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Standard-Essential Patents and the Internet of Things: Analysing Licensing Challenges

Monisha M

Post Graduate Student, Christ (deemed to be) University

Abstract

The rapid expansion of the Internet of Things (IoT) has transformed industries such as healthcare, smart homes, and industrial automation by enabling seamless device interconnectivity. However, IoT's reliance on standardized technologies has raised significant legal and commercial challenges, particularly concerning Standard-Essential Patents (SEPs). SEPs are patents that are indispensable for implementing industry standards like Wi-Fi, LTE, and 5G, ensuring interoperability across IoT devices. The licensing of SEPs often follows Fair, Reasonable, and Non-Discriminatory (FRAND) principles to balance the interests of patent holders and technology implementers. However, the absence of a dedicated legal framework for SEPs in India, coupled with inconsistencies in judicial decisions, has created uncertainty for IoT manufacturers.

This research examines the inefficiencies of traditional device-level SEP licensing, which places the licensing burden on final product manufacturers, leading to market entry barriers and legal complexities. In industries like mobile telecommunications, this model has worked effectively due to a concentrated number of manufacturers. However, IoT is a fragmented ecosystem with diverse players, making this licensing approach impractical. Challenges include uncertainty regarding infringement risks, complications in royalty determination, and increased legal exposure for smaller firms.

To address these issues, the study proposes policy reforms, including mandatory royalty transparency, compulsory arbitration mechanisms, and codification of FRAND principles within the Indian Patents Act, 1970. Strengthening competition law enforcement to prevent SEP abuse and adopting global best practices, such as those seen in the EU's 2023 SEP Regulation Proposal, are essential to fostering innovation in India's IoT ecosystem. By advocating for a structured, balanced, and legally robust SEP framework, this research contributes to the broader discourse on intellectual property, competition law, and IoT standardization.

Keywords: Standard-Essential Patents (SEPs), Internet of Things (IoT), FRAND Licensing, Patent Law, Competition Law, SEP Licensing Models, Indian Patents Act, 1970

1. Introduction

The rise of the Internet of Things (IoT) has revolutionized the global technology landscape, enabling interconnected devices to seamlessly communicate and perform complex tasks across various industries, including healthcare, transportation, smart homes, and industrial automation. IoT devices rely on standardized communication protocols to ensure interoperability, efficiency, and security. However, the widespread adoption of standardized technologies has led to significant legal and commercial challenges, particularly concerning Standard-Essential Patents (SEPs) and their licensing structures. SEPs are patents

that claim inventions essential to the implementation of technical standards. In India, as in many other jurisdictions, SEP-related disputes have emerged due to conflicting interests between patent holders (who seek to monetize their innovations) and implementers (who require access to standardized technologies to develop IoT solutions). The licensing of SEPs often follows the Fair, Reasonable, and Non-Discriminatory (FRAND) principle, which aims to strike a balance between rewarding patent holders and ensuring access to standardized technologies at reasonable costs. The Patents Act, 1970, does not explicitly address SEPs or FRAND licensing. However, SEP-related issues are governed under general patent law, competition law, and contract law.

2. Standard-Essential Patents and Licensing Levels

Standard-Essential Patents (SEPs) are patents that are indispensable for implementing industry standards such as Wi-Fi, LTE, and 5G. These patents ensure interoperability and compliance with established technical norms, making them crucial for the functioning of interconnected technologies, including those in the IoT ecosystem.

The licensing of SEPs can occur at different levels within the supply chain, depending on the approach adopted by patent holders and implementers. The two primary models of SEP licensing are:

- Integrated Licensing (Upstream): In this model, SEP holders license their patents directly to component manufacturers, such as chipmakers, who incorporate the patented technology into hardware components. This approach allows for a streamlined licensing process, as component manufacturers obtain the necessary rights before distributing their products to IoT device makers.
- Bifurcated Licensing (Downstream): Under this model, licensing takes place at the final product level, meaning that IoT device manufacturers must obtain licenses from SEP holders after integrating various components into their end products. This method is commonly observed in industries like mobile telecommunications, where device manufacturers negotiate directly with SEP owners[1].

Recent studies have examined the effectiveness of SEP licensing models and their implications for the IoT sector. While device-level SEP licensing has proven effective in the mobile phone industry, where a relatively small number of established manufacturers dominate the market, this model presents notable challenges when applied to the IoT industry, which is characterized by a diverse and fragmented ecosystem of manufacturers, ranging from large corporations to small and medium-sized enterprises (SMEs).

The bifurcated licensing model, in particular, introduces several complexities:

- Uncertainty Regarding Infringement Risks: IoT device manufacturers may unknowingly infringe on SEPs, as they integrate multiple standardized components without direct knowledge of each patent's licensing status. This increases legal risks and the potential for costly litigation.
- Challenges in Patent Ownership and Licensing Obligations: Given the vast number of SEPs involved in IoT standards, determining patent ownership and tracking licensing obligations becomes more difficult. Smaller manufacturers may struggle to identify which patents they need to license, leading to disputes with SEP holders.
- Complications in Royalty Determination: In the bifurcated model, the royalty burden falls on IoT device manufacturers, who must pay for the use of standardized technologies despite sourcing components from multiple suppliers. This can lead to double-dipping, where royalties are collected

[1] Licensing standard-essential patents in the IoT – A value chain perspective on the markets for technology Joachim Henkel TUM School of Management, Technical University of Munich, Arcisstr. 21, 80333 Munich, Germany

multiple times within the supply chain, ultimately increasing costs for smaller firms and limiting their ability to compete in the market[2].

These challenges highlight the limitations of traditional device-level SEP licensing in the IoT landscape and underscore the need for a more balanced and flexible approach to licensing, one that accommodates the fragmented nature of the industry while ensuring fair access to standardized technologies.

3. Indian Patent Law and IoT Patentability

Indian patent law, as governed by the Patents Act, 1970, sets out specific criteria for an invention to be granted patent protection. For an invention to qualify for a patent, it must satisfy three fundamental requirements Novelty, Inventive Step and Industrial Applicability. While these requirements form the foundation of patentability, Section 3(k) of the Patents Act, 1970[3], imposes a significant restriction by explicitly excluding software and business methods from patent protection unless they demonstrate a "technical effect." Section 3(k) states that "a mathematical or business method or a computer program per se or algorithms are not patentable."[4] This means that software inventions, standalone computer programs, and purely algorithmic processes are generally not eligible for patent protection in India. However, an exception exists if the software is combined with hardware in a way that produces a "technical effect" or "technical contribution." In such cases, the invention may be considered patentable. The implications are IoT devices heavily rely on embedded software that enables hardware components to communicate, process data, and perform automated functions. Since these innovations often involve a combination of hardware and software, they fall into a gray area under Section 3(k). The ambiguity surrounding what constitutes a "technical effect" creates legal uncertainty for IoT innovators, making it difficult for them to determine whether their inventions are eligible for patent protection.

Moreover, IoT-related inventions frequently require multiple patent filings due to their complex nature. A single IoT product may integrate multiple patented technologies, including communication protocols, data processing algorithms, and sensor-based mechanisms. This leads to additional licensing and enforcement challenges, as different components may be subject to separate patent rights owned by different entities. As a result, IoT developers often face legal and financial hurdles in securing patents, negotiating licenses, and ensuring compliance with existing intellectual property laws.

4. FRAND Licensing and Legal Precedents

The principle of Fair, Reasonable, and Non-Discriminatory (FRAND) licensing plays a crucial role in preventing anti-competitive practices related to Standard-Essential Patents (SEPs). FRAND ensures that patent holders do not exploit their monopoly power by imposing excessive licensing fees or unfair contractual terms on implementers. However, Indian jurisprudence on FRAND licensing remains in its early stages, with key judicial decisions highlighting inconsistencies in determining FRAND terms and the appropriate royalty base for SEP licensing.

A seminal case in Indian FRAND jurisprudence is *Telefonaktiebolaget LM Ericsson v. Mercury Electronics & Another*[5], where Ericsson, a leading SEP holder, sued Mercury Electronics for infringing upon its patents related to mobile communication standards. The case underscored the lack of a clear legal

[2] Id
[3] The Patents Act, 1970, § 3(k) (India)
[4] Rashi Shahrawat & Samrat Anand, Internet of Things and Patent Issues, 1(2) Int'l J.L. & Mgmt. Stud. 167 (2016)
[5] Telefonaktiebolaget LM Ericsson (Publ) v. Mercury Elecs. & Anr., CS (OS) No. 442 of 2013, (Del. High Ct. Dec. 6, 2013)

framework for determining FRAND-compliant royalty rates, as the Delhi High Court granted interim injunctions against Mercury Electronics without a thorough assessment of FRAND obligations. This ruling raised concerns regarding the use of injunctions as a bargaining tool in SEP disputes, potentially stifling market competition and hindering technology access for smaller IoT manufacturers. Similarly, in *Telefonaktiebolaget LM Ericsson v. Intex Technologies (India) Ltd*[6]., Intex challenged Ericsson's licensing practices, alleging that its royalty rates were excessively high and discriminatory, violating the principles of FRAND licensing. The Competition Commission of India (CCI) intervened in this dispute, examining whether Ericsson's licensing terms amounted to abuse of dominance under Section 4 of the Competition Act, 2002[7]. The CCI observed that Ericsson's licensing practices lacked transparency and potentially imposed unfair terms on Indian manufacturers, marking a landmark moment in India's competition law discourse on SEPs. However, the Delhi High Court took a divergent approach, emphasizing that patent rights must be upheld and suggesting that courts, rather than competition authorities, should determine FRAND terms. This jurisdictional conflict between the CCI and the Delhi High Court has led to uncertainty for IoT stakeholders, as businesses face inconsistent legal interpretations regarding SEP licensing.

From a global perspective, cases such as the German Orange-Book Standard and the European Huawei v. ZTE[8] decision offer significant insights into FRAND enforcement. The Orange-Book Standard case, decided by the German Federal Court of Justice, established that an implementer must make a binding licensing offer to the SEP holder and deposit a reasonable royalty to avoid an injunction. Meanwhile, the Huawei v. ZTE case, decided by the Court of Justice of the European Union (CJEU), provided a structured approach for SEP negotiations, requiring SEP holders to make a FRAND offer before seeking injunctive relief. These cases offer a potential roadmap for harmonizing India's fragmented SEP jurisprudence, ensuring a balanced approach between patent rights and competition concerns.

Given the growing importance of IoT, it is imperative for Indian legal frameworks to evolve and provide clearer guidelines on FRAND licensing. The conflict between patent law and competition law, as seen in the Ericsson cases, highlights the need for statutory amendments or judicial clarity to prevent excessive royalty demands and ensure equitable access to standardized technologies. A structured approach, incorporating lessons from global jurisprudence, could mitigate legal uncertainty and promote a fair SEP licensing regime that supports India's expanding IoT ecosystem.

5. Comparative Legal Analysis of SEP Licensing Frameworks in India, the United States, and the European Union

The licensing of Standard-Essential Patents (SEPs) under Fair, Reasonable, and Non-Discriminatory (FRAND) commitments sits at the intersection of intellectual property law, competition policy, and technological innovation. As global markets increasingly rely on standardized technologies, such as telecommunications, artificial intelligence (AI), and the Internet of Things (IoT), the legal frameworks governing SEP licensing in India, the United States (U.S.), and the European Union (EU) have evolved distinct approaches. These frameworks seek to balance the rights of patent holders with the broader public interest by ensuring accessibility to essential technologies without allowing monopolistic abuses. This

[6] Telefonaktiebolaget LM Ericsson v. Lava Int'l Ltd., CS(OS) No. 764/2015 (Del. H.C. 2016) (India)
[7] Competition Act, 2002, § 4 (India).
[8] Huawei Techs. Co. Ltd. v. ZTE Corp., Case C-170/13, ECLI:EU:C:2015:477 (CJEU 2015)

analysis explores the legislative, judicial, and policy dimensions of SEP licensing across these jurisdictions, identifying key areas of convergence, divergence, and emerging challenges[9].

The European Union has adopted a regulatory approach that places strong emphasis on antitrust enforcement to prevent the misuse of market dominance by SEP holders. Under Article 102 of the Treaty on the Functioning of the European Union (TFEU), patent holders with market dominance are prohibited from engaging in unfair licensing practices that distort competition. A landmark case in this regard is *Huawei v. ZTE* (2015)[10], in which the European Court of Justice (ECJ) established a structured negotiation framework, requiring SEP holders to provide infringement notices and make FRAND-compliant licensing offers before seeking injunctive relief. This case underscores the EU's objective of maintaining market competition while ensuring that implementers have reasonable access to standardized technologies. In November 2024, the EU introduced the *SEP Regulation*, which establishes a centralized EU-wide registry for SEPs and a mandatory conciliation process for FRAND rate determination. The European Union Intellectual Property Office (EUIPO) has been tasked with overseeing this framework, marking a shift towards administrative oversight aimed at reducing licensing asymmetry and litigation costs. While critics argue that this regulatory approach may impose excessive constraints on patent holders, its proponents highlight its potential to harmonize cross-border licensing disputes and promote transparency in SEP licensing[11].

The United States, in contrast, follows a more decentralized, judicial-driven approach to SEP licensing disputes. The U.S. courts treat FRAND commitments primarily as contractual obligations rather than antitrust issues, relying on doctrines such as *Equitable Estoppel* to enforce these commitments. Cases such as *Microsoft v. Motorola* (2013)[12] established that SEP holders cannot seek injunctive relief unless an implementer fails to negotiate in good faith. Unlike the EU, where regulatory bodies play a central role, SEP disputes in the U.S. are primarily handled through federal courts and the International Trade Commission (ITC). While the U.S. Department of Justice (DOJ) and Federal Trade Commission (FTC) have issued policy guidelines on FRAND licensing, there is no specific federal legislation governing SEP disputes, leading to legal uncertainty and forum shopping. U.S. courts have applied different methodologies for determining FRAND royalties, including the "top-down" approach, which apportions royalty burdens across all SEPs within a standard to prevent excessive licensing costs. This judicial flexibility allows case-by-case assessments, but it also results in inconsistency across different jurisdictions, making SEP licensing more complex for multinational businesses.

India, an emerging player in global technology markets, has been shaping its SEP framework through a mix of judicial decisions and competition law interventions. Unlike the EU and the U.S., India does not have dedicated SEP legislation, relying instead on its competition law framework under the Competition Act, 2002. Section 4 of the Act, which prohibits abuse of dominant position, has been used extensively to regulate SEP licensing practices. The Competition Commission of India (CCI) has played an active role in SEP disputes, as seen in *Ericsson v. Micromax* (2013[13]), where the Delhi High Court held that SEP

[9] Pier Luigi Parcu, Maria Alessandra Rossi & David Silei, FRAND Licensing of Standard-Essential Patents: Comparing Realistic Ex-Ante and Ex-Post Contracts, The B.E. J. Econ. Analysis & Pol'y, 2025
[10] Supra 8
[11] Koren Wong-Ervin, Joshua D. Wright, Bruce H. Kobayashi & Douglas H. Ginsburg, Extra-Jurisdictional Remedies Involving Patent Licensing, Competition Pol'y Int'l (forthcoming), Geo. Mason L. & Econ. Rsch. Paper No. 16-46 (2016)
[12] Microsoft Corp. v. Motorola, Inc., No. C10-1823JLR (W.D. Wash. 2013)
[13] Sahithya Muralidharan, Ericsson v. Micromax – A Kick-Start to SEP-FRAND Antitrust Jurisprudence in India, W. Bengal Nat'l Univ. Juridical Scis., July 13, 2016

holders must license patents on FRAND terms. The court also rejected Ericsson's practice of charging royalties based on the end-device price, deeming it discriminatory. However, in the absence of specific legislative guidance, Indian courts have taken divergent approaches in SEP disputes, sometimes referencing U.S. and EU jurisprudence to fill legal gaps. Recognizing the need for regulatory clarity, the Department for Promotion of Industry and Internal Trade (DPIIT) has proposed a national SEP policy aimed at improving licensing transparency and dispute resolution. However, progress on this front has been slow, leaving significant uncertainty for both domestic and international stakeholders in India's SEP ecosystem.

A comparative analysis of these frameworks reveals key differences in antitrust enforcement, FRAND rate determination, and injunctive relief. The EU follows a strict antitrust-driven approach, treating excessive royalties and restrictive licensing as potential abuses of market dominance. The *SEP Regulation* institutionalizes this perspective by introducing FRAND compliance audits. The U.S., on the other hand, applies a more lenient standard, requiring evidence of monopolization intent before an antitrust violation can be established under the Sherman Act. India aligns more closely with the EU in viewing SEP holders as dominant entities due to the essentiality of their patents, but its reliance on the CCI for enforcement poses challenges in maintaining consistency across cases.

FRAND rate determination methodologies also vary significantly. EU courts typically use the *comparable licenses* method, benchmarking rates against existing agreements for similar technologies to ensure fairness. The U.S. employs multiple approaches, including the *top-down* and *ex ante* methods, with courts like the Ninth Circuit endorsing apportionment-based calculations to prevent royalty stacking. In India, the judiciary has yet to establish a standardized methodology, with courts oscillating between device-based and value-based calculations. The *Ericsson* case critiqued device-based valuation but failed to provide a concrete alternative, leaving ambiguity in future disputes.

The availability of injunctive relief further distinguishes these jurisdictions. In the EU, *Huawei v. ZTE* imposed strict procedural requirements before SEP holders can seek injunctions, ensuring that implementers are not unfairly excluded from the market. In the U.S., the *eBay v. MercExchange*[14] (2006) ruling established a general reluctance to grant injunctions in patent cases unless irreparable harm is proven. Indian courts, however, tend to be more willing to grant injunctions, although they often condition such relief on the SEP holder's willingness to negotiate FRAND terms.

Looking ahead, the divergent approaches of these jurisdictions pose challenges for global SEP licensing. The EU's move toward regulatory centralization through the *SEP Regulation* may influence other markets to adopt similar transparency-driven frameworks. However, this could lead to conflicts with the U.S.'s decentralized, litigation-heavy model, which prioritizes flexibility over regulatory oversight. India's evolving SEP framework reflects its developmental priorities, seeking to balance foreign patent protection with the affordability of essential technologies. However, the lack of a dedicated SEP policy creates legal uncertainty that may deter foreign investment in its innovation sector.

To address these challenges, increased harmonization efforts are necessary. International standard-setting organizations (SSOs) such as ISO and ITU could play a role in developing non-binding global principles for FRAND licensing and dispute resolution. Additionally, India could benefit from establishing specialized IP courts with expertise in SEP disputes, reducing the current reliance on ad hoc judicial

[14] eBay Inc. v. MercExchange, L.L.C., 547 U.S. 388 (2006)

interpretations. Regular cross-jurisdictional dialogues between the EU, U.S., and Indian regulators could also mitigate the risks of conflicting legal obligations for global technology companies.

In conclusion, the SEP licensing frameworks in India, the U.S., and the EU reflect distinct legal traditions, economic priorities, and policy considerations. While the EU's regulatory-driven approach emphasizes competition law enforcement, the U.S. relies on judicial flexibility, and India navigates a developing legal landscape with an emphasis on access to technology. As emerging technologies such as 5G, AI, and IoT continue to shape the global economy, achieving a balanced and globally coherent SEP framework remains a pressing challenge. The EU's 2024 reforms may set a precedent for greater international harmonization, but national economic interests will continue to influence the evolution of SEP licensing policies worldwide.

6. Anticipated Results

The study critically examines the inefficiencies associated with device-level licensing of Standard Essential Patents (SEPs) in the Internet of Things (IoT) ecosystem, particularly its disproportionate impact on smaller firms. This licensing model, which bases royalties on the value of the final product rather than the specific patent-practicing component, creates substantial barriers to market entry and innovation. Smaller IoT developers, who often lack negotiation leverage, face extended licensing discussions, heightened risks of patent hold-up, and difficulties in ensuring compliance with Fair, Reasonable, and Non-Discriminatory (FRAND) terms. Notably, in *Huawei v. ZTE*[15], the European Court of Justice reaffirmed the need for FRAND compliance but failed to resolve ambiguities regarding royalty apportionment, leading to continued disputes over determining the "smallest saleable patent-practicing unit" (SSPPU).

Licensing model for fostering hold-up power, where SEP holders use the threat of injunctions to extract royalties exceeding FRAND obligations[16]. The IoT sector, characterized by complex and fragmented supply chains, exacerbates these issues. For instance, a sensor manufacturer may inadvertently infringe SEPs embedded in connectivity modules, resulting in potential litigation despite lacking direct involvement in standard implementation. Demonstrating that this licensing approach disproportionately burdens small and medium enterprises (SMEs), ultimately violating antitrust principles. Under Article 102 of the Treaty on the Functioning of the European Union (TFEU)[17] and Section 4 of the Indian Competition Act, 2002[18], the imposition of excessive licensing terms by dominant SEP holders can constitute an abuse of market power, necessitating regulatory intervention to ensure competitive fairness.

6.1 Module-Level Licensing.

An alternative and more efficient licensing approach is module-level licensing, which aligns better with tiered supply chain structures in IoT. This model shifts licensing obligations upstream to component providers, such as pre-certified 5G modem manufacturers, thereby streamlining compliance for downstream IoT device makers. The automotive industry has already adopted similar strategies, with Tier-1 suppliers securing SEP licenses for integrated telematics units, thereby shielding original equipment

[15] Huawei Techs. Co. Ltd. v. ZTE Corp., Case C-170/13, ECLI:EU:C:2015:477 (CJEU 2015)
[16] Carl Shapiro & Mark A. Lemley, The Role of Antitrust in Preventing Patent Holdup, 168 U. PA. L. REV. 2001 (2017)
[17] Consolidated Version of the Treaty on the Functioning of the European Union art. 102, Oct. 26, 2012, 2012 O.J. (C 326) 47
[18] The Competition Act, No. 12 of 2003, § 4, INDIA CODE (2002)

manufacturers (OEMs) from direct infringement claims. A relevant legal precedent is *Continental v. Avanci*[19] ,which underscored the practicality of module-level SEP licensing in reducing litigation risks and enhancing compliance.

This approach has important implications for the interpretation of FRAND obligations. Courts have affirmed that SEP holders must offer licenses to all entities in the supply chain, including component makers, as emphasized in *Unwired Planet v. Huawei*[20]. However, opponents argue that module-level licensing could lead to under compensation for SEP holders if royalties are narrowly scoped[21]. The study addresses this concern by advocating for aggregate royalty stacking caps, ensuring that cumulative licensing fees across modules remain within FRAND parameters. Additionally, competition law safeguards are required to prevent collusion among module providers, as regulated under the EU Vertical Block Exemption Regulation. By reducing transaction costs and litigation risks, module-level licensing fosters a more balanced and innovation-friendly IoT market.

6.2 Regulatory Intervention in India: Policy Imperatives

India's SEP landscape remains underdeveloped and fraught with legal uncertainties due to conflicting judicial decisions and inconsistent regulatory initiatives. A key example is *Ericsson v. Lava*[22], which highlighted the challenges of determining FRAND compliance and the use of injunctive relief in SEP disputes. The country has yet to implement a comprehensive SEP policy, as evident from the stalled 2019 Draft SEP Policy. Given the rapid expansion of India's IoT market, regulatory clarity is urgently needed to prevent forum shopping and ensure consistent judicial outcomes.

Several policy interventions to address these issues. First, the Telecom Regulatory Authority of India (TRAI) should establish clear SEP transparency guidelines, including mandatory royalty benchmarking and public disclosure of SEP licensing terms. Second, amendments to the Patents Act, 1970, could introduce compulsory arbitration mechanisms for FRAND disputes, drawing inspiration from Japan's arbitration-based approach. Additionally, codifying SSPPU-based royalty calculations under Section 84 of the Act[23] would provide clearer valuation standards, preventing arbitrary and excessive royalty demands.

A comparative analysis with international frameworks reveals valuable insights. The European Union's 2023 SEP Regulation Proposal emphasizes aggregate royalty transparency and the role of independent conciliators, serving as a potential model for India. At the same time, Indian policymakers must balance compliance with the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), particularly Article 31 on compulsory licensing, while fostering innovation. A careful approach is necessary to avoid the pitfalls of the U.S. *eBay v. MercExchange* (2006)[24] decision, which significantly restricted injunctive relief and altered the bargaining dynamics in patent litigation.

6.3 Broader Implications

Counterarguments regarding the risk of SEP holder under compensation are systematically addressed through tiered royalty models and ex-ante licensing frameworks that ensure fair returns while promoting accessibility. A critical study in the gap in Global South jurisprudence can offer a structured approach to

[19] Continental Auto. Sys., Inc. v. Avanci, LLC, No. 19-CV-02933, 2020 WL 5627224 (N.D. Tex. 2020
[20] Unwired Planet Int'l Ltd. v. Huawei Techs. Co. Ltd., [2020] UKSC 37 (U.K.)
[21] J. Gregory Sidak, Evading Portfolio Royalties for Standard-Essential Patents Through Arbitrage in Component Supply Chains, 5 CRITERION J. ON INNOVATION 29 (2019)
[22] Supra 6
[23] The Patents Act, No. 39 of 1970, § 84, INDIA CODE
[24] Supra 8

SEP governance in emerging markets, where regulatory uncertainties often hinder technological adoption. By positioning India as a key player in global IoT innovation, the study proposes regulatory measures that balance patent rights with public interest considerations, reinforcing the rule of law in intellectual property governance[25].

Ultimately, this research contributes to ongoing scholarly debates on FRAND reform, the intersection of antitrust and industrial policy, and the evolving role of Standard-Setting Organizations (SSOs) in democratizing access to essential technologies. As India aspires to become a global tech hub, an effective SEP framework will be crucial in fostering competition, reducing litigation burdens, and ensuring equitable access to standardized technologies in the rapidly evolving IoT landscape.

7. Conclusion and Suggestions

The research underscores the inefficiencies of device-level Standard Essential Patent (SEP) licensing in the Internet of Things (IoT) sector, particularly its disproportionate impact on small and medium-sized enterprises (SMEs). By imposing excessive licensing burdens at the end-product level, this approach hinders market entry, stifles innovation, and exacerbates compliance complexities. The study establishes that a module-level licensing framework—where SEPs are licensed at the component level—provides a more efficient and FRAND-compliant alternative. This model aligns with established licensing practices in the automotive and telecom sectors, offering greater predictability, reduced transaction costs, and a more equitable distribution of licensing burdens across the supply chain.

From a regulatory standpoint, the lack of clear policy direction in India's SEP framework contributes to litigation uncertainties and potential anti-competitive practices. Comparative analysis with EU and U.S. frameworks reveals the need for proactive regulatory intervention to establish transparent royalty benchmarks, enforce FRAND obligations, and mitigate SEP-related hold-up tactics. In light of this, the study proposes the following policy recommendations:

1. **SEP Transparency and Royalty Benchmarking:** The Telecom Regulatory Authority of India (TRAI) should mandate the publication of SEP licensing terms, royalty structures, and essentiality determinations to enhance transparency and prevent excessive royalty demands.
2. **Amendments to the Indian Patents Act, 1970:** Introducing compulsory arbitration for FRAND disputes and codifying Smallest Saleable Patent-Practicing Unit (SSPPU)-based royalty calculations under Section 84 would create a structured framework for fair royalty determination, minimizing hold-up risks.
3. **Adopting a Balanced Approach to Injunctive Relief:** India should strike a balance between patent enforcement and public interest, learning from the eBay Inc. v. MercExchange (2006) decision, which set stricter standards for injunctive relief in patent cases. Over-reliance on injunctions can deter innovation and disrupt supply chains.
4. **Adopting Global Best Practices:** India should draw lessons from the EU's 2023 SEP Regulation Proposal, which prioritizes aggregate royalty transparency and independent conciliators, ensuring a balanced licensing environment that fosters both innovation and competition.

Ultimately, by advocating for a module-level licensing model and regulatory clarity, this research contributes to a more sustainable and innovation-friendly SEP framework in India. A well-regulated SEP ecosystem would not only reduce litigation uncertainties but also position India as a competitive global

[25] Guido Calabresi, Some Thoughts on Risk Distribution and the Law of Torts, 70 YALE L.J. 499 (1961)

hub for IoT and emerging technologies.