Licensing Of Standard Essential Patents: Antitrust Intervention Is Not Big Enough A Fix BY ELIANA GARCÉS TOLÓN¹

The recent antitrust interventions against patent holders issuing injunctions to assert standard essential patents have caused a stir and a debate on the role of antitrust enforcement in licensing negotiations. This piece argues that the way antitrust intervention is being framed allows regulators to restrict the behavior of the patent holder staying away from the issue of FRAND determination. Yet, uncertainty about the meaning of reasonableness and about what is and is not allowed under FRAND commitments lies behind most litigation activity surrounding SEPs. Without more clarity on what can or cannot be accepted under FRAND it is unlikely that substantial progress will be achieved in reducing costly litigation. Antitrust enforcement is ill placed to do the job. In the face of uncertainty about Courts' ability to develop a consistent line across the

THE WILLINGNESS OF ANTITRUST AUTHORITIES TO ENGAGE IN THE PREVENTION OF WHAT WAS PERCEIVED AS A POSSIBLE HOLD-UP BY OWNERS OF STANDARD ESSENTIAL PATENTS PROVOKED NEW INTEREST IN WHAT SHOULD BE PERMISSIBLE IN THE ASSERTION OF RIGHTS LINKED TO SEPS YET THE SCOPE OF INTERVENTION HAS BEEN VERY LIMITED AND HAS FAILED TO ADDRESS THE UNDERLYING SOURCE OF INEFFICIENT LITIGATION: THE DISPUTE ABOUT THE MEANING OF FAIR, REASONABLE AND NON-DISCRIMINATORY (FRAND) COMMITMENTS AND THE SCOPE OF RIGHTS AND **OBLIGATIONS CONTRACTED WHEN** CONTRIBUTING TO A STANDARD. Courts' ability to develop a consistent line across the globe, standard setting organizations have a role to play in shedding some light on fair licensing of SEPs.

The launch of investigations last year by antitrust authorities in the US and Europe relating to the recourse to injunction relief in the context of standard essential patents (SEPs) has generated a renewed interest in the role of antitrust intervention in such patent disputes. In particular, the adversarial relations between licensors and licensees of SEPs have generated questions on the actual implications of FRAND commitments encumbering these patents.²

Three cases were opened in 2012 by the European Commission. One related to a complaint by Apple that alleged an injunction sought by Samsung asserting standard essential patents amounted to anticompetitive behavior. The other two consisted of similar allegations against Google/Motorola by both Apple and Microsoft. Meanwhile, on the other side of the Atlantic, a settlement was reached between the Federal Trade Commission and Google after Google's acquisition of Motorola whereby Google committed to restrict its recourse to injunctions for infringements of its SEPs.

The willingness of antitrust authorities to engage in the prevention of what was perceived as a possible holdup by owners of standard essential patents provoked new interest in what should be permissible in the assertion of rights linked to SEPs. As a consequence, discussions on these issues started and are still continuing in two major international standard-setting organizations (SSOs), ETSI and ITU. The divergence of interests among members of these organizations and the diverse interpretations given to FRAND related rights and obligations have so far prevented an agreement on how the SSOs policies could be made more precise and more conducive to an efficient standard setting process.

The request for intervention by antitrust regulators was a development in the mounting litigation battles concerning the licensing of patents between major ITC players. Patent disputes, including disputes surrounding SEPs, have traditionally been brought to courts under patent law. But some companies brought up the argument that standard essential patents were not just being asserted in order to obtain remuneration, but were being abused for the purpose of gaining illegitimate advantage in the market. Courts were not efficiently resolving these issues because they were mostly concerned with establishing patent infringement without taking into account the damage that the litigation process itself, often unmeritorious, was causing to competition. In addition, some in Europe considered certain procedures, such as the one established by the Orange Book case in Germany, imposed excessive obligations on potential licensees.³ Under Orange Book, an implementor faced with an injunction can defend itself against the patent holder but must irrevocably commit to take a license on FRAND terms and deposit a reasonable remuneration in escrow. This precludes any defense based on the merits of the patent assertion.

It was on the basis of such arguments that antitrust enforcers felt legitimized to intervene. Yet the scope of intervention has been very limited and has failed to address the underlying source of inefficient litigation: the dispute about the meaning of fair, reasonable and non-discriminatory (FRAND) commitments and the scope of rights and obligations contracted when contributing to a standard.

I. THE BASIS FOR ANTITRUST INVOLVEMENT IN SEP DISPUTES

Antitrust enforcement only rarely intervenes against the enforcement of intellectual property rights by patent owners, and almost never against refusal to license to direct competitors in the market where the patent is implemented. Refusals to license are deemed to be anticompetitive only if they relate to intellectual property rights that are objectively necessary to compete in a new downstream market that risks being eliminated without the license. In addition, the refusal to license must lead to consumer harm and not be objectively justified.⁴

In the case of SEPs, antitrust enforcers on both sides of the Atlantic felt they needed to intervene against the recourse to injunctions by firms seeking to assert their SEPs against implementers. Two facts about SEPs make them susceptible to antitrust intervention. First, the fact that SEP reading in a standard may become de facto essential for players wanting to enter the market where the functionality of the standard is used. This can create opportunities for hold up by the patent owner. Second, SEPs are more often than not encumbered by FRAND commitments designed to provide some guarantee of fair access to licensees. This is in fact a policy established by standard setting organizations aimed at mitigating the hold-up risk. We further analyze the basis for antitrust intervention and explore its limitations.

A. Hold-Up in SEP Disputes

Antitrust intervention in SEP disputes has been justified as a remedy against hold-up.⁵ In a hold-up, the owner of a standard essential patent attempts to use the market power obtained through the commitment to the technology by the licensee to extract more generous license terms than those that it could obtain if it were competing with

other technologies. Such hold-up is possible when future licensees make sunk investments that commit them to the technology before they actually negotiate the license fees. In these cases, it is possible for the licensor of an essential patent to extract some of the value of such sunk investment by raising the value of licensing terms.⁶ The licensee will be willing to pay some additional license fees rather than to incur the more expensive costs of

BUT IN THEIR RECENT INTERVENTIONS, EU ANTITRUST REGULATORS HAVE INVOKED A VIOLATION OF ANTITRUST RULES TO INVESTIGATE WHAT WERE CONSIDERED INSTANCES OF HOLD-UP BY SEP OWNERS. THE INTERVENTIONS HAVE CENTERED ON THE REQUESTS OF INJUNCTIONS BY SEP LICENSORS AGAINST IMPLEMENTERS. switching technologies. In the context of standards, implementers often make investments for the adoption of the standard before they conclude negotiations for licensing terms. This makes them susceptible to holdup by SEP owners.

Antitrust intervention has not yet sought to directly address cases in which SEP owners have attempted to extract illegitimate rates form patentees by way of hold-up. In 2008, the FTC condemned a company, Negotiated Data Solutions LLC, for attempting to

unilaterally raise its pre-agreed license fees to a number of clients after the clients had adopted and invested in the technology.⁷ But the case was brought under Section 5 of the FTC Act prohibiting unfair or deceptive practices affecting commerce, normally used under consumer protection. It was not argued as an antitrust violation under the Sherman Act, but rather the conduct was deemed "inherently coercive and oppressive" given the lock-in of the implementers.

But in their recent interventions, EU antitrust regulators have invoked a violation of antitrust rules to investigate what were considered instances of hold-up by SEP owners. The interventions have centered on the requests of injunctions by SEP licensors against implementers. While in the US the FTC complaint in the matter of Motorola Mobility was also based on a violation of Section 5 of the FTC Act, in the EU the cases relating to requests for injunctions against SEP implementers were treated as violation under Article 102 TFEU, condemning abuses of market power.

In order to construct a hold-up case as an Article 102 antitrust violation, one needs to argue that a request for high royalties to an implementer that has invested in the technology can constitute an abuse of market power. Classifying this as an abuse of market power establishes that the market power derived from the precommitment of the licensee to the standard is illegitimate and should not be exercised. One argument in support of this is that the additional rent that a patent owner can extract from implementers because these have already committed to the standard is not correlated to any additional technological value of the patent and is therefore not legitimate. This argument relies on the fact that the inclusion of the patent in a standard is not an innovation nor does it increase the actual social value of the technology.⁸ Therefore there is no justification for adjusting the value of the patent to account for the market power generated by the participation in the standard, and the SEP owner should be deterred from doing so. Under this argument a hold-up can be construed as the exercise of illegitimate market power and an antitrust violation.

B. Injunctions as a Per-se Hold-Up

The ability to request an injunction against a SEP licensee during licensing negotiations can provide with a powerful mean to extract onerous royalty terms. The cost to the implementer of having a product withdrawn

from the market can be enormous, and the risk of such an event happening will increase substantially the price that a licensee is willing to pay. At the same time, because the SEP holder has normally committed to license its SEP on FRAND terms and, in consequence, a refusal to license is not an option, the recourse to injunctive relief can then only be interpreted as a strategy to increase the value of the licensing terms. Because the pressure on the licensee brought by the possibility of an injunction is likely to result in higher value licensing terms, a request for an injunction-asserting SEP after the standard is adopted can be considered a way of achieving a hold-up. Such recourses to injunctions are therefore interpreted as evidence that illegitimate market power is being exercised.

Interestingly, it is the negotiating behavior and not the actual negotiation outcome that points to the possibility of hold-up and anticompetitive conduct. Under this reasoning there is no need to define the boundaries of FRAND licenses because the harm is assumed from the process of negotiation. An injunction requested by the SEP owner is assumed *per se* to lead to illegitimate additional rent.

This may not technically represent a departure from an effects-based assessment in that the reasoning behind

the finding of an abuse rests on a very likely negative impact on the licensing fee. But it obviates the need to actually assess the actual impact of the behavior. As a consequence, there is no need to evaluate whether the outcome of a negotiation under the threat of an injunctive relief falls within the boundaries of FRAND terms. In fact, that question does not seem, in a pure hold-up case, to be relevant.

II. CAN ANTITRUST HELP IN FRAND DETERMINATION?

In the opening of the investigation against Samsung, the European Commission stated that it would investigate whether Samsung's recourse to injunctive relief THE ABILITY TO REQUEST AN INJUNCTION AGAINST A SEP LICENSEE DURING LICENSING NEGOTIATIONS CAN PROVIDE WITH A POWERFUL MEAN TO EXTRACT ONEROUS ROYALTY TERMS. THE COST TO THE IMPLEMENTER OF HAVING A PRODUCT WITHDRAWN FROM THE MARKET CAN BE ENORMOUS, AND THE RISK OF SUCH AN EVENT HAPPENING WILL INCREASE SUBSTANTIALLY THE PRICE THAT A LICENSEE IS WILLING TO PAY.

amounted to a breach of FRAND commitments. But the reality is that demonstrating such violation does not seem material to the case if the case is argued as a hold up case.

A. Hold-up Theory does not help with FRAND determination

Antitrust intervention against injunctions to assert SEPs relies on the hold-up theory rather than on a violation of FRAND terms. None of the reasoning justifying antitrust intervention based on hold-up theory seems to rely on the existence of FRAND commitments, even though the existence of such commitments is sometimes referred to as further evidence of abuse. Once established that the extraction of market gains from participation in the standard is illegitimate and unwarranted because it does not reflect the value of the technology for the licensee, showing a violation of FRAND terms is superfluous. It is at best an exercise of tautology where the violation of FRAND and the definition of the infringement are done concomitantly.

By definition, FRAND terms will be violated if there is an attempt to extract illegitimate rent from the

licensee, and in this sense antitrust intervention informs on the definition of FRAND by making explicit the kind of rent it should not include and the kind of behavior that would be suspicious of extracting that rent opportunity. But so far the investigations opened have stayed away from defining the value or terms of the license that is in fact legitimate to extract. Many will welcome this as prudent behavior and argue that it is not for antitrust regulators to define fair, reasonable and non-discriminatory licensing terms.⁹

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Antitrust intervention in Europe seems so far to have been quite careful not to be seen as determining the scope of FRAND commitments or finding a violation of FRAND terms. Although it has contributed to the determination of FRAND commitments by arguing that the recourse to injunction is inadmissible in some cases, it has only done so indirectly by restricting the patent owner's behavior during the negotiating process. Beyond this behavioral restriction, there have

been no limitations by antitrust regulators so far of what FRAND terms can or cannot include.

One can only relate the lack of enthusiasm by antitrust authorities to get involved in the discussions surrounding the meaning of FRAND to the general avoidance in past years of cases involving arguments of excessive pricing and exploitative abuses. This aversion to getting involved in anything that could be associated with price determination is in fact the main reason why antitrust intervention is not well equipped to resolve the litigious dynamics that have developed around SEP licensing.

B. FRAND determination requires a theory of fair value

The general reticence so far to determine more concretely what is and what is not FRAND is not justified by the lack of analytical tools. A theoretical body of literature has addressed the question on how to value the technology absent the market power of the standard. The most pervasive methodology proposes a valuation based on the ex-ante value of the technology, that is, before the technology is included in the standard.¹⁰ Ways to calculate such valuation include estimating the value of the differential impact of a technology compared to the next best alternative. Such methodologies, if implemented, could help determine the "excess price" that is gained by hold-up. This ex-ante methodology has been endorsed by the European Commission as one acceptable way to approach FRAND.¹¹ But no methodology has yet been proposed in an antitrust investigation, and antitrust regulators have stopped short of defining any range for FRAND terms.

One could raise the valid argument that the current licensing terms agreed between licensing parties involve a complex equilibria of reciprocal commitments and that this does not make FRAND terms susceptible to optimal ex-ante determination. Licensing contracts for SEPs include long lists of specific rights and obligations by the signing parties and such agreements are best left to be negotiated without any outside constraints. How far can one go with determining FRAND by behavior? If such is the case, the approach adopted by antitrust authorities in Europe to only sanction behavior that is susceptible to distort negotiations is correct. The question is then whether there are other means than injunctions to extract illegitimate rent. So far, no other theory of harm has been taken up by regulators in the EU or the US, although some players in the industry have raised concerns about behavior such as the bundling of patents or the cross-licensing demands of certain SEP holders. Assessing whether such demands are consistent with FRAND or not is in fact very difficult to do without addressing upfront the question of what constitute reasonable and fair licensing terms in the case of SEPs. Antitrust enforcers have no far shown no inclination to do this.

III. WHERE TO LOOK FOR PRINCIPLES OF FRAND DETERMINATION?

And yet the lack of clarity of the meaning of FRAND continues to generate costly and possibly inefficient litigation. There is no definition of FRAND in any of the standard setting organizations that require it as a commitment for licensing. Current attempts by the industry to find common definitions, and even common principles, have brought to light the extent of disagreement among market participants. There is not one single aspect surrounding the definition of FRAND that today generates unanimity. Firms have been turning to courts to resolve licensing disputes, and the latest attempt to turn to antitrust law will shed little more light on the issue. In this context, one might want to turn to the standard setting organizations for a more efficient way to provide clarity on the boundaries of FRAND.

A. The current disputes in FRAND

Disputes surrounding FRAND touch upon all possible aspects of the concept. At present there is no agreement among industry participants of whether FRAND terms should be tilted towards guaranteeing incentives to innovate by patent holders, or whether they should aim at a socially optimal dissemination of the technology. Beyond such general principle, the more detailed application of FRAND principles is even more divisive.

Disputes and divergence of interpretation also concern the determination of the value of a technology includ-

ing for example the product for which the value of the patent must be calculated. Should the base be the value of the final product that has the standard embedded, or should the base be the smallest sellable component of the product containing the standard? Other disputes relate to whether FRAND commitment should apply patent-by-patent, or to the entire standard in which cases the stacking of license fees needs to be taken into account. Controversy goes further. Are licensees of SEPs entitled to patent-by-patent licensing, or are FRAND licensing commitments compatible with imposing portfolio licensing? Are the FRAND commitments transferred with the SEPs when they are sold, or do these commitments only bind the original owner who made the patent declaration? Are cross-licensing

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demands compatible with FRAND, or should there always be a monetary option for the patentee? Are cross licensing of standard essential patents reading to the same standard legitimate in FRAND? What about cross licensing of all SEP or cross licensing of non-SEPs?

These questions are not merely rhetorical but the subject of expensive litigation activity. According to a study commissioned by the European Commission, SEPs are five times more likely to be litigated than non-SEPs of

similar characteristics, and the propensity for litigation has increased steadily in the last 20 years.¹² Yet there are no answers to be found in antitrust enforcement, nor in the policies or declaration forms of any existing standard setting organization. But clarifying some FRAND rules could decrease the amount of costly litigation and produce a more efficient system of standard formation and standard licensing by providing legal certainty.

As it was argued before, it seems unlikely that antitrust cases will venture into this territory in the near future, but it might give enough theoretical ammunition to support the idea that rules that limit the possibility or the attractiveness of hold-up should be favored. Companies are currently turning to courts to resolve disputes and, at least in the US, they seem to be rising to the task.

B. The Role Of Courts

Most licensing disputes settle without any need for a definition of FRAND terms. In those cases that are litigated, courts have mostly established infringement and declared damage claims without making any attempts to define the terms of FRAND licenses. The ruling in *Microsoft v. Motorola* in 2013 marked a departure and an important precedent. In that case the US District Court judge set out to determine what he considered should be the fee of the FRAND license in that case.¹³ Judge James L. Robart established a methodology that embraced the principle of linking FRAND to the ex-ante value of the technology and based its determination on the license fee that the patent owner could have obtained from a negotiation absent the effect of the standard. In essence, Judge Robart endorsed the principle promoted by antitrust regulators that the market power derived from the participation in the standard is illegitimate. As a practical solution, Judge Robart used the price of a similar technology in a patent pool as a benchmark for undistorted negotiations. He took into account the relative importance of that particular patent to the standard, as well as the importance of the patent to the final product of the licensor.

Thus, in its findings, the Court seemed to go further than just establishing the principles supported by antitrust regulators, and provided much more clarity on the meaning and value of FRAND terms. First, Judge Robart established that the objective of FRAND terms is not only to induce participation in a standard but also to facilitate the dissemination of the technology. Second, the fact finding explicitly said that royalty stacking is an issue to be taken into account in the FRAND determination of a single patent.

In September 2013, another US judge followed a similar reasoning in the lawsuit initiated by patent holder Innovatio IP Ventures. In this case, Judge James F. Holderman took the smallest sellable unit in which the patent and the standard were used as the royalty base for the FRAND calculation. ¹⁴

In both cases, the determined FRAND licensing fee was significantly lower than the one sought by the patent holder.

So far, it seems that the reasoning used by courts in the United States for the determination of FRAND is consistent with the "hold-up" theory supported by antitrust regulators. But judges in the US seem ready to go further than antitrust theory ventures to go by establishing such concepts as the purpose of FRAND terms, the elements to be taken into account and even the proper base for the value of the patent.

On both sides of the Atlantic, antitrust regulators are proposing remedies to the issue of injunctions requests

to assert SEPs that involve FRAND determination by a Court or an arbitration body. This means that courts or arbitrators will possibly play an increasingly important role in determining the definition and possible range of FRAND terms. Courts in the US have so far taken the lead in providing some clarity on the meaning of FRAND terms, but it remains to be seen whether, and to what extent, EU courts will follow and whether consistency will be achieved.

C. The Role Of Standard Setting Organizations

The standard setting organizations have so far mostly stayed away from the issue of the determination of FRAND. But they could possibly play a bigger role in promoting efficient rules and improving the environment for standard setting. It is hard to argue at this point that they take no part in improving the licensing environment of standard essential patents.

Because SSOs are governed by their members, it is unlikely that SSOs will provide a precise definition of what FRAND terms are. Negotiated licensing arrangements can be very complex, and SSO members are unlikely to want to excessively restrict the flexibility of such contracts. Yet SSOs could take some useful steps that would provide legal clarity and reduce litigation. First, they could take measures that render hold-up more difficult. SSOs could include a general statement supporting the principle that the exercise of market power derived from participation in the standard is illegitimate even though the practicality of such statement is un-

clear. More actionable measures would be to explicitly link the FRAND commitment to the patent and not the owner so that the commitment survives transfer of ownership. Promoting ex-ante declaration of maximum licensing terms is another example of a way to decrease the risk of hold-up. Such ex-ante declaration has already been promoted by SSOs such as IEEE and VITA.¹⁵

In addition to imposing some restrictions in licensing behavior, SSOs would greatly improve the patenting environment in standards if they put some effort into improving the patent declaration procedures, notably through a better assessment of validity and essentiality of the patents declared. Although most patent litigation in the context of SEPs relates to a dispute in licensing terms, the pervasive over-declaration of patents in standards has incentivized players to challenge the SO FAR, IT SEEMS THAT THE REASONING USED BY COURTS IN THE UNITED STATES FOR THE DETERMINATION OF FRAND IS CONSISTENT WITH THE "HOLD-UP" THEORY SUPPORTED BY ANTITRUST REGULATORS. BUT JUDGES IN THE US SEEM READY TO GO FURTHER THAN ANTITRUST THEORY VENTURES TO GO BY ESTABLISHING SUCH CONCEPTS AS THE PURPOSE OF FRAND TERMS, THE ELEMENTS TO BE TAKEN INTO ACCOUNT AND EVEN THE PROPER BASE FOR THE VALUE OF THE PATENT.

actual validity of the patents subject to negotiations disputes. Measures to increase the quality of the patent declarations would reduce incentives for litigation by increasing the likelihood of patent validity and essentiality.

The provision of a system of arbitration would also limit the strategic use of litigation and accelerate the resolution of disputes. Such arbitration rules would have to be designed to be attractive to all members.

It is far from easy to obtain consensus for such solutions within SSOs given the divergent interest of the members. Yet many regulators have supported a greater involvement of SSOs in the solution to the current high

litigation environment.¹⁶ Any reform will have to ensure all relevant industry participants stay on board. The European Commission is currently actively engaging with SSOs in Europe in order to explore the possibility for progress. It is at this point too soon to predict what will be achieved in the current context.

IV. CONCLUSION

SO FAR, IT SEEMS THAT THE REASONING USED BY COURTS IN THE UNITED STATES FOR THE DETERMINATION OF FRAND IS CONSISTENT WITH THE "HOLD-UP" THEORY SUPPORTED BY ANTITRUST REGULATORS. BUT JUDGES IN THE US SEEM READY TO GO FURTHER THAN ANTITRUST THEORY VENTURES TO GO BY ESTABLISHING SUCH CONCEPTS AS THE PURPOSE OF FRAND TERMS, THE ELEMENTS TO BE TAKEN INTO ACCOUNT AND EVEN THE PROPER BASE FOR THE VALUE OF THE PATENT.

European regulators remain committed to Europeanwide standards and consider standardization processes as part of its internal market and industrial strategy. For this they have reacted with some concern for the increase of litigation and disputes in the context of IPR encumbered standards. The recourse to antitrust intervention is likely to result in some boundaries on the behavior of SEP licensors and, more precisely, in a restriction of their ability to request injunctions. But this is not enough. More clarity is needed about the actual boundaries of FRAND terms and antitrust policy is, for the moment, unlikely to intervene further. Courts in the US have started to provide some clarity on the meaning and calculation of FRAND terms, but in Europe courts are still hesitant on the issue. SSOs are well placed to improve the predictability of patent

licenses by improving the quality of declaration and by adopting some measures aimed at reducing the opportunity for hold-up. It will be a challenge to bring the industry together on this project, but it is a necessary effort.

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2. FRAND stands for Fair, Reasonable and Non Discriminatory. These licensing commitments are commonly called RAND in the US.

- 3. German Federal Supreme Court, KZR 39/06, «Orange Book», May 2009
- 4. Commission Decision 89/205/EEC of 21/12/1988 Magill TV Guide/ITP, BBC, RTE OJ L 78
- 5. See FTC complaint in the matter of Motorola Mobility LLC and Google Inc., File No. 121-0120

6. A theoretical explanation of hold up-in SEPs can be found in Farrell, J., Hayes, J., Shapiro, C., & Sullivan, T. (2007). Standard setting, patents, and hold-up. *Antitrust Law Journal*, *74*(3), 603-670.

- 7. N-Data, 2008 WL 258308,
- 8. Farrell, J., Hayes, J., Shapiro, C., & Sullivan, T. (2007). Standard setting, patents, and hold-up. *Antitrust Law Journal*, 74(3), 603-670.

9. See Mariniello, M. (2012) 'Standard-setting abuse: the case for antitrust control' Bruegel Policy Brief - February 2012

10. cf. 6; Swanson, D. G., & Baumol, W. J. (2005). Reasonable and nondiscriminatory (RAND) royalties, standards selection, and control of market power. *Antitrust Law Journal*, *73*(1), 1-58.

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13. Microsoft v. Motorola, 2013 WL 2111217 (W.D. Wash., Apr. 25, 2013

14. Innovatio IP Ventures Patent Litigation, MDL 2303 (N.D. Ill., Sept. 27, 2013)

15. Patent Challenges for Standard-Setting in the Global Economy, Keith Maskus and Stephen Merril Eds. National Research Council. 2013.

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