is a further source of variation that may require adjustment. Where the proposed comparable covers a substantially narrower or broader territory than the licence under determination, its effective per-unit rate may not translate directly: regional licences are often concluded at rates that reflect local market conditions, regulatory environments, or the relative strength of the portfolio in a given jurisdiction. Differences in geographic scope are also closely related to differences in portfolio composition, since the patents that are in force and relevant to a given technology may vary significantly across jurisdictions.

4.2.1.4 Potential non-FRAND factors

In the previous subsection we reviewed court discussions of whether existing licences are sufficiently comparable to the license-at-issue to be useful for a FRAND rate determination. Separately, courts often also investigate whether the potential comparable licences themselves were concluded on FRAND terms. Some licences proposed as comparables are sometimes affected by non-FRAND factors. These factors may push their terms above or below what willing parties in a hypothetical negotiation would have agreed. Three recurring categories of such distortions arise in the case law: rates affected by the pressure of litigation, those affected by asymmetric bargaining power and those arising from patent pools rather than bilateral negotiation.

The burden of establishing a non-FRAND factor rests on the party invoking it. For example, German courts have consistently held that the mere presence of such factors is not of itself sufficient to taint an otherwise comparable licence in the absence of concrete evidence of actual distortion. Examples include the *Wilus v. AsusTek* case of pending infringement proceedings at the time a licence was concluded.[202]

Whether an identified non-FRAND factor disqualifies a proposed comparable licence, or merely requires adjustment, depends on whether the distortion can be quantified. Courts have tended to prefer targeted correction over outright exclusion where the distortion can be quantified. In *InterDigital v. Lenovo*, the Court of Appeal confirmed that the trial judge was justified to correct for the non-FRAND factors that had affected the rates at which InterDigital had licensed comparable implementers in the past, rather than setting those licences aside.[203]

Licences resulting from litigation

The relationship between litigation and licence terms raises two distinct questions. The first is whether rates that were fixed by a court order or an arbitration procedure can serve as reliable comparables for a subsequent FRAND determination at all. The second is whether negotiated rates should nonetheless be treated with scepticism where they were reached in the shadow of pending infringement proceedings.

On the first question, court-ordered and arbitrated rates have sometimes been treated as unsuitable comparables, on the basis that they reflect what a court decided rather

202 *"Dabei darf die Tatsache, dass es vor dem Vertragsschluss ein Verletzungsverfahren gab, nicht überbewertet werden. Denn es ist festzustellen, dass ein nicht unbeachtlicher Teil der Marktteilnehmer ohne den entsprechenden Druck aus einem Verletzungsverfahren nicht bereit ist, Lizenzverträge zu schließen. Insofern ist das Anstrengen einen Verletzungsverfahrens ein normaler und zu akzeptierender Teil der Verhandlungen, um eine für beide Seite passende Lizenzrate zu finden." Wilus v. AsusTek*, case No. 7 O 5007/25, Leitsätze 5. English translation: *"The fact that there was an infringement procedure before the conclusion of the contract should not be overemphasized. It must be noted that a significant number of market participants are unwilling to enter into license agreements without the corresponding pressure from an infringement procedure. Therefore, initiating an infringement procedure is a normal and acceptable part of the negotiations in order to find a suitable license fee for both parties."*

203 "The judge noted, here as elsewhere, that InterDigital had sought to deal with this problem by increasing its rates for future sales; but he did not find that the increases in the rates for future sales which InterDigital was able to achieve in the Lenovo 7, and in particular LG 2017, had fully compensated InterDigital for the depression in the rates for past sales. Moreover, this is inherently improbable given the judge's clear finding that the heavy discounting of past sales was a market-wide distortion which the court was required to correct. Until corrected by the court, this factor would continue to drag down rates overall". *InterDigital v. Lenovo*, case [2024] EWCA Civ 743, [259].

than what willing parties would have accepted in a bilateral negotiation. In *In re Innovatio*, Judge Holderman excluded potential comparable licences that arose directly out of a jury verdict.[204]A similar position was taken by Judge Birss in *Unwired Planet v. Huawei*: *"Aside from certain aspects of non-discrimination which I will address separately, I do not accept that evidence of what a party is paying as a result of a binding arbitration will carry much weight. If the licence is the product of an arbitration then the paying party has no choice."*[205]

Equally, however, there are cases in which rates set through an adjudicative process have been accepted as informative data points, particularly where the record suggests that the adjudicative outcome approximates what unconstrained negotiation would have produced.

On the second question, courts have sometimes ruled that licence agreements concluded in the context of ongoing litigation are not useful as comparable licences. In *ACT v. Oppo,* the Supreme People's Court of China lists four selection criteria for comparable licences, including *"[t]he negotiation environment, specifically the transaction background and conditions of both parties, which directly relates to whether the agreement was reached voluntarily (i.e., not under psychological compulsion such as through accompanying litigation or litigation threats, or accompanying court issuance of injunctions or threats of court-issued injunctions)."*[206] In this case, the court disregarded several potential comparable licences that were concluded in the context of pending litigation.[207] The agreement that was chosen as comparable licence was considered suitable in spite of earlier litigation between the parties, because that litigation had taken place approximately five years prior to the conclusion of the licence, and the degree to which this litigation influenced the agreement can be considered negligible.[208]

In *Huawei v. InterDigital*, the Guangdong Appeal Court, e.g., agreed with the Shenzhen first instance court that the InterDigital-Apple licence was a better comparable than the InterDigital-Samsung license, as the latter had been concluded in the context of litigation. *"In contrast, Apple's patent licensing rate was entirely agreed upon through equal, voluntary, and negotiated agreements between the two parties, making Apple's patent licensing rate more relevant for reference."*[209]

US courts have also disregarded potential comparable licences that were concluded under the threat of pending or potential litigation. In *Microsoft v. Motorola*, Judge Robart found that none of the existing Motorola licences were suitable comparable licences for the determination of a FRAND rate; and the Federal Circuit ruled that he had correctly excluded these licences as potential comparables. One problem that was common to many of these licences was that they were concluded in the context of pending litigation or under the threat of potential litigation, undermining their usefulness as comparables.[210] While Judge Robart and the Federal Circuit in this case apparently considered that even a threat of potential litigation could already render a licence unsuitable for a comparable licences analysis, Judge Holderman in *In re Innovatio* noted that a *"proposed comparable license's origin in litigation of course does not automatically disqualify it from consideration."*[211] In *SLC v. ZTE*, Motorola

204 *"The problem with using the Symbol-Proxim and Symbol-Terabeam agreements as comparable license agreements is that they were both adopted under the duress of litigation and, in particular, a jury verdict awarding Symbol $22.9 million for Proxim's infringement. A proposed comparable license's origin in litigation of course does not automatically disqualify it from consideration. See ResQNet.com, Inc. v. Lansa, Inc., 594 F.3d 860, 872 (Fed. Cir. 2010) (explaining that "the most reliable license in this record arose out of litigation"*). In this case, however, there is a plain correlation between the jury verdict and the amounts of both of the license agreements." *In re Innovatio*, case: 1:11-cv-09308, at 64.

205 *Unwired Planet v. Huawei,* case [2017] EWHC 711 (Pat), at 171.

206 *ACT v. Oppo*, at 24 of English translation.

207 The court e.g. found that an agreement with "Company C" was reached in an atmosphere where overseas patent infringement litigation against Company C and its subsidiaries was simultaneously ongoing", and therefore *"is not a suitable comparable agreement." ACT v. Oppo*, at 15 of English translation.

208 Ibd.

209 *Huawei v. InterDigital*, (2013) Yue Gao Fa Min San Zhong Zi No. 305, at 21.

210 A license with VTech was dismissed in part because *"VTech indicated in an email to Motorola that its interest in taking a license was to avoid a potential infringement lawsuit." Microsoft v. Motorola* Court of Appeal, at 37. A license with RIM *"was, like the VTech agreement, entered into to resolve an ongoing infringement dispute between the parties, further diminishing its trustworthiness as an indicator of a free-standing RAND rate."* Ibd. "Lastly,the district court also reasonably concluded that Motorola's three license agreements with Symbol Technologies were not relevant. Two of the agreements were formed under threat of litigation, included monetary caps, and provided licenses for Motorola patents that expired before Motorola and Microsoft's hypothetical agreement would have occurred. (id., at 38)

211 *In re Innovatio,* case: 1:11-cv-09308, at 64. As highlighted above, the licenses in question were nevertheless excluded, because the amount of the license directly followed from the jury verdict, rather than a bilateral negotiation.

(one co-defendant in this case) unsuccessfully sought to exclude an expert witness opinion that relied on comparable licences that were *"'tainted by the coercive environment of patent litigation,' specifically, the threat of an injunction in Germany."*[212] The court denied the Daubert motion, noting that the expert *"does not use these licenses as a starting point for his opinion"*, but rather *"uses these additional licenses to justify an adjustment of the hypothetical royalty rate. In doing so, he explicitly takes into account how an injunction could place have placed [sic] pressure on the licensees and affected the rates of these additional licenses."*[213] In light of these precautions taken by the expert, the court noted that Motorola's criticisms were insufficient to undermine the admissibility of the testimony.

Similarly, German courts have observed that licences concluded while infringement proceedings are pending warrant a degree of scepticism, because the threat of an injunction may distort what would otherwise be a free negotiation.[214] A licence concluded under those conditions is not, however, automatically excluded from the comparable licences analysis. Courts have recognised that a significant proportion of market participants will only conclude licences under the pressure of infringement proceedings, so that initiating such proceedings is a normal and acceptable part of negotiations toward a mutually acceptable rate. Accordingly, the Regional Court of Munich stated in *Wilus v. AsusTek* that the fact that infringement proceedings had taken place before the conclusion of a licence contract must not be overweighted, as such proceedings are a normal and acceptable part of the negotiations to find a licence rate.[215]

What courts assess, rather, is whether the licensee had the practical means and incentive to resist excessive demands: in particular, whether it was a sophisticated commercial party capable of invoking the competition-law defences available under the *Huawei/ZTE* framework, and whether those defences were, in fact, available to it. Where those conditions are met, the resulting licence retains its evidential weight.[216]

Overall, the case law does not establish a bright line rule that licences negotiated in the context of litigation (or threats of litigation) must always be excluded from comparable licences analyses. Whether or not a licence concluded in the context of pending litigation should be excluded depends on concrete evidence indicating whether the pressure exerted was sufficient to displace the agreed rate from the FRAND range.

Bargaining power

Bargaining-power asymmetries can push agreed rates away from FRAND in either direction. In the case of hold-up, a SEP holder may exploit an injunction threat to extract supra-FRAND terms; conversely, in a hold-out situation, an implementer may use delay tactics or the threat of litigation to depress the effective rate below FRAND. Either distortion renders the affected licence unreliable as an indicator of the FRAND rate for a subsequent determination. Beyond those two well-documented concerns, any other factor that causes a party to accept terms that do not reflect fair market value may equally compromise the evidential value of a proposed comparable. In *Unwired Planet v. Huawei,* the trial court gave the 2014 Unwired Planet-Lenovo and the 2016 Unwired Planet–Samsung licence little weight as comparables, in part because of the specific commercial circumstances under which the terms of these licences had been agreed, including the severe financial difficulties of Unwired Planet at the time, and the difficulty of negotiating as a cash-constrained licensor with a large company such as Samsung.[217]

Similarly, in *Optis v. Apple*, the licence agreed between Apple and Qualcomm was argued by Apple to be

212 *SLC v. ZTE*, case no. 2:15-cv-00349-JRG, at 7.

213 Ibd.

214 *"Grundsätzlich ist jedoch der Einwand zulässig, ein zum Beleg einer Lizenzierungspraxis vorgelegter Lizenzvertrag sei nicht aussagekräftig, da er seinerseits nur das Ergebnis eines kartellrechtlichen Missbrauchs ist. Dementsprechend ist bei Lizenzverträgen, die während eines (Unterlassungs-) Klageverfahrens abgeschlossen worden sind, eine gewisse Skepsis angebracht, ob diese tatsächlich das Ergebnis freier Lizenzverhandlungen darstellen und damit Vorbildfunktion haben. Andererseits ist nicht jede Lizenzgebühr, die in einem Vertrag unter der Drohung einer Unterlassungsklage abgeschlossen wird, zwingend missbräuchlich." NTT Docomo v. HTC*, Case 7 O 66/15, [287]. English translation: *"However, the objection is generally valid that a license agreement presented to substantiate a licensing practice is not conclusive, since it is itself merely the result of antitrust abuse. Accordingly, a certain degree of scepticism is warranted regarding license agreements concluded during (injunction) proceedings, as to whether they truly represent the result of free licensing negotiations and thus serve as a model. On the other hand, not every license fee agreed upon in a contract under the threat of an injunction is necessarily abusively excessive".*

215 *Wilus v. AsusTek*, case 7 O 5007/25, [118].

216 *Samsung v. ZTE*, case [2026] EWHC 999 (Pat), [341]–[347].

217 *Unwired Planet v. Huawei,* case [2017] EWHC 711, [383-387]..

an unreliable comparable on the grounds that the bargaining dynamics specific to those parties meant that the agreed rate did not reflect what an unconstrained arms-length negotiation between a willing licensor and a willing licensee would have produced.[218] In the High Court decision, Judge Smith attempted to account for these alleged non-FRAND factors by replacing the rate paid by Apple to Qualcomm with the average rate paid to other licensors. On appeal, the Appeal Court found that it was open to the High Court judge to find that the Qualcomm licence was not a good comparable due to hold-up; nevertheless, the correct response to this finding would have been to exclude this licence from the comparable licence analysis.[219]

Patent pools

There are different ways of licensing SEPs: either bilaterally or through patent pools. Because licensor members participating in patent pools are required to make FRAND licences available, there often can be the questions whether the patent pool licence constitutes such a FRAND licence. This implies the question whether the pool rate is FRAND. However, there currently is no case law where a court determined a FRAND rate for a pool.[220] Therefore, we do not address the question on how to determine a FRAND rate for a pool.

Separately, there is the question of whether pool licences can constitute useful comparable licences for a bilateral licence. Pool licences occupy a distinctive position in the comparable-licences analysis because the efficiencies associated with pools mean that pools often offer lower royalty rates (on a per patent basis) than those achieved in bilateral negotiations. Per-patent royalties in a pool typically exhibit significant degression as the pool expands: each additional patent is remunerated at a progressively lower marginal rate, since the pool licences its entire portfolio as a bundle and distributes proceeds by a formula that does not reflect the individual value of contributing patents.[221] This structural feature is partly explained by the pro-competitive properties of pool licensing. By centralising licensing transactions, pools reduce transaction costs and constrain royalty cumulation. These effects provide an independent justification for the lower per-patent rates that pools offer, and were also recognised in German court decisions.[222]

The best-known use of pool licences to determine a FRAND rate for a bilateral licence is Judge Robart's decision in *Microsoft v. Motorola*. Based on extensive testimony on the role and functioning of patent pools, Robart agreed *"as a general matter that patent pools tend to produce lower rates than those that could be achieved through bilateral negotiations."*[223] He further notes, as an additional problem, that "the patent-counting royalty allocation structure of pools does not consider the importance of a particular SEP to the standard or to the implementer's products as the court's hypothetical negotiation requires.'[224] Despite these and other concerns, Robart ruled that *"under certain circumstances, patent pools can serve as indicators of a royalty rate that falls within the range of royalties consistent with the RAND commitment."*[225] In particular, MPEG LA's AVC pool was found to provide a useful indication of a FRAND rate, because the pool's success in attracting both licensors and licensees indicated *"that it had been set such that it is consistent with the purpose of the RAND commitment."*[226] In order to determine a FRAND rate for a bilateral license, one must, however, consider that the royalty rates of pools tend to be lower than those that can be achieved in bilateral licences. In particular, one must consider the various benefits of participating in a pool, which may induce a SEP owner to accept a lower royalty rate as a licensor member of the pool than it would be able to charge outside the pool. In this case, Robart found that, in order to account for these other benefits, it

218 *Optis v. Apple*, case [2023] EWHC 1095 [263–265]. The names of the parties to the relevant licence agreement are redacted in the High Court judgment; nevertheless, the identity of these parties was subsequently revealed in the Appeal Court's decision.

219 *Optis v. Apple*, case [2023] EWCA 1095, at 105.

220 There are ongoing cases where the ability of courts to determine FRAND patent pool rates is being addressed, for example the pending Tesla v. InterDigital, UKSC case 2025/0058, in the context of the cellular patent pool Avanci.

221 *NTT DoCoMo v. HTC*, case 7 O 66/15, [301].

222 *Fraunhofer v. ZTE*, case 4a O 15/17, at 19-20. The court endorsed the formulation in European Commission, 'Guidelines on the Application of Article 101 TFEU to Technology Transfer Agreements' (2014) and affirmed that offering a licence through a patent pool does not of itself constitute an abuse of a dominant position.

223 *Microsoft v. Motorola*, Case 2:10-cv-01823-JLR, [499].

224 *Microsoft v. Motorola*, Case 2:10-cv-01823-JLR, [500].

225 *Microsoft v. Motorola*, Case 2:10-cv-01823-JLR, [508].

226 *Microsoft v. Motorola*, Case 2:10-cv-01823-JLR, [509].

was necessary to multiply the per-patent royalty rate of the pool by three in order to derive a FRAND rate for a bilateral license.[227] With respect to Motorola's 802.11 (Wi-Fi) patents, Robart found that Via LA's 802.11 provided a less useful indication of a FRAND rate, because the pool had been much less successful in attracting licensors and licensees. Nevertheless, in the absence of a better comparable, and because he found Motorola's patents to be of limited value to the 802.11 standard, Robart nevertheless used the 802.11 pool as a starting point for his determination of a FRAND rate for Motorola's Wi-Fi patents.

In *In re Innovatio*, the court declined to use the Via 802.11 patent pool as an indicator of a RAND rate, noting that the pool had attracted only five licensors, thirty-five patents and eleven licensees, and finding it more plausible that the pool rates were "*too low to give patent holders a reasonable return on their technology*" than that they reflected the market value of the pooled patents, with the result that the pool had *"limited utility for determining a RAND rate."*[228] Both courts thus agreed that the informative value of a pool licence as a comparable is limited where the pool has not succeeded in attracting broad participation from either licensors or licensees. The key difference between the two cases was the court's assessment of the value of the patents-at-issue: as Judge Holderman in Innovatio stated, *"[u]sing the Via patent pool, which the evidence shows did not include high-value patents, to calculate a RAND rate for low-value patents may be appropriate. By contrast, this court has determined that Innovatio's patent portfolio is of moderate to moderate-high importance to the 802.11 standard. In that context, the Via patent pool is not an appropriate comparable license."*[229]

4.2.1.5 Reliability of comparable licences

An additional factor for the selection of comparable licences is whether a useful effective rate can be reliably derived from these potential comparable licences. The process of deriving an effective rate from the selected comparable license(s) is called unpacking. In its *Optis v. Apple* decision, the UK Court of Appeals made a distinction between *"the comparability of a licence and the reliability of the evidence arising from it"*.[230] In the Appeal Court's terminology, comparability *"is primarily concerned with the situation of the parties and the subject matter being licensed"*,[231] whereas *"reliability is concerned with the quality of the information derived from a given licence, perhaps involving unpacking in various respects."*[232]

Following this terminology, this (short) subsection deals with reliability, i.e., the relative difficulty of the different unpacking steps that are required, as a factor in the selection of potential comparable licences. The subsection is deliberately short, as the unpacking process itself will be addressed in greater detail in Subsection 4.2.2.

A common problem when using comparable licences is that many licences involve lump sum payments. There are two potential problems with using lump sum licences as comparable licences. Firstly, the lump sum payment represents the value of the potentially comparable licence to the licensee of that license. This lump sum only represents a useful benchmark for the licence at issue if the licensees of the two different licences make similar use of the technology.[233]

Secondly, there is a more general problem with comparing licences that have different payment structures. Lump-sum and running-royalty arrangements differ in fundamental economic respects: a running royalty ties payment directly to the licensee's

227 *Microsoft v. Motorola*, Case 2:10-cv-01823-JLR, [526].

228 *In re Innovatio* IP Ventures LLC Patent Litigation, Case No. 1:11-cv-09308, at 69–70. The Via pool had attracted only five licensors, thirty-five patents, and eleven licensees. The court quoted with approval Judge Robart's earlier observation in *Microsoft v. Motorola* that *"the less a patent pool achieves widespread adoption of the standard, the less relevant the pool becomes as an indicator of a RAND royalty rate"*.

229 *In re Innovatio*, Case No. 1:11-cv-09308, at 71.

230 *Optis v. Apple*, Case [2025] EWCA Civ 552, [90].

231 Ibd.

232 *Optis v. Apple*, Case [2025] EWCA Civ 552, [[91].

233 Outside the FRAND context, the Federal Circuit explained in *Wordtech Systems, Inc. v. Integrated Network Solutions Corp.* that, without information about the volume of sales the parties anticipated, lump-sum agreements offer *"little more than a recitation of royalty numbers."* A lump sum paid by a licensee expecting to sell one thousand units implies a very different per-unit rate than the same sum paid by a licensee expecting to sell ten million units; using the aggregate figure without accounting for this difference tells the factfinder nothing reliable about the value of the licensed technology. *Wordtech Sys., Inc. v. Integrated Network Sols., Inc.*, case 609 F.3d 1308, 1320 (quoting *Lucent Techs., Inc. v. Gateway, Inc.*, case 580 F.3d 1301, 1329).

actual usage, shifting the risk of uncertain sales volumes to the licensor, while a lump sum fixes the payment in advance and caps the licensee's liability for the patent term regardless of how many units it ultimately sells. As the Federal Circuit noted in *Lucent Technologies, Inc. v. Gateway, Inc.*, *"significant differences exist between a running royalty license and a lump-sum license"*: a running royalty *"shifts many licensing risks to the licensor because he does not receive a guaranteed payment,"* while a lump sum *"removes any risk that the licensee using the patented invention will underreport … and therefore underpay, as can occur with a running royalty agreement."* For that reason, *"[f]or a jury to use a running-royalty agreement as a basis to award lump-sum damages … some basis for comparison must exist in the evidence."*[234]

Concerns about the reliability of unpacking lump sum payments have inspired two different approaches to the selection of comparable licences: to avoid lump sum licences as comparable licences altogether; or to mitigate the unpacking problem by comparing running royalty licences with running royalty licences and lump sum licences with lump sum licences.

The first approach (avoiding lump sum licences as comparable licences altogether) was the one proposed by InterDigital in *InterDigital v. Lenovo*. InterDigital submitted that, *"due to the uncertainties in unpacking,"* it was preferable to rely on running royalty licences directly.[235] Mellor J. rejected this approach, finding that none of InterDigital's proposed 20 running royalty licences was sufficiently comparable to the issue at hand, and concluding that the lump-sum agreements with major implementers – and in particular the licence with LG – constituted the best evidence of FRAND rates for the portfolio.[236]

This example illustrates the limitations of the approach. Lump-sum payments are common in technology licensing: empirical studies suggest that a majority of patent licensing agreements include a fixed-fee element,[237] and certain categories of licensees, particularly large implementers, show a strong preference for lump-sum structures.[238] Accordingly, a comparable-licences analysis that excludes all agreements with a lump-sum component would omit a significant and systematically distinct portion of the licensing market, and would produce a picture of market prices that is skewed towards agreements with smaller licensees. Mellor J. in *InterDigital v. Lenovo* noted that Lenovo's lump-sum agreements with large implementers had delivered licence fees that, when expressed on a simple per-unit basis, fell well below InterDigital's headline running-royalty rates, and below the royalty rates from each of InterDigital's proposed running royalty comparable licences.[239]

The second approach is to use lump-sum licences as comparables exclusively for the determination of a lump-sum award, and running-royalty licences exclusively for the determination of a running-royalty rate. This approach avoids the need to convert between payment structures, but it introduces a different difficulty: making lump-sum payments across different licensees commensurable still requires ensuring that those licensees made comparable use of the technology.

In *Optis v. Apple*, Marcus Smith J. largely sidestepped this difficulty by concentrating on licences in which Apple itself was the licensee, thereby holding the product base relatively constant. However, he also included the

234 Lucent Techs., Inc. v. Gateway, Inc., case 580 F.3d 1301, 1330, 1336.

235 See *InterDigital v. Lenovo*, case [2023] EWHC 539 (Pat), where the court setting out InterDigital's submission that *"due to the uncertainties in unpacking, [it] is better to look across as broad a range of comparables as possible"*, [295], and explaining that InterDigital's expert had been instructed that *"InterDigital's case as to the value of its portfolio of 3G, 4G and 5G SEPs is primarily based on 20 running royalty licence agreements entered into by InterDigital over time"*), ibd.

236 *Interdigital v. Lenovo*, Case [2023] EWHC 1583 (Pat), [572]– [611] (The court adopting an objective, total-consideration-divided-by-units methodology).

237 An early industry survey found that a majority of licensing agreements included a fixed fee element (46% of agreements featuring a combination of running royalties and down payment, and 13% exclusively featuring down payments). Michael D. Rostoker, A Survey of Corporate Licensing, 24 IDEA 59 (1983) at 64. A study of French firms similarly finds that a majority of technology licensing agreements feature a fixed fee element, with two part tariffs (combining fixed fee and running royalty) being the single most common payment structure. Bessy, Christian, and Eric Brousseau. *"Technology licensing contracts features and diversity."* International Review of Law and Economics 18.4 (1998): 451-489.

238 *"But Apple tended, in its negotiations, to reach lump sum rates in its licences." Optis v. Apple*, case [2023] EWHC 1095 (Ch), [211-i]; *"The larger implementers favour lump sum deals", Interdigital v. Lenovo*, case [2023] EWHC 539 (Pat), [276].

239 Noting Lenovo's argument that InterDigital's lump-sum agreements with large implementers *"have delivered licence fees, which, when calculated on a simple per-unit basis, fall in a range which is multiples below InterDigital's headline rates"*, *Interdigital v. Lenovo*, Case [2023] EWHC 1583 (Pat), [361].

Optis v. Google licence in the comparison, without adequately accounting for the significant discrepancy between Google's and Apple's implementation of the patented technology. The Court of Appeal found this aspect of the approach *"plainly illogical"*; stating that *"[t]he most obvious reason why it is illogical is because the number of units the lump sum price of the Google licence relates to is entirely different from all the other licences."*[240] Beyond that specific criticism, the strategy of restricting comparables to licences between the same licensee and other licensors has a more fundamental limitation: existing licences to the portfolio itself are generally considered the best starting point for a comparable licences analysis, as discussed in Subsection 4.2.1.3.

Overall, courts have consistently held that the presence of a lump-sum payment structure is not sufficient to exclude an existing licence from consideration as a comparable. The Court of Appeal in *Optis v. Apple* characterised the difficulties of unpacking as real but not insurmountable, while Mellor J. in *InterDigital v. Lenovo* proceeded with unpacking without finding it to raise insuperable difficulties. A large number of FRAND determinations surveyed in this report involve the unpacking of lump-sum payments from comparable licences.

Similar considerations apply to the use of cross-licences as comparable licences: such licences inevitably require unpacking involving potential "subjectivities". While some commentators have argued that such unpacking is fundamentally unreliable (Putnam, 2016), others have presented it as a well-understood methodological exercise.[241] As with lump sum payments, excluding cross-licences from comparable licences analyses would result in a skewed representation of the licensing market. Accordingly, courts have frequently unpacked cross-licences for a FRAND rate determination from comparable licences.

4.2.2 Unpacking of comparable licences

This subsection examines how courts unpack comparable licences before using them to determine a FRAND rate. It first discusses the conversion of lump-sum payments into effective royalty rates, including the treatment of sales expectations, discount rates, and interest. It then addresses the unpacking of cross-licences, followed by issues arising from licences that cover multiple technologies, standards, or past-release payments. Table 7 displays the process followed by each case where comparable licences were unpacked.

Using a comparable licence to derive a FRAND rate often involves "unpacking" the payment terms into an effective per-unit or ad valorem rate; the common forms are lump-sum/running-royalty conversion, decomposition of cross-licences into unidirectional rates, separation across standards and treatment of past-release payments.[242]

Unpacking is necessary because few existing licences feature a rate directly comparable to the rate sought; the question in each subsection below is which methodology best recovers the economic terms the parties actually agreed.

While courts in different jurisdictions agree on the basic principles of the most common forms of unpacking, the underlying approach may differ. In some cases, courts have looked for subjective factors to guide the unpacking, i.e. how did the parties of the comparable agreement understand and interpret the economic basis of the agreement and how did that understanding affect the negotiation and ultimate agreement. This subjective approach emphasises interpretative language from the text of the agreement itself, from the communication between the parties in the process of negotiation, or from contextual statements made by the parties at or around the time of the agreement.[243] In other cases, courts have been wary of parties' efforts to "sculpt"[244]

240 *Optis v. Apple*, case [2025] EWCA Civ 552, [110].

241 Richard Vary, "Approaches to Determining a FRAND Royalty Rate", LES Nouvelles May 2025 (https://lesi.org/article-of-the-month/approaches-to-determining-a-frand-royalty-rate/).

242 *"A significant dimension of the task of evaluating comparable licences is the fact that many patent licences in this industry have terms which make the comparison difficult. The two major problems are that they may be based on a lump sum rather than a running royalty and they may be cross-licences with a balancing figure which may be a rate or a lump sum. They may well also have other complications such as multiple rates which are different for a variety of reasons such as different standards or different regions, and royalty floors etc. The overall agreement may also include aspects which are not patent licences at all, such as patent sales or technology transfer." Unwired Planet v. Huawei,* EWHC, at 187

243 Chinese courts accord importance to evidence about parties' understanding; e.g. *Oppo v. Nokia "and effective unpacking cannot be performed based solely on the terms of agreements. It is necessary to consider the parties' negotiation process as assistance to get the bottom of the corresponding consensus of the Parties."* (at 110).

244 *Optis v. Apple,* case [2023] EWHC 1095 (Ch), [245].

licensing agreements in view of their effects on subsequent negotiations and litigation with third parties; and have largely disregarded "cosmetic"[245] contract provisions that "do not move the dial".[246] These courts tend to give preference to objective factors; i.e., rely on objective benchmarks rather than parties' statements to determine the relative value of different contract provisions.[247] Commonly, the specific approaches to unpacking are guided by a mix of subjective and objective considerations.

An overarching requirement, however, is that the unpacking methodology is consistent and reasonable. Unpacking analyses are prone to cherry-picking. To reduce the scope for manipulations, courts have required that different comparable licences are unpacked in a similar manner; or a clear justification of why different methods are used.[248]

245 *Unwired Planet v. Huawei*, case [2017] EWHC 711 (Pat), [383].

246 *InterDigital v. Lenovo*, case [2023] EWHC 1583 (Pat), [282].

247 The UK High Court stated this objective approach in the following terms: *"Therefore, FRAND rates should focus on the money (and other benefits) which pass between licensee and licensor, with the other benefits being translated into monetary terms as part of the unpacking. FRAND is not concerned with and should not be affected by either one party's internal justification for the sum paid or received, nor with the way in which one party seeks to deal with those sums in its accounts, whether they are internal or made public, particularly when these internal justifications and financial reporting do not form part of the licence agreement." InterDigital v. Lenovo*, case [2023] EWHC 1583 (Pat), [426]. The case for the objective approach is also clearly made in TCL v. Ericsson, case no. SACV 14-341 JVS (DFMx): *"In unpacking the license agreements, the experts are not required to follow the assumptions Ericsson made in its business cases. Ericsson created a business case after signing each license agreement to memorialize some of its projections and assumptions, and to act as a 'memo to the file'. (Brismark Decl. Para. 60-61.) Ericsson did not use the business cases before the Court in its actual negotiations, and they represent nothing more than after-the-fact attempts to model certain projections. (Id.) Ericsson's business cases do not reflect how much licensees are actually paying over the course of the license. Most importantly, experts are free to provide their own expertise and analysis based on experience and industry practice. (Kennedy Rebuttal Decl. [116-17])."* at 63-64.

248 *TCL v. Ericsson*, at 64.

Table 7

Unpacking process of comparable licences across the case law

Case	Comparable	Cross-licence	Lump-sum	Multimode	Past release
ACT v. Oppo	ACT – Company B[249]	✗[250]	√[251]	Not addressed	Not addressed
Huawei v. InterDigital	Interdigital – Apple 2007	✗[252]	√[253]	✗	✗[254]
InterDigital v. Lenovo	Interdigital – LG, 2017	✗[255]	√[256]	✗[257]	√[258]
Iwncomm v. Apple	Unknown	✗[259]	✗[260]	Not addressed	Not addressed
Iwncomm v. Sony	Unknown	✗[261]	✗[262]	Not addressed	Not addressed
Microsoft v. Motorola	Via Licensing 802.11 Patent Pool	✗	✗[263]	✗	✗
	MPEG LA H.264 (AVC) Patent Pool	✗	✗[264]	✗	✗
Oppo v. Nokia	Nokia – Oppo, 2018	√[265]	√[266]	√[267]	Not addressed

249 Licensee name is redacted.

250 ACT is a global research and intellectual property licensing firm that does not produce any products, which makes it unlikely that the license is a cross-licence.

251 Yiu and Ren (2024) stated that *"The expert report submitted by ACT estimated that the sales volume covered by the USD 6 million for Company B Licence 1 was 760,416,171 units, although it is unclear how ACT's expert arrived at this volume figure. Dividing the lump sum of USD 6 million by the total sales volume of 760,416,171 units results in a per unit rate of USD 0.008."* at 6.

252 InterDigital primarily operates as a foundational research and development licensing company and do not manufacture products themselves.

253 English translation: *"IDC and Apple used a pre-determined fixed licensing fee, not a percentage of actual sales revenue" Huawei v. InterDigital*, case (2013) Yue Gao Fa Min San Zhong Zi No. 305. URL: https://www.ciplawyer.cn/articles/156542.html

254 The first iPhone was released on June 29, 2007, and the license was signed shortly thereafter, meaning no prior release was required.

255 *"InterDigital, Inc. (NASDAQ:IDCC), a wireless research and development company, today announced that the company's patent licensing subsidiaries have signed a multi-year, worldwide, non-exclusive patent license with LG Electronics, Inc. ("LG"),[...]."* Interdigital. 2017. InterDigital and LG Electronics, Inc. Sign Multi-Year Patent License Agreement (Press release). URL: https://ir.interdigital.com/news-events/press-releases/news-details/2017/InterDigital-and-LG-Electronics-Inc-Sign-Multi-Year-Patent-License-Agreement/default.aspx

256 *Interdigital v. Lenovo*, case [2023] EWHC 1583 (Pat), [404].

257 *Interdigital v. Lenovo*, Case [2023] EWHC 1583 (Pat), [671].

258 *Interdigital v. Lenovo*, Case [2023] EWHC 1583 (Pat), [380].

259 Iwncomm is a Chinese technology company recognized for its development of wireless security standards that does not produce any products, which makes it unlikely that the license is a cross-license.

260 Yiu and Ren (2024) In *Iwncomm v. Apple*, stated that *"According to the judgment, Iwncomm submitted seven agreements, all of which specified an initial licence fee of RMB 80,000 and a royalty rate of RMB */unit."* at 5.

261 Iwncomm is a Chinese technology company recognized for its development of wireless security standards that does not produce any products, which makes it unlikely that the license is a cross-license.

262 Yiu and Ren (2024) stated that *"The ruling is consistent with the parallel judgment of Iwncomm v. Sony Mobile."* at 8.

263 Pursuant to the rate schedule of the Via 14 | Licensing 802.11 patent pool, the per unit royalty rate would have been $0.20." *Microsoft v. Motorola*, case C10-1823JLR , [570].

"The News Release announced royalties of $0.20 per codec after the first 100,000 units (which were at no charge) and $0.10 per unit above 5 million units with an annual cap of $3.5 million in year one and scaling up to $5 million over the licensing term. (Ex. 1584 (MPEG LA's November 17, 2003, News Release) at 2-3.)" Microsoft v. Motorola, case C10-1823JLR, [478].

"Nokia Corporation, Nokia Technologies Oy and OPPO signed a Strategic Cooperation Agreement. The agreement stipulates that both parties will crosslicense SEPs under 2G, 3G and 4G standards, and the terms of the license is [REDACTED], from [REDACTED]." Oppo v. Nokia, case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 31.

266 *"[t]he two Parties adopted a negotiation approach of total lump-sum royalty" Oppo v. Nokia*, case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 93.

267 *"Regarding the determination of 4G multi-mode mobile phone royalty rates, both Parties used the 2018 OPPO agreement as a comparable agreement and unpacked it to calculate the corresponding rates." Oppo v. Nokia*, Case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 91.

Case	Comparable	Cross-licence	Lump-sum	Multimode	Past release
Optis v. Apple (Appeal)	Optis – Google[268]	×	√[269]	√[270]	√[271]
	Ericsson – Apple, 2015[272]	√[273]	√[274]	Not addressed	√[275]
	Interdigital – Apple, 2016[276]	×[277]	√[278]	×[279]	√[280]
	Nokia – Apple, 2017[281]	√[282]	√[283]	Not addressed	√[284]
	Sisvel – Apple, 2016[285]	×[286]	√	Not addressed	Not addressed
Unwired Planet v. Huawei	Ericsson – Samsung, 2014	√[287]	√[288]	√[289]	Not addressed
TCL v. Ericsson	Ericsson – Samsung, 2014	√[290]	√[291]	×	√[292]
	Ericsson – LG, 2014	√[293]	√[294]	×	√[295]
	Ericsson – HTC, 2014	√[296]	√[297]	×	√[298]

268 *"I reach that conclusion based on using Google and also Ericsson/InterDigital/Nokia/Sisvel as the best comparables" Optis v. Apple*, case [2025] EWCA Civ 552, [145].

269 *"Having decided to take into account the Google licence and the Apple licences, the lump sum method disguises the true relationship between them." Optis v. Apple*, Case [2025] EWCA Civ 552, [111].

270 *"In Optis' running royalty licences modelled on the Settled Licence, the licensees are required to pay 4G multimode rates on any 4G devices (whether or not these devices are also capable of operating on 5G)." Optis v. Apple*, Case [2025] EWCA Civ 552, [98].

271 *"Unpacked on Mr Bezant's "simple"* basis (i.e. all past and future sales valued at the same price) the DPU rate from the Google licence is $[XA]." *Optis v. Apple*, Case [2025] EWCA Civ 552, [110].

272 *Optis v. Apple*, Case [2025] EWCA Civ 552, [145].

273 *"The Apple licences are often cross-licences." Optis v. Apple*, case [2025] EWCA Civ 552, [40].

274 *"It was true that Apple's licences were all essentially lump sum agreements" Optis v. Apple*, Case [2025] EWCA Civ 552, [29].

275 *"While Ericsson did not specify exactly how much the Apple deal would contribute to sales and earnings, UBS analysts said in a research note it believed the deal meant a catch-up payment of 3.6 billion crowns for 2015, including a one-off sum of 0.5 billion"* Reuters. 2015. Ericsson signs patent deal with Apple, shares soar. URL : https://www.reuters.com/article/business/ericsson-signs-patent-deal-with-apple-shares-soar-idUSKBN0U40MS/

276 *Optis v. Apple*, Case [2025] EWCA Civ 552, [145].

277 *Optis v. Apple*, Case [2025] EWCA Civ 552, [40].

278 *Optis v. Apple*, Case [2025] EWCA Civ 552, [29].

279 *Interdigital v. Lenovo*, case [2023] EWHC 1583 (Pat), [658].

280 *"In 2016, past patent royalties were primarily driven by the patent license agreements with Huawei and Apple signed in third and fourth quarter 2016"* InterDigital. 2017. Annual Report for the Fiscal Year Ended 2017.

281 *Optis v. Apple*, Case [2025] EWCA Civ 552, [145].

282 *Optis v. Apple*, Case [2025] EWCA Civ 552, [40].

283 *Optis v. Apple*, Case [2025] EWCA Civ 552, [29].

284 *"Nokia received an up-front cash payment from Apple in the second quarter 2017, with additional revenues during the term of the agreement."* Nokia. 2017. Financial Report for Q2 and Half Year 2017.

285 *Optis v. Apple*, Case [2025] EWCA Civ 552, [145].

286 *Optis v. Apple*, Case [2025] EWCA Civ 552, [29].

287 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [187] – [194].

288 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [188] – [189].

289 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [220] – [225].

290 *"However, the licenses with Apple, Samsung, HTC, LG, and ZTE all involve either lump sum payments, or meaningful cross-licenses." TCL v. Ericsson*, case 8:14-cv-00341-JVS-DFM, at 62.

291 Ibid.

292 *"In January 2014, Ericsson and Samsung executed a global patent cross-license. (Ex. 1276.) The license included a release for the co~ unlicensed sales going back until 2011" TCL v. Ericsson*, case 8:14-cv-00341-JVS-DFM, at 79.

293 *TCL v. Ericsson*, case 8:14-cv-00341-JVS-DFM, at 62.

294 Ibid.

295 *"This licenses releases LG's unlicensed 4G sales as far back as 2011 , and Ericsson's business case includes LG's 4G sales data since 2011, but Kennedy only unpacks this license with data from 2013 onwards." TCL v. Ericsson*, case 8:14-cv-00341-JVS-DFM, at 84.

296 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 62.

297 Ibid.

298 *"Ericsson provided a release for HTC's unlicensed 2014 sales" TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 85.

4.2.2.1 Lump-sum payments

Lump-sum agreements fix a single payment for use of the licensed technology over the term, independent of actual sales. Deriving an implied per-unit rate from such agreements requires dividing the lump sum by some measure of the licensee's sales – the "unpacking" exercise.[299]

Different types of conversions between different payment structures

Within the broader family of "lump-sum unpacking" approaches, there are different types of conversions between different payment structures: in principle, lump-sum payments can be unpacked into either per unit rates (often called dollar-per-unit, or DPU);[300] or running royalties (also called *percentage* or *ad valorem royalties*). In case of running royalties, there may be caps or floors, so that the per-unit rate only varies within a certain range. The running royalty may be applied to the average selling price (ASP) or net selling price; and may be applied to the industry ASP or a company-specific ASP.

Courts have unpacked lump-sum payments to per-unit rates (e.g., *InterDigital v. Lenovo*, where the lump sum payment from LG to InterDigital was unpacked to a $0.175 per unit rate, and *Optis v. Apple* EWCA), or to running royalties (*TCL v. Ericsson*, *Unwired Planet v. Huawei*). In some cases, courts have used more complex unpacking methods, involving different steps of unpacking between different payment structures. In *Oppo v. Nokia*, the Chongqing court unpacked the lumpsum payment from the Nokia-Oppo (2018) licence to a DPU rate that differs between different regions; the DPU is then converted to percentage royalty on the basis of 2018 ASPs; multiplied with a factor representing the relative changes in Nokia's patent strength between 2018 and 2021 to derive a 2021 percentage royalty, and finally converted back to a DPU on the basis of projected ASPs (considering the trend of price decrease in the future agreement period).

There often is significant disagreement between the parties which of these unpacking methods is to be preferred, and these disagreements may have substantial implications for the outcome. Nevertheless, it is also common that the different parties' experts use multiple unpacking methods, so that their unpacked rates can more easily be compared with each other.[301]

Some courts have treated the type of unpacking as a matter of principle, allowing for only one correct approach. For instance, Judge Selna in *TCL v. Ericsson* provided general reasons for giving preference to unpacking lump-sum payments to a running royalty (without floors or caps). In particular, he considered that *"use of dollar-per-unit royalties is at odds with industry practices generally and specifically Ericsson's own past licensing practices,"*[302] *"a percentage-based royalty better aligns the incentives of the SEP-holder and the licensee than a dollar-per-unit royalty"* and "furthers ETSI's express policy objectives of both rewarding SEP-holders and making their intellectual property available to the public,"[303] *"Ericsson itself has repeatedly reaffirmed that royalties should be a percentage running royalty,"*[304] and *"there is no support in the record that a package of SEPs has a fixed, determinable value which would justify a fixed dollar-per-unit rate or a percentage rate as modified by floors or caps."*[305] The judge admits that different payment structures are common in real-world licences, but considers that this observed variation in existing licences should not guide his unpacking approach.[306]

299 *"The unpacking can derive a notional royalty rate from a lump sum by treating the lump sum as the net present value of an income stream from running royalties analysed using a discounted cash flow based on some appropriate estimate of sales figures." Unwired Planet v. Huawei*, case [2017] EWHC 711 (Pat), [188].

300 This terminology is not limited to the US case law, but also used, e.g. by UK and Chinese courts.

301 *"The fact that Mr Bezant had unpacked to ad valorem rates while Ms Gutteridge for Apple unpacked to DPUs reflected each party's case. Nevertheless by the end of the trial, as one might expect, both experts had expressed their unpacked conclusions in their rival's "currency" in the sense that Ms Gutteridge had expressed some of her rates in ad valorem terms to facilitate comparison with Mr Bezant's ad valorem rates and Mr Bezant had expressed some of his rates in DPU terms to facilitate comparison with Ms Gutteridge's rates. There were differences between the details of the unpacking exercises undertaken by the two experts, which sometimes made a major difference, nevertheless the results were not always all that far apart when like was compared with like" Optis v. Apple*, case [2025] EWCA Civ 552, [16].

302 *TCL v. Ericsson*, case no. SACV 14-341 JVS (DFMx), at 69.

303 ibd.

304 ibd.

305 ibd.

306 *"To be sure, in the course of private negotiations, parties may enter into a variety of licensing schemes that reflect each party's unique assessment of the risk of a particular arrangement. However, the Court prefers to conduct its FRAND analysis on principles of general application which do not require the Court to discern the peculiarities of those risk assessments."* ibd.

Other courts, in particular in the UK, have made it clear that they consider both types of unpacking to be legitimate, and that the choice of the specific unpacking method is a matter for case-by-case assessments. In *InterDigital v. Lenovo*, the UK High Court explicitly considered and rejected Judge Selna's reasons for systematically giving preference to unpacking lump-sum payments to running royalties.[307]

Accounting for sales expectations

A central difficulty in the unpacking of lump-sum payments is determining the relevant measure of sales. Because a lump sum reflects the parties' expectations about future sales at the time they concluded the agreement, deriving an implied per-unit rate requires some estimation of those anticipated volumes.[308] Courts and experts have pursued this estimation through several approaches, each with significant limitations.

Option 1: Reliance on the plain language of the agreement. One approach is to rely on recitals or other contractual language purporting to identify the sales volume or per-unit rate underlying the lump sum. Outside the FRAND context, this approach to the unpacking of lump sum comparable licences was at issue in *EcoFactor v. Google*, in which EcoFactor's expert relied on "whereas" recitals in the comparable licences that attributed the lump sum to a stated per-unit rate and projected sales volume. The Federal Circuit, sitting *en banc*, rejected this methodology, holding that the recitals reflected only the licensor's unilateral beliefs and provided no basis for concluding that the licensees had agreed to the stated rate. As observed in *Optis v. Apple*, the terms of licensing agreements are frequently "sculpted" to meet each party's commercial needs and are informed by the desire to deploy those licences in subsequent negotiations with third parties.[309] Contractual language recording one party's unilateral characterisation of the economic basis for a lump sum therefore cannot reliably serve as the foundation for unpacking.

Option 2: Reliance on additional indicia of parties' subjective beliefs. A second approach is to search for contemporaneous evidence, outside the four corners of the agreement, of what the parties expected at the time of contracting: internal documents, business plans or negotiation communications. This approach was adopted by the Chongqing First Intermediate Court in *Oppo v. Nokia*,[310] which found that the agreement's text alone did not clearly disclose the basis for the lump sum and turned to the parties' negotiation history. Finding that Nokia's offer had formed the basis for the agreement underlying the previous licence between Oppo and Nokia (which was used as a comparable for the subsequent license), the court anchored its unpacking to Nokia's own characterisation of the economic rationale underpinning the lump sum offer – in particular, an implied per-unit royalty range communicated by Nokia in a single email.

Several other courts, however, have been critical of this approach. In *TCL v. Ericsson*, Judge Selna rejected the use of Ericsson's internal "business cases" as a basis for unpacking, characterising them as *"nothing more than after-the-fact attempts to model certain projections"* that *"at best reflect only Ericsson's view of the license, not the licensee's view."*[311] Mellor J. reached a similar conclusion in *InterDigital v. Lenovo*, expressly citing *TCL v. Ericsson* and rejecting InterDigital's expert's reliance on the licensor's own unit projections, preferring instead an approach based on third-party market data, which better

307 *"With respect, I do not find any of Judge Selna's reasons for rejecting a dollar per-unit rate persuasive. Furthermore, even if the prevailing industry practice is to agree upon running royalties (whether with caps or floors or not), that does not mean that running royalties are necessarily FRAND or that FRAND rates must be expressed in terms of running royalties. I will assess all these points later on the basis of the evidence before me." InterDigital v. Lenovo,* case [2023] EWHC 1583 (Pat), at [269].

308 *"This introduces uncertainties since it needs to have some estimate of sales figures which may be historic and/or future estimates and which in any case may not represent what the negotiators thought when they negotiated the licence." Unwired Planet v. Huawei,* case [2017] EWHC 711 (Pat), [188].

309 *"[s]ophisticated consideration was given - not just in relation to this licence, but generally - to presentation as well as to legal effect" Optis v. Apple, case [2023] EWHC 1095 (Ch), [245]; and that the parties' "subjective beliefs or wishes are irrelevant to the objective construction of the contract").* See also *InterDigital v. Lenovo,* case [2023] EWHC 539 (Pat), [282], where the court quoting expert evidence that recitals *"do not move the dial"* once operative terms are agreed, and should be viewed with scepticism because *"it often is in both parties' interests to make the license rate appear higher or more difficult to understand".*

310 Turning to parties' negotiation history to determine the expected sales volume underlying Nokia's lump sum offer, and anchoring the unpacking to Nokia's per-unit royalty range disclosed in a single email, reasoning that *"Parties in the negotiations shall bear a high degree of attention to the important data presented in their negotiations" Oppo v. Nokia,* case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 93–95..

311 *TCL v. Ericsson*, case No. SACV 14-341 JVS (DFMx), Doc. 1802-1 at 25–27 (holding that the experts *"are not required to follow the assumptions Ericsson made in its business cases,"* characterizing those documents as *"nothing more than after-the-fact attempts to model certain projections"* that *"at best reflect only Ericsson's view of the license, not the licensee's view, or what the licensee actually ended up paying"*).

approximated *"what someone in the market would do with the available information."*[312]

Option 3: Use of hindsight data on actual sales. The third approach is to divide the lump sum by the licensee's actual (realised) sales over the relevant period, using ex post data as a proxy for the sales expectations that informed the agreement. This was the approach taken by the Shenzhen Intermediate People's Court and affirmed by the Guangdong Higher People's Court in *Huawei v. InterDigital*,[313] where the court used Apple's total realised sales from 2007 to 2012 to unpack the lump-sum licence that InterDigital and Apple had signed in 2007. The court rejected InterDigital's objection that Apple's commercial success was exceptional and unforeseeable, reasoning that Apple had consistently ranked among the top sellers of mobile phones and that market forecasters had some foresight of its trajectory. Judge Selna in *TCL v. Ericsson* similarly relied on actual sales data, advancing the more sweeping argument that the non-discrimination prong of FRAND applies to actual terms and conditions and therefore requires reference to actual sales rather than a licensor's own projections.[314] Mellor J. in *InterDigital v. Lenovo* accepted unpacking on the basis of actual sales data as superior to the licensor's self-serving projections, and found solace in the conclusion that, in the circumstances of that case, actual and forecast sales did not differ materially.[315]

The use of hindsight data is nonetheless methodologically problematic. The probative value of a comparable licence rests on a proper interpretation of the economic terms on which the parties actually agreed; and that economic basis was formed on the basis of expectations available at the time of contracting, not on events that subsequently materialised. Where a licensee's realised sales significantly exceed what a reasonable party could have anticipated, dividing the lump sum by those actual sales systematically understates the implied per-unit rate that the parties implicitly agreed to.

Furthermore, Judge Selna's non-discrimination argument in *TCL v. Ericsson* conflates the per-unit rate implied by the unpacking with the actual competitive conditions under the lump-sum agreement: under a lump sum, the licensee bears no marginal cost attributable to the licence regardless of sales volume, and comparing unpacked per-unit rates across licensees therefore says nothing about whether those licensees compete on a level playing field.[316]

The role of hindsight data is therefore usually limited to circumstances in which the licensee's actual sales may reasonably serve as a proxy for what a well-informed market participant could have expected at the time of agreement, as the courts in both *Huawei v. InterDigital* and *InterDigital v. Lenovo* implicitly acknowledged. The

312 *InterDigital v. Lenovo*, case [2023] EWHC 1583 (Pat), [260–261] (citing *TCL v. Ericsson* and rejecting InterDigital's expert's reliance on the licensor's own unit projections and *"programme rates,"* accepting instead the methodology of Lenovo's expert (Mr. Meyer) using IDC market data, which *"far better . . . approximated what someone in the market would do with the available information"*).

313 *Huawei v. InterDigital*, case (2011) Shen Zhong Fa Zhi Min Chu Zi No. 857 (Shenzhen Intermediate People's Court), aff'd, (2013) Yue Gao Fa Min San Zhong Zi No. 305 (Guangdong Higher People's Court) (relying on Apple's realized sales from 2007–2012 to unpack a 2007 lump-sum license between InterDigital and Apple; rejecting InterDigital's argument that Apple's success was a "business exception," on the ground that Apple had consistently ranked among the top sellers of mobile phones and that forecasters had "some foresight" of its trajectory).

314 *TCL v. Ericsson*, Doc. 1802-1 at 26 (reasoning that *"the non-discrimination prong of FRAND does not incorporate an SEP-holder's projections; it applies to the actual terms and conditions"*). This argument conflates the economic logic of unpacking with the competitive effects of a lump-sum license structure. Under a lump sum, the licensee's marginal cost of patent licensing is zero regardless of how many units it ultimately sells, so a comparison of unpacked per-unit rates across licensees does not reveal whether those licensees compete on a level playing field. It would be illogical to argue that a licensee who exceeds sales expectations under a lump-sum agreement enjoys an unfair competitive advantage over other licensees on account of the resulting lower implied per-unit rate. See Putnam (2018), supra note 182, at 999–1001 (explaining the *"downward non-discriminatory spiral"* that results from misapplying the non-discrimination obligation to effective rates derived from fixed-payment agreements).

315 *"The difference between using actual data and forecast data does not, it seems to me, make a material difference overall, particularly when I come to assess the relative value of each PLA according to my own assessment", InterDigital v. Lenovo*, case [2023] EWHC 1583 (Pat), [746]. The court was in a position to reach this conclusion because he had the benefit of an alternative expert methodology using forecast data (that of Lenovo's expert Mr. Meyer), which allowed him to verify that actual and forecast sales were not materially divergent in the circumstances of that case. Where such a cross-check is unavailable, a court cannot assume that actual and forecast sales will converge sufficiently to make the choice of denominator immaterial.

316 Applying the non-discrimination obligation to unpacked effective rates based on actual sales would produce a structurally asymmetric and economically perverse result: a licensor would be required to reduce rates whenever a prior licensee's actual sales exceeded expectations at the time of contracting (thereby lowering the implied effective rate), but could not correspondingly raise rates when actual sales fell short of expectations. Over successive licensing rounds this would generate a persistent downward pressure on rates bearing no relationship to the agreed value of the licensed technology. See Putnam (2018), supra note 182, at 999–1001 (describing the *"downward non-discriminatory spiral"* that results from applying the non-discrimination obligation to non-contractual effective rates). Furthermore, under a lump-sum structure, the licensee bears no marginal cost attributable to the license regardless of sales volume, so the unpacked effective rate does not determine competitive conditions between licensees in any economically meaningful sense.

use of actual sales does not, in other words, dispense with the need to assess whether those observed actual sales are a plausible approximation of prior expectations.

Discount and interest rates

In a running royalty agreement, the licensee reports periodically on its use of the patented technology and makes payments to the licensor on the basis of that reported use. By contrast, in a lump-sum agreement, the licensor and licensee agree on a sum of money to be paid by the licensee, which is independent of the licensee's actual use of the technology. This lump sum may be paid in multiple instalments; but lump sum licences often involve a significant upfront payment.

There are two important implications for the unpacking of lump sum payments into an effective royalty rate: firstly, the difference between the two payment structures typically means that there is a difference with respect to *when* the licensor is paid. In a running royalty agreement, the licensor is paid over time, over the entire period of the agreement. By contrast, in a lump sum agreement, a licensor may be paid (in part or in full) upfront, at the beginning of the licence period. An upfront payment is more valuable to the licensor, because money generates an interest over time – this is the time value of money. This difference between the types of agreements may be attenuated in the case of lump-sum agreements featuring payments of the lump-sum in multiple instalments over time.

Secondly, a lump-sum agreement provides the licensor with a guaranteed amount of money, which is independent of any contingencies that may affect the volume of sales. The uncertainty inherent to running royalty agreements increases over time, as sales expectations for the distant future are subject to greater uncertainty than sales expectations for the immediate future. Thus, even if a lump sum is paid in instalments over time, it is still more valuable than uncertain payments from a running royalty; especially with respect to expected sales in the distant future.

Accounting for both types of differences between lump sum and running royalty payments requires the use of discount rates when unpacking lump sum payments into effective royalties. In the case law, there are different approaches to this issue; but in most cases, courts distinguish between interests on past use, and discount rates applied to upfront payments for future use.

Just as with other aspects of unpacking comparable licences, there are subjective and objective approaches to the determination of discount and interest rates. On the one hand, subjective approaches search the record (the licence agreement itself, the negotiation history, and/or the parties' communications at the time of the agreement) for indications of the value that the parties placed on the time and certainty of payments. Objective approaches, on the other hand, rely on objectively determined interest and discount rates; i.e., those based on objectively reasonable benchmarks.

In keeping with its overall subjective approach to unpacking, the Chongqing court in *Oppo v. Nokia* held that whether and how to apply a discount factor depends on whether the net present value (NPV) of future payments was taken into account in the parties' original negotiations: in *Oppo v. Nokia*, this was treated as the "logical prerequisite" for any discount rate adjustment in unpacking. As there was no evidence of the NPV of future payments being considered during negotiation, the court declined to use discount rates in its unpacking of the comparable license.[317]

In *InterDigital v. Lenovo*, InterDigital explained that its licensing programme offered a number of different discounts. They included a "fixed fee discount" available to licensees that enter into a lump sum or fixed fee license, and a "time value of money discount" – running at "typically around 10% per annum" (based on InterDigital's cost of capital) – applied when a licensee agreed to pay by lump sum rather than running royalty.[318] For the comparable licences analysis, InterDigital's expert applied these discounts to unpack the effective rate from the lump sum payments, so that *"the rates from licences with different payment structures are placed on a more economically comparable basis."*[319] Mellor J. held that discounts of this character are *"entirely fair and consistent with FRAND"* because they reflect *"accelerated receipt of royalties, the advantage to the SEP licensor of receiving a lump sum and so forth"*. The judge thus accepted that these discounts should be applied during

317 *Oppo v. Nokia*, Case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 88.

318 *Interdigital v. Lenovo*, Case [2023] EWHC 1583 (Pat), [143].

319 *Interdigital v. Lenovo*, Case [2023] EWHC 1583 (Pat), 300

unpacking, unlike InterDigital's other (stated) commercial discounts.[320]

In a separate ruling, Mellor J. also addressed the related question of whether interest should be awarded on royalties due for past infringement – a distinct issue from the time value premium built into the lump sum itself. The accountancy experts for both parties had declined to account for any interest on past "royalties" in their unpacking analyses of comparable licences, and had therefore also refrained from applying interest rates when re-packing the effective rate to a lump sum payment for the licence at issue. Mellor J. was not satisfied that this omission was analytically correct. He noted that *"it is, of course, absolutely standard in litigation to award interest on sums which should have been paid in the past"* and that Mr Bezant had himself acknowledged in a footnote that *"[i]n principle, past royalties should be converted to present value using a relevant interest date to reflect the time value of money"*, but that *"[InterDigital] has not done this in its prior licence agreements."* [321] Ultimately, Lenovo was ordered to pay interest on all past unlicensed sales at a quarterly compounded annual interest rate of 4%; which was subsequently confirmed by the Court of Appeal.[322]

In *Optis v. Apple*, Marcus Smith J. explicitly declined to apply any time value of money adjustment: his methodology divided each lump sum by the length of the licence term to produce a simple "annualised payment" without discounting, expressly noting that the time value of money will be ignored.[323] The Court of Appeal, which unlike the High Court unpacked the lump sum payments into DPU figures, repacked the DPU figure into a lump sum royalty award on the basis of a 10% discount on the projected future sales for the 2021-2027 period.

In *TCL v. Ericsson*, Judge Selna highlighted the importance of correctly accounting for the time value of money.[324] The judge was presented with a variety of different discount rates, which were sometimes based on Ericsson's "business cases",[325] and sometimes were chosen by the different experts on the basis of the identity of the licensee and the type of payment. The judge was critical of the expert's use of varying discount rates, which he found to be lacking objective justification.[326] In order to *"avoid obvious cherry-picking problems and create comparable rates"*, the judge applied a uniform 10% discount rate to all revenue projections, and a 5% discount rate to future fixed payments.[327] Fixed payments were discounted at a lower rate than projected revenues because of the greater certainty of future fixed payments. The court also added a 0.56% interest rate, which was based on the risk-free Treasury Bill rate. Thus, the discount rates of 5% on future fixed payments and 10% on expected future revenues can be interpreted as reflecting the uncertainty inherent to deferred payments, whereas the time value of money needs to be accounted for separately on the basis of the prevailing interest rate (which was particularly low at the time of the decision).

Overall, it is apparent that there is significant variation in the treatment of time and uncertainty in the unpacking of comparable lump sum licences and the repacking of effective rates into lump sum figures for the licence at issue. As with other aspects of unpacking, the heterogeneity of existing approaches creates opportunities for cherry-picking, highlighting the importance of a consistent and principled treatment of existing comparables. The criteria that experts and courts have used for determining discount rates (accounting, e.g., for the degree of uncertainty and the parties' cost of capital) are understandable, but not necessarily sufficient

320 *Interdigital v. Lenovo*, Case [2023] EWHC 1583 (Pat), 519

321 *Interdigital v. Lenovo*, case [2023] EWHC 1583 (Pat), [519]; noting that Mr Bezant acknowledged *"[i]n principle, past royalties should be converted to present value using a relevant interest date to reflect the time value of money. However, in practice, [InterDigital] has not done this in its prior licence agreements"*, *Interdigital v. Lenovo*, Case [2023] EWHC 1583 (Pat), [547]; declining to resolve the interest question at the judgment stage and inviting further submissions, *Interdigital v. Lenovo*, case [2023] EWHC 1583 (Pat), [548] – [552].

322 *InterDigital v. Lenovo*, case [2024] EWCA Civ 743, [228], [284].

323 *"No adjustment is made – or will be made at this stage – for past or future payments. In other words, no discount for early receipt or interest for late payment will be applied." Optis v. Apple*, Case [2023] EWHC 1095 (Ch), [482].

324 *"Importantly, the net balancing payments and revenues must be stated in dollars of the same year, which generally requires determining the net present value of past and future payments and revenue". TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 63.

325 Ericsson's internal calculations attempting to provide an economic rationale for the amount of lump sum payments in different licenses, which the judge overall did not accept, see above.

326 *"For example, in unpacking the Samsung license, Kennedy used a 12% discount rate for Samsung's revenue, but only a 10% discount rate for Ericsson's revenue. (Id. Para 171). He also used a 10% for ZTE's future 3G sales and Ericsson's sales, but a 12% discount rate for ZTE's future 4G sales. (Id. Para 157.) However, Kennedy did not explain why Samsung's projected revenue should be treated differently than ZTE's, or why Ericsson's revenue should be treated differently depending on which license is being analysed.." TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 70-71

327 Ibd.

to determine a rate (or set of rates) in a fully objective manner. What seems equally important, however, is that the same criteria are used in a consistent manner during unpacking and repacking; as this will tend to mitigate the impact of methodological differences. Applying a large interest rate on past sales during unpacking, e.g., has the effect of reducing the effective royalty rate (as a significant portion of the lump sum payment will be treated as interest payment), but applying the same interest rate in the calculation of the lump sum payment for the licence at issue will have the opposite effect.[328] Thus, the numerous uncertainties with respect to the treatment of time are mitigated if the timing is not too different between the licence at issue and the comparable license(s) (similar periods of unlicensed use prior to the licence period, similar duration of the licence period itself, similar schedules of instalments). In turn, where there are significant differences between the comparable license(s) and the licence at issue, or where a lump sum comparable licence is unpacked to determine a running royalty, the treatment of the time value of money and uncertainty of sales expectations becomes very important.

4.2.2.2 Cross-licences

In a cross-licensing agreement, both companies agree to license their patents to the respectively other company. One may thus say that the cross-licensing agreement consists of two unidirectional licences. While there are pure cross-licences that do not involve any monetary payments; many cross-licences involve a balance payment from one company to another. Thus, in this case, one company is the net licensor (i.e., the company that receives a payment in addition to the cross-licence to the other company's patents), and the other company is the net licensee (i.e., the company that makes a balance payment to the other party of the cross-licensing agreement).

Using cross-licences as comparable licences is not straightforward, because the balance payment only represents a part of the value of the licence that the net licensor has given to the net licensee.[329] One must add the value of the licence that the net licensee has given to the net licensor, which also contributes to the overall value of the license. In principle, one may back out the value of licence from the balance payment using the following equation[330]:

$$\text{Balance payment} = \begin{array}{l}[\text{net licensors' rate} \times \text{net licensee's sales}] \\ -[\text{net licensee's rate} \times \text{net licensor's sales}]\end{array}$$

This equation can be solved for the net licensor's rate:

$$\text{net licensors' rate} = \frac{\begin{array}{c}\text{Balance payment} \\ +[\text{net licensee's rate} \times \text{net licensor's sales}]\end{array}}{\text{net licensee's sales}}$$

In a situation in which both the licensor's rate and the licensee's rate are unknown, an infinite combination of unilateral rates may satisfy this equation.[331]

At a high level of generalisation, two approaches exist in the case law to infer the value of a unidirectional licence from a cross-licence agreement: on one hand, one can turn to the contract itself, the negotiation history, or statements from fact witnesses, to infer the value that the net licensor placed on the cross-licence that it received from the net licensee. On the other hand, and more commonly, one may seek an objective way to compare the value of the two companies' patent portfolios, so as to infer from that *portfolio strength ratio* the relationship that should exist between the two companies' rates.

An example of the first approach is the Chongqing court's decision in *Oppo v. Nokia*. Here, to unpack the previous cross-licensing agreement between Nokia and Oppo and derive a royalty rate for Nokia's patents, the court observed that a discount *"was involved during the negotiation process, and both Parties also admitted in court that the agreement actually involves a discount*

328 Conversely, applying a large discount rate on future sales during unpacking of lump sum comparables has the effect of increasing the effective rate, as applying the assumption that the licensor would have accepted a heavily discounted lump sum payment means that a given lump sum amount implies a higher (pre-discount) effective rate. Nevertheless, when repacking the effective rate to a lump sum payment for the license at issue, the higher discount rate leads to a lower lump sum amount (as payments for future expected sales are more heavily discounted).

329 *"Cross-licences will generally be entered into by companies who are both implementers and licensors at the same time. There is a risk that the rates agreed in a cross-licence understate the inherent value of the rights being licensed because the revenue the parties earn from licensing itself will be much less than it would be if the licence was not a cross-licence but it is impossible to evaluate how significant a difference this might make." Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [190].

330 See, e.g. *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 63. Note that the court in *TCL v. Ericsson* unpacked licenses on an ad valorem basis, so that he uses parties' revenues instead of sales.

331 See Putnam (2018), who argues that this *"indeterminacy"* problem undermines the unpacking of cross-licences into effective (unilateral) rates.

of [REDACTED] US dollars."[332] Thus, the one-way royalty of Nokia's patents was calculated as follows: *"one way royalty of Nokia patents = the net payment in the agreement [REDACTED] US dollars + discount [REDACTED] US dollars"*.[333]

An example of a court following the second approach is the UK High Court's decision in *Unwired Planet v. Huawei*. The court succinctly states the basis of the objective approach to unpacking cross-licences as follows:

> "The unpacking of a cross-licence can resolve two one-way royalty rates from a single balancing figure based on the notion that the single figure represents the effect of balancing the value in royalty terms of each party's patent portfolio. If the balancing figure is a lump sum then unpacking will involve net present value assessments for each party with the attendant uncertainties. In any event there also needs to be some means for assessing the relative value of each party's portfolio unless one has a figure for one or other party directly."[334]

In essence, if one can derive an objective royalty rate for one party's unilateral license, the royalty rate of the other party's unilateral licence can then be derived from the balancing payment of the cross-licence. However, where there is no basis for independently determining the royalty rate for either party's unilateral licences, one needs to compare the value of the two parties' patent portfolios.

As a matter of principle, such an approach is difficult to reconcile with the overall approach of using comparable licences to evaluate SEP portfolios. One of the main reasons for using comparable licences to determine FRAND rates is precisely that it is difficult to objectively determine the value of a SEP portfolio independently of its market value, i.e., the rate at which the portfolio has been licensed to others.[335]

Nevertheless, where the existing comparable licences are cross-licences, there regularly is no objective basis for independently determining either party's unilateral rate. In such case, the common solution is to turn to a comparison of the two portfolios, and to calculate a portfolio strength ratio (PSR), which represents the relative strength of one portfolio, as compared to the other. The way how to use a PSR to derive a royalty rate for a unilateral licence is stated in *TCL v. Ericsson*:[336]

$$\text{Portfolio Strength Ratio "PSR"} = \frac{\text{net licensor's rate}}{\text{net licensee's rate}}$$

Inserting this into the equation above, one derives:

$$\text{net licensor's rate} = \frac{\text{Balance payment}}{\text{net licensee's sales} - \frac{\text{net licensor's sales}}{\text{PSR}}}$$

Thus, if one can calculate a PSR, the PSR can then be used to derive an effective rate for each company's unilateral license. In the absence of direct evidence on the market value (i.e., rates) of the different portfolios, the PSR is usually determined on the basis of either patent or contribution counts.[337]

The discussion of the relative merits of patent and contribution counting for the purpose of determining a PSR is similar to the discussion of which metric to use for apportionment in a top-down analysis, or for scaling in comparable licences analyses that use other licensors' licences as comparables. Furthermore, all the specific methodological questions how to count patents or contributions are shared between these different use cases. We thus concentrate the discussion of these counting methods in Chapter 5.

While there is significant overlap between the methodologies of measuring portfolio value for the purposes of deriving PSRs and apportionment, it is important to note that the two use cases for portfolio evaluation methods tend to pull in opposite directions. That is, a method that produces a favorable view of the value of a company's portfolio increases the company's rates in a top-down analysis; but it also results (on

332 *Oppo v. Nokia*, Case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 92.

333 Ibd.

334 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [189].

335 The court in *Optis v. Apple* called this a *"feedback loop [...] whereby that which is in dispute (the process of valuation) is itself affected by the process by which the disputed variable is resolved." Optis v. Apple,* Case [2023] EWHC 1095 (Ch), [310], fn 434, at 163.

336 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 63.

337 Unpacking on the basis of contribution counts was, e.g. proposed by Huawei's expert in *Unwired Planet v. Huawei,* and by Ericsson's expert in *TCL v. Ericsson*; whereas the other party's expert and court in both cases used patent counting. Patent counting was also used to unpack comparable licenses in *Optis v. Apple*.

average) in higher PSRs with respect to other companies. Higher PSRs mean that the balancing payments from cross-licences with these other companies will be unpacked to lower net rates (provided that the company is the net licensor in these cross-licences).[338] This is, e.g., what happened in *TCL v. Ericsson*, where Ericsson's expert used contribution counts PSR (which tend to favor Ericsson in comparison with other SEP licensors) for the PSR; and TCL's expert used patents counts.[339] The unpacking of Ericsson's cross-licences using the contribution counting proposed by Ericsson's expert was less favorable to Ericsson than the unpacking using patent counts.[340]

This somewhat counter-intuitive effect follows from the mechanics of the unpacking. Smaller PSRs mean that the two portfolios in the cross-licence are relatively more similar to each other; thus, the rates for both portfolios need to be very high to produce a high balance payment. If the portfolios are very dissimilar (i.e., the PSR is high), even lower rates on both unilateral licences would produce a substantial balance payment. Thus, if the balance payment is known, a small PSR produces high unilateral rates, whereas a high PSR produces small unilateral rates.

More generally, using seemingly objective PSRs is prone to producing counter-intuitive and apparently unreliable results. Thus, courts have sometimes found it necessary to make ad hoc adjustments to the unpacking of individual licences. For example, while Judge Selna in *TCL v. Ericsson* generally used PSRs based on patent counting to unpack Ericsson's cross-licences, TCL's expert found this method to produce "implausible" results in the unpacking of the Ericsson-LG license. As both parties' experts had unpacked this particular licence using a PSR based on contribution counting, Judge Selna made an exception from his general patent-counting-based approach and used contribution counting for the unpacking of this license.[341]

Judge Smith in *Optis v. Apple* similarly used patent counting to account for the value of cross-licences to Apple's patents when using the licences that Apple had received from other licensors as comparables; but found the results to be unrealistic in certain cases.[342]

The approaches cannot be directly compared, however, because Judge Smith followed a different unpacking methodology, which does not take into account the volume or value of sales of the counterparts in Apple's cross-licences. Rather, he subtracted Apple's number of patents from the licensor's number of patents to derive a "net stack"; which is then used to scale up the amounts that Apple paid to different licensors to a "100% Stack Value".[343] The Court of Appeal noted that "*[d]oing things this way ignores cross-licence factors such as a difference in each parties' sales volumes or selling prices*".[344] This is a problem that the unpacking equation used by Judge Selna in *TCL v. Ericsson* avoids.

4.2.2.3 Unpacking of different technologies

A comparable licence is rarely structured the way the court needs it. A multi-mode licence bundles all the generations the implementer practices under one payment or one blended rate. If the litigation concerns, say, 4G SEPs only, a 4G multi-mode figure will always overstate what the patentee could fairly claim for 4G alone, because part of the consideration is paying for the 2G and 3G portfolios as well. Unpacking is the exercise of stripping out the value of the other technologies, so

338 The first derivative of the net licensor's rate with respect to PSR is $-\frac{\text{Balance payment} \times \text{Net licensor' sales}}{(\text{Net licensee's sales} \times \text{PSR} - \text{Net licensor's sales})^2}$, which is strictly negative, provided that the balance payment and the net licensor's sales are non-negative; in other words, the net licensor's unilateral rate strictly decreases in the PSR.

339 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 74

340 Ibd. *"Ericsson's use of contribution counting actually creates results more favorable to TCL, while TCL's results actually crated results more favorable to Ericsson"*

341 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 83 Apparently, LG's relatively high patent count produced a small PSR, which would have resulted in large unilateral rates. By contrast, applying LG's lower contribution counts (in combination with Ericsson's large contribution counts) produced a considerably larger PSR, resulting in much lower unilateral rates.

342 *"The introduction of a cross-licence (where Apple offered one) results in the Stack value being higher than it otherwise would be. My inclination is to use the net Stack value, because the Apple SEPs have a value, and it is important to take this into account. That said, there are times when the effect of netting off is such that the Stack share is reduced so much that an artificially high value is obtained for the Stack." Optis v. Apple*, Case [2023] EWHC 1095 (Ch), [483], at 258

343 In cases in which the "net stack" is small, Judge Smith considers substituting the actual value with a minimum 1% stack share, which would also eliminate the "distorting effect" of small net stack figures produced in the case of cross-licences where Apple's patent count is similar to the patent count of the other party, and overall has the effect of reducing the implied "100% Stack Value" in cases in which the "net stack" is small. Nevertheless, this substitution is later abandoned. *Optis v. Apple*, Case [2023] EWHC 1095 (Ch), [483], at 259.

344 Optis Apple EWCA, case [2025] EWCA Civ 552, [65]

the remaining figure reflects only the technology being adjudicated.

The reverse direction – repacking – is equally possible. If the comparable instead sets out separate single-mode rates – a 3G-only rate and a 4G-only rate, for instance – while the licence in suit is multi-mode, those discrete rates have to be combined into a multi-mode figure. That is done by weighting the single-mode rates accordingly, so the blended result reflects the required technology scope.

Concretely, courts and experts do this by:

- Identifying whether the comparable and the licence in suit share the same technology scope. If both are multi-mode, or both are single-mode for the same generation, no mode adjustment is needed; a mismatch in either direction does require one.
- Establishing the weighting that links the modes, typically derived from device populations or sales mixes: for instance, what fraction of the relevant units were 4G-capable versus 3G-only versus 2G-only.
- Applying that weighting in the appropriate direction: unpacking a bundled multi-mode figure down to the target single-mode rate, or repacking separate single-mode rates up into a multi-mode equivalent, so the resulting rate feeds the comparison against the rate the patentee seeks.

A clear example of repacking is illustrated in *Unwired Planet v. Huawei,* where the court reconciled per-mode figures with multi-mode devices through fixed weighting. For a multi-mode LTE device the LTE/UMTS/GSM components were weighted 70:20:10, and for a UMTS multi-mode device the UMTS/GSM split was 67:33.[345] Having fixed Ericsson's value for a multi-mode 4G handset at 0.80%, the court did not unpack a bundle to reach the earlier generations; it derived a single 2G/3G rate of 0.67% by scaling the 4G figure by the ratio of the expert's 2G/3G rate to his 4G rate.[346]

Another good example are the Chinese court proceedings in *Oppo v. Nokia*, where the court extracted the 4G rate from the multi-mode 2018 Nokia-Oppo agreement. However, the court did not split it across generations; instead, it treated the agreement as a single *"4G multi-mode mobile phone"* lump sum and derived one blended multi-mode rate by dividing the one-way Nokia royalty by expected sales,[347] adjusting only for a regional discount and patent-strength change.[348] The next step was to determine the 5G rate. Drawing on the value-share ratios that other courts had used for 4G multi-mode phones as reference inputs in *Unwired Planet v. Huawei* and *Huawei v. Conversant*, the court adopted a value-share ratio of 50:40:5:5 for the 5G, 4G, 3G and 2G standards in a 5G multi-mode phone.[349] Within the 2G to 4G block, the court held that the generations should not be weighted equally, instead adopting a ratio of 8:1:1 for 4G, 3G and 2G – that is, the court assumed that 4G would carry roughly eight times the value share of either earlier generation.[350] As for 5G, the defendants argued that 5G would be more valuable than 4G and should be weighted higher, but the court declined to do so: It found that the evidence failed to show that the contribution of 5G to smartphones was significantly higher than that of 4G, and that, given the early stage of 5G deployment during the licence period,

345 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [220] – [221].

346 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [464] – [465].

347 *"Unpacking the 2018 OPPO Agreement to Determine the 4G Multi-Mode Mobile Phone Royalty Rate" Oppo v. Nokia*, case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 91.

348 *"The rack dollar per-unit royalty of 4G multi-mode mobile phones under the 2018 OPPO agreement = [REDACTED] USD ÷ [REDACTED] units ≈ [REDACTED] USD/unit." Oppo v. Nokia*, case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 101; *"[t]he one-way royalty of Nokia patents = the net payment in the agreement [REDACTED] US dollars + discount [REDACTED] US dollars = [REDACTED] US dollars." Oppo v. Nokia*, case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 96.

349 *"based on the value share ratios of 4G, 3G and 2G standards for 4G multi-mode mobile phones determined in UP v. Huawei and Huawei v. Conversant, which are 7:2:1 and 8:1:1 respectively... Professor Gong Jiong concluded that the value share of 5G... should not exceed a half (50%), and adopted a value share ratio of 50:40:5:5 for 5G, 4G, 3G and 2G standards in 5G multi-mode mobile phones." Oppo v. Nokia*, case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 51.

350 *"This Court agrees with the relevant precedent judgments and believes that the ratio of 4G, 3G and 2G in this case should be 8:1:1, which is in line with the current technological status and reasonable." Oppo v. Nokia*, case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 109.

the value of 5G *"should not be overestimated"*.[351] The court therefore treated 5G and the entire 2G to 4G block as contributing equally as 5G, at a ratio of 50:50.[352]

A structural consequence of this allocation is worth noting. Because the court built the 5G rate as a weighted combination of the 5G single-mode rate and the 4G multi-mode rate (5G multi-mode rate = 5G single-mode rate × 50% + 4G multi-mode rate × 50%),[353] the 5G figure exceeds the 4G figure only if Nokia's standalone 5G rate exceeds its 4G multi-mode rate. Given the court's refusal to value 5G above 4G, the 5G value share (50%) does not fully replace the 4G value share it displaces (which falls from roughly 80% of the 2G to 4G block to 40% of the 5G phone). The percentage royalty rate for the 5G multi-mode may therefore come out at or below the 4G multi-mode rate.

InterDigital v. Lenovo sits at the opposite pole. The main comparable, the InterDigital-LG 2017 patent licence agreement, was a multi-mode lump-sum licence (roughly 50:50 3G:4G by units; some 65% to 68% 4G by present-value-adjusted revenue).[354] Though the experts produced per-generation breakdowns, the court declined to *"derive rates by generation of technology,"* holding that to do so *"would involve too much guesswork or unreliable assumptions."*[355] The court kept the multi-mode bundle whole, converting it to a single blended per-unit rate adjusted only by a 0.728 Developed/Emerging-market ratio to reach $0.175 per cellular unit.[356] No mode-weighting or repacking was applied.

These examples expose a recurring difficulty in the repacking direction: how to combine per-mode rates into a single multi-mode figure. The simplest method is straightforward addition (sum the individual standards' rates), but that quickly produces unjustifiable totals because the cumulative burden per device might become too high. The Munich court's findings on the aggregate royalty burden in *Wilus v. AsusTek* put that ceiling into figures: By adding ARRs across different technologies, the court estimated that the cross-technology ARR might lie between 10% and 18%.[357] One natural correction might be to weight the per-mode rates before combining them, as the Chinese courts did in *Oppo v. Nokia*. However, weighting alone does not cure the deeper defect: As the final decision in *Oppo v. Nokia* shows, a weighting scheme that splits value between different technologies might still deliver the illogical outcomes in which a richer multi-mode bundle is priced below the most expensive single-mode license, i.e., where adding technologies to the most advanced single-mode rate results in multi-mode prices below that one single-mode rate.

Another complication might result from the fact that technologies are frequently licensed together at a discounted rate rather than priced standalone, so the figures available to a court already embed bundling effects. As *FTC v. Qualcomm* reveals, for instance, Qualcomm frequently included Wi-Fi and other non-cellular SEPs into its licence agreements rather than charging for additional technologies separately.[358] Similarly, InterDigital's published program rates make the same point, disclosing that the HEVC decoding and Wi-Fi rates for handsets will receive discounts when those technologies are licensed in conjunction with a cellular SEP licence.[359]

351 *"Defendants argued that the value of 5G technology is higher than that of 4G technology... [T]he current evidence fails to show that, when only looking at the smartphone industry, the current contribution of 5G technology is significantly higher than that of 4G technology. Especially considering that the agreement period at issue... is still in the early stage of applying 5G technology into smartphones, the value contribution of 5G technology compared to 4G technology should not be overestimated." Oppo v. Nokia*, case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 109.

352 *"determined the ratio of the value contribution by 5G technology and the value contribution by 4G multi-mode technology (i.e., 2G-4G total technical value contribution) in the 5G multi-mode mobile phone based on the value contribution share of 5G technology, which ratio is 50: 50." Oppo v. Nokia*, case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 110.

353 *"5G multi-mode mobile phone percentage royalty rate during the agreement period = 5G single-mode percentage royalty rate × 5G technology value share + 4G multi-mode percentage royalty rate × 4G multi-mode technology value share" Oppo v. Nokia*, case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 110.

354 *Interdigital v. Lenovo*, Case [2023] EWHC 1583 (Pat), [671(iii)], [800(iv)].

355 *Interdigital v. Lenovo*, Case [2023] EWHC 1583 (Pat), [803].

356 *Interdigital v. Lenovo*, Case [2023] EWHC 1583 (Pat), [807], [813].

357 *Wilus v. AsusTek*, case GRUR-RS 2026, 791, [142]–[143]. The court records that, across its mobile-communications docket, the patent holders' position on the aggregate royalty burden was around 8% and the implementers' around 4% of a device's purchase price for all patents across all mobile standards ([142]), and that the total burden for a phone covering all standards necessary for meaningful operation (mobile, Wi-Fi, streaming, etc.) is approximately 10% to 18% ([143]).

358 *FTC v. Qualcomm*, Case 5:17-cv-00220-LHK, at 6.

359 InterDigital, Rate Disclosure, https://www.interdigital.com/info_page/rate-disclosure (*"The HEVC decoding and Wi-Fi rates reflect a discounted royalty rate for handsets when taking a license to those technologies in conjunction with a cellular SEP license."*).

4.2.2.4 Past release and payments for new licence

When parties enter into a SEP licence, they typically agree not only on a going-forward royalty but also on a release from liability for past unlicensed use. In a typical licence, the implementer will *"buy his peace for past unlicensed sales with a one-time payment, or a release payment"*: released sales are those that were unlicensed at the time they were made but then retroactively covered by the licence agreement.[360] Normally, a past release is given legal effect through a release clause in the Patent Licence Agreement (PLA).[361]

The strategic dimension of past-sale discounting is a recurring feature of SEP disputes. Because past releases and forward licences are often bundled together in a single agreement, the way consideration is allocated between the two components affects the implied going-forward royalty rate that can be cited as a comparable in future negotiations or litigation. SEP holders may deliberately minimise the value attributed to past sales so that the forward-looking rate appears correspondingly higher. This dynamic was described plainly by InterDigital's own licensing witness, in *InterDigital v. Lenovo*, who characterised it as "counterintuitive":

> "[T]he exclusion and/or discounting of past sales in the royalty terms of a license may actually work to the longer term advantage of a licensor. This is because the nominal discounting or omission of significant volumes of past sales from a license in practice allows the licensor to claim a higher effective rate for those sales which are included within the scope of the forward-looking term of the license. In effect, the licensee in such circumstances can simply agree to a nominally higher forward looking headline royalty rate in return for some form of de facto or implied (as opposed to express) discounting or exclusion of past sales, which is frequently framed in a way that is practically difficult for third parties to analyze and unpack. For the licensor, extracting an increased headline rate which it may seek to rely on as a comparable in other negotiations and/or litigation, and which (in the case of a listed company) it may take back to shareholders and investors as purported vindication of its licensing program rates, is a valuable outcome."[362]

InterDigital v. Lenovo at first instance provides the most detailed judicial treatment of how parties approach past releases when unpacking comparables. Mellor J examined the approach taken by both valuation experts to splitting lump-sum consideration between past and future. The evidence showed that InterDigital applied a "donut hole" concept in negotiations: very old sales and the most recent sales would each be treated leniently, while sales in the middle would be deferred to the next renewal. InterDigital's audited financial statements revealed the average accounting discounts applied to the value of released sales in historical PLAs (2012–2016): 61% for the year immediately preceding the licence date ("–1"), 45% for –2, 34% for –3, 26% for –4, 6% for –5, and 0% for –6.[363]

Both experts – Mr Meyer for Lenovo and Mr Bezant for InterDigital – in substance adopted InterDigital's own financial-statement allocations as the basis for splitting consideration between past and future, albeit for different reasons and with substantially different results, with Mr Bezant's approach having the effect of inflating the future rates. Mellor J rejected this approach, finding that InterDigital's internal allocations were not agreed with the licensee, did not feature in the PLA, and were made "in order to be able to quote higher future rates." He held that *"the precise date when a lump sum deal is done should not affect the royalty paid per device"* and adopted a blended rate applying the same royalty to past and future sales alike – consistently with the approaches taken in *Unwired Planet v. Huawei* and *TCL v. Ericsson*. Mellor J found the strategic effect described by Mr Djavaherian *"not consistent with a FRAND approach"*.[364]

The same question arose in *Optis v. Apple* at first instance. Marcus Smith J reasoned that, as a matter of principle, a past release ought to be priced at the same rate as a future licence, such that *"a 50% – 50% split would be appropriate."* He declined to depart from that equal split in favour of a data-driven alternative derived from the comparables, which he found to be *"unprincipled and evidentially*

360 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 27.

361 For an example of a release clause, the draft Patent Licence Agreement (PLA) exchanged between Optis and Apple read: *"PANOPTIS hereby releases, acquits and forever discharges APPLE, from any and all claims of infringement of the Licensed Patents with respect to acts performed by or for APPLE before the Effective Date." Optis v. Apple*, case [2025] EWCA Civ 552, [188].

362 *Interdigital v. Lenovo*, Case [2023] EWHC 538 (Pat), Mellor J, [396]

363 *Interdigital v. Lenovo*, Case [2023] EWHC 538 (Pat), Mellor J, [394]–[413].

364 *Interdigital v. Lenovo*,Case [2023] EWHC 538 (Pat), Mellor J, [417]–[426].

very dubious." This approach echoes the blended-rate methodology in *InterDigital v. Lenovo*: in both cases the court treated past and future sales as equally valuable, rejecting any automatic discount on past use.[365]

It should be noted, however, that the 50/50 split is not a universal rule. The Munich Regional Court I in *Wilus v. AsusTek*, stated *"It is a permissible business decision for any patent holder whether to assert claims for past uses. This decision must be accepted unless there are exceptional indications of abuse. There is no presumption that a waiver of claims for past uses serves solely to establish an excessive future rate in order to create comparable license agreements with high license fees."*[366] This approach – anchoring the past-use obligation to the date of first infringement rather than the date the SEP holder first asserted its rights – is materially different from the English approach in *Optis v. Apple*, where the past release ran only from when Optis first asserted itself. Beyond jurisdictional variation, there are cases in the case law where splits materially different from an equal 50/50 were applied or implied by the parties' analyses, with discounts on past sales ranging from 0% to 95% across the comparable PLAs examined in *InterDigital v. Lenovo*.[367]

A further dimension of the analysis is the time-value of money. In *TCL v. Ericsson*, Judge Selna took the opposite approach to discounting: rather than treating past sales as worth less than future ones, he adjusted them upward on the basis that *"the licensee effectively received an interest-free loan from the SEP-holder"*, concluding that *"[r]evenue from released sales must therefore be adjusted upward."* This upward adjustment reinforces the principle articulated by the English courts that past use should not be systematically undervalued.[368]

Once an effective rate has been established, a further "repacking" step is required, which requires determining the total sum the implementer must pay to the licensor by applying that rate to both the past and future periods and adding any interest. In *Optis v. Apple*, Marcus Smith J had determined an annual FRAND rate of US$5.13 million for the Optis Portfolio. Applying that rate produced a total of US$56.43 million: a going-forward element of US$25.65 million (five years at US$5.13 million, with no discount for accelerated payment) and a past release of US$30.78 million covering six years of prior unlicensed use from 2017 to end-2022. The court further held – for the first time in English FRAND litigation – that compound interest at 5% per annum with half-yearly rests was payable on the past element, framing such interest as a mechanism to discourage hold-out.[369]

In *Unwired Planet v. Huawei,* Birss J likewise combined past and future elements into a global FRAND licence. The Settled Licence required Huawei to pay back royalties for past worldwide infringement from 1 January 2013 – when the prior Huawei–Ericsson licence had expired – through to end-2020. The rate applied to past sales was the same FRAND rate as for the forward licence: Birss J held that, absent a concluded licence, damages for past infringement are assessed at the FRAND royalty rate, applying the compensatory principle that the infringer must pay *"the sums which he would have paid by way of royalty if, instead of acting illegally, he had acted legally."* Entry into the Settled Licence extinguished the liability for past acts, meaning that the total sum established also resolved any ongoing damage claims.[370]

365 *Optis v. Apple*, Case [2023] EWHC 1095 (Ch), [485].

366 *Wilus v. AsusTek "10. Es stellt eine zulässige betriebswirtschaftliche Entscheidung eines jeden Patentinhabers dar, ob Ansprüche für die Vergangenheit geltend gemacht werden. Diese Entscheidung gilt es zu akzeptieren, solange es nicht ausnahmsweise Anhaltspunkte für einen Missbrauch gibt. Es gibt keine Vermutung, dass ein Verzicht für Ansprüche aus vergangenen Nutzungen allein dazu dient, eine überhöhte Zukunftsrate festzusetzen, um so Vergleichslizenzverträge mit hohen Lizenzgebühren zu schaffen."*

367 LG München I, FRAND-Hinweise ("Munich Guidelines"), Feb. 2020.

368 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 71.

369 *Optis v. Apple*, Case [2023] EWHC 1095 (Ch), [489]–[502].

370 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [796]–[798].

4.3 Top-down

This section examines the top-down methodology in FRAND rate-setting and how it has been used either as the primary basis for determining FRAND royalty rates or as a cross-check to other approaches. The first subsection surveys the methodology's role across jurisdictions, distinguishing between courts that treat it as a central rate-setting tool and those that use it only in a supporting role. The second subsection examines the first step of the top-down approach, namely the determination of the aggregate royalty rate (ARR). The third subsection then addresses the apportionment of the ARR to a specific SEP portfolio.

4.3.1 The status of top-down

The top-down methodology infers a FRAND rate from the total royalty burden that should be fairly borne by a standard-compliant product, for all patents that are essential to that standard, and allocates a proportionate share of that burden to the patentee's portfolio. Thus, a top-down approach typically proceeds in two steps: first, it determines an ARR, and second, it apportions the ARR to a patent owner's portfolio. This two-step sequence is common to top-down FRAND determinations in the existing case law.[371]

The basic underlying formula for a top-down FRAND determination can thus be stated as follows (see Figure 13):

Figure 13

Basic formula for a top-down FRAND rate determination

However, there have also been more detailed formulas, such as in *TCL v. Ericsson* wherein a regional strength ratio was also included:[372]

$$\text{Ericsson's Royalty Rate} = \text{Total Aggregate Royalty} \times \left(\frac{\text{Number of unexpired SEPs owned by Licensor}}{\text{Total Number of SEPs in the Standard}} \right) \times \text{Regional Strength Ratio}$$

Proponents of the top-down methodology have argued that it reduces the risk of royalty stacking by starting from an aggregate royalty burden for the standard and then allocating shares among SEP holders. Proponents of the top-down approach thus sometimes portray it as a mechanism that prevents cumulative SEP royalties from exceeding the value of the standard itself and, relatedly, to limit the risk of patent hold-up.[373]

There has been varying acceptance of the top-down methodology across jurisdictions.

371 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [178]: *"One approach (referred to as "top-down")* starts with a number representing what the appropriate total aggregate royalty burden should be for a given standard (call it T). One can take a view about what the total royalty burden for all the intellectual property relating to the standardised telecommunications technology in a handset should be and indeed various companies have made public statements about this. Starting from this figure T one can then share out the royalty across all licensors in proportion to the value of each licensor's patent portfolio based on assessing that value as a share (call it S) of the total relevant patent portfolio essential to that standard. The FRAND rate is the product of the two (TxS)." *TCL v. Ericsson*, case 8:14-cv-00341-JVS-DFM, at 14: *"A top-down model aims to value a portfolio of SEPs by determining a fair and reasonable total aggregate royalty for all patents that are essential to a standard. It then apportions that royalty to the SEP owners based on the relative value of their portfolio against the value of all patents essential to the standard." Wilus v. AsusTek*, Case 7 O 5007/25, at Leitsatz 11 (Headnote 11): *"Zunächst ist festzustellen, welcher Betrag für die Nutzung eines bestimmten Standards angemessen ist. Ausgehend von einer solchen Festlegung ist dann zu bestimmen, wie hoch der Anteil eines konkreten Patentinhabers an dem Standard ist."* English translation: "First, it must be determined what amount is appropriate for the use of a particular standard. Based on that determination, it must then be established what share of the standard is attributable to a specific patent holder. " See also *IP Bridge v. TCT*, case 6 U 149/20, at 36.

372 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 46.

373 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 15: *"The appeal of a top down approach is that it prevents royalty stacking. Stacking occurs when each individual SEP holder demands a royalty which when totaled exceeds the value of all the SEPs in a standard. Because the top down methods starts with the maximum aggregate royalty burden and works down to a fair and reasonable rate, it avoid the possibility that licensees will be force to pay an unreasonable amount in total. If the total aggregate royalty is properly based upon the total value of the patents in the standard, it can also prevent hold-up because it prevents SEP owners from charging a premium for the value added by standardization."* Courts and commentators have repeatedly linked FRAND to the avoidance of excessive cumulative royalty burdens (see Section 3.1.1); but also stressed that royalty stacking should only affect the FRAND analysis where there is evidence that such stacking exists. See *Ericsson v. D-Link*, Case No. 13-1625, at 53-54; and Section 3.1.1.

Several courts have relied on the top-down analysis as the principal basis for FRAND rate-setting, including the Nanjing court in *Huawei v. Conversant*, the Shanghai court in *Siemens v. Xiaomi*, the US District Courts in *TCL v. Ericsson* and *In re Innovatio*, and the Japanese court in *Samsung v. Apple*. As noted in Chapter 3.4., Judge Selna in *TCL v. Ericsson* divided the task of determining a FRAND rate into two separate analyses, that dealt with the FR and ND prongs of FRAND, respectively. The court applied a top-down calculation as the primary methodology for the FR component,[374] but it then relied on comparable licences for the ND component, stating that a *"[…] top down method, however, cannot address discrimination as the Court interprets the term, and is not necessarily a substitute for a market-based approach that considers comparable licenses."*[375]

More recently, the Chongqing court in *Oppo v. Nokia* likewise accepted the top-down analysis as an appropriate methodology for determining 5G royalty rates. The court rejected the argument that top-down should be excluded whenever comparable licences are available and instead emphasised that both methodologies are recognised in domestic and international judicial practice, each with its own advantages and limitations.[376] The decision further accepted Oppo's proposed top-down framework, which calculated the royalty by combining aggregate royalty rates with Nokia's relative share of patent strength across the relevant generations of mobile standards.[377]

These decisions largely treat top-down analysis as a methodology equivalent to comparable licence analysis rather than just a supporting tool. At the same time, courts generally acknowledge that both methodologies pose estimation challenges and may be combined within a single FRAND assessment.

However, some courts have taken a more cautious approach to top-down methodologies, recognising their utility as a possible indication of a FRAND rate without treating them as a method equivalent to comparable licences. German courts, in particular, have sometimes relied on top-down calculations to assess the plausibility of licensing offers rather than to determine FRAND rates independently. In *IP Bridge v. TCT*, the Karlsruhe Court of Appeal confirmed that both parties had based their offers on a top-down approach and held that this was not objectionable in principle.[378]

Similarly, the Munich Regional Court has emphasised that there is a limited empirical basis for reliably estimating the value of complex technologies and has thus expressed reservations about using top-down

374 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 3: *"The Court is presented with two principal schemes for determining the proper royalty rate. TCL advocates a "top-down"* approach which begins with an aggregate royalty for all patents encompassed in a standard, then determines a firm's portion of that aggregate. Ericsson turns to existing licenses which it has negotiated to determine the appropriate rates." *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 33: *"As described below, the Court chose to apply the top down formula twice, using TCL's conceded number of SEPs, and using Ericsson's disputed number of SEPs. This more accurately reflects the reality faced by parties in a licensing negotiation who each have different views how many SEPs the licensor owns."*

375 *TCL v. Ericsson*, 2017, Case 8:14-cv-00341-JVS-DFM, at 15.

376 *Oppo v. Nokia*, Case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 98: *"The two Parties adopted the comparable license approach and the top-down approach respectively for determining 5G multi-mode mobile phone percentage royalty rates. Defendants argued that the royalty stacking problem addressed by top-down approach does not exist, and therefore the top-down approach shall not be adopted where comparable agreements are available. In this regard, this Court believes that the existing evidence cited by both Parties shows that in theory, both the comparable license approach and the top-down approach have certain advantages and disadvantages. There is no settled conclusion concerning whether there is royalty stacking or which one of the two approaches is superior. From the perspective of judicial practice, both approaches are applied in domestic and foreign judicial cases. It can be seen that there is currently no sufficient evidence to prove the superiority of one over another, or a preference of one to another. Therefore, Defendants' arguments that the top-down approach should not be applied in this case is untenable and will not be affirmed by this Court."*

377 *Oppo v. Nokia*, Case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 99: *"Plaintiffs adopted a top-down approach, and its overall formula is: Nokia 5G multimode mobile phone percentage royalty rate = 5G standard global aggregate royalty rate × Nokia's share of patent strength in 5G standard × the value share of 5G standard in a 5G multi-mode mobile phone + 4G standard global aggregate royalty rate × Nokia's share of patent strength in 4G standard × the value share of 4G standard in a 5G multimode mobile phone + 3G standard global aggregate royalty rate × Nokia's share of patent strength in 3G standard × the value share of 3G standard in a 5G multi-mode mobile phone + 2G standard global aggregate royalty rate × Nokia's share of patent strength in 2G standard × the value share of 2G standard in a 5G multi-mode mobile phone. This methodology is consistent with the top-down calculation approach adopted in existing judicial practice. Defendants did not question the overall approach or provide evidence to refute it. Therefore, this Court adopts this approach."*

378 *"[…] Die Klägerin hat ihrem Angebot – ebenso wie die Beklagte - einen Top-DownAnsatz zugrunde gelegt. Dies ist rechtlich nicht zu beanstanden."* IP Bridge v. TCT, case 6 U 149/20, [217]. English translation: *„Like the defendant, the plaintiff based its offer on a top-down approach. This is not legally objectionable."*

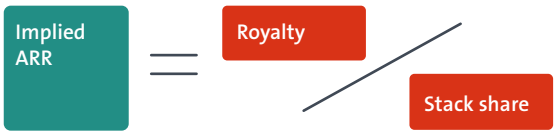
methods as a primary approach.[379] Instead, it has stressed that comparative licences are generally better suited for value determination, while top-down may be used to support or verify outcomes derived from negotiations or comparable agreements.[380]

In the UK, the High Court in *Unwired Planet v. Huawei* likewise treated the top-down methodology primarily as a supporting tool alongside comparable licences. The court indicated that comparable licences provide a better evidentiary basis for a FRAND rate determination, due to the uncertainties involved in selecting the total aggregate royalty required as a starting point for a top-down approach.[381] Nevertheless, Judge Birss indicated that a top-down analysis is useful as a cross-check.[382] In particular, he used a top-down cross-check to confirm that Unwired Planet's offer could not be supported,[383] but that the rate he had derived from a comparable licence analysis implied a reasonable total royalty burden, further corroborating his finding that this rate is FRAND.[384]

The top-down cross-check exemplified by the *Unwired Planet v. Huawei* decision can be stated as follows (see Figure 14):

Figure 14

Basic formula for a top down cross-check



Thus, in this approach, an Implied ARR is calculated by dividing the royalty (either a royalty proposed by a party, or a royalty derived by the court using a comparable license) by the licensor's stack share. This Implied ARR can be compared with existing benchmarks for a reasonable ARR. In this approach, it can be possible to find that an Implied ARR is clearly not reasonable, or falls within a reasonable range, even if there is no methodology for identifying one specific ARR for the standard.

This top-down cross-check approach has subsequently been applied in other UK decisions. In *Optis v. Apple*, the High Court initially relied on a top-down-similar approach to determine a FRAND rate. Specifically, it structured its approach around the idea of pricing the entire stack and then allocating a proportional share to the SEP holder. It sought *"to price the value of the entire Stack to Apple, and then to apportion that price pro rata amongst the co-owners of the Stack"* and describes this as *"pricing the*

379 *"Soweit man den Wert einer Technologie einschätzen muss, gibt es wenig Erfahrungen. Es ist unklar, ob der Wert der Nutzung der Mobilfunktechnologie mit 1, 10 oder 100 US$ pro Gerät bemessen werden kann. Deshalb ist es grds. problematisch, einen Top Down Approach anzuwenden. Vorrangig ist vielmehr auf eine Wertermittlung durch Vergleichslizenzen abzustellen, denn marktwirtschaftliche Mechanismen sind am besten geeignet den Wert von Lizenzen darzustellen. Allerdings kann ein Top Down Approach ein Ansatz sein, um die durch Vergleichslizenzen gefundenen Beträge zu belegen."* LG München I, Hinweis v. 14.07.2025 – 7 O 64/25, 7 O 2750/25. English translation: *"There is little experience when it comes to estimating the value of a technology. It is unclear whether the value of using mobile communications technology can be measured at $1, $10, or $100 per device. For this reason, it is generally problematic to apply a top-down approach. Instead, the primary focus should be on determining value through comparative licenses, as market-based mechanisms are best suited to reflect the value of licenses. However, a top-down approach can serve as a method to substantiate the amounts derived from comparative licenses."*

380 *"Der Top Down Approach kann aus den bereits genannten Gründen und aus der Überlegung, dass man den Wert einer gesamten Technologie kaum bestimmen können wird, nicht zu vernünftigen Ergebnissen führen. Der Top Down Approach hat nur insofern eine Bedeutung, um die durch Verhandlungen gefundenen Ergebnisse zu überprüfen."* LG München I, Hinweis v. 14.07.2025 – 7 O 64/25, 7 O 2750/25. English translation: *"For the reasons already mentioned, and given that it is virtually impossible to determine the value of an entire technology, the top-down approach cannot lead to reasonable results. The top-down approach is only useful insofar as it serves to verify the results reached through negotiations."*

381 *Unwired Planet v. Huawei,* case [2017] EWHC 711 (Pat), [268].

382 *"A FRAND rate can be determined by using comparable licences if they are available. Freely negotiated licences are relevant evidence of what may be FRAND. A top down approach can also be used in which the rate is set by determining the patentee's share of Relevant SEPs and applying that to the total aggregate royalty for a standard but this may be more useful as a crosscheck." Unwired Planet v. Huawei,* case [2017] EWHC 711 (Pat), [806(10)].

383 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [272].

384 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [476].

Stack and what Implementers (and, specifically, Apple) should pay for it".[385] The Court of Appeals later framed this reasoning as broadly consistent with a top-down logic.[386]

The Court of Appeal rejected the High Court's approach to the FRAND rate determination and returned to a more traditional comparable licences approach, but it did use the top-down methodology for cross-checks. Similar to the approach in *Unwired Planet v. Huawei,* the Court of Appeal used a top-down cross-check to confirm that the patent owner's offered rates were too high, in part based on the High Court's earlier finding that an aggregate royalty rate for the total stack of 15% would be too high.[387] The Court of Appeal also used a top down cross-check to confirm the $0.15 FRAND royalty rate it had derived from a comparable licence analysis, finding that it would imply a total DPU stack of just under $40, which would make the total stack 6.3% of the earlier relevant representative Apple average sales price, and 3.9% of a more current Apple ASP of $1000.[388]

In *InterDigital v. Lenovo*, Judge Mellor stated that *"[...] it is clear that the comparables analysis is the primary if not exclusive indicator of the appropriate FRAND financial terms, the top-down analysis being deployed by InterDigital only as a cross-check"* [389]. Importantly, he also said: *"The experts in this case accepted that in principle, top-down analyses can be informative. However, the general category of 'topdown' embraces a wide range of possible approaches and this case is a prime example of the fact that the devil is in the detail"*.[390] He later found *"[...] no value in InterDigital's Top-Down cross-check in any of its guises"*,[391] although not because of the method per-se but rather because of how InterDigital's expert suggested measuring the standard's contribution to the value of the devices and splitting the resulting gains between SEP holders and SEP licensees.[392] Judge Mellor however also rejected an alternative, more straightforward top-down analysis, which would have used the range of 6-10% supported by previous court decisions as ARR starting point.[393] The reason for rejecting this alternative top-down approach was simply that it was inconsistent with the outcome of Judge Mellor's preferred comparable licences analysis.[394] This outcome seriously calls into question the value of the top-down cross-check: if the cross-check can safely be ignored in cases in which it is inconsistent with the primary analysis, it can also not provide significant additional support for the primary analysis in cases in which it is consistent.

On appeal, Judge Lord Justice Birss likewise treated top-down analysis as a cross-check rather than as the principal basis for FRAND determination. InterDigital argued that the first-instance royalty of $0.175 per unit implied an aggregate royalty burden for 4G and 5G multimode devices of only around 1%, which it considered inconsistent with earlier FRAND determinations.[395] Birss nevertheless agreed with Judge Justice Mellor that *"the comparables analysis is a much more reliable basis for estimating FRAND than InterDigital's top-down cross-check"*. [396]

After increasing the royalty on appeal from $0.175 to $0.225 per unit, the Court of Appeal also observed that the revised rate was "less inconsistent with the top-down analysis than the judge's conclusion". The appeal decision therefore continued to treat top-down analysis primarily as a cross-check even though in this case it played only a very minor role, i.e. providing confirmation for the general direction of a relatively minor adjustment to a court-determined FRAND rate even when that adjustment still

385 *"The best approach, as it seems to me, to resolving this articulation of the FRAND Question is to seek to price the value of the entire Stack to Apple, and then to apportion that price pro rata amongst the co-owners of the Stack in proportion with their holding, as calculated by Innography. In calculating the price, I am not making any assessment of the value of the individual patents. I am pricing the Stack and what Implementers (and, specifically, Apple) should pay for it." Optis v. Apple*, Case [2023] EWHC 1095 (Ch), [456]. See also *Optis v. Apple*, case [2023] EWHC 1095 (Ch), [457].

386 *Optis v. Apple*, Case [2025] EWCA Civ 552, [30], [55].

387 *Optis v. Apple*, Case [2025] EWCA Civ 552, [140], [141], [142].

388 *Optis v. Apple*, Case [2025] EWCA Civ 552, [145].

389 *Interdigital v. Lenovo*, Case [2023] EWHC 539 (Pat), [16].

390 *Interdigital v. Lenovo*, Case [2023] EWHC 539 (Pat), [45].

391 *Interdigital v. Lenovo*, Case [2023] EWHC 539 (Pat), [945].

392 *Interdigital v. Lenovo*, Case [2023] EWHC 539 (Pat), [733], [870], [872].

393 *Interdigital v. Lenovo*, Case [2023] EWHC 539 (Pat), [880].

394 *Interdigital v. Lenovo*, Case [2023] EWHC 539 (Pat), [881].

395 *Interdigital v. Lenovo*, Case [2024] EWCA Civ 743, [285].

396 *Interdigital v. Lenovo*, Case [2024] EWCA Civ 743, [286].

left the implied ARR well outside the range supported by previous decisions.

Overall, courts have not adopted a uniform position on the top-down methodology. Some courts, particularly in the United States and China, have accepted it as a principal methodology for FRAND rate-setting, whereas courts in Germany and the United Kingdom have generally treated it primarily as a cross-check to comparable licences or negotiated outcomes. Across jurisdictions, however, courts broadly recognise that top-down analysis can be informative, while also acknowledging the methodological difficulties involved in determining and allocating aggregate royalty burdens.

4.3.2 Aggregate royalty rates (ARRs)

4.3.2.1 Overview of ARR determinations

The first step in the top-down approach is determining the ARR. The ARR captures the total royalty burden for all SEP portfolios reading on a given standard and product category. In most cases, courts and parties have expressed this burden as a percentage of the end-device price, usually the average selling price (ASP). However, the case law also contains other bases, including component-based approaches, as illustrated by *In re Innovatio*.

Table 8 presents the ARR figures that courts have set, implied or accepted across cellular standards, Wi-Fi, and combined standards contexts, while Figure 15 provides a visual representation of the ARRs set either through a single rate or as a range.

Figure 15

ARRs set in each court decision across the different technologies

Note: The figure is based on the 19 ARRs found across the case law and listed in Table 8. *In re Innovatio* is excluded for visualisation purposes because it is the only decision in the sample that reports a per-unit royalty.

Table 8

Overview of aggregate royalty rates (ARRs)

Case	ARR	Base of ARR	Technology	Country	Year	Basis
2G						
Unwired Planet v. Huawei	4.90%[397]	ASP of mobile devices	2G	UK	2017	Implied[398]
2G/3G						
TCL v. Ericsson	5.00%[399]	ASP of mobile devices	2G/3G	US	2017	Public company statements[400]
Oppo v. Nokia	5.00%[401]	ASP of mobile devices	2G/3G	CN	2023	Previous court decisions & public company statements[402]
Huawei v. Conversant	5.00%[403]	ASP of mobile devices	2G/3G	CN	2019	Expert testimony[404]
3G						
Samsung v. Apple	5.00%[405]	ASP of mobile devices	3G	JP	2014	Party statements[406]
Unwired Planet v. Huawei	5.60%[407]	ASP of mobile devices	3G	UK	2017	Implied[408]
Huawei v. Samsung	5.00%[409]	ASP of mobile devices	3G	CN	2018	Court derivation[410]
Archos v. Philips	5.00%[411]	ASP of mobile devices	3G	NL	2017	Party statements [412]

397 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [478].

398 Ibd.

399 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 21.

400 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 20-22.

401 *Oppo v. Nokia*, Case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 99.

402 Ibd.

403 CPI Antitrust Chronicle. 2024. Patent valuation in China SEP cases. At 6.

404 Ibd.

405 Samsung v. Apple, Case 10043, at 64.

406 Samsung v. Apple, Case 10043, at 64.

407 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [478].

408 Ibd.

409 Wang, Chang. 2018. *Huawei v. Samsung* – An Insight from the Shenzhen Intermediate Court on Finding Infringement on Standard Essential Patent. At 4.

410 Ibd.

411 *Archos v. Philips*, Case C/09/505587IHAZA16-206, at 9: *"Assuming with Philips, however, that its share is between 5.1-9.8%, and also the assumption that all SEP holders ask for roughly the same royalty, then the total royalty for UMTS would work out at a figure between ($0.75 x 100/9.8 =) $7.65 and ($0.75 x 100/5.1 =) $14.71."* See also Pohlmann, 2018. FRAND royalty and mobile telecoms SEPs – an analysis of recent court cases: *"No percentage-based royalty stack has been indicated – royalty stack of $7.65 to $14.71 has been argued, therefore 5% is assumed"*. URL: https://www.iam-media.com/article/frand-royalty-and-mobile-telecoms-seps-analysis-of-recent-court-cases.

412 Ibd.

Case	ARR	Base of ARR	Technology	Country	Year	Basis
4G						
TCL v. Ericsson	6.0%–10.0%[413]	ASP of mobile devices	4G	US	2017	Public company statements[414]
Unwired Planet v. Huawei	8.80%[415]	ASP of mobile devices	4G	UK	2017	Implied[416]
IP Bridge v. TCT, 2 O 136/18	8.80%[417]	ASP of mobile devices	4G	DE	2020	Party statements & previous court decisions[418]
Optis v. Apple (Appeal)	3.9%–8.4%[419]	ASP of mobile devices	4G	UK	2025	Implied[420]
Huawei v. Conversant	6.0%–8.0%[421]	ASP of mobile devices	4G	CN	2019	Expert testimony[422]
Oppo v. Nokia	6.0%–8.0%[423]	ASP of mobile devices	4G	CN	2023	Previous court decisions and public company statements[424]
Huawei v. Samsung	6.0%–8.0%[425]	ASP of mobile devices	4G	CN	2018	Court derivation[426]
5G						
Oppo v. Nokia	4.341%–5.273%[427]	Net selling price of the mobile phone	5G	CN	2023	Hedonic regression[428]

413 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 24.

414 Ibd.

415 *Unwired Planet v. Huawei*, Case [2017] EWHC 711 (Pat), [478].

416 Ibd.

417 *IP Bridge v. TCT*, Case 2 O 136/18, [187]: *"Dabei haben die Beklagten den von der Klägerin selbst angegebenen Anteil an SEP in Bezug auf den LTE-Standard in Höhe von x % in Ansatz gebracht. Zudem sind die Beklagten für den LTE-Standard von einer zulässigen Gesamtlizenzgebührenbelastung pro verkaufter Einheit von 8,8 % ausgegangen, was etwa dem im "Unwired Planet"-Urteil des High Court of London angenommenen Prozentsatz für 4G entspricht und jedenfalls nicht außerhalb eines möglichen FRAND-Korridors liegt."* English translation: *"In doing so, the defendants applied the percentage of SEPs related to the LTE standard—x%—as stated by the plaintiff itself. Furthermore, the defendants assumed a permissible total royalty burden per unit sold of 8.8% for the LTE standard, which roughly corresponds to the percentage assumed for 4G in the High Court of London's "Unwired Planet" judgment and, in any event, does not fall outside a possible FRAND corridor."*

418 Ibd.

419 *Optis v. Apple*, Case [2025] EWCA Civ 552, [145].

420 Ibd.

421 CPI Antitrust Chronicle. 2024. Patent valuation in China SEP cases. At 6.

422 Ibd.

423 *Oppo v. Nokia*, Case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 99.

424 Ibd.

425 Wang, Chang. 2018. *Huawei v. Samsung* – An Insight from the Shenzhen Intermediate Court on Finding Infringement on Standard Essential Patent. At 4.

426 Ibd.

427 *Oppo v. Nokia*, Case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 102.

428 *Oppo v. Nokia*, Case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 46.

Case	ARR	Base of ARR	Technology	Country	Year	Basis
Cellular (general)						
Wilus v. ASUS, 7 O 5007/25	4.0%–8.0%[429]	ASP of device	Cellular	DE	2026	(Previous) party statements[430]
Cellular + Wi-Fi + Streaming (combined)						
Wilus v. ASUS, 7 O 5007/25	10.0%–18.0%[431]	ASP of device	Cellular + Wi-Fi + Streaming	DE	2026	Court derivation[432]
Wi-Fi						
In re Innovatio IP Ventures	USD 1.80[433]	Per chipset	Wi-Fi	US	2013	SSPPU profit[434]

429 Wilus v. ASUS, Case 7 O 5007/25, [142]: *"Die Kammer war mit zahlreichen Verfahren insbesondere aus dem Bereich Mobilfunk befasst. Dort wurde teilweise mit Sachverständigengutachten über die Frage der mit dem Mobilfunk einhergehenden Maximalbelastung (Aggregate Royalty Burden) diskutiert, also die Frage, wie viele Prozent des Stückpreises eines Produkts auf die Lizenz zur Nutzung des Mobilfunkstandards entfallen. Dabei waren die Positionen der Patentinhaber und der Patentnutzer nicht so weit auseinander, wie vermutet werden könnte, wenn man die beidseitigen Angebote betrachtet. Es hat sich gezeigt, dass die Position der Patentinhaber bei ca. 8% lag und die Position der Patentnutzer bei etwa 4%. Mit anderen Worten: Die Parteien waren sich einig, dass zwischen 4% und 8% des Kaufpreises eines Geräts als Lizenzgebühren für die Nutzung sämtlicher Patente aller Mobilfunkstandards angemessen sind. Damit ist aber noch nicht gesagt, dass dies auch den Bereich der FRANDgemäßen Lizenzgebühren darstellt."* English translation: *"The Chamber dealt with numerous cases, particularly in the field of mobile communications. In some of these cases, expert opinions were used to discuss the issue of the aggregate royalty burden associated with mobile communications—that is, the percentage of a product's unit price attributable to the license to use the mobile communications standard. In this context, the positions of the patent holders and the patent users were not as far apart as one might assume when considering the offers from both sides. It turned out that the patent holders' position was around 8% and the patent users' position was around 4%. In other words: The parties agreed that between 4% and 8% of a device's purchase price is appropriate as a royalty for the use of all patents across all mobile communication standards. However, this does not necessarily mean that this range constitutes FRAND-compliant royalty rates."*

430 Wilus v. ASUS, Case 7 O 5007/25, [142]: *"Die Kammer war mit zahlreichen Verfahren insbesondere aus dem Bereich Mobilfunk befasst. Dort wurde teilweise mit Sachverständigengutachten über die Frage der mit dem Mobilfunk einhergehenden Maximalbelastung (Aggregate Royalty Burden) diskutiert, also die Frage, wie viele Prozent des Stückpreises eines Produkts auf die Lizenz zur Nutzung des Mobilfunkstandards entfallen. Dabei waren die Positionen der Patentinhaber und der Patentnutzer nicht so weit auseinander, wie vermutet werden könnte, wenn man die beidseitigen Angebote betrachtet. Es hat sich gezeigt, dass die Position der Patentinhaber bei ca. 8% lag und die Position der Patentnutzer bei etwa 4%. Mit anderen Worten: Die Parteien waren sich einig, dass zwischen 4% und 8% des Kaufpreises eines Geräts als Lizenzgebühren für die Nutzung sämtlicher Patente aller Mobilfunkstandards angemessen sind. Damit ist aber noch nicht gesagt, dass dies auch den Bereich der FRANDgemäßen Lizenzgebühren darstellt."* English translation: *"The Chamber dealt with numerous cases, particularly in the field of mobile communications. In some of these cases, expert opinions were used to discuss the issue of the aggregate royalty burden associated with mobile communications—that is, the percentage of a product's unit price attributable to the license to use the mobile communications standard. In this context, the positions of the patent holders and the patent users were not as far apart as one might assume when considering the offers from both sides. It turned out that the patent holders' position was around 8% and the patent users' position was around 4%. In other words: The parties agreed that between 4% and 8% of a device's purchase price is appropriate as a royalty for the use of all patents across all mobile communication standards. However, this does not necessarily mean that this range constitutes FRAND-compliant royalty rates."*

431 Wilus v. ASUS, Case 7 O 5007/25, [143]: *"Ausgehend von diesem Wert für den wichtigsten Standard (Mobilfunk) liegt die Gesamtbelastung für ein Mobiltelefon für alle für einen sinnvollen Betrieb erforderlichen Standards (Mobilfunk, Wi-Fi, Streaming, etc.) bei ca. 10% bis 18%."* English translation: *"Based on this figure for the most important standard (cellular), the total power consumption of a cell phone for all standards required for normal operation (cellular, Wi-Fi, streaming, etc.) is approximately 10% to 18%."*

432 Wilus v. ASUS, Case 7 O 5007/25, [143]: *"Ausgehend von diesem Wert für den wichtigsten Standard (Mobilfunk) liegt die Gesamtbelastung für ein Mobiltelefon für alle für einen sinnvollen Betrieb erforderlichen Standards (Mobilfunk, Wi-Fi, Streaming, etc.) bei ca. 10% bis 18%."* English translation: „Based on this figure for the most important standard (cellular), the total power consumption of a cell phone for all standards required for normal operation (cellular, Wi-Fi, streaming, etc.) is approximately 10% to 18%."

433 *In re Innovatio* IP Ventures, Case 1:11-cv-09308, at 85.

434 *In re Innovatio* IP Ventures, Case 1:11-cv-09308, at 85.

We identify one 2G ARR estimate of approximately 5% of mobile-device ASPs. In *Unwired Planet v. Huawei,* the court calculated an implied ARR for 2G of 4.9% for handsets in 2016.[435]

Similarly, the identified 2G/3G ARRs consistently cluster around 5% of mobile-device ASPs. In *TCL v. Ericsson*, Judge Selna relied on public company statements to derive a 5% ARR for both 2G and 3G standards. The Chongqing court in *Oppo v. Nokia* adopted a 5% benchmark based on previous court decisions and public company statements. Similarly, Huawei v. Conversant relied on expert testimony supporting a 5% ARR.

For 3G standards, courts likewise largely converged on an ARR of around 5% of device ASP, and in *Unwired Planet v. Huawei,* Judge Birss calculated an implied ARR of 5.60%. The court additionally cross-checked this implied rate against international practice, stating: "*The total royalty burden T implied by each of these rates falls within an appropriate range. The value of T for 3G multimode handsets at 5.6% is not far out of line with the judgment of the internationally respected IP High Court of Japan.*"[436] In *Samsung v. Apple* and Archos v. Philips, the courts relied on party statements supporting a 5% ARR, while in *Huawei v. Samsung*, the Shenzhen court likewise derived a 5% ARR. Overall, the identified case law suggests a relatively consistent ARR range for 3G mobile standards across jurisdictions.

For 4G standards, ARR estimates are broader and more contested than for earlier generations, but most identified figures remain within a corridor of roughly 3.9 to 10% of handset ASP. In *Unwired Planet v. Huawei,* the court calculated an implied 4G ARR of 8.8% from a benchmark royalty rate of 0.062% and a SEP share of 0.70%, and cross-checked this figure against prior company statements.[437] In *TCL v. Ericsson*, Judge Selna relied on public statements from Ericsson to derive a 4G ARR range of 6% to 10%.[438] Chinese courts have generally accepted similar figures: In *Huawei v. Samsung*, the court referred to a 4G ARR range of 6% to 8%,[439] and in *Huawei v. Conversant*, the court adopted a 6% to 8% range based on Huawei's expert report.[440] Additionally, the court in *Oppo v. Nokia* relied on prior judicial decisions and public company statements to support the same range.[441]

In *IP Bridge v. TCT*, the court noted that the defendants had used the claimant's own stated LTE SEP share and combined it with an assumed aggregate LTE royalty burden of 8.8% per unit. The court considered this figure to be broadly aligned with the 4G benchmark used in Unwired Planet and not outside a possible FRAND range.[442] The main point of contention in this case was not the ARR, but the base to which the rate should be applied – industry-wide ASPs, or the (lower) ASP of the defendant's products.

435 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [478].

436 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [479].

437 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), at [476].

438 *TCL v. Ericsson*, 2017, Case 8:14-cv-00341-JVS-DFM, at 24: *"Ericsson's statements were thus not a hope or prediction, but a pledge to the market that if the market adopted Ericsson's championed standard, the total aggregate royalties would be calculated as described above. Brismark also clarified in response to a question from the Court that Ericsson believed the market would drive the royalty to 6-8% in particular, and that Ericsson thought, and still thinks, that a single digit percentage royalty is a reasonable royalty rate. (TT Feb. 28, 2017, p. 113: 1-9.) This leaves the Court with the view that before the adoption of the 4G standard, Ericsson thought a total aggregate royalty for 4G would be as low as 6% (if not lower), but certainly not higher than 10%."*

439 Wang, Chang. 2018. *Huawei v. Samsung* – An Insight from the Shenzhen Intermediate Court on Finding Infringement on Standard Essential Patent. At 4: *"Huawei's 4G SEP strength equals to about 10% of the worldwide 4G SEPs, and 4G's aggregate royalty rate is between 6% – 8%."*

440 CPI Antitrust Chronicle. 2024. Patent valuation in China SEP cases. At 6: *"In Huawei v. Conversant, the Nanjing Intermediate Court adopted the rates asserted in Huawei's economic expert's expert report, i.e. 5 percent for 2G, 5 percent for 3G, 6-8 percent for 4G."*

441 *Oppo v. Nokia*, Case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 99: *"The knowledge of relevant industries and the established judicial decisions can both be used as the basis for determining the aggregate royalty rates of standards. Regarding the global aggregate royalty rate of 5% for 2G and 3G respectively, and the global aggregate royalty rate of 6%-8% for 4G, the corresponding data has been affirmed by judicial decisions in domestic and foreign cases such as Huawei v. Conversant with Nanjing court of China. On the one hand, the relevant findings in these judgments can corroborate each other. On the other hand, the public statements, as well as the arguments in judgments, of major standard essential patent holders in the industry such as Ericsson, also represent the industry's understanding. At the same time, Nokia also released a statement claiming that it owned 20%-30% of LTE patents, and the percentage royalty rate it could charge is 1.5% of the price of a single mobile phone. According to its statement, it can be directly calculated that the aggregate royalty rate recognized by Nokia for the 4G is 5%-7.5%, which is very close to the range of 6% to 8%."*

442 *IP Bridge v. TCT*, Case 2 O 136/18, [187]: *"Dabei haben die Beklagten den von der Klägerin selbst angegebenen Anteil an SEP in Bezug auf den LTE-Standard in Höhe von x % in Ansatz gebracht. Zudem sind die Beklagten für den LTE-Standard von einer zulässigen Gesamtlizenzgebührenbelastung pro verkaufter Einheit von 8,8 % ausgegangen, was etwa dem im "Unwired Planet"*-Urteil des High Court of London angenommenen Prozentsatz für 4G entspricht und jedenfalls nicht außerhalb eines möglichen FRAND-Korridors liegt. *" English translation: "In doing so, the defendants applied the percentage of SEPs related to the LTE standard—x%—as stated by the plaintiff itself. Furthermore, the defendants assumed a permissible total royalty burden per unit sold of 8.8% for the LTE standard, which roughly corresponds to the percentage assumed for 4G in the High Court of London's "Unwired Planet"* judgment and, in any event, does not fall outside a possible FRAND corridor."

More recent UK case law also shows that ARR estimates are sensitive to the chosen basis of calculation. In *Optis v. Apple*, the Court of Appeal used a top-down cross-check and showed that the implied aggregate royalty stack varied between 3.9, 6.3, and 8.4%, depending on whether the calculation used a more recent Apple ASP, an earlier representative Apple ASP, or a Google ASP.[443] This illustrates that seemingly similar ARR figures may result in substantially different outcomes when courts use different device prices or market segments as the royalty base. A similar concern appears in *InterDigital v. Lenovo*, where the High Court criticised analyses based only on retail prices because retail mark-ups differed substantially across smartphone manufacturers.[444] Box 9 details some of these discussions and pairs them with insights from *Oppo v. Nokia*, where the selection of the base also played an important role in the determination of a 5G FRAND rate. Overall, the 4G case law suggests increasing attention to the assumptions underlying ARR calculations, particularly the choice of the price base.

For 5G standards, judicial ARR analysis remains limited. The main example is *Oppo v. Nokia*, in which the Chongqing court accepted a 5G ARR range of 4.341 to 5.273%. As pointed out previously, the court decision included a detailed discussion about which base would be most reasonable to choose. Ultimately, the court used the net selling price (NSP) of mobile phones as the royalty base, rejecting Nokia's argument that the retail price or ASP should be used.[445] Unlike earlier cases, which often relied on public statements, prior decisions, or industry materials, the court accepted an economic calculation based on hedonic regression. The decision, therefore, indicates a more data-driven approach to ARR determination in emerging 5G FRAND case law, while also showing that the choice of royalty base remains an important part of the analysis.[446]

While the ARRs determined or used by different courts in top-down FRAND rate determinations are often situated within relatively narrow ranges for the different technologies, it is important to note that this merely reflects the extent to which courts use the same inputs (such as company statements), and the fact that more recent court decisions often rely on earlier court decisions for the ARR determination, rather than independent derivation of similar rates through different approaches.

443 *Optis v. Apple*, Case [2025] EWCA Civ 552, [145].

444 *Interdigital v. Lenovo*, Case [2023] EWHC 539 (Pat), [858].

445 *Oppo v. Nokia*, case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 91: *"In this case, Plaintiffs claimed that the net selling price (NSP) of the mobile phones should be used as the base for calculating royalties, while Defendants proposed the retail price (average selling price, ASP) of the mobile phones as the base. At the same time, Defendants argued that there is actually no difference between the two defined bases. In this regard, this Court believes that, first of all, for NSP, at least the costs of packaging materials, insurance and transportation costs, taxes and other expenses should be deducted as claimed by Plaintiffs, while the retail price of the mobile phones claimed by Defendants does not need to deduct the above expenses, so the royalty bases claimed by both Parties are not the same; Secondly, if the retail price is used for calculating royalties, it will actually inappropriately put the value of the implementer's innovative contribution to the profits of mobile terminal products, such as other technologies, designs, brand added value, transportation efficiency, etc. into the process of determining the value of the standard itself, leading to overcompensation. Thirdly, in foreign judicial practices, net selling price have been applied; the license agreements signed between Nokia and others have also applied net selling price (Nokia and Wavecom, SONIM Technology); Nokia and OPPO also used net selling price in the negotiations for 2018 OPPO agreement for which OPPO had a clear definition and explanation while there is no evidence that Nokia objected thereto. In summary, in this case, the net selling price of the mobile phone claimed by Plaintiffs is used as the base for calculating royalty, and this Court does not affirm Defendants' argument."*

446 *Oppo v. Nokia*, case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 102: *"To sum up, with no final conclusion in the field of economics about the applicability of relevant specific economic methodologies, the economic calculation approach in Plaintiffs' economic report is rigorous and reasonable, and the relevant issues questioned by Defendants have been reasonably explained. Based on the existing economic calculation methodology provided by the Parties, this Court affirms the calculation result of the three-year 5G standard industry aggregate rate calculated by Plaintiffs, 4.341%-5.273%."*

Box 9: Choosing the royalty base for top-down determinations

The choice of the royalty base that the ARR is applied to is a central issue in top-down FRAND determinations because the same ARR can yield very different payments depending on the base, whether it is expressed as an ad valorem rate, a per-unit rate, or a lump-sum payment. This issue was particularly visible in *Optis v. Apple*, where Optis argued for an ad valorem royalty based on the ASP of Apple's devices, while Apple argued for a lump-sum royalty.[447] The High Court explained that each format requires assumptions when converted into another format: ad valorem licences depend on both volumes and ASPs, while per-unit rates remove ASP from the rate itself but still require assumptions when converted into lump sums or ad valorem equivalents.[448]

The practical significance of the royalty base is that it affects both comparability and the allocation of value between the standard and the implementer's own contributions. The Court of Appeal in *Optis v. Apple* illustrated this with a simple example: a $10 per-unit royalty equals 5% for a device with a $200 ASP, but only 2.5% for a device with a $400 ASP; conversely, applying a 5% ad valorem rate to the $400 device results in a $20 per-unit royalty.[449]

The choice between per-unit and ad valorem conversion can therefore materially affect the outcome, particularly where implementers operate at very different price points.

Apple's concern was that ASP-based royalties could allow SEP holders to capture value attributable to the implementer's own innovation, design, brand, or product positioning, rather than the value of the standardised technology itself.[450] This also explains the use of ASP caps, which preserve an ad valorem structure but limit the extent to which higher device prices translate into higher royalty payments.[451]

The Court of Appeal's reasoning in *Optis v. Apple* further shows that the calculation basis can change the implied aggregate royalty burden. A $0.20 per-unit royalty for Optis implied a total stack price of just over $50, corresponding to 8% of an earlier representative Apple ASP and 10.6% of a $470 Google phone. The Court considered this too high.[452] By contrast, the final $0.15 per-unit rate implied a total stack of just under $40, corresponding to 6.3% of an earlier representative Apple ASP, 3.9% of a more recent Apple ASP, and 8.4% of a $470 Google phone.[453] This illustrates that ARR estimates may vary significantly depending on the selected device price, reference product, and conversion method.

Other UK courts have also addressed how the choice of price basis affects the identification of the standard's value contribution. In *InterDigital v. Lenovo*, the High Court criticised reliance on retail-price data where mark-ups differed substantially across manufacturers, since such variation undermined the reliability of comparisons based on retail prices alone.[454]

Similar concerns appear outside the UK. In *Oppo v. Nokia*, the Chongqing court selected net selling price (NSP) as the royalty base rather than retail price or ASP. The court based this on three reasons: First, the two proposed bases were not equivalent, because

447 *Optis v. Apple*, case [2023] EWHC 1095 (Ch), [55(II)a)]: *"Optis contended that the FRAND Royalty should be calculated on an ad valorem rate. In other words, Apple should (according to Optis) pay a FRAND Royalty calculated by reference to a percentage of the average sale price or ASP of each unit of relevant product (in essence, an iPhone)."* *Optis v. Apple*, case [2023] EWHC 1095 (Ch), [55(II)b)]: *"Apple, on the other hand, contended that the FRAND Royalty should be a lump sum. To be clear, Apple was not saying that the FRAND Royalty payable at an ad valorem rate should be calculated (by reference to past and anticipated future sales) and simply converted into a lump sum at a net present value. That could be achieved by ascertaining the ad valorem rate and then converting a lump sum value. Nor was Apple suggesting a similar approach utilising a per unit rate."*

448 *Optis v. Apple*, case [2023] EWHC 1095 (Ch), [303ii)]: *"Ad valorem licences. The rate – a percentage of the units sold – will of course be evident from the face of the licence if royalties are payable on an ad valorem basis. What the licence is actually worth – in terms of money transferring from licensee (Implementer) to licensor (SEP Owner) – can only be computed if the volumes sold and their ASP is known. Converting or unpacking an ad valorem licence into either a lump sum or a per unit rate will thus typically involve making assumptions about volumes sold and/or ASP. This data will not always readily be to hand or reliable."* *Optis v. Apple*, case [2023] EWHC 1095 (Ch), [303iii)]: *"Per unit rate. This is a rate that is an absolute rate per unit sold (e.g. US$4/unit). ASP does not signify, although volumes sold do. However, what the licence is actually worth – in terms of money actually payable – can only be computed if the volumes sold are known. Converting or unpacking a lump sum rate into either an ad valorem or a per unit rate will thus typically involve making assumptions about ASP. This data will not always readily be to hand or reliable."*

449 *Optis v. Apple*, Case [2025] EWCA Civ 552, [17].

450 Apple further explains here: *Optis v. Apple*, Case [2023] EWHC 1095 (Ch), [204], [222ii)c)].

451 *Optis v. Apple*, Case [2023] EWHC 1095 (Ch), [327i)], [222ii)c)].

452 *Optis v. Apple*, Case [2025] EWCA Civ 552, [144].

453 *Optis v. Apple*, Case [2025] EWCA Civ 552, [145].

454 *Interdigital v. Lenovo*, Case [2023] EWHC 539 (Pat), [858].

calculating royalties based on the NSP would require deducting items such as packaging, insurance, transportation, and taxes, whereas using the retail-price base would not require these deductions. Second, using retail prices would risk including value created by the implementer, such as design, brand value, other technologies, and distribution-related efficiencies, in the valuation of the standard itself. Lastly, NSP has typically been used in prior licensing practice, including Nokia's own agreements and negotiations with OPPO.[455]

Overall, the choice of royalty base is an important component of FRAND analysis since it may affect the level of royalties, the comparability of licences, the implied ARR, and the extent to which royalties reflect the value of the standard rather than an implementer's contributions.

455 *Oppo v. Nokia*, Case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 91: *"The Issue of Mobile Phone Royalty Base In this case, Plaintiffs claimed that the net selling price (NSP) of the mobile phones should be used as the base for calculating royalties, while Defendants proposed the retail price (average selling price, ASP) of the mobile phones as the base. At the same time, Defendants argued that there is actually no difference between the two defined bases. In this regard, this Court believes that, first of all, for NSP, at least the costs of packaging materials, insurance and transportation costs, taxes and other expenses should be deducted as claimed by Plaintiffs, while the retail price of the mobile phones claimed by Defendants does not need to deduct the above expenses, so the royalty bases claimed by both Parties are not the same; Secondly, if the retail price is used for calculating royalties, it will actually inappropriately put the value of the implementer's innovative contribution to the profits of mobile terminal products, such as other technologies, designs, brand added value, transportation efficiency, etc. into the process of determining the value of the standard itself, leading to overcompensation. Thirdly, in foreign judicial practices, net selling price have been applied; the license agreements signed between Nokia and others have also applied net selling price (Nokia and Wavecom, SONIM Technology); Nokia and OPPO also used net selling price in the negotiations for 2018 OPPO agreement for which OPPO had a clear definition and explanation while there is no evidence that Nokia objected thereto. In summary, in this case, the net selling price of the mobile phone claimed by Plaintiffs is used as the base for calculating royalty, and this Court does not affirm Defendants' argument."*

More recent German case law has also considered ARR questions from a broader perspective that extends beyond cellular standards alone. In Wilus v. ASUS, the Munich Regional Court referred to prior discussions in mobile communications cases wherein patent holders advocated an ARR of 8% of device ASP and implementers' positions centred around 4%. The court thus observed that the parties appeared to agree on an ARR range of approximately 4 to 8% for the use of all patents across mobile communication standards, while expressly clarifying that this did not necessarily define the FRAND-compliant range. Building on this observation, the court estimated that the combined aggregate burden for all standards required for smartphone functionality, including cellular, Wi-Fi, and streaming technologies, could amount to roughly 10 to 18% of device ASP. These observations were not presented as a formal FRAND determination, but rather as a plausibility-oriented cross-check of aggregate licensing burdens across related standards. Furthermore, the court did not specify how it arrived at the combined 10 to 18% range.

Outside the cellular context, *In re Innovatio* remains the principal judicial example of ARR analysis for Wi-Fi standards. Rather than using end product ASP, the court adopted an SSPPU-oriented framework based on chipset profit and derived an aggregate burden of USD 1.80 per chipset.[456] The decision is notable because it anchored the ARR to the value of the relevant component rather than the end-device price, thereby illustrating that ARR methodologies are not confined to ASP-based percentage calculations. At the same time, *In re Innovatio* remains comparatively exceptional within the broader FRAND case law, in which most ARR discussions continue to rely on handset-level percentage benchmarks.

4.3.2.2 Methodologies of ARR determinations

No single methodology governs how courts determine the ARR. Instead, the case law has developed a limited set of recurring inputs that courts use to identify, test, or approximate the total royalty burden that a standard-compliant product should bear. Four approaches are particularly relevant: public company statements on the ARR, references to ARRs used in earlier court decisions, calculations based on the available profit margin in the smallest saleable patent-practising unit (SSPPU), and hedonic regression models that estimate the value contribution of the standard to the end product.

456 *In re Innovatio* IP Ventures, Case 1:11-cv-09308, at 85: *"Multiplying the average Wi-Fi chip price of $14.85 by a profit margin of 12.1% yields an average profit of $1.80 on each chip. That $1.80 represents the total profit available to a chipmaker out of which to pay royalties for intellectual property."*

Importantly, these approaches are not mutually exclusive. For instance, courts have often combined them by using company statements alongside prior court decisions on ARRs. At the same time, the repeated use of earlier ARR figures from court decisions without independent validation has produced some convergence across jurisdictions, especially for 3G and 4G standards.

In the following subsections, we will thus discuss each of the four approaches separately and assess how they have been used in FRAND determinations.

4.3.2.3 Company statements

An initial approach derived the ARR from SEP holders' public statements about the ARR that they considered reasonable for a given standard. These statements were particularly relevant to 3G and 4G, about which several major SEP holders made public declarations on expected cumulative royalty levels. For instance, for 3G/W-CDMA, NTT DoCoMo, Ericsson, Nokia, and Siemens announced a framework intended to keep cumulative royalty rates at a modest single-digit level, with several statements referring to a target below, or around, 5%.[457] For LTE, a comparable group of companies, including Alcatel-Lucent, Ericsson, NEC, NextWave Wireless, Nokia, Nokia Siemens Networks, and Sony Ericsson, similarly supported a reasonable maximum ARR level in the single-digit percentage range for handsets.[458] However, Stasik (2010) later estimated that the combined cumulative royalty burden from company's announced rates for their specific LTE portfolios was at least 14.8%, illustrating the gap that may arise between companies' views on a reasonable aggregate rate and their statements about reasonable rates for their own portfolios.[459]

Courts have sometimes used these company statements as inputs for ARR determination. In *TCL v. Ericsson*, Judge Selna placed particular weight on Ericsson's own statements and concluded that, before adoption of the 4G standard, Ericsson had considered a 4G aggregate royalty burden *"as low as 6% (if not lower), but certainly not higher than 10%"*.[460] The Chongqing court in *Oppo v. Nokia* similarly treated public statements by major SEP holders as reflecting industry understanding and used Nokia's own

457 LightReading. 2002. Royalties Deal on WCDMA. URL: https://www.lightreading.com/cable-technology/royalties-deal-on-wcdma. See: *"Industry leaders NTT DoCoMo, Ericsson, Nokia and Siemens today reached a mutual understanding to introduce licensing arrangements whereby essential patents for W-CDMA are licensed at rates that are proportional to the number of essential patents owned by each company. The intention is to set a benchmark for all patent holders of the W-CDMA technology to achieve fair and reasonable royalty rates that will lead to fair and competitive pricing for W-CDMA handsets and infrastructure equipment. The companies together own the clear majority of the essential Intellectual Property Rights (IPR) relevant to the W-CDMA standard selected already by about 110 operators worldwide. This arrangement would enable the cumulative royalty rate for W-CDMA to be at a modest single digit level."* See also: *"It is of the utmost importance for the mobile communication industry and in the interest of both licensors and licensees that the cumulative royalty cost of W-CDMA is maintained at a competitive level which encourages both greater growth and innovation in the industry,"* says Lothar Pauly, board member of the Siemens Information and Communication Mobile Group." See also: *"This initiative means that cumulative royalty rates of W-CDMA are kept at a healthy level. For example according to the recent developments in China the cumulative royalty rate seems to remain even under our earlier targeted cumulative 5% level. This makes the W-CDMA standard safe to invest in for operators, manufacturers and application developers,"* says Yrjö Neuvo, Executive Vice President of Nokia. *"See also: "W-CDMA is the standard selected by most operators in the world for their future business, and with this initiative we believe the cumulative royalty will be even lower for W-CDMA than GSM, which has enjoyed unrivalled success compared to any other standard in the world says Torbjorn Nilsson, Senior Vice President Marketing & Strategic Business Development of Ericsson."* See also: *"This initiative is meaningful for promoting the W-CDMA services by keeping cumulative royalty rate below 5%,"* says Kota Kinoshita, Executive Vice President of NTT DoCoMo."

458 Ericsson. 2008. Wireless Industry Leaders commit to framework for LTE technology IPR licensing. URL: https://news.cision.com/ericsson/r/wireless-industry-leaders-commit-to-framework-for-lte-technology-ipr-licensing,c2246540. See: *"Specifically, the companies support that a reasonable maximum aggregate royalty level for LTE essential IPR in handsets is a single-digit percentage of the sales price. For notebooks, with embedded LTE capabilities, the companies support a single-digit dollar amount as the maximum aggregate royalty level. The parties believe the market will drive the LTE licensing regime to be in accordance with these principles and aggregate royalty levels."* See also: *"This framework balances the prevailing business conditions relevant for the successful widespread adoption of the LTE standard, which continues its progress toward definitive adoption by the industry in the applicable standards forums and organizations."*

459 Stasik. 2010. Royalty Rates For Telecommunications Royalty Rates And Licensing Strategies For Essential Patents On LTE (4G) Telecommunication Standards.

460 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 22: *"Ericsson believes the market will drive all players to act in accordance with these principles and to a reasonable maximum aggregate royalty level of 6-8% for handsets." TCL v. Ericsson*, case 8:14-cv-00341-JVS-DFM, at 22: *"Ericsson's statements were thus not a hope or prediction, but a pledge to the market that if the market adopted Ericsson's championed standard, the total aggregate royalties would be calculated as described above. Brismark also clarified in response to a question from the Court that Ericsson believed the market would drive the royalty to 6-8% in particular, and that Ericsson thought, and still thinks, that a single digit percentage royalty is a reasonable royalty rate. (TT Feb. 28, 2017, p. 113: 1-9.) This leaves the Court with the view that before the adoption of the 4G standard, Ericsson thought a total aggregate royalty for 4G would be as low as 6% (if not lower), but certainly not higher than 10%."*

LTE statement to infer an implied 4G ARR of 5% to 7.5%, close to the 6% to 8% range adopted in that case.[461]

Other courts have treated company statements with scepticism. In *Unwired Planet v. Huawei,* the court summarised several companies' LTE-related statements, including Ericsson's expectation of a 6 to 8% aggregate royalty burden, Huawei's support for a low single-digit aggregate rate alongside a portfolio-specific rate cap implying 7.5 to 10%, Nokia's statement implying an LTE aggregate burden of approximately 5 to 7.5% based on its single-mode LTE rate, and Nokia Siemens Networks' statement implying an aggregate burden of approximately 5.33 to 8%.[462] Huawei argued that Ericsson's 2008 statements were particularly important because they had been scheduled as encumbrances when the relevant portfolio was transferred to Unwired Planet.[463] Birss J nevertheless gave limited weight to such statements, emphasising that they did not reflect what SEP holders and implementers had actually agreed in later licences. He also noted that comparable licences were more concrete data points, even if their interpretation remained difficult.[464]

Therefore, the main limitation of company statements is that they may provide useful contemporaneous evidence of industry expectations, but they can also be strategic, self-serving, or disconnected from later licensing practice.[465] They are best understood as one possible ARR input and not as a substitute for evidence from actual licences or case-specific valuation.

4.3.2.4 Past court decisions

A second approach derives or validates the ARR by referencing to ARRs already used in prior FRAND decisions. Past court rates have become an important input for ARR determination, but mainly as reference points rather than as independent evidence.

The clearest example of the reliance on past court decisions is the 5% ARR for 3G, which the IP High Court of Japan used in *Samsung v. Apple* and which later courts repeatedly referenced. In *Unwired Planet v. Huawei,* Judge Birss referred to that Japanese decision when discussing the top-down approach and treated the implied 5.6% ARR for 3G multimode handsets as broadly consistent with the Japanese 5% benchmark.[466]

A similar cross-reference pattern can be observed for 4G. In *Unwired Planet v. Huawei,* the court calculated an implied ARR of 8.8% for 4G, which later served as a reference point in other cases. In *IP Bridge v. TCT*, for instance, the court noted that the defendants had assumed an aggregate LTE royalty burden of 8.8% as a rate that is *"certainly not outside the FRAND range"*.[467] The Court of Appeal in *Optis v. Apple* likewise referred to prior 4G ARR figures, including the Japanese 5% figure, the 8.8% burden in *Unwired Planet v. Huawei,* and the 6 to 10% range in *TCL v. Ericsson*.[468] The same point appears in *InterDigital v. Lenovo*, in which the High Court referred to earlier ARR figures as part of the background to InterDigital's top-down cross-check.[469] Chinese courts have followed a similar pattern: in *Oppo v. Nokia*, the Chongqing court stated that the 5% ARR for 2G and 3G and the 6 to 8% ARR for 4G had been affirmed in

461 *Oppo v. Nokia*, Case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 99: *"On the other hand, the public statements, as well as the arguments in judgments, of major standard essential patent holders in the industry such as Ericsson, also represent the industry's understanding. At the same time, Nokia also released a statement claiming that it owned 20%-30% of LTE patents, and the percentage royalty rate it could charge is 1.5% of the price of a single mobile phone. According to its statement, it can be directly calculated that the aggregate royalty rate recognized by Nokia for the 4G is 5%-7.5%, which is very close to the range of 6% to 8%."*

462 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [264i)], [264ii)], [264iii)], [264v)], [264vi)].

463 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [266].

464 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [269], [270], [271].

465 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [269].

466 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), at [472], [479].

467 *IP Bridge v. TCT*, case 2 O 136/18, [187]: *"Dabei haben die Beklagten den von der Klägerin selbst angegebenen Anteil an SEP in Bezug auf den LTE-Standard in Höhe von x % in Ansatz gebracht. Zudem sind die Beklagten für den LTE-Standard von einer zulässigen Gesamtlizenzgebührenbelastung pro verkaufter Einheit von 8,8 % ausgegangen, was etwa dem im „Unwired Planet"-Urteil des High Court of London angenommenen Prozentsatz für 4G entspricht und jedenfalls nicht außerhalb eines möglichen FRAND-Korridors liegt."* English translation: *"In doing so, the defendants applied the percentage of SEPs related to the LTE standard—x%—as stated by the plaintiff itself. Furthermore, the defendants assumed a permissible total royalty burden per unit sold of 8.8% for the LTE standard, which roughly corresponds to the percentage assumed for 4G in the High Court of London's "Unwired Planet"* judgment and, in any event, does not fall outside a possible FRAND corridor."

468 *Optis v. Apple*, Case [2025] EWCA Civ 552, [20].

469 *Interdigital v. Lenovo*, Case [2023] EWHC 539 (Pat), [880].

domestic and foreign judicial decisions, including *Huawei v. Conversant*.[470]

Overall, these references create a degree of cross-jurisdictional convergence, but this convergence often reflects repeated reliance on earlier court figures rather than independent derivation.

4.3.2.5 SSPPU profit margin

A third approach derives the ARR from the value available in the smallest saleable patent-practicing unit (SSPPU). Instead of starting from the end-device price or from prior aggregate royalty statements, this approach asks whether the total SEP burden can be supported by the profit margin available in the relevant component market. The underlying logic is that cumulative SEP royalties should, in the best case, not exceed the profits available in the underlying component market, at least where the component provides the appropriate valuation base.[471]

In re Innovatio provides the clearest example of this approach in the Wi-Fi context. The court considered whether chip-level profit should operate as a ceiling for RAND royalties and concluded that, on the facts of the case, the existing profit margin on Wi-Fi chips was an appropriate starting point.[472] It then used a 12.1% chip profit margin and an average Wi-Fi chip price of USD 14.85 to produce an available profit pool of USD 1.80 per chip.[473] From this pool, the court allocated value to the top 10% of 802.11 SEPs and then to Innovatio's nineteen-patent portfolio, resulting in a RAND rate of 9.56 cents per Wi-Fi chip.[474] The decision is important because it does not derive the ARR from end-device ASP or public royalty statements, but rather from the profit available in the component that implemented the standard.

4.3.2.6 Value added to the end product: hedonic regression and other econometric approaches

A fourth approach uses hedonic regression models to estimate the standard's incremental contribution to the price of a standard-compliant device. This estimate may then be translated into an aggregate royalty rate or used as an input in a broader top-down calculations. Hedonic regression is a specific application of linear regression models that is particularly well-suited to analysing how individual characteristics of a product contribute to its overall price.[475] In differentiated product markets, such as smartphones, cars, or real estate, this method can be used to infer the implicit value of specific attributes from observed price differences across otherwise comparable products. Box 10 provides a more detailed description of hedonic price regression models.

470 " *Oppo v. Nokia*, Case (2021) Yu 01 Min Chu No. 1232 (translated public version, 2023), at 99: *"Regarding the global aggregate royalty rate of 5% for 2G and 3G respectively, and the global aggregate royalty rate of 6%-8% for 4G, the corresponding data has been affirmed by judicial decisions in domestic and foreign cases such as Huawei v. Conversant with Nanjing court of China."*

471 *In re Innovatio* IP Ventures, Case 1:11-cv-09308, at 74-75: *"Judge Robart accepted the testimony of an expert adopting this view: [B]ecause the risk of "royalty stacking"* inflates the impact of any royalty on a company's bottom line, even a 1% royalty is a "high ceiling" benchmark. This is because the profit margin on semiconductor chips is narrow, and several royalty payments can quickly subsume a company's expected profits. (See 11/14/12 Tr. At 70:1-6 (Ochs Testimony).) Indeed, *"you can't pay too many royalties before you just run out of profit."* (Id. at 70:2-3.)"

472 *In re Innovatio* IP Ventures, Case 1:11-cv-09308, at 75-76: *"The court agrees that the profit margin on an accused product is not always dispositive for determining a RAND rate. [...] It is, however, something the court may consider as part of modified Georgia-Pacific Factors 12 and 13. In the record of this case, moreover, there is no evidence of widespread infringement of 802.11 standard-essential patents. To the contrary, Dr. Leonard testified that Broadcom, Intel, and Atheros, three major Wi-Fi chip manufacturers, are all licensed under Innovatio's patents. (Trial Tr. 2036:3-16 (Leonard).) Those three manufacturers, representing a significant portion of the chip market, have already in essence paid a royalty for the use of Innovatio's technology, and can exert downward price pressure on any currently unlicensed chip manufacturer that tried to raise its prices to account for a royalty to Innovatio. Accordingly, in light of all the evidence, the existing profit margin on chips is the likely ceiling on Innovatio's RAND royalty, and is therefore an appropriate starting point from which to calculate that royalty."*

473 *In re Innovatio* IP Ventures, Case 1:11-cv-09308, at 82: *"The court will therefore use 12.1% as the profit margin on a Wi-Fi chip."*

In re Innovatio IP Ventures, Case 1:11-cv-09308, at 85: *"Multiplying the average Wi-Fi chip price of $14.85 by a profit margin of 12.1% yields an average profit of $1.80 on each chip. That $1.80 represents the total profit available to a chipmaker out of which to pay royalties for intellectual property."*

474 *In re Innovatio* IP Ventures, Case 1:11-cv-09308, at 85-86: *"[...] Next, the court multiplies $1.80 by 84%, the value attributable to the top 10% of 802.11 standard-essential patents, to obtain $1.51, the value attributable to the top 10% of all 802.11 standard-essential patents. Finally, the court multiples $1.51 by 19/30035 to determine the pro rata share of the value in the top 10% of all 802.11 standard-essential patents attributable to Innovatio's nineteen-patent portfolio. The result is 9.56 cents. Accordingly, Dr. Leonard's Top Down method yields a RAND rate of 9.56 cents per Wi-Fi chip, which the court adopts as a RAND rate for licensing Innoatio's 802.11 patent portfolio."*

475 *Interdigital v. Lenovo*, Case [2023] EWHC 539 (Pat), [823].

Box 10: The hedonic regression

A hedonic regression is a technique used to estimate how individual characteristics or features of a good contribute to its market price. The underlying idea, first formalised by Rosen (1974), is that many products are bundles of attributes that provide utility to consumers. For example, the price of a house depends on its size, location, age, and amenities. By observing the prices of products with different combinations of characteristics, researchers can infer the implicit value, or *hedonic price,* that the market assigns to each attribute. In this sense, hedonic regression decomposes the observed price into the sum of the contributions of each characteristic.

In a typical hedonic regression model, the dependent variable is the price of the good, and the independent variables are measurable characteristics. For example, a model might regress car prices on engine size, fuel efficiency, brand, and safety features. The estimated coefficients represent the marginal implicit price of each feature, indicating how much consumers are willing to pay for an incremental improvement in that characteristic, holding other attributes constant. This approach has been widely applied in housing markets (Rosen, 1974; Freeman, 1979; Palmquist, 1984; Black, 1999; Chay and Greenstone, 2005), consumer products, and environmental valuation (Freeman, 2003).

One important limitation of hedonic regression is that the estimated relationships are not necessarily causal. The coefficients capture associations between characteristics and prices, but do not prove that changing a characteristic will lead to the estimated price change. For instance, if high-quality locations tend to have unobserved attributes – like better schools or social networks – omitted variables can bias the estimated effects. Moreover, as Rosen emphasised, the observed prices reflect an *equilibrium* of both consumer preferences and producer costs. Without further assumptions or data, it is difficult to separate demand and supply influences on prices.

Another key challenge is functional form and identification. The price function relating characteristics to prices may be nonlinear, and choosing the wrong functional form can distort results. Additionally, if the variation in characteristics is limited (e.g., if most products are very similar), estimates of implicit prices will be imprecise. As Griliches (1971) and Rosen (1974)[476] point out, this means that while hedonic regressions are powerful tools for describing market valuations, their interpretation requires caution.

476 Rosen, S. 1974. Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition. Journal of Political Economy, 82(1), 34–55.

4.3.3 Apportionment

Apportionment is the second step of the top-down approach. After an aggregate royalty rate has been identified, the remaining question is how to allocate that aggregate burden to the portfolio at issue. In this sense, top-down apportionment means allocating the ARR, or the value available for SEP royalties, across SEP owners according to their relative portfolio strength. As the court explained in *TCL v. Ericsson*, a top-down model typically starts by determining a fair and reasonable aggregate royalty rate for all patents essential to a standard and then apportions that royalty to SEP owners based on the relative value of their portfolios.[477]

Importantly, this use of apportionment must be distinguished from apportionment in US patent damages law. In US patent damages cases, apportionment usually refers to separating the value of the patented feature from the value of unpatented features, manufacturing processes, business risks, or other improvements. This principle goes back to Garretson v. Clark, wherein the Supreme Court required the patentee to separate the profits attributable to the patented improvement from those attributable to the unpatented parts of the product.[478] The same principle is reflected in later SEP cases. In *Ericsson v. D-Link*, the Federal Circuit stated that the royalty award must be based on the incremental value that the patented invention adds to the end product.[479] Similarly, in *HTC v. Ericsson*, the court held that a FRAND royalty must be based on the value of the SEP holder's patented inventions, not on the value added by the standard's adoption or by the standard's market success.[480]

In top-down analysis, apportionment is the step by which the ARR, or the value attributed to the standard, is translated into a portfolio-specific royalty. When the analysis starts from an ARR, the value available to all SEP holders has already been expressed as a royalty burden, so the remaining step is to divide that burden among patent owners. When the analysis starts from the value created by the standard, an additional step is required: the court must first determine how much of that value is available for SEP royalties before allocating it to individual portfolios. Two examples are *In re Innovatio* and *InterDigital v. Lenovo*, in which the courts considered different approaches to apportioning the measured value to the portfolio at issue.

In re Innovatio illustrates a full apportionment of the profit margin in Wi-Fi chips to SEP owners. Judge Holderman accepted a top-down approach based on the profit available to Wi-Fi chipmakers, reasoning that the total royalty burden should not exceed an amount that would make chip production uneconomic.[481] The court then treated the average Wi-Fi chip profit of USD 1.80 as the pool available for intellectual property royalties. From

477 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 14: *"A top down model aims to value a portfolio of SEPs by determining a fair and reasonable total aggregate royalty for all patents that are essential to a standard. It then apportions that royalty to the SEP owners based on the relative value of their portfolio against the value of all patents essential to the standard. (Leonard Deel. ,r 40.)."*

478 Garretson v. Clark, Case 111 US 120 (1884), at 121: *"The patentee [...] must in every case give evidence tending to separate or apportion the defendant's profits and the patentee's damages between the patented feature and the unpatented features, and such evidence must be reliable and tangible, and not conjectural or speculative; or he must show, by equally reliable and satisfactory evidence, that the profits and damages are to be calculated on the whole machine, for the reason that the entire value of the whole machine, as a marketable article, is properly and legally attributable to the patented feature."*

479 *Ericsson v. D-Link*, Case No. 13-1625, at 39-40: *"When the accused infringing products have both patented and unpatented features, measuring this value requires a determination of the value added by such features. Indeed, apportionment is required even for nonroyalty forms of damages: a jury must ultimately "apportion the defendant's profits and the patentee's damages between the patented feature and the unpatented features"* using *"reliable and tangible"* evidence. Garretson, 111 US at 121. Logically, an economist could do this in various ways—by careful selection of the royalty base to reflect the value added by the patented feature, where that differentiation is possible; by adjustment of the royalty rate so as to discount the value of a product's non-patented features; or by a combination thereof. The essential requirement is that the ultimate reasonable royalty award must be based on the incremental value that the patented invention adds to the end product."

480 *HTC v. Ericsson*, Case 19-40566, at 26: *"When dealing with SEPs subject to FRAND obligations, apportionment requires that the patentee's royalty be premised on the value of the SEP holder's patented invention(s), not any value added by the standard's adoption of the patented invention(s). That is, a FRAND royalty must reflect only the value of the patented invention(s) and not the additional value that resulted from the patent(s)' inclusion in the standard or the value resulting from the standard's success in the marketplace."* HTC v. Ericsson, case 19-40566, at 26-27: *"Additionally, in this context, to ensure that a FRAND royalty is based on the incremental value that the [SEP holder's] patented invention(s) add to the product(s), the SEP holder's patented invention(s) must be apportioned from all of the other technology reflected in the standard that is not patented by the SEP holder. The essential requirement is that the ultimate reasonable royalty award must be based on the incremental value that the patented invention adds to the end product."*

481 *In re Innovatio* IP Ventures, Case 1:11-cv-09308, at 75: *"Dr. Leonard's method of basing the total potential royalty for all 802.11 standard-essential patents on the chipmaker's profit insures that the total royalty stack will not exceed an amount that would force chipmakers out of the business. It therefore appropriately simulates the decisions that chipmakers would make in the hypothetical RAND negotiation, when Innovatio's patents were not yet part of the standard. In that situation, chipmakers would lobby for alternative technologies to be adopted into the standard, or would leave the chip-making business altogether, rather than pay a royalty that would obliterate their profits."*

this amount, it allocated value to the top 10% of 802.11 SEPs and then to Innovatio's nineteen-patent portfolio, resulting in a RAND rate of 9.56 cents per Wi-Fi chip.[482] In this setting, the court effectively treated the relevant chip profit pool as the ceiling for all Wi-Fi SEP royalties and then moved to the apportionment to patent owners.

InterDigital v. Lenovo illustrates a different allocation problem. In this case, InterDigital's expert used a hedonic regression model to first estimate the additional value associated with 3G, 4G, and 5G functionality and then proposed that SEP holders and implementers should share that value equally. The court recorded InterDigital's position that hedonic regression was a well-established econometric tool and that InterDigital presented their expert's model as conservative.[483] However, the decisive issue became the proposed 50/50 split between SEP holders and implementers. InterDigital's expert argued that such a split was reasonable, partly because implementers should not receive more than half of the gains from a standard they did not create.[484] However, the court rejected this apportionment step. It held that the 50/50 split had become the critical step in converting the hedonic-regression premium into a SEP royalty burden, but found no value in InterDigital's top-down cross-check.[485]

Once the value available for SEP royalties has been identified, the next step is to allocate it among the respective patent owners. This is usually done by relying on portfolio strength ratios. In practice, this often means using patent-counting approaches or related measures of relative SEP ownership. This part of the analysis is not unique to top-down: Similar portfolio-strength questions also arise in scaling comparable licences and in unpacking lump-sum or cross-licence agreements. For that reason, in Chapter 5 we will address the more general question of measuring portfolio-strength together with patent counting, contribution counting and quality adjustments.

4.4 Conclusions

Comparable licences emerge as the primary method in most cases with top-down trailing a distant second, often used mainly as a cross-check. Comparable licences and the top-down approach are the two main methodologies used across jurisdictions, with comparable licences serving as the primary method in most FRAND rate determinations. Among the 20 cases in the corpus involving a FRAND rate determination, comparable licences appear in the large majority. Top-down is used either as the primary method or, more often, as a cross-check on rates derived from comparables. Other methodologies – including bottom-up, cost-based and Nash bargaining approaches – have not gained comparable traction in the surveyed case law.

Courts sometimes use the two methods in combination. In a number of cases comparable licences and top-down are applied together, with top-down generally serving as a cross-check rather than as an independent primary methodology. Courts in China, Germany and the UK have used top-down to verify or bound rates derived from comparable licences. Where top-down has been used as the sole method, this has usually been because suitable comparables were unavailable or because the proceeding was specifically designed to assess a FRAND rate.

The selection of comparable licences is methodologically significant. The choice of comparable licences is often contested and can materially affect the outcome. Courts have developed criteria for assessing comparability, including the similarity of the licensed portfolio, the identity of the licensee, the geographic scope of the licence and the circumstances in which it was negotiated. There is no fixed rule on the number of licences required. Courts have cautioned against both overly narrow analyses based on a single comparable and overly broad analyses that dilute the most relevant evidence by including insufficiently similar agreements.

482 *In re Innovatio* IP Ventures, Case 1:11-cv-09308, at 85-86: *"Multiplying the average Wi-Fi chip price of $14.85 by a profit margin of 12.1% yields an average profit of $1.80 on each chip. That $1.80 represents the total profit available to a chipmaker out of which to pay royalties for intellectual property. Next, the court multiplies $1.80 by 84%, the value attributable to the top 10% of 802.11 standard-essential patents, to obtain $1.51, the value attributable to the top 10% of all 802.11 standard-essential patents. Finally, the court multiples $1.51 by 19/30035 to determine the pro rata share of the value in the top 10% of all 802.11 standard-essential patents attributable to Innovatio's nineteen-patent portfolio. The result is 9.56 cents. Accordingly, Dr. Leonard's Top Down method yields a RAND rate of 9.56 cents per Wi-Fi chip, which the court adopts as a RAND rate for licensing Innoatio's 802.11 patent portfolio."*

483 *Interdigital v. Lenovo*, Case [2023] EWHC 539 (Pat), [841], [842].

484 *Interdigital v. Lenovo*, Case [2023] EWHC 539 (Pat), [861].

485 *Interdigital v. Lenovo*, Case [2023] EWHC 539 (Pat), [870], [945].

Unpacking is necessary, frequent and manageable. Unpacking is often required when using comparable licences and courts have treated it as a manageable difficulty, rather than a reason to exclude the evidence. Most comparable licences in the corpus required some form of unpacking, most commonly the conversion of lump-sum payments into per-unit rates, the decomposition of cross-licences into one-way rates, or the isolation of rates applicable to a single standard. Courts have recognised that unpacking is difficult, but have generally held that these difficulties do not justify excluding such licences. The choice of unpacking method, whether objective or subjective, patent-counting-based or contribution-based, can materially affect the resulting rate and is often contested.

The top-down methodology lacks a uniform methodological status across jurisdictions: it is treated as the primary method in some, and as a cross-check in others. Courts in the United States (*TCL v. Ericsson*, *In re Innovatio*) and China (*Huawei v. Conversant*, *Siemens v. Xiaomi*, *Oppo v. Nokia* for the 5G rate) have relied on top-down as the principal basis for rate-setting. By contrast, courts in the United Kingdom and Germany have generally treated it as a cross-check on comparable-licence-derived rates, declining to accord it independent priority. Across all jurisdictions, courts broadly acknowledge that top-down analysis can be informative, while also recognising the methodological difficulties involved in establishing a reliable aggregate royalty rate and in allocating it to the portfolio at issue.

The determination of the aggregate royalty rate (ARR) draws on a limited set of recurring inputs, and convergence across jurisdictions reflects repetition rather than independent validation. Courts have derived ARRs from four main sources: public statements by SEP holders, rates accepted in earlier court decisions, calculations based on the available profit margin in the smallest saleable patent-practising unit (SSPPU), and hedonic regression models estimating the standard's incremental value contribution. No single method governs: courts frequently combine inputs, and the 5% figure for 3G and the 6%–10% range for 4G that recur across US, UK, Chinese and German decisions owe their persistence largely to cross-referencing of earlier decisions rather than to independent re-derivation.

The apportionment of the ARR to the portfolio at issue relies primarily on patent counting, which remains a rough and contested proxy. Courts have consistently warned that *"mere patent counting and dividing is not enough"* and have sought to refine the exercise through adjustments for essentiality, validity, family-level deduplication and patent quality.

5. Use of patent data

The previous chapter identifies the analysis of comparable licences and top-down approaches as the two most widely used methods for determining FRAND rates. The operationalisation of these two methods relies on the evaluation of the strength of a patent portfolio using portfolio strength metrics such as patent counts or contribution counts. Chapter 5 describes such patent-based analyses required for FRAND determination. A glossary of relevant concepts used throughout the chapter is provided in Box 11.

The chapter proceeds as follows. Section 5.1 provides an overview of the use cases for patent portfolio strength metrics in FRAND determinations. Section 5.2 compares the two main datasets available for such portfolio strength assessments – patents and contributions data. Section 5.3. examines the common themes that recur when courts rely on patent data, including the status of patent counts essentiality, validity, the treatment of pending applications and expired patents, and indicators of patent quality. Section 5.4 concludes by drawing together the main findings of the chapter.

Box 11: Glossary of concepts used in Chapter 5

Portfolio strength ratio (PSR). A measure of the relative strength of two patent portfolios, expressed as a ratio between the number (or quality-adjusted count) of the relevant patents held by one party and those held by another. PSRs are used primarily in the unpacking of cross-licences, where they allow the observable net balance payment to be decomposed into the two implied unilateral rates. They also arise in scaling exercises when the comparable licence covers a different portfolio than the one at issue. PSRs can be derived from raw declared patent counts, essentiality-screened counts, contribution counts or quality-adjusted measures; the choice of input can materially affect the resulting unilateral rates.

Patent counting. The exercise of quantifying the number of patents in a portfolio or the universe of standard-essential patents for the purpose of assessing relative portfolio value. Patent counting is the most widely used method for operationalising apportionment, scaling and unpacking in FRAND determinations. It rests on the simplifying assumption that each counted patent contributes equally to the value of the portfolio or the standard, and although courts have consistently noted its limitations, they treat it as the most practicable available approach for large portfolios.

Contribution counting. An alternative method of assessing relative portfolio strength that relies on counts of a party's technical contributions to the standardisation process, typically submissions to an SDO, rather than on counts of patents. Contribution counting has been proposed as a proxy for patent value based on the theory that contributions reflect the substantive technical input that gave rise to SEPs.

Essentiality check. An expert assessment of whether declared standard-essential patents are truly essential to a given standard, i.e. whether practising the standard necessarily practises the patent claims. Essentiality checks are used to filter declared SEP counts and produce a more accurate estimate of genuinely essential patents, thus reducing the distortion caused by over-declaration. Essentiality studies vary substantially in depth, scope and methodology.

Blanket disclosure. A form of patent disclosure under some SDOs' IPR policies — amongst others those of IEEE, IEC, ISO and ITU. A blanket disclosure indicates that a participant believes it owns potential SEPs, without revealing any identifying information about specific patents or patent applications, while at the same reassuring prospective implementers that may be essential to the standard but doesn't identify specific patent numbers. Blanket disclosures satisfy the participant's disclosure obligation but leave the universe of essential patents incompletely specified, which potentially leads to substantial under-counting in patent-counting exercises based solely on individually identified declarations.

Declared SEP count. The count of patents or patent families that participants have individually declared to a standards development organisation as potentially essential to a given standard. For 3GPP-related standards covered by ETSI's IPR policy, declared SEP counts are the most commonly used starting point for portfolio strength assessments.

Essential SEP count. The count of patents or patent families that have been assessed, – through an essentiality check, an expert study or a court finding – as genuinely essential to a standard rather than merely declared essential.

Patent family. A set of patent applications and grants filed in multiple jurisdictions to protect the same underlying invention, typically linked by a common priority application.

Skewness adjustment. A technique for recognising that patent values are distributed unevenly across a portfolio wherein a small number of high-value patents account for a disproportionate share of total value.

5.1 Overview of use cases for patent portfolio strength metrics in FRAND determinations

Chapter 4 identifies the analysis of comparable licences and top-down approaches as the two most widely used methods for the determination of FRAND rates. Evaluating the strength of a patent portfolio using portfolio strength metrics such as patent counts or contribution counts does not constitute a separate alternative method for FRAND rate determinations; rather, such portfolio strength determinations play an important role within the different established approaches. Portfolio strength assessments play an important role in FRAND rate determinations, and their use is not specific or limited to any particular approach. The main use cases for employing portfolio strength metrics in FRAND rate determinations are the following:

- **Apportionment:** As identified in Subsection 4.3.3., the top-down approach requires an apportionment of the aggregate royalty between different licensors involving an assessment of the relative portfolio strengths of different SEP owners.
- **Scaling:** As stated in Subsection 4.2.1.1., one category of comparable-licence analyses uses the licences of other portfolios as comparable licences. When one uses the licences for company A's patents to determine a FRAND rate for company B's portfolio, one needs to compare the strength of the two companies' portfolios.
- **Unpacking cross-licences:** As discussed in Subsection 4.2.2.2., many licences that may be used as comparable licences are cross-licensed, and they need to be unpacked into two unilateral licences with different rates. Since only one balance payment is observable, this unpacking requires an assessment of the relative value of the two different unilateral licences, which involves an assessment of the relative strength of the different portfolios (the portfolio strength ratio, or PSR).
- **Adjustments:** As illustrated by the Chongqing court's ruling in *Oppo v. Nokia*, the rates observed for comparable licences may need to be adjusted to account for changes in the (relative) strength of patent portfolios over time.

The methodological challenges that apply to portfolio strength assessments are similar for each of these different use cases. The remainder of Chapter 5 discusses these common challenges and the courts' attempts to deal with them. Unless explicitly stated otherwise, these discussions generally regard portfolio strength evaluations and are not specific to any particular approach to FRAND rate determination.

5.2 Patent and contribution data

When the value of a portfolio cannot be read directly from comparable licences, the courts and parties have turned to other data to compare the value between two portfolios or against the standard as a whole. Courts have particularly used two types of data for this: patents data and contributions data. In *TCL v. Ericsson*, the parties disagreed on which of these data to rely upon for the purpose of deriving Portfolio Strength Ratios (PSR, see Section 4.2.2.2.) and the apportionment in TCL's proposed top-down approach.[486] In addition to providing potential alternative ways to evaluate a portfolio, patents and contributions data can also work in a non-mutually-exclusive way, as in *Oppo v. Nokia*, wherein contribution and approval counts were offered to the court as additional perspectives alongside declaration counts.[487]

While parties in litigations in different jurisdictions have proposed counts of technical contributions to evaluate their SEP portfolios, several courts have identified limitations relative to contribution counting. Contribution-based measurements of SEP portfolio strength have also been controversially discussed in the literature, as explained in Box 12. In *Unwired Planet v. Huawei,* the technique was said to be *"at one remove from the legal rights, which derive from patents not technical contributions"*, and one that *"cannot handle a portfolio of patents acquired after the standards were set."*[488] In *TCL v. Ericsson*, the court similarly identified "*two major flaws"*: the *"absence of any evidence that it corresponds to actual intellectual property rights"*, and its *"inability to account for transferred or expired patents."*[489] The same court stressed that the technique *"counts contributions, not patents"* since contributions *"can be made for ideas that are unpatented, unpatentable, patented by someone else, or split into multiple contributions"*, concluding that, while it *"may have its uses"*, it *"cannot be used to determine a FRAND rate for a patent portfolio, or unpack a cross-license."*[490] The court also recorded a susceptibility to gamesmanship, noting that internal documents showed Ericsson had *"inflated its contribution counts"* by *"hijacking"* the contributions of other companies and requiring its subsidiaries to vote for its proposals.[491] In *FTC v. Qualcomm*, the court found that the FTC's patent valuation expert's methodologies were not reliable, *"as he evaluated SEP holders' relative portfolio strength in part by counting SEP holders' approved contributions to standards"*, even though he *"admitted that a company can receive credit for an approved contribution based on a mere cosmetic change to an existing standards document. For example, one approved contribution to 3GPP states that the contribution provides "editorial corrections" to a standards document and "has no impact on the implementations' of the standard."*[492] In *Oppo v. Nokia*, the court found that standard-contribution and approved-contribution counts *"cannot be used to directly analyze the share of patent strength qualitatively*

486 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 73-74: *"As noted above, the Portfolio Strength Ratio, or PSR, is the strength of Ericsson's SEP portfolio relative to the licensee's SEP portfolio, on a standard-by-standard basis... Although both experts agreed on how to use a PSR and what it represents, they used numbers derived from very different sources. TCL used PSRs derived from Dr. Ding's patent counting study of how many essential patents each company owned. Ericsson instead calculated its PSRs based on contribution counting."*

487 *Oppo v. Nokia*, Case Yu 01 Min Chu, at 69: *"The judgment of (2016) Yue 03 Min Chu No. 840 issued by the Shenzhen Intermediate People's Court of Guangdong Province shows that the number of approved contributions, the number of declarations, and research reports on patent samples' assessment of essentiality, etc., are all important measures to evaluate the SEP strength of each member."*

Oppo v. Nokia, Case Yu 01 Min Chu, at 103: *"In this case, while Defendants questioned the share of patent strength proposed by Plaintiffs and proposed to examine the share of patent strength from multiple perspectives such as the number of standard contributions, the number of approved contributions, the number of people in charge of technical work projects, and the number of chairs of relevant working groups, etc. But such proposal cannot be used to directly analyze the share of patent strength qualitatively and quantitatively."*

488 *Unwired Planet v. Huawei,* Case EWHC 711, [185]: *"[i]t is already at one remove from the legal rights, which derive from patents not technical contributions... Also the technique cannot handle a portfolio of patents acquired after the standards were set."*

489 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 75: *"The two major flaws with contribution counting are the absence of any evidence that it corresponds to actual intellectual property rights, and its inability to account for transferred or expired patents... For example, if Ericsson sold off a substantial portion of its SEP portfolio, Ericsson would still claim the exact same royalty as before it sold its SEPs based on an unchanged standards contribution count... Contribution counting also permits Ericsson to demand royalties well beyond the expiration of the corresponding patents, if those contributions were actually tied to patents at all. These are incorrect results."*

490 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 75: *"Standards contribution counting counts contributions, not patents. Contributions can be made for ideas that are unpatented, unpatentable, patented by someone else, or split into multiple contributions... Brismark testified that Ericsson has never actually done any analysis to determine whether its own contribution counts correlate to its SEPs. Ericsson's internal documents show that it has inflated its contribution counts by 'hijacking' the contributions of other companies as well as requiring its subsidiaries to vote for Ericsson's proposals... While contribution counting may have its uses, it cannot be used to determine a FRAND rate for a patent portfolio, or unpack a cross-license."*

491 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 75: *"Ericsson's internal documents show that it has inflated its contribution counts by 'hijacking' the contributions of other companies as well as requiring its subsidiaries to vote for Ericsson's proposals."*

492 *FTC v. Qualcomm,* Case No. 17-CV-00220-LHK, Findings of Fact and Conclusions of Law, p. 182 at 10-16

and quantitatively";[493] so the court instead adopted the *"patent declaration share"* to measure portfolio strength.[494]

To summarise, courts rejecting contribution counts have identified three main problems with contribution counting: first, contributions differ in value, and many contributions appear to be of only minor importance; second, not all contributions are related to patents, and there is a lack of evidence tying the number of contributions to the strength of a patent portfolio; and third, contribution counting is unable to account for changes in patent portfolios over time. The first limitation of contribution counting also applies – at least to a certain extent –to patent counting (see next subsection). Both methods share two basic assumptions, that strength is proportional to size, and each patent or contribution is given the same value.[495] The second and third limitations, however, are unique to contributions. In contrast to contributions data, patent data track the actual legal rights of companies and are capable of reflecting changes of the portfolio over time. In *TCL v. Ericsson*, it was observed that patent counts are not perfect, but they do have the advantage of reflecting current portfolio ownership, which is subject to changes resulting from the purchases, expirations and transfers of SEPs.[496] As presented in *Oppo v. Nokia*, a portfolio's strength can change in the time elapsed between two licence agreements, so patent counts are needed to properly unpack them,[497] a point also made by Yiu and Ren (2024).[498]

However, there are also examples of courts accepting contribution counts as one indicator of patent portfolio strength. As Yiu and Ren (2024) observe, Chinese courts have considered *"quality indicators"* to make a *"comprehensive assessment"* of an SEP holder's patent strength; in *Huawei v. Samsung* (Shenzhen), the Shenzhen Intermediate Court assessed patent strength using indicators, including the *"number of technical proposals being adopted"* into LTE standards.[499]

Outside the Chinese courts, expert evidence relying on counting approved contributions has been found to be admissible in *Huawei v. Samsung* (N.D. Cal.). Ruling on Samsung's Daubert motion, the court declined to strike the contribution counting opinion, holding that the moving party had not established that the expert's use of the *"Approved Contributions"* indicator was *"so unreliable that his report should be excluded"*.[500] The court treated the objection as going to weight rather than methodology, recording that the challenge was not to *"an unreliable methodology"* but to a *"faulty assumption"*, and that *"[s]haky but admissible evidence is to be attacked by cross examination, contrary evidence, and attention to the burden of proof, not exclusion"*.[501] The indicator was said to rest on a *"strong logical and intuitive connection between the number of a firm's technical contributions approved for incorporation into a standard and its number of SEPs"*, and the practice of industry firms, including the moving party, to use approved contributions to assess

493 *Oppo v. Nokia*, Case Yu 01 Min Chu, at 103.

494 *Oppo v. Nokia*, Case Yu 01 Min Chu, at 104: *"[T]his Court adopts the Plaintiffs' analysis method and statistical calculation of using patent declaration share to determine the share of Nokia's 2G-5G patent strength."*

495 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 74: *"Whether a PSR is calculated through patent counting or contribution counting, it still contains two basic assumptions. The first is that an SEP portfolio's strength is directly proportional to its size. The second is that each patent or contribution is treated equally, regardless of individual value of the invention, or whether it is for a handset, infrastructure device, or both."*

496 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 74: *"Patent counting, while not perfect, does reflect the number of SEPs that are owned by each company. In addition, patent counts will reflect changes to a company's portfolio from purchases, expirations, and transfers of SEPs."*

497 *Oppo v. Nokia*, Case Yu 01 Min Chu, at 96: *"Because there is a [REDACTED] years interval between the signing time of the 2018 OPPO agreement and the 2021 OPPO agreement, regarding the unpacking of the two agreements... this Court believes that the changes in the licensor's relevant patent strength need to be taken into consideration... [T]his Court also affirms Plaintiffs' method of measuring changes in patent strength based on the share in the number of patent declarations."*

498 Yiu and Ren (2024), at 7: *"After unpacking a royalty rate from comparable licence agreements, in some cases implementers also request to adjust that rate to account for the changes in the patentee's portfolio strength between the time of the comparable licence agreement and the time of the putative licence agreement in dispute."*

499 Yiu and Ren (2024), at 7-8: *"In SEP valuation cases, Chinese courts have considered quality indicators to make a comprehensive assessment of an SEP holder's patent strength. In Huawei v. Samsung, the Shenzhen Intermediate Court assessed patent strength of the parties in evaluating whether the offers are FRAND. The quality indicators adopted by the Court include the number of technical proposals being adopted into LTE standards; the essentiality of declared 3G/UMTS and 4G/LTE SEPs; and the invalidation status of the parties' SEPs-in-suits before the Shenzhen Intermediate Court."*

500 Huawei v. Samsung, No. 3:16-cv-02787-WHO, at 73: *"Samsung has not established that Lasin[s]ki's use of the Approved Contributions indicator is so unreliable that his report should be excluded."*

501 Huawei v. Samsung, No. 3:16-cv-02787-WHO, at 70: *"Samsung is not challenging Lasinski's opinions because they are based on an unreliable methodology; rather, it contends that his analysis is unreliable because it includes a faulty assumption. 'Shaky but admissible evidence is to be attacked by cross examination, contrary evidence, and attention to the burden of proof, not exclusion.'"*

portfolio strength in negotiations.[502] The acceptance was, however, tied to a blended use of multiple indicators: the contribution count was combined with an essentiality study and weighted, *"so a firm with a robust SEP portfolio but no contributions would still be assigned a significant patent value"*.[503]

The court distinguished the expert's approach from the approach rejected in *TCL v. Ericsson* on the basis that the expert in *Huawei v. Samsung* had addressed each of the two major flaws highlighted by Judge Selna in *TCL v. Ericsson* by accounting for transferred and expired patents.[504]

502 Huawei v. Samsung, No. 3:16-cv-02787-WHO, at 71: the report cites authority for *"[a] strong logical and intuitive connection between the number of a firm's technical contributions approved for incorporation into a standard and its number of SEPs... It also underscores the generally accepted practice that many industry firms-including Samsung-have used Approved Contributions to assess portfolio strength in licensing negotiations."*

503 Huawei v. Samsung, No. 3:16-cv-02787-WHO, at 71–72: *"Lasinski accounts for expired patents and uses a weighted calculation to combine deemed essential patent counts with Approved Contributions, so a firm with a robust SEP portfolio but no contributions would still be assigned a significant patent value."* See also at 73: *"his blended index produces results consistent with the parties' historical license agreements."*

504 Huawei v. Samsung, No. 3:16-cv-02787-WHO, at 73: *"Huawei underscores that Lasinski addressed each of these 'flaws' in his report: his blended index produces results consistent with the parties' historical license agreements, Lasinski Report ¶¶ 88–91, the effect of transfers are accounted for in Jackson's database, and Lasinski explicitly accounts for expirations, id. ¶ 91 n.213."*

Box 12: Contribution-based measures of SEP portfolio strength

Contribution-based measures of SEP portfolio strength have also been controversially discussed in the literature. Comparing between counts of declared patents and counts of a firm's approved contributions to the standard Sidak (2013) treats the latter as the stronger of the two indicators. By his account, a count of issued patents is a "trailing indicator" of a portfolio's strength, since applications take years to grant and including them inflates the count, whereas the share of approved contributions is a "leading indicator": a contribution is voted into the standard within months, and most approved contributions correspond to inventions for which patents will eventually be granted. Therefore, a firm's number of approved contributions is, in this view, an "intellectually sound proxy" for the strength of that firm's patent portfolio.[505] A central feature of this argument is its resistance to gaming: since approved contributions are *"peer-reviewed by the SSO's own members"*, they are said to be less susceptible to inflation than the unilateral act of declaring a patent essential. Sidak reads the empirical record in the same regard: by relying on the Signals Research Group and ABI Research studies of LTE, he notes that the low rate at which submissions are approved *"casts doubt on the validity of patent-counting methods"*, and treats approved contributions as a *"more reliable and less biased"* indicator of the value of a given SEP portfolio than patent counts or citation-based measures.[506]

A more systematic critique of contribution-based measurements has been developed by Baron (2020), who, by analysing a comprehensive database of contributions to 3GPP, found that the underlying data cannot bear the weight that contribution counting places on it. Contributions are highly heterogeneous in type, outcome, impact and context, so no single count meaningfully captures a firm's technological

505 Sidak (2013), at 1050: *"[T]he number of issued patents is a trailing indicator of a patent portfolio's strength, whereas the number or share of approved contributions is a leading indicator. It can take years for a patent application to be granted. Thus, by including patent applications in the patent-counting exercise, one will exaggerate the portfolio's patent strength. In contrast, it generally takes a few months for a contribution to be approved and voted into the standard by SSO members. Most approved contributions correspond to inventions for which patents will eventually be granted. Consequently, a firm's number of approved contributions is an intellectually sound proxy for the strength of that firm's patent portfolio. Because approved contributions are peer-reviewed by the SSO's own members, those approvals are less susceptible to gaming by SSO members than is the process of unilaterally declaring one's patents to be essential to the standard."*

506 Sidak (2013), at 1037: *"[E]mpirical evidence to assess the degree of inequality across the SEPs would come from estimating a model of patent value based on information such as patent citations, patent counts, and the number of countries in which a patent is licensed—although, as I explained earlier, approved contributions are likely to be a more reliable and less biased indicator of the value of a given SEP portfolio."* See also at 1016, reporting the Signals Research Group finding that *"the low rate of submission approval casts doubt on the validity of patent-counting methods for valuing a given company's contribution to the standard. Even if an SEP holder has the highest number of patents declared essential to the LTE standard, it does not necessarily follow that the SEP holder made the largest meaningful contribution to creating the LTE standard."*

contribution.[507] This heterogeneity is not incidental but structural: the standardisation process is not designed to screen contributions for significance or originality,[508] and most contributions submitted for decision are accepted since the process aims to take all members' positions into account rather than confer any ownership over the standard.[509] The distribution of technological significance across contributions is, moreover, even more skewed than it is for patents – only around 5% of contributions attract any patent citation against roughly two-thirds of patents – so any count dilutes a small number of significant contributions within a mass of incremental or editorial ones.[510] Since there is no minimum threshold a contribution must clear to be accepted, the measure is also readily manipulable, whether by slicing contributions into ever-smaller pieces or by concentrating on low-cost editorial changes;[511] moreover, at the level of the individual specification, the number of change requests turns out to be a weaker predictor of a specification's technological significance than a simple count of declared SEPs.[512]

A natural refinement is to count only approved contributions on the theory that approval reflects a form of validation by the relevant experts – the very premise on which Sidak relies. Baron's later work (2024) shows that this refinement does not rescue the measurement, and in some respects it makes it less suitable for SEP valuation, not more. Approval is overwhelmingly concentrated in change requests, a document type that is comparatively rare in the working groups RAN1 and RAN2, which together account for more than 80% of patents declared potentially essential to 3GPP specifications. RAN1 ranks second among all working groups by overall contribution volume but only thirteenth by number of approved contributions.[513] Within these groups, the documents that actually disclose patentable material, such as discussion papers and reports, are routinely marked "not treated" or "noted" rather than approved,[514] whereas the approved documents are disproportionately minor corrections or are authored not by the original proponent of a technical idea but rather by a moderator or specification editor tasked with transcribing a consensus already reached by the group.[515] Consistent with this, contributions marked "available – not treated" are cited by subsequent patents more than five times as often as approved contributions. If anything, therefore, counting approved contributions captures less of the activity relevant to SEP valuation than counting contributions generally, and the documents it does capture are largely those least likely to reflect a company's own inventive contribution.

507 Baron (2020), at 7: *"A closer look at the contributions data reveals their heterogeneity. Contributions are heterogeneous in- Type (e.g. work item, change request)- Outcome (e.g. approved, noted, etc.)- Impact (e.g. specifications impacted, new patentable inventions)- Context (e.g. type of working group, discrete vs cumulative contributions)."*

508 Baron (2020), at 9: "The decision making process of 3GPP is not designed to screen for individually significant or original technical contributions. "

509 Baron (2020), at 13: *"The processes of SDOs never intended to confer to the authors of accepted contributions any ownership over the standardized technology... By contrast, the process for submitting and approving contributions involves no assessment of the size of the technical contribution that is made. Contributions are not accepted because they are original, novel, or individually significant or valuable. Most contributions that are submitted for decision are accepted. This reflects the fact that SDOs offer open and consensus-based standard development processes..."*

510 Baron (2020), at 11: *"While two thirds of all patents are cited, only 5% of contributions receive any patent citations. The impact of contributions on new patent applications is thus even more concentrated in small number of documents than is the case for patents. These figures indicate that the technological significance of contributions (at least the significance for follow-on innovation, as measured by patent citations) is concentrated in a small number of contributions, and the overall value distribution is highly skewed."*

511 Baron (2020), at 13: *"Because standardization processes are not designed to screen individual contributions for significance, they offer little protection against manipulation. SDO members seeking to inflate their contribution counts can easily slice contributions into smaller pieces, or concentrate their efforts on low-cost editorial or other incremental changes to a specification under development."*

512 Baron (2020), at 12: *"For both measures of impact (standard references and patent citations), the ranking of specifications by change requests is less correlated with the ranking of specifications by technological impact than is a ranking based on number of patents declared essential. While both the number of change requests and the number of declared SEPs are absolutely imperfect indicators of the technological significance of 3GPP TS, the number of declared SEPs actually outperforms the number of change requests."*

513 Baron (2024), at 20: *"Figure 9 illustrates the strongly dominating role of working groups RAN1 and RAN2. More than 80% of patents identified as potentially essential to a 3GPP TS are declared to be essential to a TS for which one of these two groups is primarily responsible. Notably, RAN1 (which, as we have seen, only ranks 13th in terms of counts of approved TDocs) stands out as by far the most important working group for potential SEPs."*
At 18: "Overall, while counts of approved TDocs only take about 3% of the RAN1 TDocs into account, more than 50% of the documents that are considered are relatively minor "Correction (F)" CRs."

514 Baron (2024), at 24: *"As observed, TDocs listed as "Available – Not treated"* are cited more than five times as often as TDocs that are listed as approved."

515 Baron (2024), at 26: *"Approved CRs that make significant changes to a 3GPP TS thus represent only a very small fraction of the contributions to RAN1 and RAN2; and many of these approved CRs are authored by a moderator instead of the original source of a new proposed technical feature."*

The critique found regarding both the case law and the work just discussed is directed at counting contributions, i.e. treating each technical document (TDoc) as an equal fungible unit, and not at analysing what those contributions actually did. These are distinct exercises and should not be conflated. A qualitative contribution-level analysis asks which contributions created value and how that value maps onto patents; contribution counting, as litigated, treats all contributions as equivalent, and it is that equivalence which the courts have criticised. An initial observation in this qualitative direction is that the existing ways in which contributions data are used do not often reflect the heterogeneity of contributions; by treating submissions that vary widely in originality, scope and decision relevance as if they were equivalent, they fail to identify those that are most important.[516]

Some classes of contribution form a clear minority yet attract substantially more attention from later contributions, which suggests that the influence of a contribution is not captured by a simple tally. A second observation links the technical performance of contributions to patenting: in at least one standard, only a minority of the patents later pooled as essential have a priority date preceding the relevant call-for-proposals deadline, and a small share of patents appears to provide much of a standard's technological foundation.[517] For either observation, a contribution-level analysis measures the value and heterogeneity of contributions rather than tallying them, so it is conceptually separate from the contribution counting that the courts have criticised.

516 Baron (2020) and Baron (2024).

517 On the concentration of value in a small subset of SEPs and the weakness of raw patent counts as a proxy for technological contribution, see Leonard and Lopez (2014) and Baron (2020).

5.3 Common themes when using patent data

5.3.1 The status of patent counts

In general, many courts agree that the FRAND rate should be proportionate to the value of patents or to the contribution to the standard that they make rather than the pure number of patents. In *Microsoft v. Motorola*, Judge Robart refers to this as a commonly understood principle of proportionality: *"This is not simply a numeric equation but the compensation must, within reasonable bounds, reflect the contribution."*[518] The court further adds that in a hypothetical negotiation, *"the parties would examine a reasonable royalty rate under the RAND commitment based on the contribution of the patented technology to the capabilities of the standard, and in turn, the contribution of those capabilities of the standard to the implementer and the implementer's products. Thus, a patent that is extremely important and central to the standard would reasonably command a higher royalty rate than a less important patent."* [519] On this basis, the court proceeded to assess the importance of the contributions made by Motorola's SEPs to the 802.11 standard.[520]

Referencing *Microsoft v. Motorola*, Judge Holderman in *In re Innovatio* uses a similar formulation: "*First, a court should consider the importance of the patent portfolio to the standard, considering both the proportion of all patents essential to the standard that are in the portfolio, and also the technical contribution of the patent portfolio as a whole to the standard."*[521]

There are, however, practical limitations to the evaluation of individual patents, particularly in the case of large portfolios. In SEP licensing, patent counting (which fails to account for the value of different patents) may thus be practiced for reasons of greater practicability. This is particularly the case for patent pools, which need relatively simple and transparent royalty sharing rules for the division of the pool's royalty revenue among

518 *Microsoft v. Motorola*, Case C10-1823JLR, [68].

519 *Microsoft v. Motorola*, Case C10-1823JLR, [111].

520 *Microsoft v. Motorola*, Case C10-1823JLR, [575]: *"[I]n its hypothetical negotiation, the court must consider the importance of the 11 Motorola SEPs that Microsoft does use. Evidence at trial showed that each of the 11 patents provides very minimal technical contribution to the identified portions of the 802.11 Standard. Additionally, the record was clear that Motorola did not provide the inventive technology in any area of the 802.11 Standard, but instead built upon already existing technology."*

521 *In re Innovatio*, Case 1:11-cv-09308, at 10.

the licensor members. In *Samsung v. Apple*, the IP High Court of Japan noted that it is a common practice among patent pools to divide the amount of royalty by the number of essential patents, and it found that this industry practice provided support for the court's use of patent counts in its top-down FRAND royalty determination.[522] In *Microsoft v. Motorola*, Judge Robart similarly noted that patent pools generally *"distribute royalties on a per patent basis as part of a patent-counting system"*.[523]

Nevertheless, patent pools are distinct from bilateral licences, and comparability between pool and bilateral licences is imperfect. In *Microsoft v. Motorola*, the court did not use the pool licences as a traditional comparable licence; instead, it used the royalty that Motorola would have received from the pool – if Motorola and all other owners of relevant SEPs had joined the pool – as a benchmark for a FRAND royalty to Motorola's patents. In this approach, the pools' royalty distribution rules (which rely on patent-counting) are directly relevant, but it is not established whether a patent count accurately reflects the value of the portfolio. To the contrary, *"the court notes that the Via Licensing 802.11 patent pool as a de facto RAND royalty rate for Motorola's 802.11 [standard-essential patent] portfolio suffers from the same concerns as all patent-counting patent pools in regards to the court's RAND-modified Georgia-Pacific methodology. Namely, the Via Licensing 802.11 pool does not distinguish between patents in the pool on the basis of technical merit, but rather gives the exact same royalty to all patents in the pool. Also, the pool does not consider the importance of patents to the implementer's products."*[524] In *In re Innovatio*, Judge Holderman cites this passage to highlight the limitations of using the Via pool as a comparable licence, and he adds that *"because the Via patent pool does not allocate royalties based on relative merit, patent holders with valuable patents will not contribute their technology to the pool."*[525] Since Judge Holderman had found Innovatio's patents to be of moderate to moderately-high importance to the 802.11 standard, he declined to use the Via pool as a comparable licence on that basis. Thus, the fact that patent pools use patent-counting rules to redistribute royalties does not necessarily establish the validity of patent counting for the purpose of evaluating patent portfolios that are licensed bilaterally.

The use of patent counting in licensing negotiations is, however, not confined to patent pools. In *TCL v. Ericsson*, Judge Selna noted that *"Ericsson has long argued that a fair and reasonable royalty rate for a SEP license can be determined using a top down approach, or what the Court calls a simple patent counting system."*[526] He further referenced past statements from different companies promoting *"licensing arrangements whereby essential patents for W-CDMA are licensed at rates that are proportional to the number of essential patents owned by each company."*[527] Judge Birss in *Unwired Planet v. Huawei* similarly noted that *"[t]here was ample evidence before me that apart from Ericsson (see below), parties negotiating SEP licences in fact use methods which are based on patent counting."*[528]

The advantages of patent counting in terms of objectivity and practicability also apply to the context of FRAND rate determination in litigation. According to Judge Birss, *"when one thinks about it some sort of patent counting is the only practical approach at least for a portfolio of any size. Trying to evaluate the importance of individual inventions becomes disproportionate very quickly."*[529]

Throughout the case law, there is significant support for Birss' observation. Indeed, the vast majority of decisions entail at least some element of patent counting for the purposes of apportionment, scaling, unpacking and/or adjustments to comparable licences. Nevertheless, his reference to *"some sort of patent counting"* encompasses a spectrum of approaches. On one hand, decisions such as the High Court ruling in *Optis v. Apple* or the Chongqing court's decision in *Oppo v. Nokia* adopted a purely quantitative approach to counting (declared) patents without any attempt to account for essentiality, validity, importance or any other qualitative dimension. On the

522 *"Calculation of the amount of the FRAND royalty by dividing the amount of royalty by the number of the UMTS essential patents is consistent with such practice in patent pools."* Samsung v. Apple, Case (Ne) 10043, at 137.

523 *Microsoft v. Motorola*, Case C10-1823JLR, [465], [533].

524 *Microsoft v. Motorola*, Case C10-1823JLR, [556].

525 *In re Innovatio*, Case: 1:11-cv-09308, at 70

526 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 18-19.

527 *TCL v. Ericsson*, case 8:14-cv-00341-JVS-DFM, at 20.

528 *Unwired Planet v. Huawei*, Case [2017] EWHC 711 (Pat), [182].

529 *Unwired Planet v. Huawei*, Case [2017] EWHC 711 (Pat), [182].

other hand, Judge Holderman in *In re Innovatio* adopts an apportionment method that *"does not apportion to the value of Innovatio's patented features based solely on the numerical proportionality of Innovatio's patents to all 802.11 standard-essential patents. To the contrary, the Top Down method provides a means by which the court can account for its conclusion that Innovatio's patents are of moderate to moderate-high importance to the standard, and therefore more important than the average 802.11 standard-essential patent, without sacrificing quantitative rigor and objective verifiability."*[530] As a consequence of considering the qualitative assessment of Innovatio's patents, these patents received a share of the overall value of the standard that was 8.6 times larger than the overall per-patent average, thereby illustrating the significant importance of the qualitative element in this approach.[531]

Many other decisions fall somewhere in between on this spectrum – one must acknowledge and accept that some qualitative differences between patents, such as essentiality rates, can be taken into account while others cannot be reliably accounted for. Of course, decisions also differ relative to the role and importance of patent counting – while some decisions directly rely on some sort of patent counting to evaluate the patent portfolio at issue, other decisions use patent counting only for relatively less important aspects of the FRAND rate determination, such as the unpacking of comparable licences.

5.3.2 Essentiality

Essentiality is a central problem in patent-counting approaches. In general, a FRAND rate should reflect the value of a company's essential patents. If a company has other patents that are non-essential, these patents can still have value, and (if infringed) these patents must also be licensed and compensated; however, the value of these non-essential patents should be accounted for separately. Thus, identifying the subset of patents that are essential to a standard within a company's portfolio is an important step in determining a FRAND rate. Using a patent-counting approach to evaluate a portfolio entails that the company's essential patents should be counted to determine a FRAND rate.

Counting essential patents is difficult for two different reasons: first, it may be difficult to identify all essential patents since only a subset of the patents that are essential to a standard are known and identified. Second, it can be difficult to identify truly essential patents since many more patents are claimed or declared to be essential than those that are actually essential.

The prevalence of these two issues differs across standards and SDOs. Participants in 3GPP generally abide by ETSI's IPR policy, which requires participants to make specific disclosures of the patents that they believe (in good faith) to be (potentially) essential to a standard.[532] In 3GPP-related standards, the main problem is typically over-declaration: the universe of declared patents encompasses many more patents than those that are actually essential.[533] Empirical studies suggest that only a minority of declared patents are truly essential, with estimated essentiality rates often around 20% to 30% and potentially lower for more recent generations.[534] This is partly a consequence

530 *In re Innovatio*, Case 1:11-cv-09308, at 77.

531 Judge Holderman found that Innovatio's patents belonged to the top 10% most important 802.11 patents, and that the top 10% most important patents collectively account for 86% of the total value.

532 Paragraph 4.1. of ETSI's IPR Policy states: *"Subject to Clause 4.2 below, each MEMBER shall use its reasonable endeavours, in particular during the development of a STANDARD or TECHNICAL SPECIFICATION where it participates, to inform ETSI of ESSENTIAL IPRs in a timely fashion. In particular, a MEMBER submitting a technical proposal for a STANDARD or TECHNICAL SPECIFICATION shall, on a bona fide basis, draw the attention of ETSI to any of that MEMBER's IPR which might be ESSENTIAL if that proposal is adopted."* URL: https://www.etsi.org/images/files/IPR/etsi-ipr-policy.pdf. Paragraph 4.3. further states: *"The obligations pursuant to Clause 4.1 above are deemed to be fulfilled in respect of all existing and future members of a PATENT FAMILY if ETSI has been informed of a member of this PATENT FAMILY in a timely fashion. Information on other members of this PATENT FAMILY, if any, may be voluntarily provided."* Paragraph 6bis states: *"MEMBERS shall use one of the ETSI IPR Licensing Declaration forms at the Appendix to this ETSI IPR Policy to make their IPR licensing declarations."*

533 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [201]: *"Very many more patents are declared to be essential than in fact are essential."*

534 European Commission et al. 2023. Empirical Assessment of Potential Challenges in SEP Licensing, at 24: *"Over-declaration: It is estimated that only about 20-30% of the declared patents are essential; where there appears to be a tendency essentiality rates are even lower for more recent generations (with estimated essentiality rates for 5G as low as 10-20%)"*

of the design of SDO declaration systems, which were created to support standard development and ensure access to licences, not to provide a precise evidentiary basis for FRAND valuation.[535] As a consequence, the number of declared essential patents may not accurately reflect different companies' portfolio strength since different companies may over-declare to different extents. For instance, in *InterDigital v. Lenovo*, the High Court noted that over-declaration at ETSI was accepted by the experts as a problem and observed that over-declaration might not occur uniformly across licensors.[536]

In contrast, for other standards such as Wi-Fi and many video and audio codecs, the problem typically is under-disclosure or incomplete visibility. Many of these standards were developed by IEEE SA or joint technical committees of ISO, IEC, and/or ITU. All these SDOs have IPR policies that allow for *blanket disclosures*, i.e. companies may fulfil their patent disclosure obligations through a general statement declaring that they (may) have patents that are essential to a standard and whether they are prepared to license these patents on terms that comply with the SDO's patent policy. Because of this, some patents that are essential to such standards may not be individually declared but instead covered by a generic blanket disclosure. In addition, many patents that are essential may not have been declared under the SDO's disclosure policy because, for example, the patent owner did not itself participate in the standards development. Essential patents that have not been (individually) disclosed to the SDO may only become visible as SEPs once they are introduced into a patent pool or through litigation or bilateral licensing practice. Thus, the implication for patent counting is that any count of (known) essential patents for such standards might miss a large number of essential patents that have not (yet) been disclosed, introduced to a pool or asserted in litigation.

Since the nature of the available information on essential patents differs between types of standards, approaches to patent counting also must differ. With respect to 3GPP-related standards, there are two prevalent approaches in the case law: declared patent counting and essential patent counting. In a declared patent counting approach, the court uses the number of declared patents (or declared patent families) to measure the strength of a company's SEP portfolio. Examples include the Chongqing court's decision in *Oppo v. Nokia* and the UK High Court's decision in *Optis v. Apple* (see Subsection 5.3.1.). In an essential patent counting approach, the court attempts to determine or estimate the number of patents that are actually essential and uses this number to measure the strength of a company's portfolio. Examples include the UK court decisions in *Unwired Planet v. Huawei* and the US district court decision in *TCL v. Ericsson*. Essential patent counting relies on essentiality checks, i.e. an expert assessment of whether a declared SEP is actually essential. There are two variants of essential patent counting approaches: the use of a bespoke essentiality study to estimate the number of true SEPs (conducted specifically for the purpose of the litigation) and the use of available third-party estimates.

535 SEPs Expert Group. 2021. Group of Experts on Licensing and Valuation of Standard Essential Patents 'SEPs Expert Group' (E03600): Contribution to the Debate on SEPs, at 46-47: *"Most would agree that the processes established by SDOs for the submission of SEP declarations are designed primarily to advance standard development, not to form a basis for SEP licensing. As a result, SEP holders have been encouraged to declare patents that they believe are either essential to the standard or may become essential to the standard depending on the development process. […] From the SDO's perspective, however, over-declaration is not an issue because the goal is to ensure the broadest possible declaration of SEPs. In some cases, SDOs allow blanket declarations by SEP holders in part because such declarations are considered sufficient to remove the risk that a SEP holder would refuse to license its SEPs if the covered technical contributions are included in the standard […] Most other SDOs do not have the same requirements as ETSI […] These so called 'blanket declarations' serve to inform implementers as to the identity of possible SEP holders […] However, they fail to provide information on the existence, relevance, or number of the relevant SEPs for the standard."*

536 *Interdigital v. Lenovo*, Case [2023] EWHC 539 (Pat), [819]: *"Third, bearing in mind the experts agreed that overdeclaration of patents as Standard Essential to ETSI was a problem, it assumes overdeclaration occurs uniformly. It seems to me that overdeclaration will depend on (a) the extent to which a licensor relies on patent counting studies and (b) its perception of the strength of its portfolio. It may be that those SEP licensors with weaker portfolios engage in greater over-declaration than those with stronger portfolios."*

The first approach to essential patent counting is the use of bespoke essentiality studies prepared for the litigation itself. In *TCL v. Ericsson*, the court used an industry-wide essentiality study supervised by experts to estimate the total number of SEPs for 2G, 3G and 4G, which then formed the denominator for Ericsson's proportional share.[537] The study began with ETSI declarations, which they reduced in scope to active English-language patent families pertaining to user equipment, and then assessed a random sample for essentiality.[538] The court accepted the study despite Ericsson's objections, but they did adjust the totals downward by 11.4% to account for over-declaration identified through cross-checks.[539]

Courts have further relied on combinations of bespoke and third-party essentiality studies for essential patent counting. In *Unwired Planet v. Huawei,* the court considered two approaches: Huawei's patent analysis (HPA) and Unwired Planet's modified numeric proportionality approach (MNPA).[540] The HPA was closer to a bespoke essentiality study. It used ETSI and other declaration data, de-duplicated patent families, grouped them by status and standard, and then reviewed selected patent families for essentiality.[541] The study was overseen by Dr Kakaes and used technical evaluators who were not informed of the ultimate client or opposing party to preserve neutrality.[542] The MNPA, by contrast, relied more heavily on available third-party essentiality assessments.

537 *TCL v. Ericsson*, 2017, Case 8:14-cv-00341-JVS-DFM, at 15: *"Step 2: Dr. Zhi Ding, Dr. Apostolos Kakaes, and teams at Concur IP and Ernst & Young India determined the total number of SEPs for each standard as of September 15, 2015. [...] This became the denominator for calculating Ericsson's proportional share of each standard. The remainder of the analysis focused on determining the appropriate numerator and modifiers to apply." TCL v. Ericsson*, 2017, Case 8:14-cv-00341-JVS-DFM, at 26: *"With a total aggregate royalty in place, the next question to resolve is Ericsson's proportional share. This is a ratio calculation taking the number of Ericsson's SEPs (the numerator) over the total number of SEPs for the standard in question (the denominator)."*

538 *TCL v. Ericsson*, 2017, Case 8:14-cv-00341-JVS-DFM, at 27: *"To estimate the total number of industry-wide patent families related to user equipment ("UE") (such as handsets) that are essential to the 20, 30, and 4G standards, Dr. Kakaes, Dr. Ding, and teams of engineers from Concur IP, and Ernst & Young India conducted an extensive industry-wide essentiality study." TCL v. Ericsson*, 2017, Case 8:14-cv-00341-JVS-DFM, at 27-28: *"First, the team from Ernst & Young India, supervised by Dr. Kakaes, conducted a census of all IPR declarations submitted to ETSI as of September 2015 for the 2G, 3G, and/or 4G standards. [...] As of September 15, 2015, there were over 153,000 patents and/or patent applications declared essential to the 20, 30, and 40 standards. (Id. ¶ 31.) Dr. Kakaes and Dr. Ding then supervised Concur IP in the industry-wide essentiality study." TCL v. Ericsson*, 2017, Case 8:14-cv-00341-JVS-DFM, at 28: *"Dr. Kakaes then excluded patent families that either had only expired patents, or were not published in English. [...] Dr. Kakaes also excluded patent families that did not have an English language patent." TCL v. Ericsson*, 2017, Case 8:14-cv-00341-JVS-DFM, at 28-29: *"There were 11,469 patent families with at least one patent that is still active (i.e., non-expired) and was published in English. [...] After excluding patent families that did not have any patents with claims directed to user equipment, there were 7,106 patent families remaining. [...] These 7,106 patent families were divided into 2G, 3G, and 4G depending on which standard they were declared essential to, and then sorted by patent holder for the 15 largest patent holders. [...] Concur IP then analyzed the essentiality of a random sample of one-third of the patents in each standard, per patent holder, which totaled 2,600 patent families because some patents are essential to multiple standards. [...] Dr. Ding sampled and checked 442 (or 17%) of Concur IP's essentiality determinations for accuracy. [...] When Dr. Ding was in agreement with Concur IP, he recorded the determination as accurate. [...] When he identified a discrepancy, he and Concur IP reexamined the claims and if Concur IP's original essentiality determination was changed, Dr. Ding recorded the original determination as inaccurate, and noted the direction of the error. [...] The overall error rate for Concur IP was only 9.5o/o. [...] The error rate regarding whether patents were essential went in both directions, and thus the small number of errors largely balanced each other out over the course of the study. [...] Specifically, out of the 442 patent families that Dr. Ding reviewed, 36 out of 305 patent families (or 11.8%) were changed from non-essential to essential, and 6 out of 137 patent families (or 4.4%) were changed from essential to non-essential."*

539 TCL v. Ericsson, 2017, Case 8:14-cv-00341-JVS-DFM, at 30: *"Ericsson made numerous challenges to the process that produced these numbers, although it proposes no alternative numbers. Ericsson challenged the results of this process because: (1) Concur IP team spent an average of 20 minutes and charged only $100 per patent, (2) they did not read the entire patent specifications, (3) the individuals in the Concur IP team lacked the qualifications to perform this work, and (4) Concur IP team knew whom they were working for and against. These criticisms led to Ericsson's ultimate conclusion that patent counting studies are highly subjective and inherently unreliable. The Court disagrees."* TCL v. Ericsson, 2017, Case 8:14-cv-00341-JVS-DFM, at 32: *"Ultimately the Court finds that the flaws are not enough to justify rejecting TCL's experts' calculation of the total number of SEPs entirely. However, the Court does find it appropriate to make certain adjustments to TCL's calculation of the overall number of SEPs. The only cross-check on the total presented by Dr. Ding and Concur IP occurred when they examined the same patents as Dr. Kakaes and Dr. Jayant. Excluding 2 families where the disagreement was not caused by the substantive analysis, Concur IP disagreed with Dr. Kakaes on the essentiality of 12 of the 53 overlapping patent families. [...] These 53 patent families represent 6 2G family/standards pairs, 16 for 3G, and 35 for 4G.21 [...] There were three 4G families that Concur IP said were essential that Dr. Kakaes said were not essential. Giving Ericsson the benefit of the doubt for every dispute between Concur IP and Dr. Kakaes, Concur over-declared 4G patents to be essential four out of thirty-five times, or 11.4%. The Court uses this figure for adjusting the total number of SEPs in each standard downwards. While the Court makes the adjustment because it is warranted, shrinking the denominators favors Ericsson in determining its share of the overall royalty burden."* InterDigital v. Lenovo, Case [2023] EWHC 539 (Pat), [258]: *"To determine the denominator (i.e. the total number of industry-wide patent families relating to handsets which are essential to the 2G, 3G and 4G standards), Judge Selna had evidence from a very extensive essentiality study, supervised by Dr Kakaes. From the study, the total estimated numbers of essential patent families worldwide was: 2G: 446; 3G: 1,166; 4G: 1796. Ericsson challenged the results on the basis that the team spent an average of 20 minutes per patent, did not read the specifications, individuals were not qualified to undertake the work and for possible bias. The Judge refused to accept the process was inherently unreliable but adjusted the total number of SEPs in each standard downwards by 11.4% because, as a result of cross-checks on their conclusions, the team was found to have over-declared to that extent."*

540 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [48], [80].

541 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [286].

542 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [342].

It started from ETSI declarations, limited the analysis to LTE-specific declarations, grouped patents into families, removed duplicates, filtered for live US or EP families, separated handset from infrastructure families, and then applied percentage filters for over-declaration, optional features and non-deployed features.[543] The essentiality filters were based on publicly available studies by Fairfield and Goodman and Myers indicating that 28% of declared SEPs are truly essential. The MNPA differs further from the HPA since the HPA used the same patent-counting technique for numerator and denominator while Unwired Planet's approach used patent counting mainly for the denominator and relied on a more detailed assessment of its own patents for the numerator.[544]

Notably, the court ultimately rejected both methods as stated and instead constructed an adjusted denominator, with the judge holding that both methods produced the wrong answer: the HPA overstated the total pool of relevant SEPs whereas the revised MNPA understated it.[545] The resulting denominator was therefore not simply the output of either party's method, but rather a court-adjusted figure derived from combining two imperfect essentiality-based estimates. The decision thus highlights both the usefulness and the limits of structured essentiality assessments.

The case law further includes various other applications of third-party essentiality studies, but courts have differed in how much weight should be given to these third-party studies. In *InterDigital v. Lenovo*, InterDigital relied on several third-party essentiality studies from PA Consulting. The court acknowledged that PA Consulting was well known in the industry and that its essentiality reports were widely used.[546] However, the court ultimately treated the third-party studies with caution, noting that patent-counting studies may not be a reliable guide to portfolio value.[547]

In *Optis v. Apple*, the High Court expressed a similar concern because it could not audit the third-party data in detail and considered the evidence from PA Consulting and Innography *"patchy and very much second-hand"*.[548] For instance, the court noted that the parties' positions on third-party essentiality studies had shifted during the proceedings: Apple had initially relied on Innography and, as an alternative, PA Consulting, while Optis moved from its own portfolio assessment to PA Consulting data. After Optis moved to PA Consulting data, Apple became more critical of that same data.[549] This shift reinforced the court's concern that the reliability of third-party essentiality assessments might depend on how they are used in the litigation. The court found that PA Consulting's attempt to assess actual essentiality was overly ambitious and judgment-based, and therefore not reliable for determining the stack size or denominator.[550] The court therefore concluded that despite being careful and commercially valuable, PA Consulting's approach to determining the stack size, was not reliable enough for a judicial determination of the denominator.[551]

In contrast, Chinese courts have been more receptive to third-party studies. In *Oppo v. Nokia*, the Chongqing court referred to reports by GreyB, Amplified, PA

543 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [274].

544 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [199], [203], [204], [207].

545 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [374].

546 *Interdigital v. Lenovo*, Case [2023] EWHC 539 (Pat), [826], [827], [828].

547 *Interdigital v. Lenovo*, Case [2023] EWHC 539 (Pat), [836], [885].

548 Optis v. Apple, Case [2023] EWHC 1095 (Ch), [70]: *"All this is unsurprising, given the geometry of the litigation in general and Trial E in particular. However, what was of some concern was the extent to which I could not test the criticisms each party made of the other's data. No-one from either PA Consulting or Innography was called to give evidence, and at best opportunistic attacks were made by each party on the other's data. The evidence that I had on the quality of the PA Consulting and Innography data was patchy and very much second-hand."* See also Optis v. Apple, Case [2023] EWHC 1095 (Ch), [396ii)].

549 *Optis v. Apple*, Case [2023] EWHC 1095 (Ch), [68], [69].

550 *Optis v. Apple*, Case [2023] EWHC 1095 (Ch), [136].

551 *Optis v. Apple*, Case [2023] EWHC 1095 (Ch), [137].

Consulting, IPLytics, Fairfield and Questel, and treated declarations, approved contributions, and essentiality studies as relevant indicators of SEP strength.[552]

With respect to non-3GPP standards, particularly Wi-Fi and multimedia codecs, courts that seek to adopt an essential patent counting approach have to account for both the over-disclosure and under-disclosure of essential patents. There are also two different approaches in the case law in this regard: relying on available third-party studies, and using the population of checked SEPs included in patent pools as a starting point.

The first approach is to rely on third-party studies. Like the studies that compile patents declared to be essential to a 3GPP standard, there are commercial reports that provide counts of patents related to standards such as Wi-Fi or video codecs (AVC, HEVC, etc.). Nevertheless, the objective of these reports differs from the objective of third-party essentiality studies used for 3GPP standards. Whereas many third-party reports regarding 3GPP standards attempt to identify how many of the declared SEPs are actually essential, the purpose of the reports here is to primarily provide an indicative count of all potential SEPs for a standard.

In *In re Innovatio*, the court relied on a PA Consulting report to estimate the number of potentially essential 802.11 patents and then used approximately 3,000 patents as the denominator for the RAND calculation.[553] The court treated that estimate as credible in light of additional evidence, including expert testimony stating that there were at least hundreds or possibly thousands of 802.11 SEPs, along with IEEE letters of assurance, Judge Robart's findings in *Microsoft v. Motorola*, and a separate Sunlight Research report.[554]

552 Oppo v. Nokia, The People's Republic of China Chongqing First Intermediate Court Civil Judgment, English translation, at 69: *"The judgment of (2016) Yue 03 Min Chu No. 840 issued by the Shenzhen Intermediate People's Court of Guangdong Province shows that the number of approved contributions, the number of declarations, and research reports on patent samples' assessment of essentiality, etc., are all important measures to evaluate the SEP strength of each member."* Oppo v. Nokia, The People's Republic of China Chongqing First Intermediate Court Civil Judgment, English translation, at 70: *"GreyB and Amplified released reports showing that as of November 26, 2019, Nokia's 5G core standard essential patent families accounted for 14.6%; PA Consulting released a report showing that as of [REDACTED], Nokia's 5G true essential patent families accounted for [...]; IPLytics released a report in 2021 showing that as of February 1, 2021, Nokia's 5G issued and valid patent families accounted for 13.23%. For the share of valid 5G patents issued by EPO and USPTO, a calculation based on the essentiality rate of 1000 mapping patents shows that Nokia's share of 5G patents is 11.44%."* Oppo v. Nokia, The People's Republic of China Chongqing First Intermediate Court Civil Judgment, English translation, at 70: *"On January 6, 2010, Fairfield International Resources analyzed patent data declared as essential for 3GPP Release 8, showing that as of June 30, 2009, Nokia's 4G true essential patent families accounted for 54.3%; On January 6, 2009, Fairfield International Resources released a report showing that Nokia's 3G true essential patent families accounted for 26.1%; On December 31, 2007, Fairfield International Resources released a report showing that Nokia's 2G true essential patent families accounted for 42.4%;"* Oppo v. Nokia, The People's Republic of China Chongqing First Intermediate Court Civil Judgment, English translation, at 71: *"[...] PA Consulting published a report showing that the percentage of Nokia's true essential FDD patents is [...], PA Consulting published a report showing that the percentage of Nokia's true essential LTE patents is [...], PA Consulting published a report showing that the percentage of Nokia's true essential patents of LTE-advanced version is [...]."* Oppo v. Nokia, The People's Republic of China Chongqing First Intermediate Court Civil Judgment, English translation, at 71: *"Questel conducted an analysis and reported on the true essentiality of the 5G standard essential patents declared by each right holder to ETSI as of [...]. According to the analysis results, the true essential rate of the standard essential patents declared by Nokia is [...]."* Oppo v. Nokia, The People's Republic of China Chongqing First Intermediate Court Civil Judgment, English translation, at 102: *"In this case, based on statistics collected from third-party companies, Plaintiffs calculated the strength of Nokia's 2G-5G patents based on the share of the number of Nokia's patent declarations to the number of all standard essential patent declarations. The comprehensive average shares of Nokia's 2G, 3G, 4G, and 5G standard essential patents are [...]. Plaintiffs also submitted Questel's report regarding the true essentiality of 5G SEPs declared by the patentees to ETSI until [...]. According to the report, the true essential rate of standard essential patents declared by Nokia is [...]."*

553 In re Innovatio IP Ventures, Case 1:11-cv-09308, at 82-83: *"Dr. Leonard suggested that the court use 3000 as a reasonable estimate of the number of 802.11 standard-essential patents to use when determining a RAND rate. To arrive at his number of 3000 standard-essential patents, Dr. Leonard relied primarily on a July 2013 report by the P A Consulting Group, a management consulting firm with a technology division. [...] According to the deposition testimony of Diego Giancola, an employee of P A Consulting Group, the P A Report was developed in response to demand from a number of customers in the industry. [...] Cisco, one of the Manufacturers, inquired through its counsel in this litigation about the report before it was completed, but it does not appear that Cisco itself commissioned the report. [...] In light of the testimony of Dr. Leonard and Mr. Giancola, the court determines that the P A Report is admissible as a market report under FRE 803(17). The P A Report, based on a search of all patents for keywords related to the 802.11 standard and a technical analysis of a portion of the search results, concludes that there are 3106 patents potentially essential to the 802.11 standard. [...] The PA Report stresses, however, that it has not performed a complete legal analysis of the patents, and that its conclusion is only that those patents may be potentially essential."*

554 *In re Innovatio* IP Ventures, Case 1:11-cv-09308, at 83: *"In addition, Innovatio's expert Dr. Nettleton testified that there are "at least hundreds"* of 802.11 standard-essential patents, and he did not disagree with an assertion that there are *"a couple of thousand patents"* covering the 802.11 standard. [...] In addition, Judge Robart found that 92 entities have submitted letters of assurance to the IEEE indicating that they would license their over 350 patents at a RAND rate, and at least another 59 companies have filed blanket letters of assurance covering an undisclosed number of patents. [...] If the court assumes that Innovatio has an average size patent portfolio, and that each of the 59 companies submitting blanket letters of assurance has twenty-three patents like Innovatio, there would be approximately 1700 standard essential patents. That is consistent with Judge Robart's acceptance of Dr. Lynde's testimony in that case that there are possibly *"thousands"* of patents essential to the 802.11 standard. Id. Finally, in this case, Dr. Lynde relied on another report by Sunlight Research and concluded that there are 3,266 patents aside from Innovatio's patents that are potentially essential to the 802.11 standard."

At the same time, the court clearly distinguished potentially essential patents from confirmed essential patents. It accepted the figure from PA Consulting only as an estimate of potentially essential patents and expressly recognised that many of those patents might not be found essential if subjected to judicial analysis. In contrast, Innovatio's own twenty-three patents had been confirmed essential in the court's essentiality hearing. The court therefore treated Innovatio's patents as more valuable than many patents in the broader potential-SEP universe.[555] On that basis, the court used the 3,000-patent denominator but conducted the rest of the analysis with the understanding that many patents in that denominator were likely less valuable than Innovatio's confirmed-essential patents.[556]

In *Wilus v. AsusTek*, the Munich regional court referenced a LexisNexis report on Wi-Fi-6 which states that Huawei is the company with the highest number of Wi-Fi-6-related patents, and each of the six members of the Sisvel Wi-Fi 6 pool is among the 40 companies with the highest number of Wi-Fi 6 patents.[557] The referenced report does not purport to assess essentiality or identify essential patents; rather, it identifies Wi-Fi 6-related patents based on a keyword search.[558] The court did not rely on any specific count from the report, but merely assessed that it can be safely concluded that the patents included in the Sisvel Wi-Fi 6 pool accounted for at least 10% of the total number of Wi-Fi 6 patents since it is not plausible that the Wi-Fi 6 standard encompassed more than 2,450 patent families or more than 20,000 patents.[559] Thus, the pool's rate could be considered FRAND if it did not exceed 10% of a reasonable ARR for Wi-Fi 6.

In other cases, patent pools provide a benchmark for a FRAND royalty rate for a bilateral licence (see Subsection 4.2.1.4.c). In *Microsoft v. Motorola*, the court accepted the MPEG LA pool rate for H.264 as a strong indicator of a RAND royalty rate and used the Via pool as a weaker indication of the FRAND value of Motorola's 802.11 (Wi-Fi) patents.[560] Because participation in both pools (particularly the Via pool) was limited, the court had to estimate what Motorola would receive if all other SEPs were also licensed through these pools. That required adjusting the number of patents included in the pool to also include Motorola's asserted SEPs, Microsoft's asserted SEPs, and other patents that were specifically disclosed as essential to 802.11 or AVC/H.264 under the respective SDOs' disclosure policies.[561] One central limitation of this approach is that the patent count lumps together very different types of patents. The court included essentiality-assessed pool patents, patents from Motorola and Microsoft that were not independently assessed by a third party, and other patents specifically disclosed in IEEE submissions. However, the denominator did not include patents held by firms that had submitted blanket letters of assurance even though some of those firms were major wireless companies and the overall 802.11 SEP universe may have included thousands of patents. As a result, the denominator is subject to both over-disclosure and under-disclosure, but on balance it most likely understates the full SEP universe to a large degree.[562]

Overall, the case law illustrates the significant difficulties that courts encountered when attempting to identify and count the patents that are essential to a standard.

555 *In re Innovatio* IP Ventures, Case 1:11-cv-09308, at 83-84: *"Taking into account all of the evidence and Judge Robart's findings on this question, the court determines that the PA Report's number of approximately 3000 is a credible account of the number of potentially standard-essential patents. Nonetheless, there is no guarantee that all of those approximately 3000 potentially essential patents are in fact essential. Indeed, the court notes that in the Microsoft case, Judge Robart explained that at least one of Motorola's alleged standard-essential patents was found not to be standard-essential by the Via Patent Licensing pool. [...] It is likely that many other allegedly standard essential patents would be found not essential after undergoing a judicial analysis such as the one this court conducted during the July 2013 essentiality hearing to determine that all of the claims in Innovatio's twenty-three patents are standard-essential. Innovatio's confirmed standard-essential patents are by virtue of that confirmation more valuable to the 802.11 standard than many of the potentially essential patents, at least some of which will be found to be not essential."*

556 *In re Innovatio* IP Ventures, Case 1:11-cv-09308, at 84: *"Accordingly, the court will use Dr. Leonard's suggested number of 3000 802.11 standard-essential patents. Nonetheless, the court will conduct the remainder of the analysis cognizant of the fact that many of those 3000 patents are likely less valuable to the standard than Innovatio's patents because their essentiality has not been judicially confirmed."*

557 *Wilus v. AsusTek*, Case 7 O 5007/25, [138].

558 See IPlytics (2020): *"In order to identify patents related to these WiFi 6 technologies, the IPlytics platform database was used to perform an extensive keyword search of patents filed worldwide for both MU-MIMO and OFDMA. The search was based on the patent's content (ie, title, abstracts, description and claims), making use of state-of-the-art stemming and semantic indexing methods."* URL: https://www.lexisnexisip.com/wp-content/uploads/2023/09/IPlytics-Report-Who-is-Leading-the-WiFi-6-Patent-Race.pdf.

559 *Wilus v. AsusTek*, Case 7 O 5007/25, [140].

560 *Microsoft Corp. v. Motorola, Inc.*, Case C10-1823JLR, [559].

561 *Microsoft Corp. v. Motorola, Inc.*, Case C10-1823JLR, [521] and [564].

562 *Microsoft Corp. v. Motorola, Inc.*, Case C10-1823JLR, [573].

Counts of declared essential patents are often over-inclusive or incomplete depending on the standard and SDO. Essentiality checks can improve the informativeness of the count, but they are themselves contested and sensitive to the method used, the depth of review, the treatment of patent families and the distinction between potentially essential and confirmed-essential patents. Courts have thus relied on several imperfect tools, which include litigation-specific essentiality studies, third-party reports, pool data, declarations and judicial findings. Each of these tools is subject to significant limitations, and the correct approach to determining or estimating the number of essential patents continues to be a subject of significant controversy.

5.3.3 Validity

In addition to essentiality, the value of a (declared) SEP depends on its validity. Not every granted patent is valid since the patent office may have granted the patent in error and the patent may be revoked if challenged in court. In principle, the relationship between validity and value is binary: a patent that is invalid should not enter into the FRAND value of a SEP licence, whereas a patent that is valid has a value which depends on the value of the patented invention.[563] However, when licensing a larger portfolio, *"the question of validity inevitably assumes a less hard edged aspect in the sense that the validity or invalidity of each and every patent in the portfolio cannot economically be determined."*[564] Therefore, the licensing value of a patent whose validity is not known with certainty is probabilistic – the value of the patent depends on the likelihood that the patent is valid (in addition to depending on the value of the patented invention).[565]

Courts have taken different views on whether, and how to, reflect the potential invalidity of granted patents in portfolio valuations. On one hand, many courts (and a parties' experts) that have sought to account for the varying *essentiality rates* of declared SEPs have not attempted to similarly account for the share of patents that are valid.[566] When describing the existing approaches to account for over-declaration, Judge Birss in *Unwired Planet v. Huawei* noted that *"[n]otably also no-one tries to take account of validity."*[567] In *InterDigital v. Lenovo*, InterDigital proposed a top-down cross-check based on counts of assessed SEPs, acknowledging that its approach *"assumes that all such patents are equally valid (or that each portfolio has an equal proportion of assessed essential patents which are valid)"*.[568] InterDigital referred to this as a simplification, and asserted that it is *"common ground that it is a virtually universal one for studies of this sort"*.[569]

One potential justification for treating the questions of essentiality and validity differently is that the validity of granted patents has undergone a third-party examination at the patent office, whereas for declared SEPs, the only basis for considering the patent essential is the company's own essentiality declaration. While a significant number of declared SEPs presented in court have been found to be invalid, the existence of third party validity verification provides for an objective basis, and reduces the potential for obvious gamesmanship (whereas SDOs' disclosure processes are prone to opportunistic over-disclosure).

On the other hand, Judge Smith in *Optis v. Apple* found that *"[i]t is unsatisfactory to leave questions of validity out of account. The fact is that an SEP as an individual chose in action is only valuable if it is both valid and essential. A qualitative approach to the Stack and to portions within the Stack only makes sense if both essentiality and validity are factored in."*[570] Judge Smith also rejected the proposition that granted patents should be presumed valid, as *"Intellectual property lawyers the world round know that validity challenges to granted patents are an everyday occurrence; and that such challenges often succeed."*[571] Nevertheless, for Judge

563 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [588]. *"Any declared SEP in a country which is determined by a relevant court to be invalid or not essential would cease to count as a declared SEP."*

564 *Optis v. Apple*, Case [2023] EWHC 1095 (Ch), [16].

565 See Lemley and Shapiro (2005) for a discussion of the economic literature on the probabilistic value of patents.

566 *Microsoft v. Motorola*, *In re Innovatio*, *TCL v. Ericsson,* and *Unwired Planet v. Huawei* are all examples of court decisions in which a court has used estimated counts of SEPs, without attempting to determine the share of these SEPs that are valid.

567 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [201].

568 *Interdigital v. Lenovo*, Case [2023] EWHC 1583, [816].

569 Ibid.

570 *Optis v. Apple*, Case [2023] EWHC 1095, [123].

571 *Optis v. Apple*, Case [2023] EWHC 1095, [136 iii].

Smith, the implications of these arguments was not that it was necessary and appropriate to estimate different companies' validity rates since *"making judgements about levels of validity in the stack is an extremely unsafe thing to do"*;[572] rather, the consequence of not being able to account for the patents' validity was, according to Judge Smith, that any attempt at a qualitative approach to patent portfolio valuation should be abandoned in favour of counting declared SEPs since this is an objective approach not subject to the subjectivities necessarily inherent in essentiality or validity rate assessments.

Other courts have recognised that it may in principle be necessary to account for validity rates in SEP counts. When comparing the value of an asserted patent that has undergone the scrutiny of litigation to a large stack of declared SEPs, it is particularly important to account for the difference that the asserted patent's validity has been corroborated, whereas many patents in the stack may not have undergone similar scrutiny. In *Unwired Planet v. Huawei,* Huawei had initially advocated a patent-by-patent licensing approach whereby *"they were only prepared to take a licence under a patent found by the court to be valid and infringed and were not prepared to take a licence under any other patent."*[573] Unwired Planet's position, with which Judge Birss agreed in principle, was that under such an approach *"the rates should be higher than they would otherwise have been"*, because *"all the comparable licences in issue would have been negotiated on a less stringent basis and therefore the rates would inevitably be reduced somewhat to price in some uncertainty about the issues of validity and infringement/essentiality."*[574] Thus, comparing the number of Unwired Planet's asserted patents (checked for validity and infringement) with the number of patents licensed in comparable licences would understate the value of Unwired Planet's patents, in part because the patent counts from the comparable licences include patents that would not be found valid if challenged. Nevertheless, the court considered that the issue was moot since Huawei abandoned its strict patent-by-patent approach to licensing.

There are also examples in the case law of courts attempting to take into account validity rates when assessing SEP portfolio strength. For example, in *"Huawei v. Samsung, the Shenzhen Intermediate Court assessed patent strength of the parties in evaluating whether the offers are FRAND. The quality indicators adopted by the Court include the number of technical proposals being adopted into LTE standards; the essentiality of declared 3G/UMTS and 4G/LTE SEPs; and the invalidation status of the parties' SEPs-in-suits before the Shenzhen Intermediate Court."*[575]Thus, the court relied on the validity status of the patents-in-suit as an indicator of the quality of the overall portfolio. In *Optis v. Apple*, however, Judge Smith specifically rejected the proposition that *"litigating essentiality and validity in the case of one patent would cast light on the quality of the portfolio as a whole."* [576]

5.3.4 Counting patent applications and expired patents

5.3.4.1 Counting of patent applications

A recurring question in patent-counting exercises is whether to count not only granted patents but also pending applications, and if so, whether to weight them equally to issued patents or to scale them down to reflect that not every application proceeds to grant – and that those that do are often granted more narrowly than filed. The case law diverges on this point.

The most direct authority for counting applications is *Oppo v. Nokia*, wherein the court included applications alongside issued patents and weighted them equally under a large-sample rationale. The court reasoned that the parties' own negotiations and declared-patent lists already encompassed applications, and that the length of the application process means many declared patents will still be pending during the licensing period yet may issue during the term. It concluded that *"it is obviously more reasonable to take the patents applications into consideration."*[577] The court nonetheless left room to adjust this equal-weighting

572 *Optis v. Apple*, Case [2023] EWHC 1095, [136 iii].

573 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [598].

574 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [599].

575 Yiu and Ren (2024), at 7-8.

576 *Optis v. Apple*, Case [2023] EWHC 1095, [211 iii c].

577 *Oppo v. Nokia*, Case Yu 01 Min Chu, at 103: *"[g]iven the lengthy patent application period, many declared 5G patents may be in the application process during the licensing negotiation, but there is the possibility of being granted during the agreement period. Therefore, when evaluating the share of patent strength, it is obviously more reasonable to take the patents applications into consideration."*

assumption when there was sufficient evidence that the declared portfolio's quality departed materially from the industry average.

Conversely, several courts and the studies they relied upon have tended to filter toward issued patents rather than counting applications at full weight. In *Microsoft v. Motorola*, the IEEE framework expressly extended to pending applications, and the court noted that *"approximately 92 companies have identified – in LOAs – over 350 patents and 30 patent applications as essential to the 802.11 Standard;"*[578] however, its rate calculation counted disclosed issued SEPs on a country-weighted basis, treating the broader realm of undisclosed patents and applications as a reason its figure was conservative, rather than scaling applications directly into the denominator. The essentiality study in *TCL v. Ericsson* operated similarly: although the initial census lumped together *"over 153,000 patents and/or patent applications declared essential to the 2G, 3G, and 4G standards,"*[579] the operative analysis filtered down to families with *"at least one patent that is still active (i.e., non-expired) and was published in English,"*[580] without separately addressing whether application-only families should be counted, weighted or scaled. The same filtering instinct appears in *Unwired Planet v. Huawei,* in which both competing counting methods narrowed the count toward granted patents. Unwired Planet's method retained only "Live" families, a step that "*removes patents and applications that have been abandoned or expired and filters out families which do not have a pending or issued US or EP patent,"*[581] while Huawei's method reserved analysis for families with at least one issued patent and set aside families with *"no issued patents ('issued' means granted)."*[582]

A related strand of reasoning bears on whether applications, even when counted, warrant the same weight as granted patents, mainly since applications have not been examined. In *Optis v. Apple*, the court noted that scrutiny *"cannot be said of patent applications, where no scrutiny is received,"*[583] thus distinguishing them from granted patents that have passed through examination. The point connects to a broader observation in *Unwired Planet v. Huawei,* wherein the court remarked that, among the adjustments the parties made to account for over-declaration, *"[n]otably also no-one tries to take account of validity."*[584] Both observations address the same underlying concern – that not every counted asset is equally likely to be valid or to issue – though neither court translated the concern into a rule requiring applications to be scaled down.

5.3.4.2 Counting expired patents

There is broad agreement that expired patents should not be counted in the numerator because a portfolio's strength falls when its patents lapse or are invalidated and a licensor cannot demand prospective value for protection that no longer exists. The more particular question – whether expired patents should also be removed from the denominator – has received its clearest treatment in *TCL v. Ericsson*, which held that expirations should reduce the numerator only.

The court grounded the exclusion from the numerator in domestic patent law, observing that *"United States patent*

578 *Microsoft v. Motorola*, Case C10-1823JLR, [335]: *"Since 1994, approximately 92 companies have identified—in LOAs—over 350 patents and 30 patent applications as essential to the 802.11 Standard... Companies may also provide "blanket"* LOASs to the IEEE, which do not identify specific patents... As stated previously, through 'blanket' LOAs, SEP holders commit to license unspecified patents or pending applications for a particular standard."

579 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 27-28: "To estimate the total number of industry-wide patent families related to user equipment ('UE') (such as handsets) that are essential to the 2G, 3G and 4G standards, Dr. Kakaes, Dr. Ding, and teams of engineers from Concur IP, and Ernst & Young India conducted an extensive industry-wide essentiality study.

First, the team from Ernst & Young India, supervised by Dr. Kakaes, conducted a census of all IPR declarations submitted to ETSI as of September 2015 for the 2G, 3G, and/or 4G standards... As of September 15, 2015, there were over 153,000 patents and/or patent applications declared essential to the 2G, 3G, and 4G standards."

580 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 28-29.

581 *Unwired Planet v. Huawei,* Case EWHC 711, [274 (4)].

582 *Unwired Planet v. Huawei,* Case EWHC 711, [286 (3)]: *"[t]he patents and applications were collected into families. The families were collected into five groups. Only group 1 was selected for further analysis. The five groups were: Group 1 – at least one issued and non-expired patent and an English or Chinese language member; Group 2 – at least one issued and non-expired patent but no English or Chinese language member; Group 3 – only expired members Group 4 – no issued patents ('issued' means granted) Group 5 – family information not available on INPADOC."*

583 *Optis v. Apple*, Case EWHC 1095, [164 n. 219].

584 *Unwired Planet v. Huawei,* Case EWHC 711, [201].

law does not permit Ericsson to demand value for patents that have expired,"[585] and that since FRAND operates as an encumbrance on top of national patent systems, *"SEPs that expire before a licence begins therefore have no bearing on a fair and reasonable prospective royalty rate."*[586] Regarding the asymmetric treatment of the two sides of the ratio, the court reasoned that the aggregate royalty already reflects the value of every invention in the standard, so the denominator must continue to include expired patents. It explained that *"expirations should only modify the numerator,"*[587] because *"[t]he invention however still has value, that value has merely been transferred to the public domain,"*[588] and that *"[t]o remove expired patents from the denominator (without decreasing the total aggregate royalty) would result in transferring the value from expired inventions to the remaining patents in the standard instead of the public."*[589] This asymmetry is reflected in the court's formula, which sets a *"[n]umber of unexpired SEPs owned by Licensor" over the "[t]otal [n]umber of SEPs in the [s]tandard."*[590] Consistent with that logic, the court treated the exclusion of expired families from the denominator-side sample as an error, even while noting it happened to favour the licensor.[591] For patents expiring during the licence term, the court did not exclude them outright but pro-rated them by months of validity, dividing each patent's months of remaining life *"by 60 to represent the effective number of unexpired SEPs Ericsson will own throughout the licence."*[592]

Other counting exercises have handled expiry differently by removing expired patents from both sides of the count rather than only the numerator. In *Unwired Planet v. Huawei,* the "Live" filter stripped expired patents from one method, and the other placed families with *"only expired members"*[593] outside the set selected for analysis so that expired patents fell out of both numerator and denominator. This was a feature of how the counting methods were built rather than a reasoned position on which side of the ratio expirations should affect.

5.3.5 Indicators of patent value

Patent importance is a separate question from essentiality and validity. Even if patents are valid and essential, they do not necessarily contribute the same value to the standard or to the licensed product. Courts and experts have thus considered different indicators of importance, including forward citations, patent family size, timing within the standard-development process, and technical evaluations. None of these indicators is conclusive, but each can provide information about a different aspect of patent value.

Forward citations are one possible indicator of patent importance, which is widely used in the academic literature, but courts have treated them cautiously in SEP cases. In *TCL v. Ericsson*, Dr Leonard used a forward-citation analysis as a cross-check based on the idea that more important patents

585 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 35-36: *"Both sides argued over the essentiality of patents that expired before any license would begin... United States patent law does not permit Ericsson to demand value for patents that have expired... Because the FRAND undertaking is an encumbrance and commitment that exists on top of national patent systems, FRAND cannot permit what domestic patent law prohibits... SEPs that expire before a license begins therefore have no bearing on a fair and reasonable prospective royalty rate... Unlike other adjustments which should generally affect both the numerator and the denominator of the proportional share, expirations should only modify the numerator. Because the total aggregate royalty represents the value of all expired and unexpired inventions in the standard, also removing an expired SEP from the denominator treats the invention as no longer having value. The invention however still has value, that value has merely been transferred to the public domain. To remove expired patents from the denominator (without decreasing the total aggregate royalty) would result in transferring the value from expired inventions to the remaining patents in the standard instead of the public. By removing expired SEPs from only the numerator of the top down formula the Court therefore apportions their value from the still patented features of the standard."*

586 Ibid.

587 Ibid.

588 Ibid.

589 Ibid.

590 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 46: *"The basic formula to calculate a top down royalty rate using a simple patent count is: Ericsson's Royalty Rate = Total Aggregate Royalty × (Number of unexpired SEPs owned by Licensor / Total Number of SEPs in the Standard) × Regional Strength Ratio."*

591 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 28: *"Dr. Kakaes then excluded patent families that either had only expired patents, or were not published in English... Dr. Kakaes did not provide an explanation for excluding expired patent families. For reasons discussed in the next section, this was an error. Nonetheless, it is an error which favors Ericsson, and it may have been necessary to conduct a feasible study."*

592 *TCL v. Ericsson*, Case 8:14-cv-00341-JVS-DFM, at 37: "After determining the total number of months of validity for each of Ericsson's SEPs in each standard, the Court divides that number by 60 to represent the effective number of unexpired SEPs Ericsson will own throughout the license."

593 *Unwired Planet v. Huawei,* Case EWHC 711, [286 (3)].

are more likely to be cited by later patent applications.[594] However, the court was not persuaded that the analysis provided a meaningful way to value SEPs, in part because its results contradicted the technical importance analysis and because the incentives to cite prior art may differ in the standards context.[595] In *Realtek v. LSI,* an expert opinion using patent citation counts to evaluate SEPs was excluded since the expert had used the portfolio average citation counts rather than the citations received by the patents-in-suit that were relevant for the determination of patent damages.[596] In *Huawei v. Samsung, "[t]he Shenzhen Intermediate Court rejected the patent forward citation analysis by Samsung's economic expert as a quality indicator because the court must comprehensively evaluate the strength of the parties' global portfolio, while the expert only relied on US patents to evaluate the strength of the parties' SEPs, which was not comprehensive or objective."*[597]

Outside the SEP-specific FRAND litigation, patent citations analysis has been proposed as a possible indication of patent value in a number of cases (see Malaspina, 2019, for a review).[598] In a number of cases, expert opinions relying on forward-citation analysis were excluded because of specific flaws such as failing to include citation counts to the predecessor patents of a re-issued patent[599] or failing to address self-citation issues.[600] In at least two other cases, however, expert opinions that relied on patent citation analyses for patent valuation in damages cases were found to be admissible.[601] One court noted that *"the forward citation method of analysis has been recognized in the academic literature as reliable since the 1990s. [...] In short, courts have not rejected forward citation analysis outright."*[602]

Patent family size is another indicator of patent importance because it can reflect both the geographic scope of protection and the private value attributed to the invention by the patent owner. A patent family with members in several major jurisdictions may protect a larger market, show that the owner was willing to incur higher filing and prosecution costs, and be considered more robust because the family members have been examined by several patent offices.[603] The literature generally finds a positive relationship between patent value and the number of jurisdictions in which protection is sought, and this is

594 *TCL v. Ericsson*, 2017, Case 8:14-cv-00341-JVS-DFM, at 16: *"Dr. Leonard then confirmed his view on the value of Ericsson's patents with a forward-citation analysis, which attempts to determine the value of U.S. patents based on the frequency with which they are cited in later patent applications."*
TCL v. Ericsson, 2017, Case 8:14-cv-00341-JVS-DFM, at 40: *"As a cross-check on his results, Dr. Leonard confirmed his results using a forward citation analysis, which attempted to determine the strength of patents by examining how often they are cited in future patent applications. (Leonard Decl. 11102, 109-117, Table 7.) The economic logic behind using forward citations as an indicator of patent value is that a patent that is more important and valuable would be expected to generate a greater number of future innovations that then cite back to the patent in question. (gl ¶ 102) Dr. Leonard argued that the positive relationship between forward citations and patent value has been confirmed by some empirical economics research. (Leonard Decl. ¶ 102; ~' Ex. 1104 at 1-20.) The results of the forward citation analysis demonstrate that Ericsson owns a 4.0% value share of U.S. 4G patents, a 5.7% value share of U.S. 3G patents, and an 8. 1 % value share of 2G patents (Leonard Decl. ¶ 116, Table 7.)."*

595 *TCL v. Ericsson*, 2017, Case 8:14-cv-00341-JVS-DFM, at 42-43: *"Similarly, the Court is not persuaded by Dr. Leonard's forward citation analysis, which he used as a check on the importance and contribution analysis. [...] Its results generally contradicted the importance and contribution analysis done by Dr. Kakaes, and the Court is not convinced on this record that it provides a meaningful way to value SEPs. [...] It does not appear that any other court or company has used a forward citation analysis for such a task, and it is unclear whether companies would have the same incentives to cite to potential prior art, particularly in the context of multiple standards. In addition, while ignoring self-citations reduces the risk of gaming the system, it would also appear to ignore the possibility that one patent owner would naturally cite to itself because it has been the leader in developing a particular technical area. Because the Court has found fatal flaws with certain steps in TCL's top down approach, it does not accept Dr. Leonard's final numbers. However, the Court does find some value in the technical analysis, particularly to show that Ericsson's patent portfolio is certainly not as strong or essential as it has claimed. The Court uses this finding in part to assist it in determining the final FRAND rate."*

596 *Realtek v. LSI*, Case C-12-03451, at 6-8.

597 Yiu and Ren (2024), p. 8.

598 Malaspina, P. A. (2019). Patent citation analysis and patent damages. Chi.-Kent J. Intell. Prop., 18, 232.

599 *Oracle Am., Inc. v. Google Inc*, No. C 10-03561 WHA, 2012 WL 877125, at *1 (N.D. Cal. Mar. 15, 2012). See Malaspina (2019), at 236.

600 Sidak, J. G. and Skog, J. O. (2017), Hedonic prices and patent royalties: *"At least one court has excluded an expert witness's forward-citation analysis, in part, for failing to account for self-citations. In Finjan, Inc. v. Blue Coat Systems, Inc., Judge Beth Freeman of the Northern District of California observed that "a patent's objective quality cannot be based on the number of times an inventor cites himself in prosecuting related patents."* No. 13-cv-03999, 2015 WL 4272870, at *8 (N Sidak, J. G., Skog, J. O. 2017. Hedonic prices and patent royalties. D. Cal. July 14, 2015) (excluding the expert testimony of Anne Layne-Farrar)."

601 *Better Mouse Co., LLC v. Steelseries ApS*, et al., No. 2:14-CV-198-RSP, 2016 WL 115686, (E.D. Tex. Jan. 9, 2016); *Comcast Cable Commc'ns LLC v. Sprint Commc'ns Co. L.P.,* 218 F. Supp. 3d 375, 379 (E.D. Pa. 2016). From Malaspina, P. A. (2019), at 239-241.

602 *Comcast Cable Commc'ns LLC v. Sprint Commc'ns Co. L.P.,* 218 F. Supp. 3d 375, 379 (E.D. Pa. 2016), at 383. From Malaspina (2019), at 240.

603 As de Rassenfosse et al. (2019, at 3) explain, *"a refusal by an examiner in one jurisdiction raises doubts as to the legitimacy of any patent grant secured elsewhere."*

also reflected in indicators such as triadic or transnational patent families.[604] In *Huawei v. Samsung*, the US District Court for the Northern District of California declined to exclude an expert opinion that used *"Global Deemed SEPs"* (families with issued members in the US, Europe, and China) as an indicator of relative portfolio value, reasoning *"that a company's share of Global Deemed SEP Families is more indicative of its relative portfolio strength when assessing a global license than its share of declared SEP families and/or deemed SEP families with issued members in any one jurisdiction anywhere in the world would be."*[605]

The timing of a patent can also be used as an indicator (or proxy) of importance. In *Unwired Planet v. Huawei,* Unwired Planet's MNPA distinguished between "Core" LTE and later LTE patents using a pre-2009 priority-date cut-off.[606] The court accepted the general point that LTE Release 8 was the first and fundamental LTE release and that FRAND negotiators would take this into account.[607] However, the court also held that a method giving no value to later releases would become flawed once those releases existed and were licensed.[608] The court therefore recognised the difficulty: including all later-release patents may overstate their value, whereas excluding them entirely may understate it.[609] Timing can therefore help distinguish foundational technology from later improvements, but it cannot fully measure patent importance once standards evolve and later features become commercially relevant.

Technical evaluation is the most direct way to assess patent importance, but it is also costly and difficult to generalise across large SEP portfolios. In *In re Innovatio,* the court stated that RAND analysis should consider both the proportion of SEPs held by the portfolio and the portfolio's technical contribution to the standard.[610] The court also made clear that value cannot be determined by numbers alone: owning 10 out of 100 SEPs does not automatically mean that the portfolio contributes 10% of the standard's value.[611] Based on its technical assessment, the court found Innovatio's patents to be of moderate to

604 Dechezleprêtre et al. (2017) summarize this literature as follows: *"Putnam (1996), Harhoff et al. (2003) and van Pottelsberghe and van Zeebroeck (2008) find a positive correlation between patent value and the number of countries in which patent protection is sought for the same invention. Patent families are also at the origin of simpler indicators. Triadic families (e.g. families including patents applied for at JPO, USPTO and EPO patent offices) are probably the most common one (Guellec and van Pottelsberghe de la Potterie 2004; Dernis and Kahn 2004; Aghion et al. 2016). Other indicators require patent families to include at least two triadic offices (Henderson and Cockburn 1996; Grupp 1998) or more than one patent office (Dechezleprêtre et al. 2011). Frietsch and Schmoch (2010) propose a measure called "transnational patents".* It includes all patent families with at least a PCT application (see below) or an EPO application. The rationale behind these measures is that a patent should be more valuable if the cost associated to multiple filings has been born to acquire the protection in a large number of countries."

605 Huawei v. Samsung, Order on Motions for Summary Judgment, Daubert Motions, Motions to Strike and Exclude, at 74.

606 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [274]: *"The MNPA was devised by Unwired Planet as a technique to use in licensing negotiations. It is applied to 4G/LTE and in the original method consisted of the following steps: [...] Separating out what Unwired Planet called "Core"* LTE. Here the word core connoted importance. It is not drawing the distinction drawn elsewhere between different kinds of infrastructure (RAN and Core network). Core in this sense is identified using a simple pre-2009 cut off. Any patent with a priority date after 31st December 2008 was non-Core."

607 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [309], [319].

608 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [320], [321].

609 *Unwired Planet v. Huawei,* Case [2017] EWHC 711 (Pat), [322]: *"There are a limited number of ways in which one can deal with this. Unless one is going to make a list of Releases 9 to 11 features and identify each patent relevant to that feature, which would be impractical, the only alternatives are broad brush. One can include all patents knowing that this overstates the value of post-2009 patents, which is the HPA method, or exclude them all knowing this understates the same value, which is the MNPA. The 80:20 approach by Unwired Planet is an attempt to mitigate this problem, among others, because it gives some value for patents put to one side by the pre-2009 cut-off. In that sense the intention behind the 80:20 approach is sensible but I am concerned that it is so crude as to be arbitrary."*

610 *In re Innovatio* IP Ventures, Case 1:11-cv-09308, at 10: *"First, a court should consider the importance of the patent portfolio to the standard, considering both the proportion of all patents essential to the standard that are in the portfolio, and also the technical contribution of the patent portfolio as a whole to the standard." In re Innovatio* IP Ventures, Case 1:11-cv-09308, at 17: *"The court's analysis of the technical value of Innovatio's patents to the 802.11 standard will therefore take into account the ease of those patents' integration into the standard as a whole."*

611 *In re Innovatio* IP Ventures, Case 1:11-cv-09308, at 18: *"Imagine, for example, that the court has determined that a given patent portfolio provides 25% of the functionality of a standard, and that the court is considering a proposed RAND rate based on that determination. Logically, the other standard-essential patents outside of the portfolio should comprise 7 5% of the value of the standard, or three times the value of the asserted portfolio. If an independent evaluation of the technical merit of those other standard-essential patents would suggest a value greater than three times the royalty for the asserted patent portfolio, however, it would suggest that the court has overvalued the asserted portfolio." In re Innovatio* IP Ventures, Case 1:11-cv-09308, at 18-19: *"In making this determination, the court notes that it is not appropriate to determine the value of the non-asserted standard-essential patents based merely on numbers. If a patent holder owns ten out of a hundred patents essential to a given standard, it does not automatically mean that it contributes 10% of the value of the standard. [...] As a practical matter, therefore, this analysis will necessarily be imprecise, as the court cannot undertake a full technical evaluation of the hundreds or thousands of patents that sometimes comprise a standard."*

moderately high importance and treated them as falling within the top 10% of 802.11 SEPs.[612]

Technical evaluation also played an important role in *TCL v. Ericsson*. The court recognised that even within the realm of SEPs, some patents are relatively trivial while others cover key features of the standard.[613] TCL's experts therefore ranked Ericsson's SEPs by importance and considered factors such as the incremental improvement over prior solutions, the impact of removing the feature from the standard, whether the technology was optional, and how widely it was deployed.[614] The court criticised parts of the scoring exercise, especially the distinction between moderate and marginal contributions, but it still found some value in the technical analysis because it helped show that Ericsson's portfolio was not as strong as Ericsson had claimed.[615]

Microsoft v. Motorola similarly illustrates that technical importance can affect RAND valuation even when a patent is essential. The court stated that a RAND royalty must value the patented technology itself, including the patent's importance and contribution to the standard, and that the incremental contribution may depend on available alternatives.[616] The court then assessed the technical contribution of Motorola's H.264 and 802.11 patents. They found several H.264 families technically valuable because they related to core features of the standard, but they treated the 802.11 patents used by Microsoft as only providing a very limited technical contribution.[617] The decision also illustrates that the Via Licensing 802.11 pool

612 *In re Innovatio* IP Ventures, Case 1:11-cv-09308, at 84-85: *"The court is now ready to calculate using Dr. Leonard's Top Down analysis. Dr. Leonard provided three calculations for the court's consideration, depending on whether the court determined that Innovatio's patents were in the top 50% of the 3000 802.11 patents, in the top 20%, or in the top 10%. Specifically, Dr. Leonard adjusted the value attributable to Innovatio's patents in each of those cases by relying on a 1998 article finding that the top 10% of all electronics patents account for 84% of the value in all electronics patents. (See DTX-192, Mark Schankerman, How Valuable is Patent Protection? Estimates By Technology Field, 29 RAND J. ECON. 77, 94 tbl.5 & n.12 (1998).) For example, for the top 10% hypothesis, Dr. Leonard multiplied the profit margin on a Wi-Fi chip by 84% to determine the percent of that value attributable to the top 10% ofall802.11 standard-essential patents. (See DDX-5, at 43.) He then multiplied that value by 23/300 (Innovatio's patents divided by 10% of all 802.11 standard-essential patents) to determine Innovatio's share of the value in the top 10% of 802.11 standard-essential patents." In re Innovatio* IP Ventures, Case 1:11-cv-09308, at 85: *"As described above, the court has found that Innovatio's patents are all of moderate to moderate-high importance to the standard, meaning that they provide significant value to the standard. Because 84% of the value in electronics patents is found in the top 10% of electronics patents, the court can conclude that any patents providing significant value are likely among the top 10% of all patents essential to the 802.11 standard. Moreover, a large percentage of the 3000 standard-essential patents are less valuable to the standard than Innovatio's patents because they have not had their essentiality confirmed, further indicating that Innovatio's patents are in the top 10%. The court therefore finds that Innovatio's patents are in the top 10% of all 802.11 standard-essential patents."*

613 *TCL v. Ericsson*, 2017, Case 8:14-cv-00341-JVS-DFM, at 38: *"The rationale for evaluating the importance of SEPs is that even in the universe of standard essential patents, many are relatively trivial, while some are key features of the standard. TCL ranked Ericsson's SEPs on a scale from 1-3, with a I for patents that were important or technically valuable, 2 for patents that were moderately important, and 3 for patents that were only marginally important."*

614 *TCL v. Ericsson*, 2017, Case 8:14-cv-00341-JVS-DFM, at 39: *"The importance analysis began by identifying the sections of the 2G, 3G, or 4G standards cited in Ericsson's claim chart. [...] Key claim limitations of Ericsson's patents were then determined by considering what the patent described as the heart of the invention, or by reviewing the arguments and amendments the applicant used to overcome prior art, and/or the reasons identified by the patent office as the patentable subject matter. [...] Once these key claim limitations were identified, the corresponding features of the standards cited in Ericsson's claim charts were identified." TCL v. Ericsson*, 2017, Case 8:14-cv-00341-JVS-DFM, at 39: *"The overall value of the key features to the standard were then analyzed by considering the following factors: (a) a prior technical solution (if any) that was in the standard prior to the adoption of the key feature, and if so, the incremental improvement (or technical value) of the key feature over the prior technical solution; (b) the incremental improvement of the key feature over other well-known prior art, including technology identified in the background section of the patent, or prior related standards; (c) the impact of removing the key feature from the standard in terms of performance degradation and implementation cost; (d) whether the accused technology is optional to the standard; and (e) how widely the accused technology/key accused feature is deployed in major markets."*

615 *TCL v. Ericsson*, 2017, Case 8:14-cv-00341-JVS-DFM, at 42: *"Dr. Leonard assumed that any patent which received a contribution score of 1 or 2 was in the top 10% of patents in the standard that provided 65% of the value in the standard, while a patent that received contribution score of 3 or 4 was in the bottom 90% of patents that provided 35% of the value of the standard. [...] As it turned out, the importance scores had no impact on Dr. Leonard's estimate of their value. 27 The critical distinction between a contribution score of 2 or 3 was whether its contribution was moderate, or marginal. [...] Neither Dr. Kakaes nor Dr. Jayant provided a meaningful explanation on the difference between a moderate or marginal improvement, and it is not clear that this score can be used for determining whether a patent a top 10°/o or bottom 90% SEP. [...] Dr. Leonard drew his top 10%:65% ratio from a paper by Dr. Jonathan Putnam, who found that across various industries the top I 0% of patents contained 65% of the value in the industry. [...] The Court is not persuaded Putnam's findings are applicable to telecommunications SEPs. Dr. Leonard also did not explain why a different skew was appropriate here compared to Innovatio, where he testified based on a different paper that the top 10% of Wi-Fi SEPs provided 84o/o of the value."*

TCL v. Ericsson, 2017, Case 8:14-cv-00341-JVS-DFM, at 43: *"[...] the Court does find some value in the technical analysis, particularly to show that Ericsson's patent portfolio is certainly not as strong or essential as it has claimed. The Court uses this finding in part to assist it in determining the final FRAND rate."*

616 *Microsoft Corp. v. Motorola, Inc.*, Case C10-1823JLR, [80]: *"a reasonable royalty rate for an SEP committed to a RAND obligation must value the patented technology itself, which necessarily requires considering the importance and contribution of the patent to the standard. [...] the actual value provided by the patented technology is its incremental contribution."*

617 *Microsoft Corp. v. Motorola, Inc.*, Case C10-1823JLR, [168], [177], [188], [202], [217], [225], [237], [243], [256], [353], [358], [373], [379], [390], [400], [575].

did not distinguish patents by technical merit but allocated the same royalty to all patents in the pool.[618]

However, even when courts can identify technical importance, they still need to decide how much more valuable an important patent is than a less important one. Courts have sometimes used patent-value skewness studies to address this issue. In *In re Innovatio*, Dr Leonard relied on Schankerman's finding that the top 10% of electronics patents accounted for 84% of the value of all electronics patents, and the court used that framework after finding Innovatio's patents to be of moderate to moderately high importance.[619] In *TCL v. Ericsson*, Dr Leonard used a different skewness assumption based on Putnam's work that treated the top 10% of patents as accounting for 65% of the standard's value. The court was not persuaded that this assumption applied to telecommunications SEPs and criticised the lack of explanation for why this different skew was more appropriate here than in Innovatio.[620] These cases show that skewness analysis may help avoid treating all patents as equally valuable, but it does not solve the weighting problem, so courts have generally been cautious toward such approaches.

Extant literature also highlights that older skewness studies should be treated cautiously. For instance, Sidak accepts the general point that SEP value may be skewed, but cautions that courts should not place too much weight on dated studies that do not focus on SEPs or on the specific standard at issue. Instead, courts should rely on more recent data that are specific to SEPs and to the standard being valued.[621]

Overall, valid and essential patents are not necessarily equally valuable, and measuring their relative importance remains difficult. Forward citations, family size, timing and technical evaluation each capture a different aspect of patent importance, and none provides a complete measure on its own. Citations may indicate technological influence, but they have not been accepted as an SEP valuation tool in extant case law. Family size may reflect geographic scope, prosecution investment and private value, but it might be affected by patent office practice and filing incentives. Timing may help identify foundational contributions, but it might undervalue later standard releases. Technical evaluation comes closest to assessing the substance of the invention, but it is difficult to apply across large portfolios, and it still requires a weighting rule that considers the typically skewed value distribution across patents. The assessment of patent importance therefore remains case-specific and imperfect, with no closed list of criteria for determining what makes one SEP more valuable than another.

618 *Microsoft Corp. v. Motorola, Inc.*, Case C10-1823JLR, [556]: *"Namely, the Via Licensing 802.11 pool does not distinguish between patents in the pool on the basis of technical merit, but rather gives the exact same royalty to all patents in the pool."*

619 In re Innovatio IP Ventures, Case 1:11-cv-09308, at 84-85: *"The court is now ready to calculate using Dr. Leonard's Top Down analysis. Dr. Leonard provided three calculations for the court's consideration, depending on whether the court determined that Innovatio's patents were in the top 50% of the 3000 802.11 patents, in the top 20%, or in the top 10%. Specifically, Dr. Leonard adjusted the value attributable to Innovatio's patents in each of those cases by relying on a 1998 article finding that the top 10% of all electronics patents account for 84% of the value in all electronics patents. (See DTX-192, Mark Schankerman, How Valuable is Patent Protection? Estimates By Technology Field, 29 RAND J. ECON. 77, 94 tbl.5 & n.12 (1998).) For example, for the top 10% hypothesis, Dr. Leonard multiplied the profit margin on a Wi-Fi chip by 84% to determine the percent of that value attributable to the top 10% ofall802.11 standard-essential patents. (See DDX-5, at 43.) He then multiplied that value by 23/300 (Innovatio's patents divided by 10% of all 802.11 standard-essential patents) to determine Innovatio's share of the value in the top 10% of 802.11 standard-essential patents."* In re Innovatio IP Ventures, case 1:11-cv-09308, at 85: *"As described above, the court has found that Innovatio's patents are all of moderate to moderate-high importance to the standard, meaning that they provide significant value to the standard. Because 84% of the value in electronics patents is found in the top 10% of electronics patents, the court can conclude that any patents providing significant value are likely among the top 10% of all patents essential to the 802.11 standard. Moreover, a large percentage of the 3000 standard-essential patents are less valuable to the standard than Innovatio's patents because they have not had their essentiality confirmed, further indicating that Innovatio's patents are in the top 10%. The court therefore finds that Innovatio's patents are in the top 10% of all 802.11 standard-essential patents."*

620 *TCL v. Ericsson*, 2017, case 8:14-cv-00341-JVS-DFM, at 42: *"Dr. Leonard assumed that any patent which received a contribution score of 1 or 2 was in the top 10% of patents in the standard that provided 65% of the value in the standard, while a patent that received contribution score of 3 or 4 was in the bottom 90% of patents that provided 35% of the value of the standard. [...] As it turned out, the importance scores had no impact on Dr. Leonard's estimate of their value. 27 The critical distinction between a contribution score of 2 or 3 was whether its contribution was moderate, or marginal. [...] Neither Dr. Kakaes nor Dr. Jayant provided a meaningful explanation on the difference between a moderate or marginal improvement, and it is not clear that this score can be used for determining whether a patent a top 10°/o or bottom 90% SEP. [...] Dr. Leonard drew his top 10%:65% ratio from a paper by Dr. Jonathan Putnam, who found that across various industries the top I 0% of patents contained 65% of the value in the industry. [...] The Court is not persuaded Putnam's findings are applicable to telecommunications SEPs. Dr. Leonard also did not explain why a different skew was appropriate here compared to Innovatio, where he testified based on a different paper that the top 10% of Wi-Fi SEPs provided 84o/o of the value."*

621 Sidak, 2013, at 1020: *"In short, Judge Holderman based his analysis on the correct conceptual proposition—that the distribution of value of SEPs for a given standard is skewed, such that the top ten percent of SEPs contributes greater value to the standard than the bottom ten percent. Although Schankerman provided a robust methodology for his intended purposes, courts should not put too much weight on Schankerman's now-dated analysis, which does not focus specifically on the value of SEPs. Rather, courts should use recent data that are specific to SEPs for the standard at issue."*

5.4 Conclusions

Patent data plays a pervasive role across both main FRAND methodologies, not only in the top-down approach. Patent portfolio strength assessments arise in at least four distinct contexts: apportionment under the top-down approach; scaling between the portfolio covered by a comparable licence and the portfolio at issue; unpacking of cross-licences into two unilateral rates using portfolio strength ratios (PSRs); and adjustments to reflect changes in relative portfolio strength over time. These use cases cut across the comparable-licences and top-down methods and share common methodological challenges.

Contribution counting has been widely rejected by courts, although it has not been entirely excluded. Several courts – including those in *TCL v. Ericsson*, *Unwired Planet v. Huawei, FTC v. Qualcomm*, and *Oppo v. Nokia* – have identified three fundamental limitations of contribution counting: the heterogeneity of contributions, many of which are of minor significance; the absence of a demonstrated link between contributions and actual patent ownership; and the inability of contribution counts to track portfolio changes from transfers, expirations or acquisitions. In contrast, patent counts are favoured because they track actual legal rights. Chinese courts have accepted contribution counts as one among several quality indicators, and one US court in *Huawei v. Samsung* (N.D. Cal.) declined to exclude a contribution-based expert opinion in which the expert blended the measure with an essentiality study and addressed the limitations identified in *TCL v. Ericsson*.

Patent counting is widely used in practice but is recognised by courts as an imperfect proxy. Courts across jurisdictions have acknowledged that FRAND rates should reflect the value of patents rather than their mere number, but they have equally recognised that evaluating individual patents within a large portfolio is disproportionately burdensome. Some form of patent counting appears in the vast majority of surveyed decisions. Courts have consistently warned, however, that *"mere patent counting and dividing is not enough."*[622] Case law reflects a spectrum of approaches, from purely quantitative declared-patent counts and exercises incorporating essentiality screening, to validity adjustments, family deduplication and technical evaluation.

Essentiality screening improves the reliability of patent counts but remains contested. For 3GPP-related standards, over-declaration is a well-documented problem, and empirical studies suggest true essentiality rates of around 20–30% of declared patents. Courts have relied on essentiality studies – whether bespoke litigation-specific studies or third-party assessments – to refine declared counts, but such studies vary substantially in methodology, scope and results. For non-3GPP standards such as Wi-Fi and video codecs, blanket disclosure policies mean that declared counts may substantially under-represent the true universe of essential patents.

Validity is theoretically relevant but largely unaddressed in current patent-counting practice. The vast majority of decisions that adjust for essentiality make no corresponding adjustment for validity, treating it as a uniform factor that cancels out across portfolios or as a simplifying assumption. Only a minority of decisions – notably *Optis v. Apple* – have substantively addressed the validity dimension of patent value. Even when courts acknowledged the concern, they generally stopped short of requiring validity adjustments, citing the difficulty of estimating portfolio-level validity rates reliably.

622 *GBT v. Apple*, case No. 5:12-cv-04882-PSG, at 13-14, referencing *Microsoft Corp. v. Motorola, Inc.*, Case No, 10-cv-1823-JLR, 2013 WL 2111217, at *80 (W.D. Wash. Apr. 25, 2013); *In re Innovatio IP Ventures*, LLC Patent Litig., MDL 2303, 2013 WL 5593609, at *39 (N.D. Ill. Oct. 3, 2013).; and citing directly from Uniloc, 632 F.3d at 1315.

The treatment of pending applications and expired patents remains inconsistent across jurisdictions. Case law diverges on whether pending applications should be included in portfolio counts. *Oppo v. Nokia* represents the clearest authority for counting applications alongside granted patents under a large-sample rationale, while other courts have filtered toward granted patents. There is broader agreement that expired patents should be removed from the numerator, but courts differ on the denominator: *TCL v. Ericsson* held that expirations should reduce the numerator only, not the denominator, because the standard's aggregate value already incorporates the contribution of those now-public inventions.

Indicators of patent quality – forward citations, family size, timing and technical evaluation – each capture different aspects of value, but none has been accepted as a comprehensive or universal measure. Forward citations have been proposed as a value indicator, but they have not been accepted as a reliable SEP valuation tool in the surveyed case law. Patent family size may reflect geographic scope and prosecution investment. Timing has been used to distinguish foundational contributions from later releases, but it cannot fully capture value once later releases become commercially significant. Technical evaluation is conceptually the most direct approach, but it is costly, difficult to generalise across large portfolios, and still requires a weighting convention – often derived from skewness studies – that courts have treated cautiously.

6. Concluding remarks

Technology standards are a cornerstone of the modern digital economy since they enable interoperability across technologies such as mobile connectivity, Wi-Fi and multimedia codecs. The patent system plays a key role in the development of technology standards since it incentivises the R&D needed to advance the standard toward the best market solutions. However, the inclusion of patented technologies in standards creates a structural tension. Once a standard has been adopted and widely implemented, the very purpose of standardisation means that alternative technical solutions may no longer provide a realistic substitute. When implementation of that standard requires the use of patented technology, implementers may be concerned that the absence of practical alternatives weakens their bargaining position in negotiations over SEP licensing terms.

The FRAND commitment is designed to manage this tension by preserving incentives to contribute patented technology to standards while ensuring that standard-compliant products and services can be brought to market on fair, reasonable and non-discriminatory terms. However, FRAND commitments do not prescribe a fixed royalty rate, and most SDOs deliberately refrain from providing a more specific definition. The meaning of FRAND is concretised case by case through negotiation between the parties and, when negotiations fail, through judicial determination. This flexibility allows licensing terms to reflect the circumstances of the technology, the parties and the market at issue, yet it can also create uncertainty. Disagreements over what constitutes a FRAND rate may prolong negotiations, increase transaction costs and lead to litigation. Greater clarity on FRAND terms is therefore valuable for SEP holders, implementers, courts, competition authorities and policymakers.

This study contributes to the objective of providing greater clarity on what constitutes FRAND by assembling and analysing the most comprehensive global corpus of judicial FRAND determinations compiled to date. The study covers 65 court decisions across seven jurisdictions, including decisions in which courts set FRAND rates, decisions assessing whether specific rates or offers were FRAND, and decisions on the admissibility of particular methodologies. This corpus is particularly valuable because most FRAND licensing discussions take place behind closed doors, and much of the information generated in bilateral negotiations remains unavailable to the wider market. Court decisions thus provide an important window into the subset of this information that enters the public domain through litigation. They also offer benchmarks on the principles, methods and evidentiary standards that courts are prepared to accept.

The analysis shows that, despite differences in legal frameworks, courts have converged on a common understanding of the purpose of FRAND. Across jurisdictions, FRAND is understood as a mechanism for securing fair compensation for SEP holders while ensuring broad access to standards for implementers. The hypothetical negotiation between a willing licensor and a willing licensee has become the dominant construct for structuring FRAND analysis. In the United States, this is often expressed through the modified Georgia-Pacific framework. In the United Kingdom and other jurisdictions, it appears through the willing licensor and willing licensee test. These approaches seek to identify the rate that reasonable parties would have agreed in circumstances that exclude the distortions created by standardisation while still recognising the value of the patented contribution.

The evolution of the case law also points to a shift in the way courts understand the risks that FRAND is meant to address. Early decisions placed particular emphasis on patent hold-up and royalty stacking. Subsequent decisions have taken a more balanced approach, treating hold-up and hold-out as parallel risks. Courts increasingly require these risks to be evidenced rather than presumed. This evolution suggests that judicial FRAND analysis has moved beyond its initial definitional phase. The central question is now less what FRAND means in the abstract and more how FRAND can be applied reliably in concrete licensing disputes.

The study identifies two methodologies as central to judicial FRAND determinations, with the comparable-licence method emerging as the primary method in most cases. The top-down approach is used less frequently as a primary method and more often as a cross-check or when suitable comparables are unavailable or unreliable. Both methods, however, raise significant implementation challenges. Comparable-licence analysis depends on the selection of suitable agreements and on the unpacking of complex licences, including lump-sum licences, cross-licences, portfolio licences and multi-standard licences. Top-down analysis depends on the determination of an aggregate royalty rate and the apportionment of that rate to the portfolio at issue. In both settings, patent data plays an important role, but patent counting remains a contested proxy that requires careful treatment of essentiality, validity, family definitions, patent quality and the life cycle of patent rights, and above all an understanding that not every invention is of equal value and not every SEP is equally relevant to a given standard.

The EPO Observatory on Patents and Technology (epo.org/observatory) supports the European innovation ecosystem by providing studies, data and tools. This study forms part of the Observatory's Patents and standards programme (epo.org/standards), which aims to improve transparency and predictability in the relationship between patents and standards. This study can help readers better understand both the convergence that has emerged in FRAND case law and the methodological challenges that remain unresolved. It also provides guidance for future licensing practice and for the continued development of the patent and standardisation system. Earlier deliverables under the programme include the study Standards and the European patent system and the Patents Standard Explorer. Future work under the programme will continue to support users of the system by improving access to relevant information.

Annex

Table A1

FRAND case law: full case list by type of decision

Case	Juris.	Year	Type of decision	Citation
FRAND rate determinations				
Huawei Technologies Co., Ltd v. InterDigital Communications, Inc.	CN	2013	FRAND rate determined	Shenzhen Intermediate People's Court (2011) Shen Zhong Fa Zhi Min Chu Zi No. 857; Guangdong High People's Court (2013) Yue Gao Fa Min San Zhong Zi No. 305
IWNCOMM Co., Ltd v. Sony Mobile Communications (China) Co., Ltd	CN	2017 / 2018	FRAND rate determined	Beijing IP Court (2015) Jing Zhi Min Chu Zi No. 1194; Beijing High People's Court (2017) Jing Min Zhong No. 454
Huawei Technologies Co., Ltd v. Conversant Wireless Licensing Sàrl	CN	2018	FRAND rate determined	Nanjing Intermediate People's Court (2018) Su 01 Min Chu Nos. 232, 233, 234
Advanced Codec Technologies (ACT) v. Oppo Guangdong Mobile Telecommunications Co., Ltd	CN	2021 / 2023	FRAND rate determined	Nanjing Intermediate People's Court (2018) Su 01 Min Chu Nos. 3350, 3354, 3355, 3356, 3358, 3364; Supreme People's Court (2022) Zui Gao Fa Zhi Min Zhong Nos. 907, 910, 911, 916, 917, 918
Advanced Codec Technologies (ACT) v. Vivo Mobile Communication Co., Ltd	CN	2021 / 2023	FRAND rate determined	Nanjing Intermediate People's Court (2018) Su 01 Min Chu Nos. 3348, 3357, 3359, 3361, 3363, 3365; Supreme People's Court (2022) Zui Gao Fa Zhi Min Zhong Nos. 908, 909, 912, 913, 914, 915
IWNCOMM Co., Ltd v. Apple Inc.	CN	2021 / 2022	FRAND rate determined	Shan'xi High People's Court (2016) Shan Min Chu No. 10; Supreme People's Court (2022) Zui Gao Fa Zhi Min Zhong No. 817
Spreadtrum Communications (Shanghai) Co., Ltd v. ASR Microelectronics (Shanghai) Co., Ltd	CN	2021 / 2023	FRAND rate determined	Shanghai IP Court (2021) Hu 73 Zhi Min Chu No. 194; Supreme People's Court (2022) Zui Gao Fa Zhi Min Zhong No. 2040
Siemens v. Xiaomi Communications Technology Co., Ltd.	CN	2022	FRAND rate determined	Shanghai IP Court (2018) Hu 73 Min Chu No. 869
Oppo Chongqing Mobile Telecommunications Co., Ltd v. Nokia Technologies Oy	CN	2023	FRAND rate determined	Chongqing No. 1 Intermediate People's Court (2021) Yu 01 Min Chu No. 1232 [judgment vacated following settlement]
Telefonaktiebolaget LM Ericsson v. Lava International Ltd	IN	2024	FRAND rate determined	High Court of Delhi, CS(COMM) 65/2016
Koninklijke Philips NV v. Maj. (Retd.) Sukesh Behl & Anr	IN	2025	FRAND rate determined	High Court of Delhi, CS(COMM) 423/2016
Samsung Electronics Co., Ltd v. Apple Japan LLC	JP	2013 / 2014	FRAND rate determined	Tokyo District Court, 28 February 2013, Heisei 23 (Wa) No. 38969; IP High Court (Grand Bench), 16 May 2014, Heisei 25 (ネ) 10043
Unwired Planet International Ltd v. Huawei Technologies Co. Ltd	UK	2017 / 2018	FRAND rate determined	[2017] EWHC 711 (Pat); [2018] EWCA Civ 2344(jurisdiction and non-discrimination; not counted as a rate determination)
InterDigital Technology Corporation v. Lenovo Group Ltd	UK	2023 / 2024	FRAND rate determined	[2023] EWHC 1583 (Pat); [2024] EWCA Civ 743
Optis Cellular Technology LLC v. Apple Retail UK Ltd	UK	2023 / 2025	FRAND rate determined	[2023] EWHC 1095 (Ch); [2025] EWCA Civ 552

Case	Juris.	Year	Type of decision	Citation
Ericsson, Inc. v. D-Link Systems, Inc.	US	2014	FRAND rate determined	No. 6:10-cv-473, 2013 WL 4046225 (E.D. Tex. Aug. 6, 2013); 773 F.3d 1201 (Fed. Cir. 2014)
In re Innovatio IP Ventures, LLC Patent Litig.	US	2013	FRAND rate determined	Case No. 1:11-cv-09308, 2013 WL 5593609 (N.D. Ill. Oct. 3, 2013)
Microsoft Corp. v. Motorola, Inc.	US	2013 / 2015	FRAND rate determined	No. C10-1823JLR, 2013 WL 2111217 (W.D. Wash. Apr. 25, 2013); aff'd 795 F.3d 1024 (9th Cir. 2015)
CSIRO v. Cisco Systems, Inc.	US	2014 / 2015	FRAND rate determined	No. 6:2011cv00343 (E.D. Tex. 2014); 809 F.3d 1295 (Fed. Cir. 2015)
TCL Communication Technology Holdings Ltd. v. Telefonaktiebolaget LM Ericsson	US	2017 / 2019	FRAND rate determined	No. 8:14-cv-00341-JVS-DFM (C.D. Cal. Dec. 21, 2017); 943 F.3d 1360 (Fed. Cir. 2019) [reversed in part]
FRAND rate assessments				
Huawei Technologies Co., Ltd v. Samsung Electronics Co., Ltd (CN)	CN	2018	FRAND compliance assessed	Shenzhen Intermediate People's Court (2016) Yue 03 Min Chu Nos. 816, 840
Saint Lawrence Communication GmbH v. Vodafone GmbH	DE	2016 / 2017	FRAND compliance assessed	LG Düsseldorf, 31 March 2016, Case No. 4a O 73/14; OLG Düsseldorf, 30 March 2017, Case Nos. I-15 U 35/16 and I-15 U 36/16
Fraunhofer-Gesellschaft (MPEG-LA) v. ZTE Deutschland GmbH	DE	2018	FRAND compliance assessed	LG Düsseldorf, 9 November 2018, Case No. 4a O 15/17
Intellectual Ventures LLC v. Deutsche Telekom AG / Vodafone GmbH / Telefónica Germany GmbH	DE	2018	FRAND compliance assessed	LG Düsseldorf, 11 July 2018, Case Nos. 4c O 72/17, 4c O 77/17, 4c O 81/17
Tagivan GmbH (MPEG-LA) v. Huawei Technologies Deutschland GmbH	DE	2018	FRAND compliance assessed	LG Düsseldorf, 15 November 2018, Case No. 4a O 17/17
IP Bridge 1 GmbH & Co. KG v. TCT Mobile Europe SAS	DE	2020 / 2022	FRAND compliance assessed	LG Mannheim, 21 August 2020, Case No. 2 O 136/18; OLG Karlsruhe, 2 February 2022, Case No. 6 U 149/20
LG Düsseldorf, 4b O 91/18 (officially anonymised; inferred parties: Siemens v. TCT)	DE	2020	FRAND compliance assessed	LG Düsseldorf, 18 June 2020, Case No. 4b O 91/18
Nokia Technologies Oy v. Daimler AG	DE	2020 / 2021	FRAND compliance assessed	LG Mannheim, 18 August 2020, Case No. 2 O 34/19; OLG Karlsruhe, 12 February 2021, Case No. 6 U 130/20
GE/Access Advance LLC v. Vestel Elektronik Sanayi ve Ticaret A.Ş.	DE	2021	FRAND compliance assessed	LG Düsseldorf, 21 December 2021, Case No. 4c O 42/20
Avago (Broadcom) v. Renault	DE	2026	FRAND compliance assessed	LG München I, 7th Civil Chamber, 5 February 2026, Case No 7 O 7655/25
Wilus Institute of Standards and Technology Inc. v. ASUSTeK Computer Inc.	DE	2026	FRAND compliance assessed	LG München I, 7th Civil Chamber, 29 January 2026, Case No. 7 O 5007/25
Telefonaktiebolaget LM Ericsson v. Intex Technologies (India) Ltd	IN	2015	FRAND compliance assessed	High Court of Delhi, CS(OS) No. 1045/2014 (13 March 2015)
Koninklijke Philips NV v. ASUSTek Computers Inc.	NL	2017 / 2019	FRAND compliance assessed	Rechtbank Den Haag, October 18, 2017, Case No. C/09/514186 / HA ZA 16-805; Gerechtshof Den Haag, 7 May 2019, Case No. 200.221.250/01

Case	Juris.	Year	Type of decision	Citation
Federal Trade Commission v. Qualcomm Inc.	US	2019	FRAND compliance assessed	411 F. Supp. 3d 658 (N.D. Cal. 2019); 969 F.3d 974 (9th Cir. 2020)
HTC Corp. v. Telefonaktiebolaget LM Ericsson	US	2019 / 2021	FRAND compliance assessed	No. 6:18-CV-00243-JRG (E.D. Tex. 2019); 12 F.4th 476 (5th Cir. 2021)
In re Certain Memory Modules and Components Thereof (Netlist, Inc. v. SK Hynix Inc.)	US (ITC)	2017	FRAND compliance assessed	Investigation No. 337-TA-1023, Initial Determination (USITC 4 December 2017)
FRAND methodology admissibility (Daubert ruling)				
Ericsson, Inc. v. D-Link Systems, Inc. (Daubert ruling)	US	2013	FRAND methodology admissibility (Daubert ruling)	No. 6:10-cv-00473 (E.D. Tex. 2013) [pre-trial Daubert ruling]
WiLAN, Inc. v. Alcatel-Lucent USA Inc.	US	2013	FRAND methodology admissibility (Daubert ruling)	No. 6:10-cv-00521 (E.D. Tex. 2013)
GBT v. Apple Inc.	US	2014	FRAND methodology admissibility (Daubert ruling)	Case No. 5:12-cv-04882-PSG (N.D. Cal. 2014)
Realtek Semiconductor Corp. v. LSI Corp.	US	2014	FRAND methodology admissibility (Daubert ruling)	No. C-12-03451-RMW (N.D. Cal. 2014)
Core Wireless Licensing S.à.r.l. v. Apple Inc.	US	2016	FRAND methodology admissibility (Daubert ruling)	No. 15-cv-05008 NC (E.D. Tex. 2016)
Network-1 Technologies, Inc. v. Alcatel-Lucent USA Inc.	US	2017	FRAND methodology	No. 6:11-cv-492-RWS-KNM, Doc no. 810 (E.D. Tex. 2017)
Saint Lawrence Communications LLC v. ZTE Corp.	US	2017	FRAND methodology admissibility (Daubert ruling)	No. 2:15-cv-00349-JRG (E.D. Tex. 2017)
Huawei Technologies Co. v. Samsung Electronics Co. (US)	US	2018	FRAND methodology admissibility (Daubert ruling)	No. 3:16-cv-02787-WHO (N.D. Cal. 2018)
In re Qualcomm Antitrust Litigation	US	2018	FRAND methodology admissibility (Daubert ruling)	No. 17-MD-02773-LHK (N.D. Cal. 2018)
Qualcomm Inc. v. Apple Inc.	US	2019	FRAND methodology admissibility (Daubert ruling)	No. 3:17-cv-01375-DMS-MDD (S.D. Cal. 2019)
FRAND Methodology admissibility (Other court orders and guidelines)				
Guidelines of the Munich Regional Court on FRAND determination methodology	DE	2020	FRAND methodology admissibility	-
ZTE v. Samsung Electronics Co.	DE	2026	FRAND methodology admissibility	LG München case ID: 21 O 366/25; case ID: 7 O 64/25; case ID: 7 O 2750/25
Guidelines of the IP Divisions of the Tokyo District Court on FRAND determination methodology	JP	2026	FRAND methodology admissibility	-

Table A2

Reference list of cases outside the FRAND sample

Cases referenced in the body text and footnotes of the report that fall outside the FRAND sample collected in the Annex Table above.

Case	Juris.	Year	Citation
Other cases			
Oppo Guangdong Mobile Telecommunications Co., Ltd v. Sharp	CN	2020	First Instance (Shenzhen Intermediate People's Court): (2020) Yue 03 Min Chu No. 689; Second Instance (Supreme People's Court): (2020) Zui Gao Fa Zhi Min Xia Zhong No. 517
Orange-Book-Standard	DE	2009	Federal Court of Justice (BGH), Case No. KZR 39/06, BGHZ 180, 312
Saint Lawrence Communications GmbH v. Deutsche Telekom AG	DE	2015	LG Mannheim, Case No. 2 O 106/14
Koninklijke Philips NV v. Archos S.A	DE	2016	LG Mannheim, Case Nos. 7 O 209/15; 7 O 19/16
NTT DoCoMo v. HTC	DE	2016	LG Mannheim, Case No. 7 O 66/15
Pioneer Corp. v. Acer Inc.	DE	2016	LG Mannheim, Case No. 7 O 96/14; OLG Karlsruhe, Case No. 6 U 55/16
Confidentiality order in the context of the Huawei v. ZTE framework – Step 3	DE	2018	OLG Düsseldorf, Case No. I-2 W 8/18
Koninklijke Philips NV v. Wiko	DE	2019	OLG Karlsruhe, Case No. 6 U 183/16
Unwired Planet International Ltd v. Huawei Technologies Co. Ltd	DE	2019	OLG Düsseldorf, Case No. I-2 U 31/16
Conversant Wireless Licensing v. Daimler AG	DE	2020	LG Munich I, Case No. 21 O 11384/19.
HEVC (Dolby) v. MAS Elektronik	DE	2020	LG Düsseldorf, Case No. 4c O 44/18
Sisvel International S.A. v. Haier Deutschland GmbH	DE	2020	Federal Court of Justice (BGH), Case No. KZR 35/17 and KZR 36/17 (judgments of 5 May 2020); OLG Düsseldorf, 30 March 2017, Case No. I-15 U 66/15; LG Düsseldorf, Case No. 4a O 126/14; LG Düsseldorf, Case No. 4a O 93/14
Sisvel International S.A. v. Wiko SAS	DE	2020	OLG Karlsruhe, Case No. 6 U 103/19
Koninklijke Philips NV v. TCT Mobile	DE	2022	OLG Düsseldorf, Case No. 2 U 13/21
Nokia Technologies Oy v. Oppo	DE	2022	LG Munich I, Case No. 21 O 11522/21
Broadcom v. Renault	DE	2025	Regional Court of Munich I,case 7 O 7655/25
Samsung Electronics Co. v. ZTE Corp	DE	2026	LG Frankfurt, Case No. 2-06 O 426/24
VoiceAge EVS LLC v. HMD Global Oy	DE	2026	Federal Court of Justice (BGH), Case No. KZR 10/25
Wiko SAS v. Sisvel International S.A.	FR	2016	Tribunal de Commerce de Marseille, RG 2016F01637
Telefonaktiebolaget LM Ericsson v. Micromax	IN	2013	CS(OS) No. 442/2013
Smith Kline & French Laboratories Ltd's (Cimetidine) Patents	UK	1990	[1990] RPC 203
Unwired Planet International Ltd v. Huawei Technologies Co. Ltd	UK	2020	[2020] UKSC 37
Tesla, Inc. v. Avanci, LLC	UK	2025	UKSC/2025/0058; [2025] EWCA Civ 193
Panasonic Holdings Corp., v. Oppo Guangdong Mobile Telecommunications Co., Ltd	UPC	2024	UPC_CFI_210/2023 (Local Division Mannheim)
Huawei Technologies Co. Ltd., v. Netgear Inc.	UPC	2024	UPC_CFI_9/2023 (Local Division Munich)

Case	Juris.	Year	Citation
Panasonic Holdings Corporation v. Guangdong OPPO Mobile Telecommunications Corp. Ltd.	UPC	2024	UPC_CFI_210/2023 (Mannheim Local Division)
Koninklijke Philips N.V. v. Belkin companies	UPC	2024 / 2025	UPC_CFI_390/2023 (Munich Local Division); UPC_CoA_534/2024 (UPC Court of Appeal)
Sun Patent Trust v. Vivo Mobile Communication Co., Ltd.	UPC	2025	UPC_CFI_361/2025, UPC_CFI_362/2025 (Paris Local Division)
Telefonaktiebolaget LM Ericsson v. Shenzhen Transsion Holdings Co. Ltd.	UPC	2025	UPC_CFI_1568/2025, UPC_CFI_1791/2025, UPC_CFI_1793/2025 (The Hague Local Division); UPC_CFI_1570/2025 (UPC Mannheim Local Division); UPC_CFI_1571/2025 (UPC Paris Central Division)
Dolby v. Beko	UPC	2026	UPC_CFI_135/2024, UPC_CFI_477/2024 (Düsseldorf Local Division)
Telefonaktiebolaget LM Ericsson v. Verifone	UPC	2026	UPC_CFI_661/2026 (Mannheim Local Division); UPC_CFI_662/2026 (The Hague Local Division)
Garretson v. Clark	US	1884	111 US 120 (1884)
Georgia-Pacific Corp. v. United States Plywood Corp.	US	1970	318 F. Supp. 1116 (SD NY 1970)
Daubert v. Merrell Dow Pharmaceuticals, Inc.	US	1993	509 US 579 (1993)
Minco, Inc. v. Combustion Engineering, Inc.	US	1996	95 F.3d 1109 (Fed. Cir. 1996)
Brown & Williamson Tobacco Corp. v. Philip Morris Inc.	US	2000	229 F.3d 1120 (Fed. Cir. 2000)
Lucent Technologies Inc. v. Gateway, Inc.	US	2008 / 2009	3:07-cv-02000 (S.D. Cal.); No. 07-1546 (Fed. Cir. 2008); 580 F.3d 1301 (Fed. Cir. 2009)
Cornell University v. Hewlett-Packard Co.	US	2009	609 F. Supp. 2d 279 (N.D.N.Y. 2009)
Primiano v. Cook	US	2010	598 F.3d 558 (9th Cir. 2010)
ResQNet.com, Inc. v. Lansa, Inc.	US	2010	594 F.3d 860, 870 (Fed. Cir. 2010
Wordtech Systems, Inc. v. Integrated Networks Solutions, Inc.	US	2010	609 F.3d 1308 (Fed. Cir. 2010); No. 09-1454 (Fed. Cir. 2010)
Ellis v. Costco Wholesale Corp.	US	2011	657 F.3d 970 (9th Cir.2011)
Uniloc USA, Inc. v. Microsoft Corp.	US	2011	632 F.3d 1292 (Fed. Cir. 2011).
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LaserDynamics, Inc. v. Quanta Computer, Inc.	US	2012	694 F.3d 51 (Fed. Cir. 2012)
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EcoFactor, Inc. v. Google LLC	US	2025	No. 2023-1101, 2025 WL 1453149 (Fed. Cir. 2025)
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