

Determining RAND Royalty Rates for Standard-Essential Patents

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BY ALLOWING INTEROPERABILITY between different manufacturers' products, technical standards have furthered the widespread adoption of high-technology products, such as Wi-Fi routers and smartphones. The resulting scale economies and network effects, intense product-level competition, and product variety have had substantial positive effects on consumer and social welfare.

However, the very act of standardization, along with the up-front investments required to design, develop, and market products compliant with a standard, create the possibility for what has been termed "patent hold-up," whereby the owner of a patent essential¹ to the standard may be able to obtain royalty rates from licensees that are considered to be excessive.² As a response to the potential hold-up problem (i.e., to ensure that the standard can be used at a reasonable cost), standard-setting organizations (SSOs) typically require that participants agree to license their standard-essential patents (SEPs) on reasonable and non-discriminatory (RAND) terms.³

The challenge lies in how to define reasonable and non-discriminatory and then how to determine the appropriate RAND royalty rate for an SEP or a portfolio of SEPs.⁴ SSOs generally have left these questions unanswered for various reasons, including not wanting to be responsible for policing patent licensing terms. Yet the answers have important policy ramifications. If RAND is defined in a way that allows SEP owners to charge royalties that exceed the level appropriate for the patented technology, widespread adoption of standards and the associated economic benefits may be

threatened. Conversely, if RAND is defined in a way that does not properly compensate an SEP owner for the value of the patented invention, current or prospective patent owners may choose not to participate in SSOs and inventors may have decreased incentives to innovate, both of which may also reduce the welfare.

The appropriate definition of RAND and appropriate approaches for determining a RAND royalty are the subject of litigation between SEP owners and product manufacturers in various venues around the world.⁵ In this article, we discuss developments in how U.S. federal courts have addressed RAND royalty determination.

Preliminary Considerations

Three considerations related to standard setting and SEPs for high-technology industries⁶ can have important implications for the determination of RAND royalties: (1) there may be many SEPs, but most have low value, (2) when there are many SEPs, the overall royalty burden to implement the standard could be large even with relatively small average royalties per patent, and (3) expected litigation outcomes may affect licensing negotiations.

Most Patents Have Low Value . . . But Not All. A patent may have value because it allows the patent owner, by exercising its right to exclude (assuming the patent is found to be valid and infringed), to (1) prevent competitors from practicing the patent or (2) collect royalty revenues from users of the patented invention. A patent is an asset. Financial economics teaches that an asset's value is equal to the present discounted value of the future cash flows it is expected to generate.⁷ In the case of a patent for which the primary driver of value is licensing, the expected future cash flows are the royalty revenues minus the incremental costs of efforts to license the patent. Thus, for such patents, including SEPs where the patent owner has made a commitment to license on RAND terms, there should be a close relationship between a patent's value and the size of the royalty stream it is expected to generate.

Economic research has found that the distribution of patent values in the electronics industry (which would include many of the industries at issue in the litigated RAND cases) is highly skewed.⁸ That is, if one considers the total value of all unexpired patents in the electronics industry, a large percentage of the total value is concentrated in a small percentage of the patents. A corollary to this proposition is that most patents have low value. Innovation therefore is similar to "superstar" markets like those for professional athletes and concert pianists: a relatively small number of the participants capture the large majority of the industry value.⁹ An implication of this finding is that most patents would be expected to generate relatively small royalty streams.

This is particularly likely to be true of many SEPs given the purpose of standardization. Even if each company in an industry recognizes the benefits of interoperability when there are various alternatives to solve a given technological

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problem, coordination through standard setting is often required to achieve the desired interoperability. Thus, when the industry has chosen to engage in standard setting, this suggests that there were alternatives to the technologies that were included in the standard. In competitive markets, the price for a product tends to be lower the greater the number of substitutes for the product, all else equal. The right to use a patent, for which the royalty is the price, is not immune from such competition, either from other patented technologies or non-patented technologies.

Given that most patents have relatively low value, and the industry's choice to engage in standard setting implies the likely existence of technical substitutes for many SEPs, most SEPs are likely entitled to only a relatively low royalty. However, one should not conclude that all SEPs are necessarily entitled to a relatively low royalty. In fact, a second implication of the distribution of patent values is that for a given standard there likely are a small number of SEPs that are entitled to a relatively large royalty. Some patented inventions provide important benefits and have no close substitutes. Qualcomm's CDMA patents are an example. It is widely acknowledged that Qualcomm is responsible for the fundamental technologies that made the CDMA standards possible.¹⁰ The royalty rates that Qualcomm has been able to charge for its CDMA portfolio reflects this economic reality.¹¹

A Standard May Incorporate Many Technologies. A standard may incorporate thousands of technologies covered by thousands of SEPs owned by dozens of patent owners. For example, this is the case for the 802.11 Wi-Fi standard,¹² for which it has been estimated that there are over 3000 potentially essential patents.¹³ Even a small royalty on each SEP could lead to a large overall royalty burden on an implementer. High royalty costs to implementers, in turn, may result in high prices to consumers and low levels of adoption of the standard, due to either few implementers being able to survive in the market given the royalty costs or low consumer demand if the royalties result in higher end user prices. The term "royalty stacking" is often used in RAND litigation to describe the overall royalty burden that manufacturers have to pay and the danger that excessive royalty demands would quickly exhaust manufacturers' total profits and threaten adoption of the standard.¹⁴

Some commentators have argued that royalty stacking is only a theoretical concern.¹⁵ However, recent cases demonstrate that the concern is, in fact, real in the Wi-Fi space. Recent decisions in *Microsoft v. Motorola*, *Ericsson v. D-Link*, *Realtek v. LSI*, *Innovatio*, settlements in various litigations, and assertions by other entities have led to a substantial royalty burden for 802.11.¹⁶ The total of the court-determined royalties in *Microsoft v. Motorola*, *Ericsson v. D-Link*, *Realtek v. LSI*, and *Innovatio* alone are more than \$0.25 per unit.¹⁷ In contrast, the current price of a Wi-Fi chip is approximately \$2. Judge Robart in *Microsoft v. Motorola* was persuaded by these facts that royalty stacking is a real concern.¹⁸

Litigation Is the Endgame that Influences a Patent Licensing Negotiation. The royalty to be paid by a licensee for the right to use a patented technology is typically determined via a private negotiation between the patent owner and the licensee. When the parties cannot agree on licensing terms, the patent owner may bring a patent infringement lawsuit, seeking reasonable royalty damages on the defendant's past sales, as well as an injunction enjoining future infringement or imposing a court-determined royalty for future sales.

Given this legal structure, the parties in any patent licensing negotiation would be expected to understand that failure to reach mutually agreeable terms could result in litigation. Thus, from the perspective of rational economic bargaining theory, the outcome of a patent licensing negotiation will be influenced by the endgame of litigation, even if that endgame is never reached.¹⁹ This, in turn, implies that the results of licensing negotiations can be influenced if any economically inappropriate royalties are awarded by courts. Results of licensing negotiations can also be affected by the potential costs of litigation, particularly costs that are asymmetric between parties.

In short, the parties' expectations regarding the outcome of potential future litigation shapes the licensing negotiation itself. Because parties' expectations regarding the outcome of litigation, in turn, can be influenced by past litigated outcomes, the outcome of a litigated case can have ramifications for future patent license negotiations.

We discuss below how the causation may run in the other direction as well. Because "comparable" licenses are often used in patent litigation to determine reasonable royalty damages, there is an incentive for a patent owner to obtain high royalties from some licensees early on to establish licensing terms that will later support large damage awards in other cases.

Definition of RAND

Before attempting a measurement, it is useful to have a conceptual definition of what one is trying to measure. As a starting point for a definition of the "reasonable" prong of RAND, economists have focused on the royalty that could have been obtained by the SEP owner at the time the standard was set, the so-called ex ante royalty.²⁰ Such a royalty is consistent with the goal of avoiding the inclusion of hold-up value in the royalty because, prior to the standard being set, the SSO was free to choose any available technology and thus the SEP owner would have been constrained by substitute technologies that existed at that time.

The definition of RAND can be further refined to be the ex ante incremental value of the SEP, which is the additional value provided by the SEP over the next-best substitute technology. The ex ante royalty would approximately equal the ex ante incremental value if the owners of the potential technologies at issue faced little opportunity cost to contributing their technologies to the standard and competition

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between them to be included in the standard would have been intense. Under those conditions, the ex ante royalty that the SEP owner could have charged would have been driven down to the ex ante incremental value of the SEP.

For many SEPs, the owner likely had no significant opportunity cost to contributing to the standard but faced intense competition to be included in the standard. An important potential source of opportunity cost is if the patent owner had the ability to set up a proprietary alternative standard or organize an alternative SSO. However, few patent owners have such an ability and thus few patent owners face a significant opportunity cost of this type. For example, in the case of 802.11, there are too many technologies required for any one patent owner to be able to offer a proprietary alternative standard. For similar reasons, the competition between substitute technologies to be chosen for the standard would be expected to be intense. It would generally be a winner-take-all proposition, with technologies not chosen for inclusion in the standard receiving no royalties in the technology area in question.²¹ Of course, if an SEP owner could demonstrate that a significant opportunity cost existed, the ex ante royalty definition of RAND, which assumes that the ex ante alternatives had a more limited impact, could be used.²²

The U.S. courts that have made RAND determinations have recognized the importance of an ex ante evaluation of the SEPs in question relative to the next best substitute technology. For example, Judge Robart stated in *Microsoft v. Motorola*: “[C]omparison of the patented technology to the alternatives that the SSO could have written into the standard is a consideration in determining a RAND royalty.”²³

Several objections to the ex ante definition of RAND have been raised. For example, some commenters claim that ex ante incremental value does not provide sufficient incentives to innovate or participate in the SSO.²⁴ However, these claims mistake increased innovation for increased social welfare, incorrectly define incremental value, or make unrealistic assumptions that do not apply at least to the standards and SEPs that have been involved in U.S. litigation to date.²⁵

More generally, it is a basic economic principle that the closeness of substitutes for a good is a fundamental determinant of the good’s price in a competitive market economy. Thus, the starting place for an economically reasonable definition of RAND should be consideration of the extent to which there were close substitute technologies. For example, there is no reasonable economic basis under which an SEP covering a minor feature of the standard and for which many

good substitutes existed at the time the standard was set should be entitled to anything other than a small royalty. Moreover, the ex ante definition of RAND is entirely consistent with a situation that most people would agree is the canonical example of the patent system working the way it should: an inventor develops an innovation, obtains a patent, and markets the patented innovation to manufacturers to include in their products.²⁶ Such an inventor may face intense competition from another inventor who developed an innovation with similar properties and may, in fact, receive a low or negative return on its investments as a result. There is no reason that an SEP owner deserves special treatment relative to the inventor in the canonical case.

Furthermore, there has been no convincing showing in an actual litigated U.S. case that any error in the royalty rate associated with defining RAND based on the ex ante incremental value exceeds the additional cost that would be required to address the added complexity resulting from the use of alternative definitions. This should not be surprising. Again, the value of most patents is low, and this is particularly true for SEPs. Any error in such a case must be small. For the relatively rare case of an SEP with no substitutes, the increased complexity of using, for example, the ex ante royalty definition of RAND may be warranted. To determine whether it is worth proceeding down this road for a given SEP, a court could perform a preliminary screen based on whether or not there were reasonable technical alternatives available for the technology of the SEP.

Approaches to RAND Royalty Determination

We now turn to a description of the approaches that have been used in the RAND cases litigated in U.S. courts to date: the bottom-up approach, which focuses on measuring the incremental value of the SEP, the top-down approach, which involves apportioning a total royalty burden to the SEP in question, and the comparables approach, which uses a pre-existing license or other market transaction as a benchmark.

Bottom-Up Approach: Evaluating Incremental Value.

One approach to the determination of a RAND royalty is to measure the ex ante incremental value of the SEPs directly. This begins by identifying the set of alternatives that would have been available prior to standardization and then determining the incremental value, if any, of the SEPs relative to those alternatives. The bottom-up approach is consistent with the conceptual definition of RAND and is commonly performed in patent infringement cases.²⁷ In particular, it is common practice to determine the cost of implementing a design-around to the alleged infringer, where the cost could include lower profits as a result of performance degradation or increased manufacturing or development costs.

In theory, the list of alternatives includes any technological workaround that the SSO might have considered had the SEP in question not been available. One difficulty is that it may be hard to determine what the alternatives were at the

time the standard was being set. This approach also requires technical experts in the relevant fields to identify the alternatives and to assess the differences between and quantify the benefits of the SEP technology and the alternatives.

The SSO context can make it easier to identify alternatives. Many SSOs have working committees that develop the technical specifications for various components of the standard. In fact, committees typically start with a number of technical proposals put forth by members, iterating for months or years, drafting specifications, and voting on different proposals. An obvious starting place therefore is to look to the alternatives that the committees considered at the time.

However, the list of alternatives need not be limited only to those considered by the SSO. In addition to the alternatives considered explicitly by the SSO, alternatives might also include: (1) prior art, (2) other technical design-arounds, (3) technology that was available in prior versions of the standard, (4) delaying the incorporation of the features to wait for alternatives that might soon be available, and (5) dropping the SEP from the standard all together if it relates to an ancillary feature of the standard.

Calculating the incremental value of the SEP requires translating the technical improvements into the monetary value of those improvements. In general, the benefits of an SEP will fall into one of two categories. First, the SEP technology may offer some benefit in performance—e.g., incrementally faster download speeds. Second, it may offer a cost-savings benefit—i.e., a lower cost of production or a lower cost of development. Thus, the appropriate calculation of the incremental value not only takes into account the value in the marketplace of the improvement, but any benefits that would accrue to manufacturers by avoiding the expense and time of design around the SEP. These benefits may include lower development costs (e.g., if some alternatives required more upfront engineering efforts) or avoided delay costs (if the alternative would have taken longer to implement, delaying the adoption of the feature into the standard).

One challenge is calculating a royalty for SEP technology that provides very little (or even no) discernible incremental value over the alternatives. Even if a technology was *technically* superior to the alternatives, it may not have had a measureable incremental economic value to implementers of the standard. For example, a technology that allowed an increase in the maximum Wi-Fi throughput speed may have had little value because such speeds would not have been attainable in practice due to the bottleneck associated with broadband connections.²⁸ In such cases, using the next-best alternative over the SEP in question would not have had any effect on the commercial success of present products embodying the standard. Thus, the current value of such a technology would be very low.

In our view, the evaluation of alternatives is an important piece of the RAND analysis even if it does not lead to a precise estimate of the RAND royalty. Understanding the value

provided by the SEP in question versus the alternatives that were available, at least qualitatively, provides important context for implementing the other approaches described below. It also places some discipline on the analysis. If the SEP owner cannot identify benefits that the SEP brought to the SSO over alternatives, there is no basis to claim a high RAND royalty. Eventually a substantial RAND royalty claim must be supported with a demonstration of incremental benefits.

Top-Down Approach: Apportionment of the Aggregate Royalty Burden. A second approach for determining a RAND royalty is a top-down approach. This approach involves first determining the aggregate royalty burden that could be charged for all SEPs.²⁹ The aggregate royalty burden is then divided among all SEPs, taking into account differences in the relative value of those SEPs. A RAND royalty for a particular set of SEPs is an apportionment of the aggregate royalty burden.

The top-down approach is appealing for a number of reasons. First, assessing the aggregate royalty burden for all SEPs from an ex ante perspective appropriately excises any excessive value that might arise from ex post switching costs. Prior to standardization, the maximum possible royalty burden that would have been considered is that which would have exhausted the total economic profits that manufacturers expected from products compliant with the standard.³⁰ Calculation of expected economic profits would take into account the contributions of other factors necessary to bring products to market, such as manufacturing, research and development, marketing, sales force, and other costs.³¹ Expected economic profits would represent an upper bound on the aggregate royalty burden because some of these profits may be due to the act of standardization itself rather than any of the technologies chosen to be part of the standard; that is, the value of standardization could have been achieved using alternatives to the chosen SEPs. In some cases, the expected aggregate royalty burden may have been the subject of discussions in the SSO at the time the standard was being set.³² This could provide another basis for determining the aggregate royalty burden.

Second, the top-down approach specifically acknowledges the contributions of other SEP technologies that are necessary to implement the standard. Apportioning the aggregate royalty burden among all SEPs not only ameliorates royalty stacking issues, but (if done correctly) also addresses the problem of contributions of other SEPs being incorrectly assigned to the SEPs in question.

Third, the apportionment of the aggregate royalty burden among SEPs can be structured to account for the fact that some SEPs are more valuable than others. A larger portion of the aggregate royalty burden can be assigned to those SEPs that represent relatively more valuable contributions, than patents for only relatively minor contributions.

Despite its conceptual appeal, applying the top-down approach in a real-world setting requires addressing some practical issues. A preliminary question is where in the distri-

bution chain the aggregate royalty burden should be assessed. This question is closely related to patent damages case law which, in most cases, requires that a royalty for an infringed and valid patent be assessed on what is called the “smallest salable unit,” i.e., the smallest product priced in the marketplace that contains the substantive aspects of the invention.³³ In *Innovatio*, the court found that the smallest salable unit was a Wi-Fi chip, and the court assessed the aggregate royalty burden with reference to the profitability of a Wi-Fi chip.³⁴

There may be sound economic and practical reasons for using an upstream component to assess the aggregate royalty burden. First, in some cases, participants in the standard-setting process had expectations that royalties would be assessed at the component level. This was the case for Wi-Fi, where general committee discussions regarding royalty burden assumed that royalties would be assessed on the chips. Under these circumstances, it is reasonable to assume that a chip manufacturer would have taken into account expected future royalties when setting prices. The economic profit on Wi-Fi chips would then reflect expected future royalties.

Second, while a royalty applied to end-consumer devices for a single SEP owner may seem relatively small, in aggregate across all SEP owners, the royalty burden could impede the adoption of the standard, a primary concern of SSOs.³⁵ *Innovatio*, for example, claimed that RAND royalties for its 19 SEPs should be calculated on end-consumer products and argued that royalties should be \$3.39 to \$36.90 per unit, a royalty that, even at the low end, would exceed the expected profit margin and even the current price of Wi-Fi chips.³⁶ The court also found that 3000 patents related to the Wi-Fi standard.³⁷ Thus, even if a small number of SEP holders demanded similar royalties, the royalty burden would have been substantial, and adoption of the standard would have been threatened.

Third, as a practical matter, it is often easier to isolate the contributions of the standard to the value of upstream components, whereas attempting to evaluate the royalty burden on downstream products may require a substantially more complex apportionment task and may introduce significant measurement errors.³⁸ For example, a downstream product may incorporate other standards, non-standardized technologies, research and development, know-how, and other contributions of the downstream manufacturers (e.g., brand name), all of which need to be taken into account in the apportionment. Even if the aggregate royalty burden were larger for downstream products, it would need to be apportioned among a greater number of factors. This task is both more complex and more subject to error.

Finally, the institutional details and history of the industry may have some bearing on where it makes sense to assess the aggregate royalty burden. For example, component manufacturers often indemnify their downstream product manufacturer customers against any patent infringement allegations that might arise due to the component. Having committed to such an indemnity, an economically rational

component manufacturer would have built a cushion into its pricing to account for future royalties that might be owed. As another example, several significant Wi-Fi chip manufacturers already were licensed to *Innovatio*'s SEPs with no ongoing royalty obligation as a result of license agreements entered into by the previous owner of the *Innovatio* SEPs. Given this situation, and the competitiveness of the Wi-Fi chip industry, the Wi-Fi chip manufacturers whose chips were accused of infringement would not have been able to pass through any royalties they had to pay. This effectively limits the aggregate royalty burden to at most the economic profit on Wi-Fi chips. This remains the case even if the royalties were nominally paid by downstream manufacturers. The unlicensed chip manufacturers would have to lower their prices by the amount of the royalty to compete with licensed chip manufacturers that did not face an ongoing royalty obligation.

After the aggregate royalty burden has been assessed, the next question is how to divide this aggregate royalty burden among all SEPs. The first step is to determine the total number of SEPs. In some cases, participants in an SSO will submit letters of assurances where they identify which patents they believe or claim to be essential to the standard. Some SEP owners submit only an exemplary list of patents, while others submit only blanket letters of assurance (i.e., a statement indicating that the SEP owner will license any patent that it owns that turns out to be essential, without identifying any specific patents). On the other hand, a well-known problem is that SEP holders have an incentive to over-declare the number of standard essential patents.³⁹ In some cases, third-party research is available that provides an estimate of the number of SEPs owned by various entities, as well as assessments of the proportion of SEPs in an owner's portfolio that are likely actually to be essential.

A more challenging economic issue is how to assess the value of the SEPs in question relative to all of the SEPs related to the standard. Estimates of the distribution of patent values used in *Innovatio*, for example, found that the top 10 percent of Wi-Fi SEPs accounted for 84 percent of the total value of all Wi-Fi SEPs. For the purpose of apportioning the aggregate royalty burden, it is necessary to know where the SEPs in question fall in the distribution of all SEPs. In the absence of a rank ordering of all the SEPs, a practical approach is to begin with a technical evaluation of the SEPs in question, assessing their contributions to the standard. Based on this assessment, reasonable bounds can be placed on the relative value of the SEPs. For example, in *Innovatio*, the court ruled that *Innovatio*'s patents were of “moderate to moderate high-importance” to the standard, and it accordingly calculated a RAND royalty under the assumption that *Innovatio*'s patents fell in the top 10 percent of Wi-Fi SEPs. On the other hand, if the evidence shows that the SEPs in question were no better than the average patent, then the average patent value from the distribution can be used as a conservative measure.⁴⁰

By way of example, if a particular SEP has been determined to be in the top 10 percent of all SEPs, its RAND royalty could be calculated as follows:⁴¹

$$\text{RAND} = (\text{Aggregate Royalty Burden})^*$$

(Percentage of all patent value accounted for by the top 10 percent of patents)*

$$(1/(0.1 * (\text{Total Number of SEPs})))$$

Comparables: Use of “Comparable” Licenses or Other Market Transactions. A third approach for determining a RAND royalty is to use comparable market transactions as benchmarks for the value of the SEPs in question. Potentially comparable market transactions include existing patent licenses and the sale of patent portfolios. The basic principle is to identify economic evidence of the market’s valuation of the SEPs at issue or comparable technologies.⁴²

The most obvious candidates for comparable existing patent licenses are licenses that cover the SEPs in question.⁴³ However, even these licenses may have terms and conditions that make them dissimilar in important ways to the RAND license at issue. For example, whereas the RAND license at issue is typically considered to be a one-way “naked” license to just the SEPs at issue, an existing license may cover a broader patent portfolio, may have cross-licensing provisions, or may provide for technology transfer. Before using such an existing license as a comparable, adjustments may need to be made to account for the dissimilarities.

Another potential dissimilarity between an existing patent license and the RAND license at issue that arises in the RAND context is that the royalty in an existing license may include hold-up value if the existing license was negotiated after the standard was adopted.⁴⁴ This is of particular concern in a RAND case where the SEP owner is alleged to have attempted to extract hold-up value.⁴⁵ However, even where the SEP owner previously appears to have bargained in good faith, the royalties in an existing license may exceed the RAND level if the SEP owner (in good faith, but incorrectly) overvalued its SEPs and the licensee was concerned about the outcome of the litigation endgame, including the possibility of being subject to an injunction. Licenses negotiated prior to recent changes in the patent damages case law, when there was more uncertainty about the meaning of the RAND obligation and the definition of a RAND royalty and the possibility of an injunction was greater, may be particularly subject to this concern. For example, the court in *Microsoft v. Motorola* rejected a license as a valid comparable because it was negotiated following (and influenced by) a jury damages award where it was unclear whether the jury had been instructed about the patent owner’s RAND obligation.⁴⁶

For a manufacturer of standards-compliant products, an injunction can pose a significant financial threat because of the ex post infeasibility of designing around the SEP, assuming it is actually essential. Until recently, SEP owners regularly

sought injunctions for SEPs though the International Trade Commission and federal courts (although in practice injunctions have not often been granted for an SEP due, in part, to many cases settling prior to consideration of an injunction). All else equal, this will tend to increase the amount the licensees in previous licenses would have been willing to pay. Recently, the Department of Justice and Federal Trade Commission have recommended that injunctions or exclusion orders should be issued for RAND encumbered patents only under extreme circumstances—i.e., when the infringer is an “unwilling licensee”—and courts seem to be sympathetic to these arguments, lowering the likelihood of such injunctions.⁴⁷ Moreover, with the *eBay* case, the Supreme Court made it much more difficult for a non-practicing entity to obtain an injunction.⁴⁸

In considering existing licenses involving the SEPs at issue, it is also important to consider that the litigation endgame may create incentives to game the system. If an SEP owner knows that licenses will be used as comparables in future litigation, it has an increased incentive to seek high royalty rates from early licensees.⁴⁹ Even if its SEPs are of low value, by obtaining relatively high royalty rates early on, each subsequent licensee will face pressure from the prospect of the litigation endgame to agree to relatively high royalty rates as well.⁵⁰ As a result, such an SEP holder may have ended up with a strong litigation position even if its SEPs are of low value.

In the RAND cases that have been litigated to date, courts have come to different conclusions regarding the relevance of existing licenses, although there generally appears to have been skepticism as to the usefulness of licenses covering the SEPs in question. In *Microsoft v. Motorola*, the court rejected existing licenses that covered the Motorola SEPs and instead relied on royalty rates from patent pools containing other SEPs and the royalty rates charged by ARM, a mobile chip designer.⁵¹ In *Innovatio*, the court rejected both licenses covering the Innovatio SEPs as well as licenses for other technologies that Innovatio claimed were comparable.⁵² In *Ericsson v. D-Link*, Ericsson relied on licenses that covered the SEPs in question. The court found that the RAND rate was below the rate that Ericsson had proposed.⁵³ In *Realtek v. LSI*, LSI relied on a license that covered the SEPs in question and Realtek relied on a license agreement that it had entered into that covered other SEPs that were originally from the same portfolio as the LSI SEPs. The jury found that the RAND rate was somewhere between the parties’ positions.⁵⁴

The second type of market transaction that may provide useful information in determining the appropriate RAND royalty rate is a sale of the SEPs at issue.⁵⁵ Such transactions are not uncommon. For example, patent assertion entities often obtain their patents by purchasing them from other entities. For example, Innovatio purchased its SEPs from Broadcom. The sales price of a patent should generally reflect the present discounted value of the expected future licensing profits (at least where the purchaser is a non-practicing enti-

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ty). While the market for the sale of patents is not necessarily perfectly efficient in every case, there is certainly no sound economic basis for claiming tremendous inefficiencies when the seller is a prominent industry participant (like Broadcom). Thus, the sale price for a patent (together with, for example, an estimate of the profit percentage for licensing activities and an appropriate risk-adjusted discount rate) can provide an estimate of the expected future royalty stream for the patent.⁵⁶ If the sale encompassed more than the SEPs at issue or the set of potential licensees was wider than the party to the lawsuit, the expected future royalty stream could be apportioned to account for these factors.

An Important Open Issue

The RAND cases that have been litigated to date in the United States have, of course, not addressed and resolved every issue related to potential methodologies for determining RAND royalties. To our mind, the most important unresolved issue is what will be done in the case of an SEP where the patented invention is an important driver of demand for the downstream product. Such an SEP might be expected to have a relatively large royalty compared to the average SEP. However, such an SEP should also be relatively rare given the skew in the distribution of patent values.

In a patent damages case, if the patent owner can demonstrate that the patented invention drives demand for the downstream product, a royalty based on the entire market value of the downstream product may be appropriate under the so-called Entire Market Value Rule (EMVR).⁵⁷ For the EMVR to apply, it is not sufficient for the patented invention to be one of several important drivers of demand; it must be the primary driver of demand. Note also that, if there is a good substitute technology for the patented invention, the patented invention cannot be said to be the driver of demand, even if the feature that allegedly infringes the patent is the driver of demand. This is because at least a substantial portion of the demand could have been achieved using the substitute technology as was achieved using the patented invention.

One problem with the EMVR principle—for both SEP and non-SEPs—is that it is a somewhat blunt instrument in that it creates only two possible categories into which each patent must be placed. One can imagine a patented invention that is not the driver of demand for the downstream product, but is nevertheless an important driver of demand. Under the EMVR principle, the royalty on such a patent would be based on the smallest salable unit, which could lead to an undervaluation of the patent.⁵⁸

One response for a patent owner with an SEP that covers a feature that is an important driver, but not the sole driver of demand for the downstream product and thus would not qualify for EMVR status, would be to argue that it was entitled to a larger royalty rate than implied by a top-down approach predicated on the smallest salable unit, and that the licensee would have passed the royalty through and increased the price of the component it sold (thus increasing the potential overall royalty burden to accommodate the SEP in question).⁵⁹ However, such an argument would not apply where the licensee competed with other suppliers that did not face an ongoing royalty, for example, because they already had a royalty-free cross license or a paid-up license with the SEP owner.⁶⁰ More generally, an increase in prices may have had adverse effects on the adoption of the standard and this would need to be taken into account.

Conclusion

As noted above, licensing negotiations are affected by the parties' expectations concerning the litigation endgame. Recent U.S. cases have laid out principles for the determination of RAND royalties and thereby provided greater specificity as to the nature of the litigation endgame for SEPs. As a result, these cases, and the methodologies they describe, are likely to influence RAND licensing negotiations between SEP owners and manufacturers of products compliant with standards going forward. ■

¹ A participant in a standard-setting organization may identify or declare patents that it believes are essential to the standard. However, a declared-essential patent may not actually be found to be essential by a court, for example. In some of the litigated cases, the RAND royalty for a set of declared-essential patents has been determined before any assessment of the actual essentiality of the patents (e.g., *Microsoft v. Motorola*), while in other cases, the RAND royalty determination has been made after an initial assessment of essentiality (e.g., *Innovatio*). See *Microsoft Corp. v. Motorola, Inc.*, No. C10-1823JLR (W.D. Wash. Apr. 25, 2013); *In re Innovatio IP Ventures, LLC Patent Litig.*, No. 11 C 9308 (N.D. Ill. Sept. 27, 2013).

² The pure Williamsonian concept of “hold-up” or “opportunism” involves malicious intent, or “self-interest seeking with guile.” See OLIVER WILLIAMSON, *THE ECONOMIC INSTITUTIONS OF CAPITALISM: FIRMS, MARKETS, RELATIONAL CONTRACTING* 47 (1985). Accordingly, some have argued that, in the absence of bad acts (such as deliberate patent ambush), there can be no hold-up. However, even without malicious intent on the part of an SEP owner, implementers may be locked into technology included in the standard, and their bargaining positions relative to SEP owners may therefore be weakened, leading to royalties that exceed the RAND level. While another term might be preferable, we continue the common practice of using the term “hold-up” to describe this situation.

- ³ See, e.g., Brief of Amicus Curiae Institute of Electrical and Electronics Engineers, Inc. at 16, *Ericsson Inc. v. D-Link*, No. 13-1625 (Fed. Cir. Dec. 20, 2013). Some standard-setting organizations use the following terminology: fair, reasonable, and non-discriminatory (FRAND). From an economist's point of view, there is no material difference between these terms. See, e.g., *Economists' Roundtable on Hot Patent-Related Antitrust Issues*, ANTITRUST, Summer 2013, at 12 (comment of Gregory K. Leonard).
- ⁴ It is common for licensing involving SEPs to be done on a portfolio basis. However, if an SEP owner brings a patent infringement lawsuit, the SEP owner may be limited in the number of patents on which it can sue, either as a practical matter or by order of the court. The court may then be determining a RAND royalty for only a subset of the SEP owner's portfolio. In principle, this could lead to additional lawsuits and perhaps inefficiency in the legal process. However, this is less of a concern than one might initially think. As discussed below, the distribution of patent values is highly skewed. This property likely holds for many individual SEP owners' portfolios as well. In that case, valuing a relatively small subset of the patents in the SEP owner's portfolio can come close to valuing the entire portfolio, reducing the SEP owner's need to bring any further lawsuits.
- ⁵ For example, the Intermediate People's Court in Shanghai, China, was the first court of which we are aware to determine a RAND royalty rate, in the case *Huawei v. InterDigital*. For a discussion, see Fei Deng & Su Sun, *Determining the FRAND Rate: U.S. Perspectives on Huawei v. InterDigital*, CPI ANTITRUST CHRON., Feb. 2014.
- ⁶ The discussion in this article is focused on these types of industries but may apply to others as well.
- ⁷ See, e.g., RICHARD A. BREALEY ET AL., *PRINCIPLES OF CORPORATE FINANCE* 93–96, 220–21 (11th ed. 2014).
- ⁸ See, e.g., Mark Schankerman, *How Valuable Is Patent Protection? Estimates by Technology Field*, 29 RAND J. ECON. 77 (1998). Our discussion in this article is limited to these types of industries, although it may apply more widely.
- ⁹ See, e.g., Carolina Castaldi & Bart Los, *Are New Silicon Valleys Emerging? The Changing Distribution of Superstar Patents Across US States*, DRUID Summer Conference 2012, available at http://druidd8.sit.aau.dk/acc_papers/d2r3lbvkb962pbf3im5i29e0859.pdf. The skewed distribution of patent value measures has been studied in a number of contexts. See, e.g., Gerald Silverberg & Bart Verspagen, *The Size Distribution of Innovations Revisited: An Application of Extreme Value Statistics to Citation and Value Measures of Patent Significance*, 139 J. ECONOMETRICS 318 (2007).
- ¹⁰ In particular, one of Qualcomm's patents was "likely to be the key technology for CDMA." See Rudi Bekkers et al., *An Empirical Study on the Determinants of Essential Patent Claims in Compatibility Standards*, 40 RESEARCH POL'Y 1001, 1007 (2011). Author Leonard has consulted for Qualcomm.
- ¹¹ Qualcomm's published rates for CDMA are 5 percent of a mobile handset's price. See, e.g., Elliot Spagat, *Qualcomm's Business Model Attacked*, WASH. POST, Jan. 26, 2007, <http://www.washingtonpost.com/wp-dyn/content/article/2007/01/26/AR2007012600826.html>.
- ¹² The 802.11 standard, also known as "Wi-Fi," is promulgated by the Institute of Electrical and Electronics Engineers (IEEE) and lays out a particular form of wireless local area network communication. Wi-Fi capability is generally provided by a Wi-Fi chip, which is installed in downstream products, such as wireless access points, routers, computers, and mobile devices. The original 802.11 specification was ratified in 1997. Commercial sales of Wi-Fi chips in meaningful volumes began after the ratification of the 802.11a and 802.11b amendments in 1999 and increased substantially after the ratification of the 802.11g amendment in 2003 and the 802.11n amendment in 2009.
- ¹³ See *In re Innovatio IP Ventures, LLC Patent Litig.*, No. 11 C 9308, slip op. at 82–84 (N.D. Ill. Sept. 27, 2013).
- ¹⁴ *Microsoft Corp. v. Motorola, Inc.*, No. C10-1823JLR, slip op. at 23, 192 (W.D. Wash. Apr. 25, 2013). Royalty stacking is related to the economic concept of Cournot complementarity, in which multiple SEP owners independently set royalty rates but each SEP owner fails to take into account the effect its royalty rate will have on other SEP owners' profits. The aggregate royalty is higher than would be set by a single entity, and generally this outcome is economically inefficient.
- ¹⁵ See, e.g., Damien Geradin et al., *The Complements Problem Within Standard Setting: Assessing the Evidence on Royalty Stacking*, 14 BU J. SCI. & TECH. L. 144 (2008).
- ¹⁶ A royalty stacking analysis is complicated by the fact that implicit royalty payments made between parties who have entered into a cross-license should also be included in the stack.
- ¹⁷ In *Innovatio*, Judge Holderman determined a RAND royalty of 9.56 cents per Wi-Fi chip for 19 *Innovatio* SEPs. *Innovatio*, *supra* note 13, at 88. In *Microsoft v. Motorola*, Judge Robart determined RAND royalties to be 3.471 cents per unit for sales of Xbox for 11 of Motorola's 24 SEPs (it determined a rate of 0.8 cents per unit for other Wi-Fi enabled products covering all of Motorola's SEPs). *Microsoft v. Motorola*, *supra* note 14, at 188, 207. In *Ericsson v. D-Link*, the court determined that the RAND royalty should be the same as the reasonable royalty found by the jury, 15 cents per unit for 5 Ericsson SEPs. *Ericsson Inc. v. D-Link Sys., Inc.*, No. 6: 10-CV-473, slip op. at 45 (E.D. Tex. Aug. 6, 2013). In *Realtek v. LSI*, a jury assessed a RAND royalty of 0.19 percent of average selling price of Wi-Fi chip for two of LSI's patents, which was estimated to be approximately 0.19 to 0.33 cents per Wi-Fi chip. *Realtek Semiconductor Corp. v. LSI Corp.*, No. C-12-3451-RMW (N.D. Cal. Feb. 26, 2014) (*Realtek v. LSI*). See also David Long, *Jury Returns RAND-Royalty Rate of 0.19 Percent of Average Selling Price of Wi-Fi Chip Sale Price*, ESSENTIAL PATENT BLOG (Feb. 27, 2014), <http://www.essentialpatentblog.com/2014/02/jury-returns-rand-royalty-rate-of-0-19-percent-of-wifi-chip-sale-price-realtek-v-lsi/>.
- ¹⁸ *Microsoft v. Motorola*, *supra* note 14, at 23–25, 147–48; see also *Innovatio*, *supra* note 13, at 17–19.
- ¹⁹ The prospect of litigation outcomes affecting licensing negotiations has been noted by others. See, e.g., Suzanne Michel, *Bargaining for RAND Royalties in the Shadow of Patent Remedies Law*, 77 ANTITRUST L.J. 889 (2011); Carl Shapiro, *Injunctions, Hold-Up, and Patent Royalties*, 12 AM. L. & ECON. REV. 280 (2010).
- ²⁰ An influential work laying out this argument is Daniel Swanson & William Baumol, *Reasonable and Nondiscriminatory (RAND) Royalties, Standards Selection, and Control of Market Power*, 73 ANTITRUST L.J. 1 (2005). Carl Shapiro defines a "benchmark" royalty rate that is effectively the same as the ex ante royalty. See Shapiro, *supra* note 19, at 289.
- ²¹ While the patents could be licensed in other technology areas, such uses generally would not represent an opportunity cost to contributing the patents to the standard in question.
- ²² In *Innovatio*, Judge Holderman was concerned that the ex ante incremental value for an SEP did not take into account the royalty that would have been required to use an alternative technology covered by a patent. *Innovatio*, *supra* note 13, at 36–39. However, a patent owner cannot (in most circumstances) commit to any given royalty and thus would be forced by the competition it faced to get into the standard to lower its royalty offer to the incremental value of the patent.
- ²³ *Microsoft v. Motorola*, *supra* note 14, at 28.
- ²⁴ See, e.g., Gregory Sidak, *The Meaning of FRAND, Part I: Royalties*, 9 J. COMPETITION L. & ECON. 931 (2013).
- ²⁵ It is well known that almost any result one desires concerning the welfare effects of the patent system can be obtained from a theoretical model with a judicious choice of assumptions. See, e.g., Bronwyn H. Hall & Dietmar Harhoff, *Post-Grant Reviews in the U.S. Patent System—Design Choices and Expected Impact*, 19 BERKELEY TECH. L.J. 991 (2014).
- ²⁶ An example that many people would agree is the patent system working less well is when a patent owner seeks a royalty from a company that was unaware of the patent, had independently developed the invention, and included it in its products. There is a strong economic argument that social welfare would be improved if independent inventors were awarded prior user rights. See, e.g., Carl Shapiro, *Prior User Rights*, 96 AM. ECON. REV. 92 (2006).
- ²⁷ The courts in *Microsoft v. Motorola* and *Innovatio* were skeptical that alternatives could be identified and appropriately evaluated in those cases. *Innovatio*, *supra* note 13, at 47, 52, 57–58, 72; *Microsoft v. Motorola*, *supra* note 14, at 107. However, as mentioned above, identification and evaluation of non-infringing alternatives or other design-arounds is common in patent infringement cases.
- ²⁸ There could be "option value" to the greater throughput (in the event that

- in the future the broadband speed bottleneck was eliminated), but such option value would be only a fraction of the value if there were no bottleneck and that fraction would be small if the probability of breaking the bottleneck was small over the relevant time period.
- ²⁹ This was an approach that we proposed in *Innovatio*, a version of which was adopted by the court. The approach is conceptually similar to an approach proposed in Jonathan D. Putnam, What (Exactly) Are Patents Worth at Trial?: The “Smartphone War” Example, at 8–16, Paper Presented at the Am. Intell. Prop. Lawyers Ass’n Spring Meeting (May 11, 2012), available at <http://www.competitiondynamics.com/wp-content/uploads/AIPLA-text-and-exhibits.pdf>.
- ³⁰ Technically, if there were alternative standards that could have been used, then it would be the incremental profits gained by use of the standard relative to the profits that could be attained by use of alternatives.
- ³¹ This might be thought of as the incremental long-run operating margin of the products from an ex ante perspective.
- ³² For example, we understand that members of the committee that set the 802.11 Wi-Fi standard discussed an expectation that the overall royalty burden would be approximately \$0.25 per Wi-Fi chip. Conversation with Matthew Shoemake. Dr. Shoemake was Chairman of the IEEE 802.11g Task Group.
- ³³ There is exception to the smallest salable unit requirement, called “the entire market value rule” (EMVR). If the patent owner can demonstrate that the patented invention is the driver of demand for a downstream product, the royalty can be assessed on the downstream product rather than the smallest salable unit. See, e.g., *Laserdynamics, Inc. v. Quanta Computer, Inc.*, 694 F.3d 23 (Fed. Cir. 2012).
- ³⁴ *Innovatio*, *supra* note 13, at 23–27, 34, 76.
- ³⁵ *Microsoft v. Motorola*, *supra* note 14, at 147, 177; *Innovatio*, *supra* note 13, at 17–19.
- ³⁶ *Innovatio*, *supra* note 13, at 22.
- ³⁷ *Id.* at 82–84.
- ³⁸ In *Innovatio*, the court rejected *Innovatio*’s expert’s attempt to apportion based on estimates of the incremental value that Wi-Fi added to end-products. *Id.* at 27.
- ³⁹ See, e.g., Philippe Chappatte, FRAND Commitments—The Case for Antitrust Intervention, 5 EUR. COMPETITION J. 345 (2009).
- ⁴⁰ The court in *Microsoft v. Motorola*, for example, found that since there was no evidence presented in court that Motorola’s SEPs to the H.264 standard were more valuable than the average patent in a VIA licensing pool for the standard, it used the VIA licensing rates for the pool in the calculations of a RAND royalty. *Microsoft v. Motorola*, *supra* note 14, at 155, 172. If the evidence showed that the SEPs in question were no better than the median SEP, rather than the average SEP, one would want to use the median of the value distribution, rather than the average of the value distribution. Given the likely skew in the value distribution, the median value could be well below the average value.
- ⁴¹ The top-down approach adopted by the court in *Innovatio* calculated the aggregate royalty burden for the Wi-Fi standard by taking the average price of a Wi-Fi semiconductor chip (\$14.85) and multiplying it by the long-run operating margin of those chips (12.1 percent), resulting in an aggregate royalty burden of \$1.80. The court then apportioned this royalty burden down to *Innovatio*’s SEPs, based in part on a study that showed that were approximately 3000 SEPs to the Wi-Fi standard. The court found *Innovatio*’s SEPs to be of “moderate to moderate-high importance” to the Wi-Fi standard, placing *Innovatio*’s 19 SEPs in the top 10 percent of all Wi-Fi SEPs. *Innovatio*, *supra* note 13, at 85. Based on an economic study showing that the top 10 percent of patents accounted for 84 percent of total patent value, the top 300 patents (10 percent of the 3000 Wi-Fi SEPs) were worth \$1.51 (84 percent times the aggregate royalty burden of \$1.80). A RAND royalty for *Innovatio*’s patents was calculated by taking *Innovatio*’s share of the top 10 percent of patents (19 patents ÷ 300 patents in the top 10 percent), or 9.56 cents per unit.
- ⁴² A commonly used analogy is estimating the value of a house by looking at the prices of houses with similar characteristics that have recently sold. Even when characteristics of the potential comparables and the house in question differ—e.g., the potential comparable has greater square footage, fewer bathrooms, a recently renovated kitchen—adjustments can be made to account for these dissimilarities. Of course, there are specific issues that arise when valuing patents rather than houses.
- ⁴³ Existing licenses that cover patented technologies other than the SEPs in question are also potential comparables. Before using such a license as a comparable, in addition to addressing the issues of comparability discussed in the text for existing licenses covering the SEPs at issue, it may be necessary to analyze whether the technologies covered in the existing license are sufficiently comparable to the technologies of the SEPs at issue and making adjustments for any dissimilarities. While this presents additional complexities for using licenses covering other patents as comparables, it does not rule out these licenses. An SEP holder that has established that its patents cover fundamental technologies may point to licenses covering other fundamental technologies. Likewise, licenses covering a portfolio of “average” SEPs may provide a proxy for an average SEP.
- ⁴⁴ We have heard it stated that a license covering the SEP in question must be the best indicator of the RAND royalty because it was a market transaction in which the licensee agreed to pay the specified royalty. However, by the same argument, a price-fixing conspirator could claim that its fixed prices were free of an overcharge because the customer agreed to pay them.
- ⁴⁵ As discussed above, it is not particularly important for the RAND determination whether there was intent to hold the licensees up as opposed to good faith, but incorrect, overvaluation of the SEPs. Regardless of the existence of any intent, the previous licenses may reflect royalties greater than the RAND level and thus not be valid comparables.
- ⁴⁶ *Microsoft v. Motorola*, *supra* note 14, at 141–42.
- ⁴⁷ *Apple, Inc. v. Motorola, Inc.*, 869 F. Supp. 2d 901 (N.D. Ill. 2012).
- ⁴⁸ *eBay Inc. v. MercExchange, LLC*, 547 U.S. 388 (2006).
- ⁴⁹ It can achieve this, for example, by targeting small licensees for whom the expected litigation costs exceed the difference between the SEP owner’s royalty demand and the RAND royalty.
- ⁵⁰ The leverage that the SEP owner could use with early licensees would derive from the injunction threat or, in the case of relatively small licensees, litigation costs.
- ⁵¹ This is basically the approach taken by the court in *Microsoft v. Motorola*, *supra* note 14, at 135, 140–48, 164–66, 183–202.
- ⁵² *Innovatio*, *supra* note 13, at 58–59.
- ⁵³ *Ericsson v. D-Link*, *supra* note 17, at 28, 45.
- ⁵⁴ *Realtek v. LSI*, *supra* note 17; Long, *supra* note 17.
- ⁵⁵ See, e.g., Gregory K. Leonard & Stephen P. Rusek, *Patent Purchase Price Is Useful in Damages Analysis*, LAW360, Sept. 8, 2014.
- ⁵⁶ If the seller anticipated that the buyer would seek above-RAND royalties, the expected royalties implied by the sale price may overstate the appropriate RAND royalties.
- ⁵⁷ See the discussion regarding the EMVR at *supra* note 33. We have argued elsewhere that, if a sound economic approach to calculating a royalty is being used, the same dollar royalty should be obtained regardless of how the royalty base is defined because the dollar royalty should reflect the value of the technology, which is independent of the royalty base. Elizabeth Bailey et al., *Making Sense of “Apportionment” in Patent Damages*, 12 COLUM. SCI. & TECH. L. REV. 255 (2011). However, as discussed below, the further downstream the product chosen to be the royalty base, the more complex the apportionment problem.
- ⁵⁸ As noted *supra* note 57, in principle the correct dollar royalty on such a patent could be obtained even if the royalty is based on the smallest salable unit as long as the downstream value were properly taken into account. However, because an analysis of downstream value adds a layer of complexity, the possibility of error is greater.
- ⁵⁹ Another possible approach is to use a larger aggregate royalty burden than would result from the smallest salable unit. This approach might be supported, for example, if there was evidence that SSO members anticipated the larger royalty burden.
- ⁶⁰ This was the case in *Innovatio*, where some of the largest suppliers of Wi-Fi chips were licensed under the SEPs at issue and had no ongoing royalty obligations. In such a case, the suppliers of the allegedly infringing chips could not have paid *Innovatio*’s royalty demands and remained viable businesses. *Innovatio*, *supra* note 13, at 74–76.