

Portfolio Licensing to Makers of Downstream End-User Devices: Analyzing Refusals to License FRAND-Assured Standard-Essential Patents at the Component Level

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Abstract

Competition agencies around the globe are investigating whether a standard-essential patent (SEP) holder's choice to license to the makers of downstream end-user devices, rather than to makers of the components of those devices, violates competition laws. Some authorities have already reached that conclusion. While much has been written about FRAND-assured SEPs, the literature to date focuses largely on the appropriateness of seeking and obtaining injunctive relief on such patents or on the meaning of "fair and reasonable," and has largely ignored the "nondiscriminatory" prong of FRAND (fair, reasonable, and nondiscriminatory). This article analyzes what we observe to be the common industry practice of licensing on a portfolio basis at the end-user device level, and whether a patent holder's refusal to license at only at the downstream end-user device level, and not at other levels of the production chain, may constitute an antitrust violation. We conclude that (1) whether the "nondiscriminatory" prong of the FRAND promise requires licensing at the component level is a fact-specific inquiry that depends upon the specific standard-development organization's policy; (2) even if there is potential for a failure to comply with a FRAND assurance, that alone does not constitute an antitrust violation; and (3) the refusal to license at component level cannot be anticompetitive when the vertically integrated holder of one or more SEPs does not assert its patents against the makers of components but, instead, licenses its SEP portfolio to end-device manufacturers on FRAND terms.

Keywords

standard-essential patents, FRAND, refusals to license, tying, bundling

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Competition agencies around the globe are investigating whether a standard-essential patent (SEP) holder's choice to license to the makers of end-user devices, rather than to makers of the components of those devices, violates competition laws. Some have already reached that conclusion. For example, the Competition Commission of India (CCI) has brought two investigations against Ericsson, alleging that the company "seem[s] to be acting contrary to the FRAND terms by imposing royalties linked with cost of product of user for its patents," that is, for charging royalties based on the end-user device as opposed to a component part.¹ Thus, "[f]or the use of [a] GSM chip in a phone costing Rs. 100, [the] royalty would be Rs. 1.25 but if this GSM chip is used in a phone of Rs. 1000, [the] royalty would be Rs. 12.5."² According to the CCI, "[c]harging of two different license fees per unit phone for use of the same technology *prima facie* is discriminatory and also reflects excessive pricing *vis-à-vis* high cost phones."³ Similarly, the Korea Fair Trade Commission (KFTC) investigated Qualcomm for allegedly "abusing its dominance" by "licensing patents only at the device level" as opposed to the component level.⁴ The Taiwan Fair Trade Commission (TFTC) is also investigating the company based on similar conduct.⁵ Other competition agencies, including in China and Japan, have recently issued revised final or draft guidelines that would seem to increase scrutiny of such conduct. For example, in 2016, the Japan Fair Trade Commission (JFTC) issued final revised antitrust intellectual property (IP) guidelines that create an unfair trade practices violation for refusing to license a FRAND (fair, reasonable, and nondiscriminatory)-assured SEP to any party willing to take a license "if they tend to impede fair competition, even if the acts do not substantially restrict competition."⁶ Similarly, in 2015, China's National Development and Reform Commission (NDRC) issued several draft versions of its antitrust-IP guidelines, which would prohibit "unjustified" refusals to license patents, focusing on, among other things, "the license commitments undertaken" by patent holders, such as commitments to license on FRAND terms.

While much has been written about FRAND-assured SEPs, the literature to date focuses largely on the appropriateness of seeking and obtaining injunctive relief on such patents or on the appropriate royalty rate and the meaning of "fair and reasonable" (FR), and has largely ignored the "nondiscriminatory" (ND) prong of FRAND or the common industry practice of licensing on a portfolio basis at the end-user device level. To the best of our knowledge, the literature has not considered whether an SEP holder's refusal to license at the component level represents a failure to comply with a FRAND assurance or constitutes an infringement of the antitrust laws.

Part I of this article considers whether failure to comply with a FRAND assurance should be regarded as an infringement of the antitrust or competition laws *per se*. Here we analyze the nature

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1. *In re* Micromax Informatics Ltd. v. Telefonaktiebolaget LM Ericsson ¶ 17 (Nov. 12, 2013), http://cci.gov.in/sites/default/files/502013_0.pdf; *In re* Intex Techn. Ltd., v. Telfonaktiebolaget LM Ericsson ¶ 17 (Jan. 16, 2014), http://cci.gov.in/sites/default/files/762013_0.pdf.
 2. *In re* Intex ¶ 17; *In re* Micromax ¶ 17.
 3. *In re* Intex ¶ 17 (emphasis omitted); *In re* Micromax ¶ 17.
 4. *Qualcomm Says "Not a Patent Troll" amid Korea Antitrust Probe*, HERALD BUSINESS (Sept. 5, 2016); Danbee Lee, *KFTC to Hold Series of Hearings on Qualcomm Investigation Between August and September*, MLEX (Aug. 1 2016) ("The [KFTC's] hearing came almost eight months after the KFTC issued an examiner's report in November challenging Qualcomm's device-level licensing practices, whereby the company charges royalties based on the price of a complete smartphone rather than on the chip itself."); Danbee Lee, *Qualcomm Set to Have Second Hearing with KFTC on Aug. 17 over Antitrust Probe*, MLEX (Aug. 12, 2016) ("In November 2015, the KFTC issued an examiner's report challenging Qualcomm's device-level licensing practices, whereby the company charges royalties based on the price of a complete smartphone rather than on the chip itself."); Press Release, Korea Fair Trade Comm'n, "Strict Sanctions on Qualcomm's Abuse of Cellular SEPs" (Dec. 28, 2016), <https://www.qualcomm.com/media/documents/files/kftc-issued-press-release-dated-december-28-2016-unofficial-english-translation.pdf>.
 5. *Qualcomm Discloses Details of Taiwan Antitrust Probe*, PaRR Stock Exchange Announcement(s) (July 21, 2016).
 6. JFTC ANTITRUST-IP GUIDELINES Part 4(2)(iv) (2016), http://www.jftc.go.jp/en/pressreleases/yearly-2016/January/160121.files/IPGL_Frand_attachment.pdf.

of the FRAND commitment, concluding that it is a contractual commitment.⁷ It also discusses that even if there is a potential failure to comply with a FRAND assurance, that alone does not amount to an antitrust violation. Absent deception, an SEP holder's attempts to renegotiate or deviate from the original FRAND commitment made in good faith to obtain higher royalty payments amounts to no more than pure *ex post* contractual opportunism. At least under U.S. law, which does not condemn exploitative practices but only exclusionary or predatory conduct that harms competition and consumers, that conduct is thus properly analyzed under contract, not antitrust, law.⁸

Part II then discusses whether a SEP holder's refusal to license at the component level constitutes a *per se* violation of a FRAND commitment or, instead, whether the answer depends on the specific standard-development organization's IP policy. We survey standard-development organization (SDO) Intellectual Property Rights (IPR) policies on the meaning of the "nondiscriminatory" prong of FRAND, finding that SDO IPR policies vary widely. Under at least one major SDO's IPR policy pertaining to the mobile or cellular telecommunications space, "nondiscriminatory" requires licensing only to "any system or device fully conforming to the standard" at issue.⁹ This means that only licensing at the end-user device level (or handset level) is required given, among other things, that cellular standards do not specify the circuitry of a chip, but rather how an operational cellular device must respond to and interact with a cellular network.

Part III considers the conditions under which a SEP holder's refusal to license at the component level would infringe the antitrust laws in the U.S. and the European Union (EU), irrespective of whether it is regarded as a breach of a FRAND commitment. It reviews U.S. and EU agency practice and law on refusals to license, concluding that U.S. antitrust law generally does not prohibit refusals to license (particularly given that the right to exclude is a core right of patent holders), and is highly critical of imposing compulsory licensing remedies. In addition, at least under U.S. law, the existence of a legitimate business justification is likely to preclude liability under a refusal to deal theory. There are a number of legitimate business reasons for the common industry practice of licensing at the end-user device level, including avoiding patent exhaustion, reducing administrative costs, and ease of monitoring or verifying the number of units sold. These efficiency reasons motivate the decision of both vertically integrated and, tellingly, nonintegrated SEP holders to license at the end-user device level only.

The conditions for finding infringement under EU antitrust law are less restrictive. Under EU law, an SEP holder is likely to be regarded as dominant and in possession of an asset that is indispensable to compete. A refusal to license at the component level may thus be considered an abuse of dominance, but only if it is likely to impact effective competition among component manufacturers. This is a fact-specific inquiry that requires a case-by-case analysis. However, as we explain in Part IV, the refusal to license at the component level would not cause the exit or marginalization of component manufacturers when the SEP holder does not assert its patents at the component level, and it licenses its SEP

7. See, e.g., *Realtel Semiconductor Corp. v. LSI Corp.*, 2013 WL 2181717, at *7 (N.D. Cal. May 20, 2013); Verdict Form at 3, *Microsoft v. Motorola*, Case No. C10-1823JLR (Sept. 4, 2013); *Apple v. Motorola, Inc.*, 869 F. Supp. 2d 901, 913–14 (N.D. Ill. 2012); *Microsoft Corp. v. Motorola, Inc.*, 696 F.3d 872, 884–85 (9th Cir. 2012); Douglas H. Ginsburg et al., *The Troubling Use of Antitrust to Regulate FRAND Licensing*, 10 COMPETITION POL'Y INT'L ANTITRUST CHRON. 10 No. 1 (Oct. 15, 2015), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2674759; Comment of the Global Antitrust Institute, George Mason University School of Law, on the India Department of Industrial Policy and Promotion's Discussion Paper on Standard Essential Patents 5–6 (Mar. 31, 2016), http://masonlec.org/site/rte/uploads/files/GAI%20DIPP%20Comments%20%28India%20SEP%20Paper%29_3-31-16_Final.pdf.

8. The situation is, of course, different in jurisdictions, such as the European Union, where dominant companies setting excessive prices are found to be abusing their market power and fined. Note, however, that the European Commission has been reluctant to condemn exploitative prices in innovative industries, such as those subject to standardization.

9. ETSI Intellectual Property Rights Policy § 15(4), 16(1) (Apr. 20, 2016) (emphasis omitted), <http://www.etsi.org/images/files/ipr/etsi-ipr-policy.pdf>.

portfolio to end-device manufacturers on FRAND terms irrespective of the source of the components they purchase. When those conditions hold, therefore, the refusal to license at the component level will not constitute an infringement of EU law.

Finally, Part IV extends the legal analysis in Part III and investigates the conditions under which such conduct could be regarded as anticompetitive as a matter of economics. It explores alternative theories of harm that could potentially be considered when assessing an SEP's decision not to license at the component level from an antitrust perspective, and which seem to be behind the investigations of that practice by various agencies around the world. We first consider whether the refusal to license to component manufacturers could be seen as *exploitative*, whether that action constitutes a violation of the FRAND commitment or not, and show that this cannot be the case. We find that under a wide range of circumstances, how royalty rates are split along the production or value chain has no real consequence for the overall royalty burden and hence for social welfare.

We then consider whether an SEP's decision not to license at the component level could be characterized as *exclusionary bundling*. Some authors contend that, by refusing to license at the component level, a vertically integrated SEP holder (that is, one that also produces the component at issue, in competition with unintegrated component makers) in effect bundles its component with its SEP portfolio (the bundling, or "tying," product), and that this conduct is necessarily anticompetitive. We employ an economic model to show that a refusal to license at the component level cannot lead to the foreclosure of rival component suppliers when (1) the vertically integrated SEP holder does not assert its patents at the component level, and (2) it licenses its SEP portfolio to the downstream end-user device manufacturers on FRAND terms irrespective of whether they source components from its own subsidiary or from the nonintegrated rival.

We finally consider whether the decision not to license component manufacturers could be seen as an anticompetitive attempt by a vertically integrated firm selling both SEP licenses and components to *raise its rivals' costs*. We explain the practical reality that while most SEP holders at least in the mobile industry license at the end-user device level, they do not assert their patents at the component level. Thus, a covenant not to sue from the vertically integrated firm combined with the availability of licenses on FRAND terms *at the end-user device level* would resolve the issue. The intuition parallels the intuition for the bundling theory of harm: when the essential patents are offered on a standalone basis on FRAND terms irrespective of whether components are sourced from and patents are not asserted at the component level, the component price of the vertically integrated firm is effectively constrained by the prices offered by the nonintegrated component manufacturers, since the latter need not offer indemnification to their customers to be competitive. Under those circumstances, the decision not to license at the component level causes no distortion of the competitive process.

In a nutshell, Part IV of this article shows that there is no justification, as a matter of either law or economics, to intervene against the decision of a SEP holder to refuse licensing patents to component manufacturers when it does not assert its patents at the component level *and* licenses its portfolio to end-device manufacturers on FRAND terms irrespective of where they source their components. That is, whether the refusal to license at the component level constitutes a violation of the FRAND assurance—and we have argued that it does not—such conduct cannot be regarded as exclusionary *per se* and may *only* distort competition if the royalty terms offered to handset original equipment manufacturers (OEMs) purchasing their components from third parties effect a "margin squeeze" in the component market. In particular, the refusal to license at the component level would be exclusionary if the royalty terms offered to handset OEMs purchasing their components from third parties at above-cost prices give rise to a "constructive" refusal to deal at the end-product level, which would likely constitute a violation of the FRAND assurance.¹⁰

10. See, e.g., *In re Innovatio IP Ventures, LCC Patent Litig.*, 2013 WL 5593609, at *4 (N.D. Ill. Oct. 3, 2013).

I. The Nature of the FRAND Assurance

An assurance to license on FRAND terms is a voluntary commitment made by a patent holder to an SDO intended to implement the specific terms of the SDO's IPR policy (or bylaws), which vary widely. Indeed, empirical evidence shows that SDO contract terms vary both across organizations and over time in response to changes in the perceived risk of patent holdup and other factors.¹¹ While the debate often refers to “the FRAND commitment” as if it were a monolithic promise, there are in fact subtle, but important, differences across SDOs with respect to their IPR policies. For example, the definition of what is and is not considered “essential” varies, as do the details included in the FRAND pledge requested, such as the requested geographic scope for the license, reciprocity in licensing, and the license duration.¹²

In addition, many SDOs ask participants voluntarily to commit in writing to license their SEPs on FRAND terms; with other SDOs, the commitment may be implicit from the patentees' participation in the standard-setting process per the SDO's bylaws, which typically have an opt-out provision for patent holders that do not wish to make a commitment. In either case, it is ultimately within the patent holder's discretion whether to make the commitment, just as it is within the discretion of the SDO not to incorporate in its standard a patent as to which the patentee will not make a commitment (or, under some SDOs, will not provide a nonassert policy).¹³

Thus, at its core, a FRAND commitment is a contractual commitment. In analyzing the contractual nature of the FRAND commitment, U.S. courts have held that:

1. a commitment to an SDO to license on FRAND terms constitutes a binding contract between the SEP holder, the SDO, and its members;¹⁴
2. potential users of the standard are third-party beneficiaries of the agreements with standing to sue¹⁵; and
3. FRAND licensing “includes an obligation to negotiate in good faith,” which obligation is “a two-way street,” that is, both patent holders and implementers must negotiate in good faith.¹⁶

Under U.S. law, the evasion of a FRAND assurance, absent *ex ante* deception that results in the unlawful acquisition of market power, does not constitute an antitrust violation.¹⁷ Rather, an SEP holder's attempts to renegotiate or deviate from the original FRAND commitment made in good faith to obtain higher royalty payments amounts to no more than “pure” *ex post* contractual opportunism.¹⁸

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11. See Joanna Tsai & Joshua D. Wright, *Standard Setting, Intellectual Property Rights, and the Role of Antitrust in Regulating Incomplete Contracts*, 80 ANTITRUST L.J. 157 (2015).
 12. For a comparison of RAND commitments across SSOs, see RUDI BEKKERS & ANDY UPDEGROVE, NAT'L ACADS. OF SCI., A STUDY OF IPR POLICIES AND PRACTICES OF A REPRESENTATIVE GROUP OF STANDARDS SETTING ORGANIZATIONS WORLDWIDE (2012), http://home.tn.tue.nl/rbkkers/nas/Bekkers_Updegrove_NAS2012_main_report.pdf.
 13. See Anne Layne-Farrar, *Proactive or Reactive? An Empirical Assessment of IPR Policy Revisions in the Wake of Antitrust Actions*, 59 ANTITRUST BULL. 373 (2014).
 14. See, e.g., *Innovatio*, 2013 WL 5593609, at *4 (citing *In re Innovatio IP Ventures, LLC Patent Litig.*, 921 F. Supp. 2d 903, 923 [N.D. Ill. 2013]); *Microsoft Corp. v. Motorola, Inc.*, 854 F. Supp. 2d 993, 999 (W.D. Wash. 2012); *Apple, Inc. v. Motorola Mobility, Inc.*, 886 F. Supp. 2d 1061, 1083–85 (W.D. Wis. 2012).
 15. See, e.g., *Innovatio*, 2013 WL 5593609, at *17; *Microsoft Corp.*, 854 F. Supp. 2d at 999; *Apple, Inc.*, 886 F. Supp. 2d at 1083–84; *Research In Motion Ltd. v. Motorola, Inc.*, 644 F. Supp. 2d 788, 797 (N.D. Tex. 2008); *ESS Tech., Inc. v. PC-Tel, Inc.*, 1999 WL 33520483, at *4 (N.D. Cal. Nov. 4, 1999).
 16. *Ericsson Inc. v. D-Link Sys., Inc.*, 2013 WL 4046225, at *25 (E.D. Tex. Aug. 6, 2013), *aff'd in part, rev'd in part, and vacated in part on other grounds by Ericsson, Inc. v. D-Link Sys., Inc.*, 773 F.3d 1201 (Fed. Cir. 2014).
 17. See note 8, *supra*, for a brief discussion of the treatment of excessive prices in EU law.
 18. See, e.g., Bruce H. Kobayashi & Joshua D. Wright, *Federalism, Substantive Preemption, and Limits on Antitrust: An Application to Patent Holdup*, 5 J. COMPETITION L. & ECON. 469, 493–501 (2009).

Although the breach of a FRAND commitment absent *ex ante* deception can result in consumer injury, such injury alone is insufficient to establish an actionable *antitrust* claim. As the U.S. Supreme Court explained in *NYNEX Corp. v. Discon, Inc.*, while the evasion of a pricing constraint may hurt consumers, it does not harm the competitive process.¹⁹ The Court distinguished the mere breach of a pricing commitment from the unlawful acquisition or exercise of monopoly power by pointing out that, with the former, the “consumer injury naturally flowed . . . from the exercise of market power lawfully in the hands of a monopolist.”²⁰ Lower courts have held that antitrust liability can be incurred by a patent holder who breaches a FRAND commitment when the SDO would not have included the technology into the standard, but for the deceptive FRAND assurance. The key factor in determining liability is whether the SEP holder unlawfully acquired market power, that is, but for the deception, the technology would not have been included in the standard. When the SDO would have adopted the technology despite the deception, antitrust laws do not recognize liability.²¹

SEP holders who commit their patents to FRAND licensing cannot be assumed to have gained market power as a result of inclusion in the standard. The U.S. antitrust agencies distinguish between “the market power that comes from the technology on its own and the market power that comes just from the standard, the act of setting a standard that elevates a technology above the competitors.”²² Empirical research suggests that there are limited cases in which a standard makes a patent a “winner” in the market; instead, more important technologies are natural candidates for inclusion in standards, and therefore SDOs tend to “crown winners” as opposed to creating market power.²³ For example, a recent study analyzing a database of patents declared as essential to a range of standards including telecommunications technology (e.g., W-CDMA) and imaging standards (e.g., MPEG2 and MPEG4) found that inclusion in a standard has no or negligible impact on the value or importance of a patent, measured by forward citations, suggesting that the inclusion in a standard in itself does not create market power.²⁴

Thus, whether a particular SEP holder has market power requires a case-by-case fact-specific inquiry into whether a single declared SEP constitutes a well-defined relevant market, whether there are potential substitutes, and the degree to which market power is mitigated by complementarities. SEPs are self-declared to SDOs, yet no SDO evaluates essentiality, which may change as the standard continues through development. Therefore, until an independent legal and technical review establishes that a particular patent declared “essential” is in fact essential for want of substitutes or offsetting complementarities, there should be no presumption that a declared SEP confers market power.²⁵

II. The “Nondiscriminatory” Prong of FRAND

Some contend that a patent holder’s FRAND assurance obligates it to license its SEPs to “all comers,” including component manufacturers. In doing so, they rely on *Microsoft Corp. v. Motorola, Inc.*, a

19. 525 U.S. 128, 135–37 (1998).

20. *Id.* at 129.

21. *Id.*; see also *Rambus v. FTC*, 522 F.3d 456 (D.C. Cir. 2008), *cert. denied*, 129 S. Ct. 1318 (2009).

22. DEP’T OF JUSTICE & FED. TRADE COMM’N., ANTITRUST ENFORCEMENT AND INTELLECTUAL PROPERTY RIGHTS: PROMOTING INNOVATION AND COMPETITION 39 (2007).

23. See, e.g., Anne Layne-Farrar & A. Jorge Padilla, *Assessing the Link Between Standard Setting and Market Power*, in INNOVATIONS IN ORGANIZATIONAL IT SPECIFICATION AND STANDARDS DEVELOPMENT 19, 26–27 (Kai Jacobs ed., 2012). These empirical studies examine the effects an SDO might have on patents that are declared as potentially essential to a standard. The research indicates that SDOs tend to attract and identify higher value, more important patents, which are in turn more frequently cited. *Id.* at 42.

24. *Id.* at 40–43.

25. Koren W. Wong-Ervin et al., *Comments on the U.S. Antitrust Agencies’ Proposed Updated IP Guidelines*, CPI ANTITRUST CHRON., Sept. 2016, at 1, 2.

breach of contract case in which the Ninth Circuit was interpreting a specific declaration made by Motorola to ITU. Specifically, the court analyzed Motorola's declarations to ITU, in which it promised to "grant a license to an unrestricted number of applications on a world-wide, nondiscriminatory basis and on reasonable terms and conditions to use the patented material necessary." The court stated that "[t]his language admits to no limitations as to who or how many applicants could receive a license."²⁶ As such, the Ninth Circuit's decision is limited to the specific declarations made by one SEP holder. As the Federal Circuit recognized in *Ericsson, Inc. v. D-Link Systems, Inc.*, a FRAND assurance is not a monolithic promise; instead, SDO IPR policies vary widely and there are important differences across SDOs in regards to their IPR policies.²⁷ As such, the Federal Circuit explicitly instructed that lower courts must consider the specific SDO IPR policy at issue.²⁸ Moreover, this argument misunderstands the nature of SEPs, which, as we explain below, tend to recite on the entire system, not the device level and certainly not the component level.

Because SDO policies vary widely, any analysis must begin with the specific SDO IPR policy at issue.²⁹ Many SDO policies are silent on whether a patent holder must license at all levels of the production chain. Some others are more specific. At least one major SDO, the European Telecommunications Standards Institute (ETSI), requires licensing only to "any system, or device fully conforming to a standard" at issue.³⁰

Specifically, the ETSI's IPR policy states that, by making a FRAND commitment, the patent-holder is committing that it is "prepared to grant irrevocable licenses on fair, reasonable, and nondiscriminatory . . . terms and conditions under such IPR to at least the following extent: MANUFACTURE" (§ 6.1). Manufacture is defined as "production of EQUIPMENT" (§ 15.8). Equipment is defined as "any system, or device fully conforming to" the standard (§ 15.4). It seems significant that ETSI chose to use "device" as opposed to "device or component," particularly given its use of the word "component" elsewhere in the policy.

In addition, cellular standards, which are those covered by ETSI, do not specify the circuitry of a chip; they specify how an operational cellular device must respond to and interact with a cellular network. Separate components cannot respond to and interact with a cellular network, and thus cannot conform to any cellular standard. Formal suites of tests exist to determine whether a device is "fully conforming" to a standard, and no separate component could pass any of these tests.

Therefore, it seems to us that a FRAND commitment under ETSI's IPR policy does not imply, and much less require, licensing at all levels of the value chain. ETSI's IPR policy is consistent with, and seems to endorse, industry practice (i.e., the practice of most if not all major SEP holders, including Qualcomm, Ericsson, InterDigital, and Nokia). There are many legitimate business reasons for SEP holders to license only at the end-user device level. One of the primary reasons is the nature of the technology. For example, many SEPs related to wireless cellular technologies incorporated in 2G, 3G, and 4G standards are inventions designed to optimize the wireless system and network, and have little to do with only the mobile device or only a specific component within the device.³¹ One study looking

26. 696 F.3d 872, 884 (9th Cir. 2012).

27. See, e.g., Joanna Tsai & Joshua D. Wright, *Standard Setting, Intellectual Property Rights, and the Role of Antitrust in Regulating Incomplete Contracts*, 80 ANTITRUST L.J. 157 (2015) ("The significant variation in SDOs' IPR policies is what one expects to see in competitive contracting process in a diverse ecosystem of technologies and SDOs."); Anne Layne-Farrar, *Proactive or Reactive? An Empirical Assessment of IPR Policy Revisions in the Wake of Antitrust Actions*, 59 ANTITRUST BULL. 373 (2014) (noting several changes in the terms of SDO policies over the course of several years).

28. 773 F.3d 1201, 1231 (Fed. Cir. 2014).

29. See generally *Ericsson, Inc. v. D-Link Sys., Inc.*, 773 F.3d 1201, 1231 (Fed. Cir. 2014) (instructing trial courts to consider the specific FRAND commitment at issue in crafting jury instructions in patent damages suits).

30. ETSI Intellectual Property Rights Policy § 15(4) (Apr. 20, 2016) (emphasis omitted), <http://www.etsi.org/images/files/ipr/etsi-ipr-policy.pdf>.

at the representative sample of a large SEP portfolio found that over 80% of the SEPs recited on the cellular network and the device rather than the component. On the other hand, very few of the SEPs in the study recited on noncellular network (e.g., WiFi or Bluetooth) components.³² This suggests that, at least within the ecosystem of mobile phones, the majority of SEPs read on the entire system and not on the component level alone. By following the economics, the scope of the licensed technology should not be limited to the device or component.³³

A number of considerations may dictate private parties' selection of a royalty base in a freely negotiated license agreement.³⁴ Industry practice and the convenience of the parties is one such consideration; other commercial dealings between the parties is another. In order to reduce administrative costs, a royalty base is often selected to allow for easy monitoring or verification of units sold; end product prices are often chosen for these reasons.³⁵ Indeed, as a practical matter, most licenses in many high-tech markets, including smartphones, are negotiated on a patent portfolio basis using the end-user device as the royalty base, even though some of the inventions being licensed are system-level inventions, providing technical and economic benefits well beyond the end-user device. Other reasons include responding optimally to the constraints imposed by the "patent exhaustion" doctrine, under which the first unrestricted sale by a patent owner of a patented product exhausts the patent owner's control over that particular item.

At the other end of the policy spectrum, another major SDO, the Institute of Electrical and Electronics Engineers (IEEE), recently revised its policy to arguably require licensing at the component level for those who voluntarily agree to make a commitment to license under the new policy. Specifically, the policy specifies that those making a FRAND commitment under the new policy shall agree to license any "compliant implementation," which is defined as "any product (e.g., component, sub-assembly, or end-product) or service that conforms to any mandatory or optional portion of a normative clause of an IEEE Standard."³⁶ The revised IEEE policy is highly controversial, with a number of the largest SEP holders and contributors to IEEE standards refusing to make FRAND commitments under the new policy.³⁷

31. See Jonathan D. Putnam & Tim A. Williams, *The Smallest Salable Patent-Practicing Unit (SSPPU): Theory and Evidence* (Sept. 2016), <https://ssrn.com/abstract=2835617>.

32. *Id.* at 41, tbl. 3.

33. See *id.* at 47.

34. See Jorge Padilla & Gerard Llobet, *The Optimal Scope of the Royalty Base in Patent Licensing*, 59 J.L. & ECON 45 (2016).

35. See Anne Layne-Farrar & Koren W. Wong-Ervin, *An Analysis of the Federal Circuit's Decision in Ericsson v. D-Link*, CPI ANTITRUST CHRON., Mar. 2015, at 4–5.

36. IEEE-SA Standards Board Bylaws § 6.1–6.2 (Dec. 2015), <http://standards.ieee.org/develop/policies/bylaws/sect6-7.html>.

37. See, e.g., Letter from Lawrence F. Shay, Exec. Vice President of Intellectual Prop., InterDigital, Inc., to David Law, Patent Comm. Chair, IEEE-SA Standards Bd. (Mar. 24, 2015), <http://wpuploads.interdigital.com.s3.amazonaws.com/uploads/2015/03/Letter-to-IEEE-SA-PatCom.pdf> ("InterDigital will not make licensing assurances under the new policy; and will instead make alternative licensing assurances, on a case-by-case basis, that are consistent with the goals of driving technology adoption while ensuring fair compensation for research success."); Letter from Gustav Brismark, Vice President, Strategy & Portfolio Mgmt., Ericsson AB, to Eileen M. Lach, Gen. Counsel & Chief Compliance Officer, IEEE (Oct. 21, 2014), http://www.mlex.com/Attachments/2015-10-26_5P338037F7HPVP5L/rand-terms.pdf ("Consequently, it appears that, moving forward, Ericsson would not be able to submit any [Letters of Assurance] under the terms of the proposed new IEEE-SA policy."); Letter from Irwin Mark Jacobs, Founding Chairman & CEO Emeritus, Qualcomm, to Dr. Roberto Boisson de Marca, President & CEO, IEEE (Nov. 19, 2014), <http://www.advancingengineering.org/irwin-jacobs>; see also generally <https://mentor.ieee.org/802.11/dcn/15/11-15-1489-03-0000-register-of-loa-requests.docx> (registry of missing letters of assurances).

III. U.S. and EU Agency Practice and Law on Refusals to License

The U.S. antitrust agencies have stated that antitrust “liability for mere unilateral, unconditional refusals to license will not play a meaningful part” in their enforcement efforts.”³⁸ This approach, consistent with the U.S. case law, recognizes that antitrust liability for refusals to license would impair an IPR holder’s core right to exclude, which is likely to lessen the incentive to innovate.

As the U.S. Supreme Court explained in *Verizon Communications Inc. v. Law Offices of Curtis V. Trinko, LLP*, “as a general matter, the Sherman Act ‘does not restrict the long recognized right of [a] trader or manufacturer engaged in an entirely private business, freely to exercise his own independent discretion as to parties with whom he will deal.’”³⁹ The Court reasoned that

firms may acquire monopoly power by establishing an infrastructure that renders them uniquely suited to serve their customers. Compelling such firms to share the source of their advantage is in some tension with the underlying purpose of antitrust law, since it may lessen the incentive for the monopolist, the rival, or both to invest in those economically beneficial facilities.⁴⁰

The Court went on to explain that “[e]nforced sharing also requires antitrust courts to act as central planners, identifying the proper price, quantity, and other terms of dealing—a role for which they are ill suited. Moreover, compelling negotiation between competitors may facilitate the supreme evil of antitrust: collusion.”⁴¹

With respect to refusals to license IPRs in particular, U.S. federal appellate courts have taken two main approaches, ranging from granting near-absolute immunity to applying a rebuttable presumption of legality.

In *Image Technical Services, Inc. v. Eastman Kodak Co.*,⁴² the Ninth Circuit purported to adopt a modified version of *Data General*’s rebuttable presumption test, holding that this presumption may be rebutted by evidence of pretext, which was relevant in *Kodak* but not in *Data General*.⁴³ *Kodak* involved a refusal to deal in the secondary market for patented and copyrighted parts, that is, an alleged leveraging from the parts market to the service market. The court relied on *Aspen Skiing* to endorse the plaintiffs’ theory “that § 2 of the Sherman Act prohibits a monopolist from refusing to deal in order to create or maintain a monopoly absent a legitimate business justification.”⁴⁴ In specifically addressing the IPR, the court stated that “[h]armonizing antitrust monopoly theory with the monopolies granted by intellectual property law requires that some weight be given to the intellectual property rights of the monopolist.”⁴⁵ In other words, “[u]nder the fact-based approaches of *Aspen Skiing* and *Kodak*, some measure must guarantee that the jury account for the procompetitive effects and statutory rights extended by the intellectual property laws.”⁴⁶ To assure such consideration, the court adopted a modified version of the rebuttable presumption created by the First Circuit in *Data General*.⁴⁷

38. DEP’T OF JUSTICE & FED. TRADE COMM’N., *supra* note 22, at 30.

39. 540 U.S. 398, 408 (2004) (quoting *United States v. Colgate & Co.*, 250 U.S. 300, 307 [1919]).

40. 540 U.S. 407–8.

41. *Id.* at 408.

42. 125 F.3d 1195 (9th Cir. 1997).

43. *Id.* at 1219.

44. *Id.* at 1209.

45. *Id.* at 1217.

46. *Id.* at 1218.

47. *Id.*

In *In re Independent Services Organizations Antitrust Litigation CSU, L.L.C.* (previously *CSU v. Xerox Corp.*),⁴⁸ the Federal Circuit explicitly refused to follow *Kodak*, stating that it would “not inquire into [the patent holder’s] subjective motivation for exerting his statutory rights, even though his refusal to sell or license his patented invention may have an anticompetitive effect, so long as that anticompetitive effect is not illegally extended beyond the statutory patent grant.”⁴⁹ In other words, “[i]n the absence of any indication of illegal tying, fraud in the Patent and Trademark Office, or sham litigation, the patent holder may enforce the statutory right to exclude others from making, using, or selling the claimed invention free from liability under the antitrust laws.”⁵⁰ While some contend that a FRAND assurance arguably makes this law inapplicable to FRAND-assured SEPs, at the very least it would seem to apply to FRAND-assured SEPs where the SEP holder complies with FRAND by licensing to all end-user device manufacturers.

Whether a refusal to license at the component level (which may or may not violate a FRAND assurance depending upon the specific SDO IPR policy at issue) results in harm to competition or consumers requires a case-by-case fact-specific inquiry relying on factors such as: (1) whether competition has been substantially foreclosed, which seems unlikely when the industry practice is not only not to license but also not to assert SEPs at the component level and instead to license at the end-user device level; and (2) whether there are any procompetitive or legitimate business justifications for such conduct, such as avoiding the patent exhaustion doctrine, reducing administrative costs to allow for easy monitoring or verification of units sold, and following industry practice.⁵¹

Many regard *Kodak* as an outlier. Indeed, *Kodak* has been widely criticized as, among other things, “set[ting] a dangerous precedent that has the potential to elevate intent-based inquiries over the analysis of the likely competitive effects,” and for adopting a standard that is “impractical and unworkable” to administer.⁵² As Judge Easterbrook remarked in *Schor v. Abbott Laboratories*, the court in *Kodak* “just got it wrong.”⁵³

In contrast with the U.S. approach, the EU appears to take a more interventionist approach to refusals to deal. In the EU, while all firms, including dominant firms, are generally free to deal with whom they wish, firms in a dominant position may, under limited circumstances, be required to license (or be found to violate Article 102 of the Treaty on the Functioning of the European Union [TFEU]) when the intellectual property at issue is deemed indispensable and the refusal to license results in anticompetitive foreclosure.⁵⁴

An EC Guidance Paper on the application of Article 102 TFEU further states:

When setting its enforcement priorities, the Commission starts from the position that, generally speaking, any undertaking, whether dominant or not, should have the right to choose its trading partners and to dispose freely of its property. . . . Typically competition problems arise when the dominant undertaking competes on the “downstream” market with the buyer whom it refuses to supply. The term “downstream market” is used to refer to the market for which the refused input is needed in order to manufacture a

48. 203 F.3d 1322 (Fed. Cir. 2000). *Xerox* involved a claim that Xerox’s refusal to sell patented parts and copyrighted manuals and to license copyrighted software violated antitrust laws. *Id.* at 1324.

49. *Id.* at 1327–28.

50. *Id.* (“We answer the threshold question of whether Xerox’s refusal to sell its patented parts exceeds the scope of the patent grant in the negative.”)

51. Koren W. Wong-Ervin et al., *supra* note 25, at 3.

52. R. Hewitt Pate, *Refusal to Deal and Intellectual Property Rights*, 10 GEO. MASON L. REV. 429, 438–39 (2002). See also Michael A. Carrier, *Refusals to License Intellectual Property After Trinko*, 55 DEPAUL L. REV. 1191, 1209 (2006) (contending that Supreme Court precedent “would tend not to support presumptions that could be rebutted based on intent,” *i.e.* *Kodak*).

53. 457 F.3d 608, 613 (7th Cir. 2006).

54. ROBERT O’DONOGHUE & A. JORGE PADILLA, *THE LAW and ECONOMICS of ARTICLE 102 TFEU* Ch. 10 (2d ed. 2013).

product or provide a service. This section deals only with this type of refusal. . . . The concept of refusal to supply covers a broad range of practices, such as a refusal to supply products to existing or new customers, refusal to license intellectual property rights, including when the license is necessary to provide interface information, or refusal to grant access to an essential facility or a network. . . . The Commission will consider these practices as an enforcement priority if all the following circumstances are present:

- ←the refusal relates to a product or service that is objectively necessary to be able to compete effectively on a downstream market,
- ←the refusal is likely to lead to the elimination of effective competition on the downstream market, and
- ←the refusal is likely to lead to consumer harm.⁵⁵

While the relevance of the Guidance Paper is under debate given the recent ruling of the European General Court in *Intel*,⁵⁶ as regards refusals to deal and in particular refusals to license IP, the Guidance is in line with European Union case law in *Magill*,⁵⁷ *IMS Health*,⁵⁸ and, most importantly, *Microsoft*,⁵⁹ which are the cases that have dealt in particular with a refusal to license IP.⁶⁰

Under Article 102 TFEU, causes of action for refusals to deal have certain parallels with the “essential facilities” doctrine, while the U.S. Supreme Court has made it clear that it will treat so-called “essential facilities” claims with great skepticism, stating that courts should be very cautious in recognizing exceptions to the general rule that even monopolists may choose with whom they deal.⁶¹ This is because, although a firm’s competitors may desire to use a particular technology in their own products, there are few situations in which access to a particular intellectual property right is necessary to compete in a market. Indeed, those who advocate forced sharing of an “essential” facility often have underestimated the ability of a determined rival to compete around the facility, with resulting benefits to consumers. This is particularly true with respect to fast-moving technologies, where technological and market developments can present multiple opportunities to work around a competitor’s intellectual property, and it is easier to work around an intellectual property right than it is to work around a physical structure. This analysis also applies in the same way to SEPs. Indeed, as discussed below, applying the essential facilities doctrine to SEPs may do more harm than good.

The U.S. approach also recognizes that potential inventors may be less likely to undertake the research and development that lead to an invention if the inventor’s reward for its efforts is reduced by having to share its patent. Conversely, if businesses know they can easily gain access to the patents of other firms, then they have less incentive to innovate and more incentive instead to free-ride on the risky and expensive research of others. Requiring businesses to grant licenses to competitors wishing to use a patented invention is likely to result in less innovation, which will harm consumers in the long run.

To sum up, antitrust liability for refusals to license is highly disfavored under U.S. law. In addition, under the burden-shifting framework applicable to U.S. antitrust cases, the existence of a legitimate business justification is likely to preclude liability at least in the United States under a refusal to deal

55. EUR. COMM’N, GUIDANCE ON THE COMMISSION’S ENFORCEMENT PRIORITIES IN APPLYING ARTICLE 82 OF THE EC TREATY TO ABUSIVE EXCLUSIONARY CONDUCT BY DOMINANT UNDERTAKINGS, 2009 O.J. (C 45) 7, ¶¶ 75–88 (hereinafter EC Guidance Paper) (only the essential points are reproduced, with footnotes omitted).

56. Case T-286/09, *Intel Corp. v. Comm’n*, ECLI: EU: T:2014:547 (GC June 12, 2014).

57. Joined Cases C-241/91 P & C-242/91 P, *Radio Telefis Éireann (RTE) & Independent Television Publications Ltd (ITP) v. Comm’n*, 1995 E.C.R. I-743.

58. Case C-418/01, *IMS Health GmbH & Co OHG v. NDC Health GmbH & Co KG*, 2004 E.C.R. I-5039.

59. Case T-201/04, *Microsoft Corp. v. Comm’n*, 2007 E.C.R. II-3601.

60. O’DONOGHUE & PADILLA, *supra* note 54.

61. *Verizon Commc’ns Inc. v. Law Offices of Curtis V. Trinko, LLP*, 540 U.S. 398, 408 (2004).

theory. As previously discussed, there are a number of legitimate business reasons for licensing at the end-user device level, including avoiding patent exhaustion, reducing administrative costs, and ease of monitoring or verifying the number of units sold. Under EU law, refusals to license may result in antitrust liability when the SEP holder has a dominant market position, the intellectual property is deemed indispensable, and the refusal to license results in anticompetitive foreclosure. As explained below, this theory of harm for licensing at the end-user device level only is unlikely to prevail under EU law.

IV. Potential Theories of Harm

In what follows, we extend the legal analysis in Part III to investigate the conditions under which such conduct could be regarded as anticompetitive as a matter of economics. This is done by considering from an economic perspective alternative theories of harm that are consistent with the U.S. and EU legal tests discussed above.

One potential theory of harm is that the refusal to license at the component level may be *exploitative*. However, as explained by Layne-Farrar et al., a refusal to license SEPs to component manufacturers cannot have an impact on the overall royalty payment and/or the end consumer price and, hence, cannot be regarded as an exploitative abuse.⁶² While in a world where licensing occurs at the component level, the end manufacturer saves on royalties, the price of the component it pays is higher because the component manufacturer will pass on a fraction of the royalties it pays. The authors show that, under general conditions, the total costs faced by the end product manufacturer (i.e., the sum of the component price and the royalty payment) will be as high when licensing occurs at the component level than when it only occurs at the end product level. Because its costs are unchanged, so will be the price it charges to its customers. In short, forcing SEP holders to license to component manufacturers will not result in lower royalties and/or lower end-consumer prices.

Another potential theory of harm is that by refusing to license at the component level, the vertically integrated SEP holder may, in effect, be bundling its component (the bundled product) with its essential patent portfolio (the bundling product) in order to monopolize the component market. Any end product manufacturer that buys the component of the vertically integrated firm simultaneously acquires a license to its SEPs. Instead, when the end product manufacturer buys the components sold by its nonintegrated rivals it still needs to negotiate a license for the patents of the vertically integrated SEP holder. If the bundled discount, implicit or explicit, is sufficiently large,⁶³ then this strategy might marginalize or evict its nonintegrated component rivals.

However, as shown with the help of the stylized model developed in Appendix A, this *bundling* strategy cannot lead to the foreclosure of the component market if (1) the vertically integrated SEP holder does not assert its patents at the component level, and (2) it licenses its SEP portfolio to downstream (finished device) manufacturers on FRAND terms, irrespective of whether they source components from its own subsidiary or from the nonintegrated rival. Intuitively, when (1) and (2) hold, the bundle offered by the vertically integrated SEP holder can be replicated competitively by end-device manufacturers by mixing and matching the component sold by the nonintegrated component supplier and the patent portfolio of the integrated SEP holder. This is because the essential patents (the bundling products) are offered on a standalone basis (i.e., outside the bundle) on competitive terms and, therefore, the end product manufacturers can choose either the bundle of the vertically integrated SEP holder or create their own bespoke bundle by purchasing the component from a nonintegrated

62. See Anne Layne-Farrar, Gerard Llobet, & Jorge Padilla, *Patent Licensing in Vertically Disaggregated Industries: The Royalty Allocation Neutrality Principle*, 95 COMM. & STRATEGIES 61 (2014).

63. It would be infinite in case the integrated SEP holder tied the component to its patents, i.e., it would only license its SEP portfolio to purchasers of its components. This, however, would be a clear infringement of its FRAND obligations.

component manufacturer and still license the SEPs of the vertically integrated SEP holder on fair and reasonable terms. As a result, the bundle is effectively constrained by the unbundled products and vice versa and, hence, bundling causes no distortion of the competitive process.

A third potential theory is *raising rivals' costs*. According to the raising rivals' cost literature, a firm may be subject to antitrust liability where it engages in conduct that unavoidably and significantly increases the costs of its competitors and, as a result, obtains the ability to exercise monopoly power by raising its price above the competitive level.⁶⁴ Central to the raising rivals' cost theory is the fact that while conduct that raises rivals' costs may harm competitors, it does not harm competition *unless* the firm whose conduct is scrutinized is thereby enabled to raise its price above the competitive level.⁶⁵

Under this theory, the allegation could be that in order to compete with a vertically integrated firm that sells the relevant SEP licenses *and* component parts, a nonintegrated component manufacturer must offer indemnification to its customers from patent infringement liability. This is a fact-specific issue that turns on issues such as whether the vertically integrated firm would act against its self-interest by asserting its patents at the component level, which would likely have the effect of exhausting its patents and defeating its entire business model of licensing at the end-user device level. There is also the issue of what the indemnification is for, given that customers of component parts, that is, end-user device manufacturers, will arguably have a license to the necessary SEPs at the end-user device level.

Regardless, a covenant not to sue at the component level from the vertically integrated firm could resolve the issue, provided manufacturers of end-user devices are licensed on FRAND terms irrespective of whether they source components from its own subsidiary or from the nonintegrated rival. When the essential patents are offered on a standalone basis on FRAND terms irrespective of whether components are sourced from and patents are not asserted at the component level, the component price of the vertically integrated firm is effectively constrained by the prices offered by the nonintegrated component manufacturers, since the latter need not offer indemnification to their customers to be competitive. It follows that under those circumstances, the decision not to license at the component level causes no distortion of the competitive process.

A variant of the raising rivals' costs theory above is that customers could be worried about reliability of supply from a component manufacturer that is unlicensed and could be enjoined from selling its product. Here, again, a covenant not to sue from the vertically integrated firm combined with the availability of licenses on FRAND terms at the end-user device level would resolve the issue.

V. Conclusion

Whether the "ND" in FRAND requires licensing at the component level is a fact-specific inquiry that depends upon the specific SDO IPR Policy at issue. The inquiry is not, however, relevant to the question of whether a refusal to license a FRAND-assured SEP at the component level amounts to an antitrust violation because evasion of a FRAND assurance alone does not constitute an antitrust violation.

The relevant antitrust question under refusal to license law is whether such conduct results in anticompetitive harm such as foreclosure. If it is true, as we believe based on our experience, that most FRAND-assured SEP holders do not assert their patents at the component level *and* offer FRAND terms to downstream manufacturers irrespective of the supplier of their components, then there is likely no foreclosure or exclusionary conduct, and seemingly none that cannot be solved by a covenant

64. See, e.g., Thomas G. Krattenmaker & Steven C. Salop, *Anticompetitive Exclusion: Raising Rivals' Costs to Achieve Power over Price*, 96 YALE L.J. 209, 214 (1986); Steven C. Salop & David T. Scheffman, *Raising Rivals' Costs*, 73 AM. ECON. REV. 267 (1983).

65. Krattenmaker & Salop, *supra* note 64, at 242.

not to sue. Moreover, there are a number of legitimate business reasons for the common industry practice of licensing at the end-user device level, including avoiding patent exhaustion, reducing administrative costs, and ease of monitoring or verifying the number of units sold.

We thus conclude that there is no justification, either as a matter of law or economics, to intervene against the decision of an SEP holder to refuse licensing patents that it has committed to license on FRAND terms to component manufacturers when it does not assert its patents at the component level and licenses its portfolio to end-device manufacturers on FRAND terms irrespective of where they source their components. Under those circumstances, there is no risk of foreclosure and hence no antitrust harm.

Appendices

In the body of this article, we conclude that: (1) whether the “nondiscriminatory” prong of the FRAND promise requires licensing at the component level is a fact-specific inquiry that depends upon the specific standard-development organization’s policy; (2) even if there is potential a failure to comply with a FRAND assurance, that alone does not constitute an antitrust violation; and (3) the refusal to license at component level cannot be anticompetitive when the vertically integrated holder of one or more SEPs does not assert its patents against the makers of components but, instead, licenses its SEP portfolio to end-device manufacturers on FRAND terms. Appendixes A and B provide an economic basis for the latter two parts of this conclusion.

Appendix A demonstrates, under the assumptions of a simple game-theoretic model, conditions under which a refusal by a SEP owner that is integrated vertically into the supply of components will or will not foreclose rival component suppliers. We find that, in the absence of a FRAND commitment on the part of the vertically integrated SEP holder or any other constraint on the royalty it can charge, its choice to not license to rival component makers will foreclose the competing component makers. When instead the vertically integrated component maker is bound by a FRAND commitment, however, such a decision will not lead to anticompetitive foreclosure. Thus, in the presence of a binding FRAND commitment, the vertically integrated SEP holder’s refusal to license to rival component makers—but, instead, to the makers of downstream devices—would not constitute anticompetitive exclusion as such.

Appendix B extends the analysis to the more complex case in which the non-vertically integrated SEP owner secures a cross-license from the vertically integrated one, and passes that license through to downstream device manufacturers.

Appendix A

1. The Model

Our model features two SEP holders (SEP holder 1 and SEP holder 2). SEP holder 2 is vertically integrated with Chipset OEM 2. The vertically integrated SEP holder competes with a nonintegrated component manufacturer, Chipset OEM 1, for the demand of Q handset OEMs, each with value v for one chipset unit.^{66,67} See Figure A1. SEP holder 1 and SEP holder 2 only license to handset manufacturers, but do not enforce their patents at the component (chipset) level.

66. We assume that v is sufficiently large so that producing handsets is socially efficient. This implies that $v - r_1 - c - F/Q$ is greater than zero, where r_1 , c , and F are defined below.

67. Note that we are assuming that each handset OEM produces only one unit of its handset and, therefore, demands only one unit of the component (which we refer to as a “chipset”). We also assume that handset manufacturers sell homogeneous products. This is done for expositional simplicity only. Our intuition is that the main results derived in this appendix, as well as in Appendix B, are robust to more complex demand systems and product differentiation, meaning that their conclusions

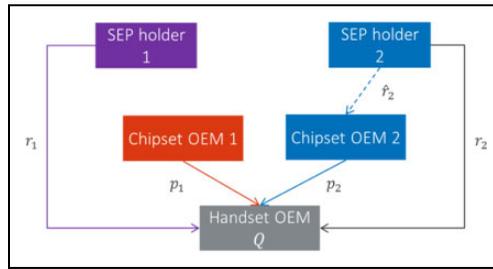


Figure A1. The industry.

Each of the Q handset OEM has two options as regards its component needs.

- ←First, it can buy from the vertically integrated firm the component it needs and, if it chooses to do so, it then obtains a license to the patent portfolio of SEP holder 2. The total cost of this option is $p_2 = \hat{p}_2 + \hat{r}_2$, where \hat{r}_2 denotes the implicit royalty rate charged to its component subsidiary (Chipset OEM 2) by SEP holder 2 and \hat{p}_2 is thus the implicit price of the component sold by Chipset OEM 2 to the handset manufacturers.
- ←Second, it can purchase the component from Chipset OEM 1 and pay a price p_1 . In this case, it will have to enter into a separate licensing agreement with SEP holder 2. SEP holder 2 will apply a royalty r_2 in this case.

The portfolios of SEP holder 1 and SEP holder 2 are strict complements. So irrespective of the component option each handset manufacturer exercises, it will have to pay a royalty r_1 to SEP holder 1. In this model, we take royalty r_1 as given.

Based on these assumptions, a handset will choose to acquire the bundled product if $p_2 < p_1 + r_2$; it will create its own mix-and-match bundle if $p_2 \geq p_1 + r_2$.⁶⁸ Let q_1 be the quantity of chipsets sold by Chipset OEM 1 and q_2 be the quantity of chipsets sold by Chipset OEM 2 and F denotes the fixed cost of Chipset OEM 2. Then,

$$q_1 = q_1(p_1, p_2, r_2) = \begin{cases} Q & p_2 \geq p_1 + r_2, \\ 0 & p_2 < p_1 + r_2. \end{cases}$$

and $q_2 = q_2(p_1, p_2, r_2) = Q - q_1(p_1, p_2, r_2)$. We can then write the following expressions:

- ←Handset profits when purchasing from Chipset OEM 1: $v - r_1 - r_2 - p_1$.
- ←Handset profits when purchasing from Chipset OEM 2: $v - r_1 - p_2$.
- ←Profits for Chipset OEM 1: $(p_1 - c)q_1 - F$, where c denotes the marginal cost of producing a chipset by Chipset OEM 1 and F denotes the fixed cost of Chipset OEM 1.
- ←Profits for Chipset OEM 2: $(p_2 - c)q_2 - \hat{r}_2q_2 - F$, where c denotes the marginal cost of producing a chipset by Chipset OEM 2 and F denotes the fixed cost of Chipset OEM 2.
- ←Profits for SEP holder 2: $(p_2 - c)q_2 + r_2q_1 - F$. These are the profits of the vertically integrated SEP holder and are equal to the sum of the profits of Chipset OEM 2 (see above) and the

can be applied to situations when handset makers produce multiple units of their products and offer different types of handsets.

68. Note that, in principle, handset manufacturers are indifferent between the bundled product and the mix-and-match solution when $p_2 = p_1 + r_2$. For expositional simplicity we have adopted a “tie-breaking rule,” which however allocates all handset demand to Chipset OEM 1 when that equality holds. Note that Chipset OEM 1 will only set a price $p_1 = p_2 - r_2$ if $p_1 > c + F/Q$. If p_2 and r_2 are such that $p_2 - r_2 < c + F/Q$, then the tie-breaking rules becomes irrelevant as Chipset OEM 1 will prefer to exit the market.

licensing revenue of SEP holder 2; i.e. $r_2q_1 + \hat{r}_2q_2$. We assume that the vertically integrated SEP holder 2 strictly prefers to be active in the component market (i.e. $q_2 > 0$) provided its sales command a non-negative margin.⁶⁹

We investigate the subgame perfect Nash equilibria p_1^*, p_2^*, r_2^* of a sequential price setting game, where SEP holder 2 first sets p_2, r_2 and then Chipset OEM 1 sets p_1 .⁷⁰ In this equilibrium, Chipset OEM 1 sets p_1 to maximise its profits taking p_2, r_2 as given, and SEP holder 2 sets p_2, r_2 to maximise its profits anticipating Chipset OEM 1's optimal response.⁷¹

2. No FRAND Scenario

Suppose SEP holder 2 is not bound by a FRAND commitment, i.e. it faces no pricing constraint or cap when setting r_2 . In equilibrium,⁷²

- ← Chipset OEM 1's reaction function is
 - ← $p_1(p_2, r_2) = p_2 - r_2$, provided $p_2 - r_2 \geq c + F/Q$, and
 - ← exit the market, otherwise.
- ← SEP holder 2 sets
 - ← $r_2 > p_2 - c - F/Q$, and
 - ← $p_2 = v - r_1$.⁷³

That is, there are multiple subgame perfect equilibria of the form *exit*, $v - r_1, r_2^*$ with $r_2^* > v - r_1 - c - F/Q$.

Given SEP holder 2 choices, Chipset OEM 1 will be foreclosed. Note that this happens even when SEP holder 2 does not enforce its IP against chipset OEM 1. SEP holder 2 sets its royalty r_2 so high that its bundled price p_2 cannot be competed away profitably by Chipset OEM 1. The discount Chipset OEM 1 would have to offer to compensate for r_2 is so high that the net price will not cover its unit costs. This strategy yields SEP holder 2 profits equal to $(v - r_1 - c)Q - F$, which are greater than the profits it would obtain if it set $r_2 \leq p_2 - c - F/Q$, for all break even $p_2 \geq c + F/Q$, and thus left the component market to be contested by Chipset OEM 1.

In equilibrium, handset manufacturers end up paying v for the chipset and the essential patents of SEP holders 1 and 2, and their profits are therefore equal to 0. That is, all gains from trade over and above r_1 are appropriated by SEP holder 2.

Hence, in the absence of a FRAND commitment from SEP holder 2, or any other constraint on its royalty, SEP holder 2's decision not to license at component level will lead to anticompetitive foreclosure in the component market. In this case, a covenant not to sue from the vertically integrated firm

69. This assumption ensures that the one monopoly profit theorem does not apply to the game we are modelling, so that SEP holder 2 has an incentive to monopolize the downstream component market.

70. In subgame perfect equilibrium of a game with sequential moves, each player—in this case SEP holder 2 and Chipset OEM 1—takes its action rationally anticipating that later its rival will respond optimally, selecting a profit maximizing action given the actions taken by the first mover.

71. We model a sequential game for expositional simplicity only. None of our qualitative results would change if SEP holder 2 and Chipset OEM 1 moved simultaneously. Furthermore, we conjecture that our results are robust to alternative sequential structures, such as, e.g., if SEP holder chooses r_2 first and then SEP holder 2 and Chipset OEM 1 choose their prices simultaneously.

72. We solve the game set out above by backward induction, which is the standard way of characterizing subgame perfect Nash equilibria. STEVEN TADELIS, GAME THEORY. AN INTRODUCTION, SEC. 2.4.1 (2013).

73. Because the vertically integrated SEP holder 2 strictly prefers to be active in the component market provided its sales command a nonnegative margin, it will not find it optimal to set $p_2 = c + F/Q + r_2$ and $r_2 = v - r_1 - (c + F/Q)$. While this nonexclusionary strategy yields the same profits as the exclusionary strategy above, $[v - r_1 - (c + F/Q)]Q$, it involves no sales in equilibrium.

would not resolve the issue. SEP holder 2 can leverage its essential patents to exclude Chipset OEM 1 from the component market.

3. FRAND Scenario

SEP holder 2’s equilibrium royalty r_2^* in section IV.B is not FRAND. This is because at that royalty no handset manufacturer that would have acquired a component from Chipset OEM 1 at an above-cost price would be able to license from SEP holder 2 profitably.⁷⁴ That is, the royalty terms offered by SEP holder 2 to handset OEMs purchasing their components from third parties at above-cost prices give rise to a constructive refusal to deal at the end-product level. This implies that the royalty terms offered by SEP holder 2 exceed the incremental value of SEP holder 2’s technology, which is given by $v - r_1 - c - F/Q$.

Suppose instead that SEP holder 2 is bound by a FRAND commitment. The ND prong of that requirement implies that $r_2 = \hat{r}_2$ or, in words, that the royalty rate SEP holder 2 applies to handset manufacturers is independent of whether they purchase components from its subsidiary (Chipset OEM 2) or its competitor (Chipset OEM 1).

A necessary condition for \hat{r}_2 (and hence r_2) to satisfy the FR and ND prongs of the FRAND commitment is:

$$\hat{r}_2 = p_2 - \hat{p}_2 \quad p_2 - c - F/Q.$$

Or, in other words, the implicit royalty rate charged by SEP holder 2 to its component subsidiary (Chipset OEM 2), \hat{r}_2 , must allow Chipset OEM 2, and any of its as-efficient competitors, to break even when it sells its component at p_2 . Clearly this condition is not satisfied by SEP holder 2’s equilibrium royalty r_2^* in section IV.B., since that royalty exceeds the incremental value of SEP holder 2’s technology, which is given by $v - r_1 - c - F/Q$.

This necessary condition may not be sufficient, however. The FR prong of the FRAND commitment may impose an even tighter upper bound \bar{r}_2 .^{75,76} Whether \bar{r}_2 is strictly smaller than or equal to $p_2 - c - F/Q$ is however irrelevant for the analysis below.

As before, we solve the game set out in section IV.A by backward induction:

- ←Chipset OEM 1’s reaction function is
 - ← $p_1(p_2, r_2) = p_2 - r_2$, provided $p_2 - r_2 \geq c + F/Q$, and
 - ←exit the market, otherwise.
- ←SEP holder 2 sets
 - ← $r_2 = \bar{r}_2$,⁷⁷ and
 - ← $p_2 = c + F/Q + \bar{r}_2$.

So, there is a subgame perfect equilibria of the form $c + F/Q, c + F/Q + \bar{r}_2, \bar{r}_2$. In this equilibrium,

74. The profits of a handset manufacturer which purchases from Chipset OEM 1 at a price $p_1 - c + F/Q$ are smaller than or equal to $v - r_1 - c - F/Q - r_2 < 0$ for $r_2 = r_2^* > v - r_1 - c - F/Q$.

75. The meaning of FR prong of a FRAND commitment is the subject of much controversy. See, e.g., J. Gregory Sidak, *The Meaning of FRAND, Part I: Royalties*, 9 J. COMP. L. & ECON. 931 (2013).

76. Since $p_2 - v - r_1, \bar{r}_2$ must be such that $(v - r_1 - \bar{r}_2) \geq c + F/Q$.

77. Strictly speaking, $r_2 = \min\{\bar{r}_2, v - r_1 - c - F/Q\}$.

- SEP holder 2 prices its bundle and its patents competitively: it sets an implicit chipset price equal to the unit costs of manufacturing and commercializing the chipsets and an implicit royalty, equal to the market royalty, at a level consistent with its FRAND commitment.
- Chipset OEM 1 will not be foreclosed from the market. In fact, given that the assumptions of our stylized model,⁷⁸ all chipset sales are made by Chipset OEM 1 in equilibrium. This result would change had we assumed that the chipsets sold by Chipset OEM 1 and Chipset OEM 2 were differentiated. However, the no foreclosure result would carry to that more complex scenario.
- Handset manufacturers profits of each manufacturer will be greater than or equal to $v - r_1 - \bar{r}_2 - c - F/Q > 0$.⁷⁹ This means that handset manufacturers will benefit from unfettered competition in the component market.

Hence, when SEP holder 2 is bound by a FRAND assurance, SEP holder 2’s decision not to license at component level will not lead to anticompetitive foreclosure.⁸⁰ That is, the refusal to license at the component level is not exclusionary per se and can only distort competition if the royalty terms offered to handset OEMs purchasing their components from third parties effect a margin squeeze in the component market. In particular, the refusal to license at the component level would be exclusionary if the royalty terms offered to handset OEMs purchasing their components from third parties at above-cost prices give rise to a “constructive” refusal to deal at the end-product level, which would likely constitute a violation of the FRAND commitment.⁸¹

Appendix B

Consider the model in Annex A. above but now suppose that SEP holder 1 granted a license to Chipset OEM 2 at a royalty r_1 . Those rights are then pass through to the handset OEMs patronizing Chipset OEM 2. See Figure B1.

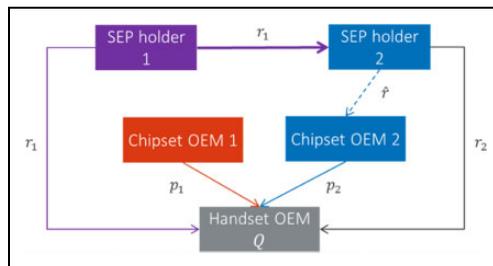


Figure B1. Modeling pass-through rights.

This means that when a handset OEM purchases from the vertically integrated firm the component it needs, it now obtains a license to the patent portfolios of both SEP holders 1 and 2. So, in order to

78. More precisely, the tie-breaking rule according to which $q_1(p_1, p_2, r_2) = Q$ if $p_2 = p_1 + r_2$.
 79. Strictly speaking, greater than or equal to $v - r_1 - \min\{\bar{r}_2, v - r_1 - c - F/Q\} - c - F/Q = 0$ with the inequality being strict if $\bar{r}_2 < v - r_1 - c - F/Q$.
 80. In Annex B we prove that this result extends to a scenario where SEP holder 2 obtains a cross license from SEP holder 1 and passes it through to the purchasers of the components sold by its subsidiary, Chipset OEM 2.
 81. See, e.g., *In re Innovatio IP Ventures, LLC Patent Litig.*, 2013 WL 5593609, at *4 (N.D. Ill. Oct. 3, 2013).

remain competitive, Chipset OEM 1 will have to set $p_1 = p_2 - r_1 - r_2$, provided that allowed it to break even, or else will leave the market. In this scenario, $\hat{p}_2 = p_2 - \hat{r}$.

As in section IV.C., the FRAND requirement implies:

$$\hat{r} = r_1 + r_2$$

$$\hat{r} = p_2 - \hat{p}_2 \quad p_2 - c - \frac{F}{Q}.$$

The first condition is driven by non-discrimination. If the last condition did not hold the implicit royalty implicit royalty rate charged to its component subsidiary (Chipset OEM 2) by SEP holder 2 would effect a margin squeeze at the end-product level or, as explained in Annex A, will exceed the incremental value of SEP holder 2's technology. The last condition can be written as $\hat{r}_2 = \hat{r} - r_1 = p_2 - r_1 - c - \frac{F}{Q}$.

From the conditions above we have that

$$\hat{p}_2 = c + \frac{F}{Q}$$

This means that the implicit price of the component sold by Chipset OEM 2, \hat{p}_2 , is not predatory and, therefore, Chipset OEM 1, which is an as-efficient competitor to Chipset OEM 2, will be able to break even when setting $p_1 = p_2 - r_1 - r_2$.

Solving the game set out above, which modifies the model in section IV.A, by backward induction:

- ← Chipset OEM 1 sets
 - ← $p_1 = p_2 - r_1 - r_2$, provided $p_2 - r_1 - r_2 \geq c + \frac{F}{Q}$, and
 - ← it exits the market, otherwise.
- ← SEP holder 2 sets
 - ← $r_2 = \bar{r}_2 = p_2 - r_1 - c - \frac{F}{Q}$, and
 - ← $p_2 = c + \frac{F}{Q} + r_1 + \bar{r}_2$.

So, there is subgame perfect equilibria of the form $c + \frac{F}{Q}, c + \frac{F}{Q} + r_1 + \bar{r}_2, \bar{r}_2$. In this equilibrium,

- ← SEP holder 2 prices its bundle and its patents competitively.
- ← Chipset OEM 1 will not be foreclosed from the market.
- ← Handset manufacturers profits of each manufacturer will be greater or equal than $v - r_1 - \bar{r}_2 - c - \frac{F}{Q} > 0$.

Authors' Note

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Dr. Padilla has represented and still represents SEP holders and implementers in various antitrust and commercial disputes related to FRAND issues.

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