UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA

TCL COMMUNICATION TECHNOLOGY HOLDINGS, LTD., *et al.*,

Plaintiffs/Counterclaim-Defendants,

v.

TELEFONAKTIEBOLAGET LM ERICSSON, *et al.*,

Defendants/Counterclaim-Plaintiffs,

ERICSSON INC., *et al.*,

Plaintiffs/Counterclaim-Defendants,

TCL COMMUNICATION TECHNOLOGY HOLDINGS, LTD., *et al.*,

Defendants/Counterclaim-Plaintiffs.

CASE NO: SACV 14-341 JVS(DFMx)
Consolidated with
CASE NO: CV 15-2370 JVS(DFMx)

Memorandum of Findings of Fact and Conclusions of Law

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This case focuses on the licensing of patents in the telecommunications field affecting 2G, 3G, and 4G[1] cellular technologies. As discussed below, TCL Communication Technology Holdings, Ltd., TCT Mobile Limited, and TCT Mobile (US) Inc. (collectively "TCL") manufacture and distribute cell phones on a world-wide scale. Telefonaktiebolaget LM Ericsson and Ericsson Inc. (collectively "Ericsson") hold an extensive portfolio of telecommunications patents. TCL seeks to license Ericsson's patents, but the parties cannot agree on terms.

There is a critical overlay to this dispute. Standards organizations have evolved with the development of technology. The adoption of standards facilitates the overall development of technology and provides a common base which allows many manufacturers' devices to perform reliably and interchangeably in a given telecommunications environment. The relevant standards organization here is the European Telecommunications Standards Institute, or "ETSI." The acceptance of a patent holder's patent into a standard is of great value to the patent holder, and enhances the monopoly which the patent holder has by virtue of his patent. The accepted patents are referred to as standard essential patents, or "SEPs." Anyone who wishes to manufacture in accordance with the standard must secure a license from the patent holder. However, in exchange for acceptance of a patent as part of a standard, the patent holder must agree to license that technology on fair reasonable and non discriminatory terms, or "FRAND" terms.

The task of the Court here is three fold.[2] The Court must determine whether Ericsson met its FRAND obligation, and then whether Ericsson's final offers before litigation, Offer A and Offer B, satisfy FRAND. If they are not, the Court must determine what terms are material to a FRAND license, and then supply the

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[1]Unless otherwise specified, 2G refers to GSM, GPRS, and EDGE, 3G refers to W-CDMA, and 4G refers to LTE and LTE advanced standards.

[2]TCL's complaint contained a cause of action for breach of contract, here the ETSI third party obligation. (Docket No. 31, Second Amended Complaint, First Cause of Action.) However, the Court granted summary judgment on that claim in light of TCL's discovery defaults with regard to damages. (Docket No. 1061.)

FRAND terms.[3] (Docket No. 1055 at 3-5.) The Court is presented with two principal schemes for determining the proper royalty rate. TCL advocates a "top-down" approach which begins with an aggregate royalty for all patents encompassed in a standard, then determines a firm's portion of that aggregate. Ericsson turns to existing licenses which it has negotiated to determine the appropriate rates. Ericsson also offers an "*ex ante*," or ex-Standard, approach which seeks to measure in absolute terms the value which Ericsson's patents add to a product.[4]

The Court discusses the procedural and factual background of the dispute, considers the ETSI overlay, and then turns to the parties' competing royalty approaches.

At the end of the day, the Court reaches the following conclusions:

- Ericsson negotiated in good faith and its conduct during the course of negotiations did not violate its FRAND obligation.

- It is unnecessary for the Court to determine whether the failure to arrive at an agreed FRAND rate violated Ericsson's FRAND obligation. Regardless of the answer to that question, the Court is required to assess whether FRAND rates have been offered in light of the declaratory relief which both sides seek.

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[3]The claims here are framed by the following pleadings in Case No. SACV14-341: TCL's Second Amended Complaint (Docket No. 31), Ericsson's Answer, Defenses and Counterclaims (Docket No. 59), and TCL's Reply (Docket No. 66), as well as the following pleadings in Case No. CV 15-2370: Ericsson's First Amended Complaint (Docket No. 17), TCL's Answer, Affirmative Defenses, and Counterclaims (Docket No. 22), and Ericsson's Amended Answer and Affirmative Defenses to TCL's Counterclaims (Docket No. 52). However, the only claims tried were the parties' respective claims for breach of contract and declaratory relief regarding Ericsson's compliance with its FRAND obligation and declaratory relief for determination of FRAND rates. The parties' respective claims regarding infringement, invalidity, and other substantive patent defenses were previously stayed. (See Docket No. 1448-1, p. 3.)

[4]The royalty rates determined by the Court will also form the basis for the calculation of a release payment from TCL to Ericsson to compensate for TCL's prior unlicensed use of Ericsson's patents.

• Ericsson's Offer A and Offer B are not FRAND rates, and thus the Court proceeds to determine FRAND rates, and does so.

Pursuant to Federal Rule of Civil Procedure 52(a), the following constitute the Court's Findings of Fact and Conclusions of Law.[5]

PART I: BACKGROUND[6]

I. The Parties' License Dispute and Litigation.

A. The Parties' Negotiations and the Foreign Litigation.

On March 6, 2007, two TCL affiliates–T&A Mobile Phones Limited (later renamed TCL Mobile Ltd.) and TCL Mobile Communication (HK) Company Limited–entered into 2G licenses with Ericsson with seven-year terms. (Exs. 64, 65; Brismark Decl. ¶ 76; Guo Decl. ¶¶ 19-20.)

Although there were some prior discussions, it was not until 2011 that TCL and Ericsson began to negotiate a 3G license in earnest. (Alfalahi Depo., Jan. 12, 2016, pp. 206:20-207:6; Ex. 102 at 14-15.) TCL did not sell a meaningful volume of 3G phones until that year. (TT Feb. 28, 2017, p. 103:11-15; Ex. 142.)

In 2012, while the parties were still negotiating, Ericsson initiated a series of foreign litigations against TCL for alleged infringement of Ericsson's SEPs.

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[5]Although the court has labeled its final section as Conclusions of Law and so by implication the remainder are Findings of Fact, these labels are only applied to aid in understanding the opinion. See Tri–Tron Int'l v. A.A. Velto, 525 F.2d 432, 435–36 (9th Cir.1975) ("We look at a finding or a conclusion in its true light, regardless of the label that the district court may have placed on it.... [T]he findings are sufficient if they permit a clear understanding of the basis for the decision of the trial court, irrespective of their mere form or arrangement") (citations omitted); In re Bubble Up Delaware, Inc., 684 F.2d 1259, 1262 (9th Cir.1982) ("The fact that a court labels determinations 'Findings of Fact' does not make them so if they are in reality conclusions of law.").

[6]The parties have filed extensive evidentiary objections, some of which the Court ruled on during the trial. (E.g., Docket Nos. 1378, 1494, 1497, 1507, 1571, 1627, 1635, 1638.) Where evidence is cited, the Court overrules all objections. With regard to the balance of the objections, the Court does not rely on those matters and the objections are moot.

Between October 2012 and late 2014, Ericsson filed at least 11 lawsuits against TCL and/or its affiliates in 6 different jurisdictions— France, the U.K., Brazil, Russia, Argentina, and Germany. (Docket No. 279-1, pp. 6-9; Brismark Decl. ¶ 78; Guo Rebuttal Decl. ¶ 59.)

TCL continued to negotiate with Ericsson. In 2013, the parties began negotiating a license covering Ericsson's 4G patents. (Ex. 102 at 19-20.) That year TCL started selling 4G phones, and Ericsson offered 4G rates to TCL for the first time. (Id.; Ex. 142.) But there was no offer or counteroffer exchanged that TCL considered to be on FRAND terms. (TT Feb. 15, 2017, pp. 17:7-19:9.)

The rates Ericsson offered evolved over the course of the parties' negotiations. For example, Ericsson's first 4G offer on March 25, 2013 was a running royalty rate of 3% for 4G handsets and tablets, with a $3 floor and $8 cap (on top of a $10 million release payment). (Ex. 102 at 19-20.) Less than two months later, Ericsson reduced the cap for 4G devices to $7. (Id. at 21-23.) About a month after that, Ericsson dropped the floor to $2.50 per 4G device. (Id. at 24-25.) After TCL filed this lawsuit, Ericsson made another offer on April 23, 2014, reducing the 4G rate to 2% and eliminating the floor and cap for any sales exceeding $3 billion U.S. (plus lump sum payments of $30 million per year for 5 years and a release payment). (Id. at 27-29; Docket No. 138, Ex. A at 9-10, ¶ 7.1.) On February 11, 2015, Ericsson made another offer, reducing the 4G rate to 1.5%, with a $2 floor and a $4.50 cap (plus a release payment but no lump sum payments). (Ex. 102 at 29; Docket No. 138, Ex. B, pp. 8-9, ¶ 6.1.)

Ericsson's 3G offers show a similar drop during the negotiations. Ericsson's first offer on July 25, 2011 was a 2% running royalty rate with a $2 floor and $6 cap. (Ex. 102 at 14-15.) By the time Ericsson proposed Option B on February 11, 2015, Ericsson had reduced the running royalty rate to 1.2% with no floor or cap. (Docket No. 138, Ex. B, p. 8, ¶ 6.1.)

At a meeting in February 2014, Ericsson made the license offer to TCL that would later form the basis for Option A. (Brismark Decl. ¶79; TT Feb. 14, 2017, p. 169:13-18.) TCL's George Guo followed up with an email stating that "[w]e just had an internal discussion on your proposal, it looks promising. We will form a team quickly to start the detail negotiation." (Ex. 137 at 2; TT Feb. 14, 2017, pp. 169:19-170:8.) However, TCL filed this lawsuit before the process could proceed

further. (TT Feb. 14, 2017, p. 170:9-15.)

At that time, the parties had already engaged in more than six years of negotiations: Ericsson had made over a dozen offers to TCL and multiple concessions in the process. (Brismark Decl. ¶¶ 78, 82; see also Exs. 1471, 1477, 1481, 1483, 1485, 1487, 1491, 1494, 1497.) In addition, when the parties' negotiations failed, TCL and Ericsson agreed to engage in a binding court adjudication of terms for a worldwide portfolio license. (Guo Rebuttal Decl. ¶ 60; Brismark Decl. ¶¶ 76-82.)

B. The Filing of This Lawsuit and Subsequent Anti-Suit Injunction.

In March 2014, the 2G licenses between TCL and Ericsson were set to expire. (Exs. 64, 65.) On March 5, 2014, TCL initiated this action. (SACV 14-341,[7] Docket Nos. 1, 31; Guo Rebuttal Decl. ¶ 60.) Among other things, TCL sought a declaration that Ericsson had failed to offer FRAND terms and conditions, as well as a determination of the FRAND rates to which TCL is entitled. (Docket No. 31, p. 41, ¶¶ A, D, G.) Ericsson asserted counterclaims. (Docket No. 59.)

On June 3, 2014, Ericsson filed what was essentially a mirror-image action against TCL in the Eastern District of Texas. (C.D. Cal., Case No. 2:15-cv-02370-JVS-DFM (as transferred), Docket No. 1.) In that case, Ericsson sought a declaration that it had complied with its FRAND obligation. (Id. ¶¶ 53-59.) In the alternative, Ericsson asked the Court to "declare what steps would be required to achieve such compliance." (Id. p. 18, ¶ G.) Ericsson also sought a "compulsory forward royalty" in lieu of an injunction. (Id. ¶ I.) TCL asserted counter-claims. (Id., Docket No. 22, pp. 12-54.) On April 2, 2015, the Texas action was transferred to this Court. (Id., Docket No. 104.) On June 29, 2015, the transferred action was consolidated with TCL's lawsuit. (Docket No. 279-1, p. 16.)

On May 7, 2015, TCL filed a motion to enjoin Ericsson "from further prosecuting any actions alleging infringement of its 2G, 3G, and 4G patents until the FRAND issues are resolved here." (Docket No. 195, pp. 12-13.) On June 29, 2015, the Court granted TCL's motion and enjoined the foreign litigation.

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[7]Unless otherwise noted, docket number reference as to Case No. SACV 14-341 JVS DFM.

(Docket No. 279-1, pp. 5-11.) In the Court's view, a stay of the foreign litigation would allow the parties to concentrate on the overriding FRAND issues. Moreover, during the course of this litigation, TCL agreed to be bound by the Court's determination of FRAND terms and conditions for a worldwide portfolio license, including a release payment for TCL's past unlicensed sales. This effectively mooted Ericsson's pending patent infringement claims against TCL in this Court and other courts around the world.

C. Ericsson's FRAND Contentions.

On February 24, 2015, the Court ordered Ericsson to file its "FRAND contentions," i.e., what Ericsson contended would constitute FRAND terms for a license to its SEPs. (Docket No. 120.) Ericsson's FRAND contentions contained two offers: "Option A" and "Option B." (Docket No. 138, 205 (as amended in March and May 2015).) Options A and B are based on Ericsson's April 23, 2014 and February 11, 2015 offers, respectively. (Brismark Decl. ¶ 84.)

Both Options A and B, if accepted, would grant TCL a forward license to Ericsson's 2G, 3G, and 4G SEP portfolios, with coverage for TCL's global sales of 2G, 3G, and 4G standard-compliant end user terminals,[8] external modems, and personal computers (as those product categories are defined in the offers). (Exs. 458, 459.) Both offers specify a release payment intended to compensate Ericsson for TCL's unlicensed use of Ericsson's SEPs in the past. (Exs. 458, 459.)

Under Option A, for mobile phones, TCL would make an annual payment of $30 million for its first $3 billion in sales, with percentage running royalties for additional sales. (Brismark Decl. ¶¶ 89, 90.) The running royalty rates are 0.8% of the net selling price for phones with 2G GSM/GPRS, 1.1% for phones with 2G EDGE, 1.5% for 3G devices, and 2.0% for 4G devices, with a 50% discount for sales in China. (Brismark Decl. ¶¶ 89, 90.) For the first $3 billion in sales, TCL would pay an effective percentage rate of 1.0%. However, lower or higher sales volumes would produce a higher effective rate.

[8]End user terminals are defined in Options A and B to include handsets (feature phones and smartphones) and tablets. (Ex. 458 at 2; Ex. 459 at 2.) In this Order, the Court uses the terms "end user terminal," "handset," "cell phone," and "device" interchangeably.

Option A also includes running royalty rates for external modems and personal computers. For external modems, the non-China per-unit rates are 1.5% of the net selling price for 2G or 3G with a $0.40 floor, $3 for 4G if the net selling price is $60 or more, and $1 for 4G if the net selling price is under $60 (the China rates are half as much). (Brismark Decl. ¶ 89.) For personal computers, the non-China per-unit rates are $0.50 for 2G GPRS, $0.75 for 2G EDGE, $2.25 for 3G single mode, $2.75 for 3G multi-mode, and $3.5 for 4G (the China rates are half as much). (Id.)

Under Option B, for mobile phones, TCL would pay percentage running royalty rates as follows: 0.8% of the net selling price for 2G GSM/GPRS, 1.0% for 2G EDGE, 1.2% for 3G, and 1.5% for 4G with a $2.00 floor and a $4.50 cap. (Brismark Decl. ¶ 96.) For external modems, TCL would pay $0.75 per unit for 2G or 3G, and 1.5% of the net selling price for 4G with a $2.00 floor. (Id.) For personal computers, the rates are the same as the non-China rates in Option A. (Id.)

Ericsson's Option A and Option B offers also contained a variety of other license terms. TCL subsequently agreed that certain terms—those regarding Non-Exclusivity, Licensed TCL Products, and the License Period—were undisputed and could be adopted into a final judgment. (Docket No. 935- 2, pp. 15-16.) The Court later adopted these concessions. (Docket No. 1055, p. 9.)

On March 22, 2016, well into this litigation, Ericsson offered TCL a license based on a pure dollar-per-unit rate structure. (Exs. 213-14; TT March 1, 2017, (Sealed Vol. 1) p. 18:13-23.) This was the first time in the lengthy negotiations that Ericsson had offered a per unit royalty. Ericsson later filed a motion to supplement its FRAND contentions with its March 22, 2016 offer as "Option C." (Docket No. 694.) The Court denied Ericsson's motion because Ericsson had not been not diligent and the late change would prejudice TCL. (Docket No. 760, pp. 5, 6.)

D. The Trial.

Following the Court's ruling that TCL failed to provide evidence of damages because of its discovery defaults, the Court ruled that TCL's remaining claims were equitable and the trial would be before the Court. (Docket No. 1448-1

at 2.) The Court held a 10-day bench trial starting on February 14, 2017. Following the Court's standard procedure for bench trials, the parties submitted their direct examinations as by declarations. The Court heard live testimony from twenty-four witnesses and received additional written direct testimony from three experts in foreign law. Closing arguments occurred on May 18, 2017. Prior to closing arguments the parties prepared proposed Findings of Fact ("FOF") and Conclusions of Law ("COL") which the Court cites to for each party's contentions. (Docket No. 1650 (Ericsson's proposed FOF and COL); Docket No. 1651 (TCL's proposed FOF and COL).)

II. ETSI and the FRAND Obligation.

ETSI is a not-for-profit association under French law. (Fauvarque-Cosson Decl. ¶¶ 14, 18; Stoffel-Munck Rebuttal Decl. ¶ 11.) The parties do not dispute that this case is governed by the ETSI Directives, and that the ETSI Directives are governed by the laws of France. (Fauvarque-Cosson Decl. ¶¶ 14, 18; Stoffel-Munck Rebuttal Decl. ¶ 11; ETSI IPR Policy § 6, Ex. 223 at 6[9].) Similarly, ETSI's Intellectual Property Rights ("IPR") licensing declarations state that "[t]he construction, validity and performance of this IPR information statement and licensing declaration shall be governed by the laws of France." (ETSI IPR Policy Annex A, Ex. 223 at 9.) Thus, the FRAND commitment must be interpreted, and its performance evaluated, pursuant to French law. Fauvarque-Cosson Decl. ¶18; Apple, Inc. v. Motorola Mobility, Inc., 886 F. Supp. 2d 1061, 1081-1082 (W.D. Wis. 2012).

ETSI's acceptance of a patent holder's patent as an SEP forms a contract which includes the patent holder's obligation to license. Under French law, TCL is entitled to enforce this contract through the doctrine of *stipulation pour autrui*, or stipulation on behalf of a third party. (Fauvarque-Cosson, ¶¶19-22.) The doctrine is akin to the concept of a third-party beneficiary at common law. ETSI is the promisee, the owner of a SEP who submits the IPR licensing declaration is the promisor, and the third-party beneficiaries are prospective licensees who benefit from the stipulation. Id.; Apple, Inc., 886 F. Supp. 2d at 1085.

Under French law, a contract must be interpreted unless its terms are "clear

[9]For the ease of readers, when the Court cites to the ETSI IPR Policy or ETSI Guide on IPRs it will cite to both the documents' internal section numbering and the trial exhibit number.

and precise." (Stoffel-Munck Rebuttal Decl. ¶ 12.) Although many contract interpretation rules exist, none are mandatory. (Id.) The main objective is to determine the common intent of the parties. (Id. ¶ 13.) If that cannot be discovered, the inquiry focuses on the understanding of a reasonable person. (Id.) It is common to use extrinsic materials, including negotiation documents, in following these rules. (Id. ¶ 12.) Contracts should also be interpreted such that they are internally consistent, and in a manner that complies with the law. (Id. ¶¶ 20, 21.)

For this case, the two relevant parts of the ETSI Directives are the ETSI IPR Policy (Ex. 223) and the ETSI Guide on IPRs (Ex. 224). The actual form signed by each SEP-holder is ETSI's IPR Licensing Declaration Form, which is part of the ETSI IPR Policy. (ETSI IPR Policy, Annex A, Ex. 223 at 9-10.) The FRAND commitment is found at § 6.1 of the ETSI IPR Policy and states:

> When an ESSENTIAL IPR relating to a particular STANDARD or TECHNICAL SPECIFICATION is brought to the attention of ETSI, the Director-General of ETSI shall immediately request the owner to give within three months an irrevocable undertaking in writing that it is prepared to grant irrevocable licences on fair, reasonable and non-discriminatory ("FRAND") terms and conditions under such IPR to at least the following extent:
>
> - MANUFACTURE, including the right to make or have made customized components and sub-systems to the licensee's own design for use in MANUFACTURE;
> - sell, lease, or otherwise dispose of EQUIPMENT so MANUFACTURED;
> - repair, use, or operate EQUIPMENT; and
> - use METHODS.
>
> The above undertaking may be made subject to the condition that those who seek licences agree to reciprocate.

(ETSI IPR Policy § 6.1, Ex. 223 at 1-2 (emphasis added).) The capitalized terms are all defined in the ETSI IPR Policy's Definitions section. (Id. § 15, Ex. 223 at 6-8.) The Court will discuss ETSI's definition of essential below.

ETSI's definition of IPR is "any intellectual property right conferred by statute law including applications therefor other than trademarks. For the avoidance of doubt rights relating to get-up, confidential information, trade secrets or the like are excluded from the definition of IPR." (ETSI IPR Policy § 15.7, Ex. 223 at 7.) As is clear from this definition, ETSI does not grant rights to IPR, and the FRAND obligation is not a supra-national patent. Instead, the FRAND undertaking is to be expressly interpreted as an encumbrance on the IPR, where applicable under the laws of the jurisdiction. (Id. § 6.1bis, Ex. 223 at 2.)

A. The Mechanics of ETSI.

Under ETSI's IPR Policy, patent owners must disclose a patent which is or may become, essential to a standard. (Bekkers Decl. ¶ 37.) When ETSI becomes aware of a patent that is, or may become, essential to a standard, it asks the owner to declare that it is "prepared to grant irrevocable licences on fair, reasonable and non-discriminatory ('FRAND') terms and conditions . . . ."[10] (Id. ¶ 38, quoting ETSI IPR Policy § 6.1, Ex. 223 at 1-2.) If a patent owner refuses to commit to license on FRAND terms and conditions, ETSI will attempt to design around the patent, and if that is impossible, then work will cease. (Bekkers Decl. ¶¶ 39-40, citing ETSI IPR Policy §§ 8.1.1, 8.1.2, Ex. 223 at 3.) According to ETSI, "in the absence of an agreement between the parties involved, the national courts of law have the sole authority to resolve IPR disputes." (Bekkers Decl. ¶ 41, quoting ETSI Guide on IPRs § 4.3, Ex. 224 at 15.)

In formulating its IPR Policy ETSI was concerned, among other things, with addressing the problem of "hold up." (Bekkers Decl. ¶¶ 31, 46-50; Kennedy Rebuttal Decl. ¶ 259.) Hold up occurs when a patent holder seeks to extract more for the use of his patent than the value which his patent adds to a standard. ETSI's precursor noted an IPR policy was necessary because "a standard may bestow a

[10]ETSI's process does not assess whether declared patents actually are essential. This leads to a substantial over-declaration of patents. As discussed below in Part 2, Section IV.B.2, this is an issue where an SEP holder's share of an aggregate royalty is based in whole or in part on patent counting.

'windfall' monopoly position for an individual supplier." (Bekkers Decl. ¶ 31, quoting Ex. 1069 at 1.) Similarly, in 1993 the ETSI Chairman of Technical Assembly explained that an IPR Policy was needed because of the investment lock-in created by a standard. If a firm takes a license and incorporates that technology in its product, it cannot easily take an alternative path in developing and marketing its product. This lock-in "tilts the negotiating balance in favour of the IPR owner," such that "the term 'fair and reasonable' for royalty becomes whatever anyone cares to demand," increasing the risk that "[s]mall enterprises get pushed out of the market." (Bekkers Decl. ¶ 52, quoting Ex. 1027 at 3.)

ETSI was also concerned with price discrimination among potential licensees. (Bekkers Decl. ¶¶ 46-50, 57-60; Bekkers Rebuttal Decl. ¶¶ 20-28; TT, 2/16/17, pp. 24:24-32:5.) For example, ETSI's predecessor noted that absent uniform IPR commitments, "there will be a serious risk of distortion of market forces against [small and medium-sized enterprises] and in favour of large multinationals." (Bekkers Decl. ¶ 47, quoting Ex. 1584 at 14.)

The ETSI IPR Policy forbids discrimination based on nationality or ETSI membership, but the policy is not so limited. (Bekkers Rebuttal Decl. ¶ 21; ETSI IPR Policy § 6.1, Ex. 223 at 1.) ETSI organic documents specifically note the concern with protecting small and medium-sized enterprises. (Ex. 1584 at 14; Ex. 5289 at 4, 6.) They also demonstrate that ETSI sought to extend the same protections against discriminatory terms and conditions for ETSI members to non-members. (Ex. 5289 at 5.)

Yet the precise contours of the FRAND obligation were never crystalized in a definitive formulation. Over time, there have been several efforts within ETSI to further define the meaning and application of the FRAND obligation. (Bekkers Rebuttal Decl. ¶¶ 7-12; Ex. 238 at 8-9, 19-22, 67; Ex. 239 at 2-6; Ex. 240 at 1-2; Ex. 241 at 2; Ex. 242 at 2-4.) During these efforts, two camps emerged among ETSI's members: They disagreed on whether to further define FRAND in the ETSI IPR Policy, and if so, how. (Bekkers Rebuttal Decl. ¶¶ 7-12; see also Ex. 240 at 2.)

The first camp has sought a more specific policy that would provide information that implementers of the standards believe would prove useful by removing ambiguities (e.g., by defining specific practices as non-FRAND, and

identifying a common royalty base). (Bekkers Rebuttal Decl. ¶ 10.) The second camp sought to preserve the policy's status quo, such that aggrieved implementers (or patent owners) can go to the courts or submit to arbitration in order to resolve IPR disputes. (Id. ¶ 11.) This camp took the view that there is "no sense in such attempts [to define exemplary non-FRAND practices] as each case is different and the decision on FRAND conditions is, finally, a matter for the courts of law." (Id. quoting Ex. 238 at 9.) Ultimately, the efforts within ETSI to further define FRAND were unsuccessful because the two competing camps could not find sufficient common ground to pass any reforms. (Bekkers Rebuttal Decl. ¶ 12.)

The inconclusive history of ETSI's development of FRAND presents the Court with difficulties in applying the concept. ETSI's IPR Special Committee has explained that "[t]he absence of an agreement on a more detailed definition of FRAND or on compensation elements under the FRAND commitment does not imply their inexistence." (Ex. 4622 at 6 (October 2012 report).) Early ETSI documents also show that ETSI did not want to "tilt[] the negotiating balance in favour of the IPR owner" by defining FRAND so broadly as to mean "whatever anyone cares to demand." (Ex. 1027 at 3.) The lack of consensus within ETSI about further defining the FRAND obligation has left the resolution of FRAND-related disputes to the national courts. (Bekkers Rebuttal Decl. ¶ 18; see also Ex. 241 at 2.)

There is at least some guidance in ETSI's consideration and ultimate rejection of the "most favored nations (or here licensee) concept." The 1993 version of ETSI's IPR Policy contained a "most-favored licensee" provision. (Ex. 1583 at 46.) This provision concerned the re-opening and re-negotiation of existing licenses that would require a licensor to:

> promptly notify a licensee of any licence granted by it to a third party for the same IPRs under comparable circumstances giving rise to terms and conditions that are clearly more favourable, in their entirety, than those granted to the licensee and allowing the licensee to require replacement of the terms and conditions of its licence, in their entirety, either with those of the third party licence, or with such other terms and conditions as the parties may agree."

(Id.)

ETSI's members ultimately approved an ETSI IPR Policy that did not require such re-opening and re-negotiation of prior licenses. (Bekkers Decl. ¶¶ 59- 60.) In particular, the 1994 version of the IPR Policy did not include the "most-favored licensee" provision quoted above. (Id.) However, the obligation of the patent owner to license its patents on non- discriminatory terms and conditions remained essentially unchanged between the 1993 and 1994 versions of the ETSI IPR policy, and continues in effect today. (Bekkers Decl. ¶¶ 56, 60; TT, Feb. 16, 2017, pp. 22:22-24:23.)

Neither the history of ETSI's policy development nor the meager case law development of the FRAND concept provides the Court definitive guidance in assessing whether Ericsson's offers have been non-discriminatory. As TCL suggests, the Court must turn to law, logic, and economics. (TCL FOF,¶ 81.)

PART 2: TCL'S TOP DOWN ANALYSIS

Before turning to the royalty setting analyses advanced by the parties' experts, the Court makes one central observation as the fact finder in this case. The search for precision and absolute certainty is a doomed undertaking. See Apple Inc. v. Motorola, Inc., 757 F.3d 1286, 1315 (Fed. Cir. 2014). The complexity of the analyses and the number of variable components inevitably lead to criticism. Indeed, there are facial limitations in the analyses themselves.[11] The Court's effort has been to determine whether each expert's work has a reasonable level reliability and convincing force that allows the Court to make a judgment whether to accept the ultimate conclusions advanced.

To establish the appropriate FRAND rate in this case, TCL advances a so-called "top down" approach. A top down model aims to value a portfolio of SEPs by determining a fair and reasonable total aggregate royalty for all patents that are essential to a standard. It then apportions that royalty to the SEP owners based on the relative value of their portfolio against the value of all patents essential to the standard. (Leonard Decl. ¶ 40.) In simplest terms, TCL's top down approach computes a fraction of the aggregate royalty where the numerator is the value of the SEPs owned by Ericsson for that standard, and the denominator is the total

[11]For example, Dr. Leonard only used United States patents in his survey of SEPs. And Dr. Kakaes looked only to English language patents in his work.

value of all SEPs in that standard.

The appeal of a top down approach is that it prevents royalty stacking. Stacking occurs when each individual SEP holder demands a royalty which when totaled exceeds the value of all the SEPs in a standard. Because the top down methods starts with the maximum aggregate royalty burden and works down to a fair and reasonable rate, it avoid the possibility that licensees will be force to pay an unreasonable amount in total. If the total aggregate royalty is properly based upon the total value of the patents in the standard, it can also prevent hold-up because it prevents SEP owners from charging a premium for the value added by standardization.

The top down approach used by TCL directly examined the essentiality, importance, and contribution of Ericsson's patents for each standard and provided a method to account for the value of expired and acquired patents, as well as regional differences in Ericsson's patent portfolio. A top down method, however, cannot address discrimination as the Court interprets the term, and is not necessarily a substitute for a market-based approach that considers comparable licenses.

Significantly, Ericsson did not present its own top down model.

I. Summary of TCL's Top Down Approach.

TCL presented its top down analysis in nine steps.

Step 1: Dr. Gregory K. Leonard selected a maximum aggregate royalty of 6% of the price of a 4G handset, and 5% of the price for a 2G/3G handset. (Leonard Decl. ¶ 73.)

Step 2: Dr. Zhi Ding, Dr. Apostolos Kakaes, and teams at Concur IP and Ernst & Young India determined the total number of SEPs for each standard as of September 15, 2015. (Kakaes Decl. ¶ 31.) This became the denominator for calculating Ericsson's proportional share of each standard. The remainder of the analysis focused on determining the appropriate numerator and modifiers to apply.

Step 3: Dr. Kakaes and Dr. Nikil Jayant ranked all of Ericsson's 192 claim

charted patent families on a scale of 1-3 for essentiality.

Step 4: Dr. Kakaes and Dr. Jayant then evaluated the importance and contribution of each patent family they found essential.

Step 5: Dr. Leonard then applied certain adjustments to arrive at royalty rates. He adjusted the numerator based on the importance and contribution rankings from Dr. Kakaes and Dr. Jayant to reflect the relatively low value of Ericsson's patents.

Step 6: Dr. Leonard then confirmed his view on the value of Ericsson's patents with a forward-citation analysis, which attempts to determine the value of U.S. patents based on the frequency with which they are cited in later patent applications. (Leonard Decl. ¶¶ 109–117.)

Step 7: Dr. Leonard then adjusted for changes in Ericsson's portfolio due to acquisitions and expirations. (Id. ¶¶ 120–131.)

Step 8: Dr. Leonard then accounted for Ericsson's weaker patent portfolio in some countries, by determining its patent portfolio strength in each region relative to Ericsson's strongest patent portfolio, which is for the United States. (Id. ¶¶ 132–134.)

Step 9: Dr. Leonard then used TCL's sales data to weight the royalty by region and blended the regional royalties together to create a single global royalty rate for each standard. (Id. ¶¶ 67, 139, 142.) He determined that a fair and reasonable royalty for Ericsson's 4G SEPs was .16%, and for 2G/3G was .21%. (Id. ¶ 11, Table 1.)

II. Summary of Court's Conclusions

As explained below, the Court rejects TCL's analysis presented in steps 4-6, and 9 on factual and/or legal grounds. This ultimately meant that the Court did not accept Dr. Leonard's final results. However, the Court uses the data it did accept to construct a number of rates based on different assumptions and approaches. The Court adopts a simple patent counting system which treats every patent as possessing identical value, and then applies the numbers that it found reliable from

the analyses provided by TCL's experts. The formula for Ericsson's royalty rate is its proportional share of the total aggregate royalty. This can be expressed as:

$$\begin{aligned} &\textit{Total Aggregate Royalty} \\ &\quad \times \textit{Ericsson's Proportional Share of the Total Aggregate Royalty} \\ &\quad = \textit{Ericsson's Royalty Rate} \end{aligned}$$

Ericsson's proportional share can be further broken down as:

$$\textit{Proportional Share} = \frac{\textit{Number of unexpired SEPs owned by Licensor}}{\textit{Total Number of SEPs in the Standard}}$$

Throughout this section, the Court refers to the number of unexpired SEPs owned by Ericsson as the numerator, and the total number of SEPs as the denominator. As explained below, because Ericsson's SEP portfolio is weaker in some countries than others, the Court also had to apply a regional strength ratio. The full top down formula used by the Court can be expressed as:

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

III. Summary of Experts and their Qualifications

TCL's top down approach primarily relies on the testimony of three experts, Dr. Kakaes, Dr. Ding, and Dr. Leonard.

Dr. Kakaes is a consultant at Cosmos Communications Consulting Corporation. (Kakaes Decl. ¶ 1.) He holds a B.S. and M.S. in Applied Mathematics and Electrical Engineering from the University of Colorado. (Id.) In 1988, he was awarded a Ph.D. in Electrical Engineering from the Polytechnic Institute of New York. (Id.) From 1987 to 1994, he worked in the Department of Electrical Engineering at George Washington University, Washington D.C., where he developed and taught George Washington University's first course on mobile communications (Id. ¶ 2.) As part of his consulting work, he provides advice on telecommunications patents, their features, and their technical development. (Id.)

He has also served as an expert witness in a number of cases involving SEPs. (Id. ¶ 4.)

Dr. Ding has been a Professor in the Department of Electrical and Computer Engineering at the University of California, Davis, since July 2000. (Ding Decl. ¶ 1.) He holds a Ph.D. in Electrical Engineering from Cornell University, and a Masters of Applied Science from the University of Toronto. (Id. ¶ 2.) He has published over 160 peer-review research articles on communications and signals, as well as an introductory textbook to communications systems. (Id.) Since 2007, he has engaged in extensive work as an expert in litigation involving cellular and Wi-Fi SEPs. (Id. ¶ 10.)

Dr. Leonard is an economist and partner at Edgeworth Economics. (Leonard Decl. ¶ 2.) He received his bachelors degree in Applied Mathematics-Economics from Brown University, and a Ph.D. in Economics from the Massachusetts Institute of Technology. (Id.) He currently serves as a senior editor of the Antitrust Law Journal. (Id. ¶ 4.) He has published over sixty papers in scholarly and professional journals, many of them addressing econometrics, intellectual property, and FRAND royalty rates. (Id. ¶ 3.) He has also served as an expert witness in a substantial number of cases over the past for years. (Id. ¶ 6.)

Even though the Court did not accept each expert's opinions in their entirety, the Court found the experts well qualified in their fields of endeavor.

IV. The Components of TCL's Top Down Analysis.

The Court reviews TCL's steps in more detail, including Ericsson's criticisms.

A. Setting the Total Aggregate Royalty Burden.

Ericsson has long argued that a fair and reasonable royalty rate for a SEP license can be determined using a top down approach, or what the Court calls a simple patent counting system. This is significant apart from the specific aggregate burdens Ericsson has advanced. In 2008 for example, Ericsson stated on its website that its licenses complied with the "prevalent industry interpretation

of FRAND, i.e. the basis is a reasonable maximum aggregate royalty rate to which each patent holder is entitled a proportion according to its relative share of all standard essential IPR." (Ex. 1152 at 1.) Ericsson has repeatedly affirmed its policy of calculating rates based off of a total aggregate royalty burden in its interrogatory responses, depositions, and during trial. (E.g., Ex. 131 at 26, 34; TT, Feb. 28, 2017, p. 14:1-19; Brismark Depo., Dec. 18, 2015, pp. 65:9-21.)

Historically, Ericsson has advanced specific targets for an appropriate total aggregate royalty burden. TCL has not advanced a methodology to independently determine a fair and reasonable total aggregate royalty. Instead, TCL pegs the total aggregate royalty to statements made by Ericsson and other SEP owners before each standard was adopted. These statements are important because (1) they were made prior to, or around, the time the respective standards were being set, such that they reflect the *ex ante* expectations of what a reasonable aggregate royalty burden should be before the standard was adopted and manufacturers are locked-in; and (2) they were made at a time when Ericsson was both a licensor and licensee with respect to SEPs that read on handsets, and thus Ericson had an incentive to strike a reasonable balance. (Leonard Decl. ¶¶ 77, 78.) These statements were thus intended to provide insight and incentives to encourage other companies to invest in the standard. (Brismark Rebuttal Decl. ¶ 12.)

Ericsson contends that any method for determining a FRAND rate that starts with the total aggregate royalty should be excluded because it does not account for subsequent releases of the standard that include additional valuable features. (Ericsson FOF, ¶ 258.) The only feature added to any standard after Ericsson's initial estimates of an appropriate total aggregate royalty is carrier aggregation for 4G. (Id.) However, Ericsson knew that 4G would continue to advance just as every standard before it continued to advance. Carrier aggregation itself was a part of 3G, and given its participation in 3GPP Ericsson certainly should have anticipated that carrier aggregation, along with other valuable features, would be added to 4G. (Kakaes Decl. ¶ 389 (describing 4G carrier aggregation as "a simple extension of well-known techniques, plus a bit of common sense.").) Adding features to a standard does not undermine TCL's reliance on statements Ericsson made to induce the market to adopt Ericsson's preferred standards. The Court does not believe that Ericsson's shift from advocating a top down approach to preferring a comparable license analysis was caused by or at all related to subsequent additions to the standard. The Court would have certainly considered

applying a higher total aggregate royalty than the one initially announced by Ericsson if Ericsson had provided evidence that showed the value of subsequent additions to each standard. However, without any such evidence the Court cannot simply assume that additions to the 3G or 4G standards make Ericsson's own top down methodology unreliable. Finally, Ericsson has patents for later additions to each standard which are included in the numerator of a top down calculation. Thus, Ericsson does receive credit in its proportional share for later additions to the each standard.

The Court now discusses the press releases where Ericsson and other companies publicly announced total aggregate royalty rates for each standard.

1. 2G/3G.

Beginning in at least 2002, Ericsson endorsed the concept of an aggregate maximum royalty. In a joint press release with other companies in the industry, Ericsson told the market:

> Industry leaders NTT DoCoMo, Ericsson, Nokia and Siemens today reached a mutual understanding to introduce licensing arrangements whereby essential patents for W-CDMA are licensed at rates that are proportional to the number of essential patents owned by each company. The intention is to set a benchmark for all patent holders of the W-CDMA technology to achieve fair and reasonable royalty rates.
>
> The companies together own the clear majority of the essential Intellectual Property Rights (IPR) relevant to the W-CDMA standard selected already by about 110 operators worldwide. This arrangement would enable the cumulative royalty rate for W-CDMA to be at a modest single digit level.

(Ex. 333 at 1; emphasis added.) In the same press release, Nokia endorsed a 5% figure and NTT DoCoMo advocated for "keeping cumulative royalty rate below 5%." (Ex. 333 at 2.) Equally important is the fact that these companies advocated a licensing system based on a proportional number of SEPs owned by each company which treated each patent equally. In other words, none of the

adjustments made by Dr. Leonard were reflected in the industry pronouncements at the time.

Ericsson did not dispute the press release or its intentions, but instead sought to put it in context. (Brismark Rebuttal Decl. ¶¶ 15–16.) In 2001, NTT DoCoMo introduced the first 3G handset, which retailed for $560, or $800 with a video camera, and in 2003 Ericsson (through its joint venture with Sony) released its first 3G phone which was priced at $835. (Ex. 5397; Brismark Rebuttal Decl. ¶ 16.) Ericsson executive Lars Gustav Brismark stated that "These are the 3G mobile phone prices that we had in mind when we made the public statements found in the 2002 press release . . . ." (Brismark Rebuttal Decl. ¶ 16.) A 5% total aggregate royalty applied to phone prices of $560, $800, and $835 would provide a royalty of roughly $28, $40, and $42, respectively. It is not clear whether Brismark had the foundation for these observations, given that he was on the engineering side of the business and was a project manager for W-CDMA radio access networks at the time. (Brismark Decl. ¶ 5.) Regardless, the Court is unconvinced by his attempt disavow Ericsson's commitment to calculate royalties based on a proportional share of a total aggregate royalty capped at a modest single digit. These statements were about the overall rate for the industry, and Ericsson has provided no evidence that shows they were conditional on specific returns for itself. More telling is the fact that three of the documents Ericsson annexed to its 2014 sale of SEPs to Interdigital were: the ETSI IPR Policy, its 2002 press release, and the 2008 press release discussed below. (Ex. 1150 at 128, 135, 136.) Ericsson has not produced any evidence that shows that these public statements were conditioned on a particular set of prices or return to Ericsson.

The Court finds that on this record 5% is an appropriate number to use for the total aggregate royalty for 2G[12] and 3G. While outside groups not a part of this press release may have expected higher rates, Ericsson advocated and expected a rate close to 5%. Ericsson may feel that such a rate for its 3G SEPs would undercompensate it now, but it has not shown that its desire for a higher rate today

[12]TCL creates a blended 2G/3G rate, which necessarily means that its 2G-only devices would be subject to the same 5% total aggregate royalty, although it provides no similar statements from Ericsson regarding 2G. However, Ericsson does not dispute that if 5% is an appropriate total aggregate royalty figure for 3G, it is also an appropriate total aggregate royalty for 2G. The Court therefore accepts that 5% is appropriate total aggregate royalty for both standards.

is fair, reasonable, or sufficient to ignore the commitment it made that successfully induced manufacturers to adopt the 3G W-CDMA standard.

2. 4G/LTE.

In April 2008, Ericsson again stated its commitment to a total aggregate royalty approach. In a posting on its website, Ericsson advised:

> . . . Ericsson expects to hold a relative patent strength of 20-25% of all standard essential [4G] IPR. Ericsson believes the market will drive all players to act in accordance with these principles and to a reasonable maximum aggregate royalty level of 6-8% for handsets. Ericsson's fair royalty rate for LTE is therefore expected to be around 1.5% for handsets.

(Ex. 1152 at 1.) Ericsson also issued a joint press release with Alcatel-Lucent, NEC, NextWave Wireless, Nokia, Nokia Siemens Networks, and Sony Ericsson that announced:

> Specifically, the companies support that a reasonable maximum aggregate royalty level for LTE essential IPR in handsets is a single-digit percentage of the sales price. . . . The parties believe the market will drive the LTE licensing regime to be in accordance with these principles and aggregate royalty levels.
>
> This framework balances the prevailing business conditions relevant for the successful widespread adoption of the LTE standard, which continues its progress toward definitive adoption by the industry in the applicable standards forums and organizations.

(Ex. 1146 at 1.) The press release also invited "all interested parties to join this initiative which is intended to stimulate early adoption of mobile broadband technology across the communications and consumer electronic industries." (Id.) Brismark confirmed at his deposition and at trial that Ericsson had repeated its commitment to a "single-digit aggregate royalty burden for LTE" during its 2015 arbitration with Huawei. (TT Feb. 28, 2017, pp. 24:22-25:9; Brismark Depo. Dec. 18, 2015, p. 66:4-18.) Ericsson also confirmed its commitment to a single-digit

royalty for LTE in its interrogatory responses to TCL in this case. (Ex. 131, p. 26:8-10 ("Ericsson's position is that the total accumulated royalties for 4G standard essential patents should be in the single digits, and Ericsson has been consistent in this position over time.").

Ericsson admits making these statements, but argued that: (1) they were intended to be a prediction or hope for where the market would eventually drive royalty rates, (2) these statements were made against the backdrop of much higher industry estimates of the total aggregate royalty burden, and (3) they were made in the context of higher average selling prices for 4G phones which Ericsson did not expect to drop so low. (Ericsson FOF, ¶¶ 246, 249.)

On the first point, the Court does not interpret Ericsson's statements merely as a prediction of the market. Ericsson is a major player in the telecommunications industry, and a joint press release with other major companies is fundamentally different than, for example, a prediction by an academic in a journal. The statements were current endorsements of a conceptual approach that sought to have LTE adopted as the 4G standard instead of two competing standards, UMB and WiMAX. (Brismark Decl. ¶¶ 38-39.) At the time of Ericsson's press release, WiMAX had a substantial head start because two U.S. carriers had already launched WiMAX networks, while LTE would not be commercially launched for another eighteen months. (Id. ¶ 41.) The joint press release was designed to entice manufacturers to invest in LTE over WiMAX and UMB by promising them that Ericsson and others would use this approach with these expected LTE royalty rates. Ericsson was willing to do this it was invested heavily in LTE, but had not invested at all in WiMAX or UMB.[13] (Id. ¶ 38; Ex. 4366 at 30.) If LTE were not adopted as the 4G standard, Ericsson's investments would have been wasted, and instead it would be forced to pay other companies in order to build its own infrastructure equipment. Ericsson was ultimately

[13]This reason also requires the Court to find that the announced rates are implicitly for multi-mode devices. A 4G multi-mode device, for example, can use 4G, 3G, or 2G networks. (Parkvall Decl. ¶ 22.) Backwards compatibility is especially important when a standard is first adopted so that carriers and consumers can continue using existing products and gradually transition to newer standards. If the rates Ericsson and others announced in their press release were for single-mode devices, it would undermine an important advantage of LTE over WiMAX, and would create obvious stacking issues if these companies actually expected to add the 4G total aggregate royalty to the 3G total aggregate royalty and multiple 2G total aggregate royalties. (Brismark Decl. ¶ 39.)

successful: Qualcomm announced in November 2008 that it was abandoning UMB, and by late 2011 WiMAX was being phased out. (Id. ¶ 40-41.) Now both standards are essentially obsolete. (Id. ¶ 41.) Ericsson's statements were thus not a hope or prediction, but a pledge to the market that if the market adopted Ericsson's championed standard, the total aggregate royalties would be calculated as described above. Brismark also clarified in response to a question from the Court that Ericsson believed the market would drive the royalty to 6-8% in particular, and that Ericsson thought, and still thinks, that a single digit percentage royalty is a reasonable royalty rate. (TT Feb. 28, 2017, p. 113:1-9.) This leaves the Court with the view that before the adoption of the 4G standard, Ericsson thought a total aggregate royalty for 4G would be as low as 6% (if not lower), but certainly not higher than 10%.

Ericsson also cites to various studies and papers that estimated a much higher 4G total aggregate royalty rate. The Court discounts these. These include three surveys by an industry consortium called Next Generation Mobile Networks Alliance that combined anonymous industry surveys to produce total royalties of 33%, 37.3%, and 28.8%, respectively. (Ex. 1172 at 7; Ex. 1173 at 8, Ex. 1155 at 6.) Ericsson also points out that the publicly declared rates in 2010 from just nine SEP owners totaled 14.8% of the handset selling price. (Ex. 1063 at 3.) However, these figures were volunteered by individual companies, virtually all of whom had yet to convince anyone to pay anything close to these rates because the first connection between an 4G device and a 4G network only occurred in October 2009. (Brismark Decl. ¶ 29.) The Court would actually expect that the rates companies publicly declared in 2008-2010 to be artificially high because each company knows that the figure it announces will naturally turn into the ceiling for what it can demand from future licensees. In addition, no one was checking whether the individual rates that companies announced were fair, reasonable, or based on anything other than a desire to maximize royalty revenue. (E.g., Ex. 1063 at 3.) Simply totaling individually announced rates plays into the trap of stacking, a vice which standardization seeks to avoid. The total aggregate royalty announced in the joint press release is more accurate and reasonable because those firms faced a countervailing pressure to keep the aggregate estimate low enough to encourage investment and adoption of LTE over the alternatives, they know that they will be asked to pay the same rates as licensees, and because if LTE was not adopted then their investments in it become obsolete.

Ericsson also suggested that its statements in 2008 cannot be used in this case because it did not anticipate the decline in the price of phones. (Ericsson FOF, ¶¶ 248-48.) Ericsson is correct that 4G phone prices have fallen since 2008, but Ericsson certainly expected that to happen. In 2008 the average price of a 3G smartphone was $430, and Ericsson anticipated that 4G phones would initially be priced at over $500. (Brismark Rebuttal Decl. ¶ 17.) This was initially true, and when 4G smartphones debuted in 2011-2012, the average retail price was $630. (Id.) Sony Ericsson's phone, the Sony Xperia V was priced around $750. (Id.) By 2015, however, nearly half of all smartphones sold for less than $150. (Kennedy Rebuttal Decl. ¶¶ 176, 178.) Ericsson's argument that in 2008 it did not anticipate phone prices would drop is not credible in the face of Brismark's own testimony that starting in 2005-2007 Ericsson had just seen the prices of low-end 3G phones drop more quickly than expected. (Compare Ericsson FF, ¶ 248 with TT Feb. 28, 2017, p. 81:7-22.) This drop in prices was even borne out by the prices of Ericsson's own phones. Ericsson's first 3G phone retailed for $835 in 2003, while its first 4G smartphone debuted nine years later already showed a decline in prices and cost $750. (Brismark Rebuttal Decl. ¶¶ 16–17.)

It is also unclear why the drop in the price of phones matters, because Ericsson's public statements were never conditioned on a particular dollar-per-unit return. If Ericsson had wanted that, it certainly could have proposed that, such an idea would not have been shocking to the industry because in that same press release in 2008 Ericsson announced a royalty in dollar per unit terms for notebook computers. (Ex. 1146 at 1.) Moreover, while Ericsson earned less royalty revenue because prices dropped, Ericsson also earned substantially more revenue as 4G technology became cheaper and spread around the world. IDC estimates that in 2008 global phone sales were $245 billion, while in 2015 global phone sales were $438 billion. (Ex. 1000.)

The Court therefore finds some merit in applying a top down approach starting with a total aggregate royalty. While this approach is not perfect, it has merit because: (1) it relies on statements that Ericsson and other SEP owners made to induce people to adopt and invest in each standard when the risk of hold-up was low; (2) these statements were made before the standard was adopted, providing the SEP owners with incentive to be reasonable with their overall expectations and greatly reducing the risk of hold-up and royalty stacking; (3) Ericsson was a licensor and licensee, giving it stronger incentive to be fair and reasonable with its

own estimate; (4) Ericsson still stands by this methodology, (TT Feb. 28, 2017, p. 113:1-9); and (5) it at least provides the ceiling for a FRAND rate, because increasing the royalty rate after the standard has been adopted, without showing that the increase is due to additions to the standard, is the definition of hold-up. Use of an aggregate figure in fact hews to the principle of setting rates to reflect Ericsson's own estimate of the total value the licensed technology contributed to the product.

The Court applies the 5% figure to 2G/3G, and applies both 6% and 10% to 4G.

B. Ericsson's Proportional Share of Standard-Essential Patents.

With a total aggregate royalty in place, the next question to resolve is Ericsson's proportional share. This is a ratio calculation taking the number of Ericsson's SEPs (the numerator) over the total number of SEPs for the standard in question (the denominator). (Leonard Decl. ¶¶ 39-42, 94-95, Table 4.) To determine essentiality the Court relied on ETSI's definition of essential:

> "ESSENTIAL" as applied to IPR means that it is not possible on technical (but not commercial) grounds, taking into account normal technical practice and the state of the art generally available at the time of standardization, to make, sell, lease, otherwise dispose of, repair, use or operate EQUIPMENT or METHODS which comply with a STANDARD without infringing that IPR. For the avoidance of doubt in exceptional cases where a STANDARD can only be implemented by technical solutions, all of which are infringements of IPRs, all such IPRs shall be considered ESSENTIAL.

(ETSI IPR Policy § 15.6, Ex. 223 at 7.)

The only dispute that arose concerning ETSI's definition of essential was whether the informative annex was part of the 3G standard. Ericsson argued that ETSI's definition of standard includes "any standard adopted by ETSI including options therein . . . ." (Id. § 15.11.) This means that the optional parts of the standard are still a standard, and thus patents that cover the optional parts of the standard are essential. However, informative annexes "shall not contain

provisions to which it is necessary to conform in order to be able to claim compliance with the ETSI deliverable." (Ex. 404 at 12.) Based on this definition, TCL argued that patents covering optional parts of the standard cannot be essential. The Court agrees with TCL that patents for inventions solely in the informative annex, while part of a standard, are not standard-essential patents. To hold otherwise would rewrite ETSI's definition of informative annex. This is further confirmed by the definition of normative annex directly above the definition of informative annex, which states that provisions in the normative annexes are necessary to conform in order to be able to claim compliance with the standard. (Ex. 404 at 12.)[14]

The Court first determines how many SEPs are in each standard (the denominator), and then determines how many SEPs are owned by Ericsson (the numerator).

1. Determining the Number of Industry-Wide SEPS: The Denominator.

To estimate the total number of industry-wide patent families related to user equipment ("UE") (such as handsets) that are essential to the 2G, 3G, and 4G standards, Dr. Kakaes, Dr. Ding, and teams of engineers from Concur IP, and Ernst & Young India conducted an extensive industry-wide essentiality study. (Ding Decl. ¶¶ 35-87; Kakaes Decl. ¶¶ 28-42.)

First, the team from Ernst & Young India, supervised by Dr. Kakaes, conducted a census of all IPR declarations submitted to ETSI as of September 2015 for the 2G, 3G, and/or 4G standards.[15] (Kakaes Decl. ¶¶ 29-30, 315.) As of September 15, 2015, there were over 153,000 patents and/or patent applications

[14]The Court therefore finds that Ericsson's P08333 family and corresponding U.S. Pat. No. 5,991,330 ("'330 patent") are not essential to the 3G standard. Ericsson makes additional arguments for why the '330 patent is essential to the 3G standard, (Cason Rebuttal ¶¶ 24-28), but since Ericsson cannot identify a required part of the standard covered by this patent, the Court has no basis to find this patent essential.

[15]The patent census involved extracting the declarations of essentiality from the ETSI database. (Kakaes Decl. ¶ 318.) There were 1800 declarations submitted to ETSI, representing 119,850 patents and applications. (Id.) ETSI rules also specify that the FRAND commitment applies to all members of that patent family, unless a specific exclusion has been made. (ETSI IPR Policy § 6.2, Ex. 223 at 2.) Based on International Patent Documentation Center data, this added an additional 34,030 patents to the census. (Kakaes ¶ 319.)

declared essential to the 2G, 3G, and 4G standards. (Id. ¶ 31.) Dr. Kakaes and Dr. Ding then supervised Concur IP in the industry-wide essentiality study. (Ding Decl. ¶¶ 59-60; TT Feb. 17, 2017, p. 73:2-10.)

Dr. Kakaes then excluded patent families that either had only expired patents, or were not published in English. (Kakaes Decl. ¶ 31.) Dr. Kakaes did not provide an explanation for excluding expired patent families. For reasons discussed in the next section, this was an error. Nonetheless, it is an error which favors Ericsson, and it may have been necessary to conduct a feasible study. Dr. Kakaes also excluded patent families that did not have an English language patent. (Id.) He explained that he did this because there were relatively few non-English patents, and including them would not have made a significant difference because the vast majority of families contained at least one English-language patent. (TT Feb. 17, 2017, pp. 69:24-70:3.) This exclusion is corroborated by Ericsson itself, because despite being a Swedish company, it has more patents in the United States than any other jurisdiction. (E.g., Ex. 1122.) The Court is satisfied that the subset actually examined was a reasonable surrogate for the whole.

There were 11,469 patent families with at least one patent that is still active (i.e., non-expired) and was published in English. (Kakaes Decl. ¶ 31.) After excluding patent families that did not have any patents with claims directed to user equipment, there were 7,106 patent families remaining. (Id. ¶¶ 31-32.) These 7,106 patent families were divided into 2G, 3G, and 4G depending on which standard they were declared essential to, and then sorted by patent holder for the 15 largest patent holders. (Id. ¶ 34.) Concur IP then analyzed the essentiality of a random sample of one-third of the patents in each standard, per patent holder, which totaled 2,600 patent families because some patents are essential to multiple standards. (TT Feb. 17, 2017, p. 72:3-20.) Dr. Ding sampled and checked 442 (or 17%) of Concur IP's essentiality determinations for accuracy. (Ding Decl. ¶¶ 64, 68.) When Dr. Ding was in agreement with Concur IP, he recorded the determination as accurate. (Id.) When he identified a discrepancy, he and Concur IP reexamined the claims and if Concur IP's original essentiality determination was changed, Dr. Ding recorded the original determination as inaccurate, and noted the direction of the error.[16] (Id. ¶¶ 64-68.) The overall error rate for Concur IP was only 9.5%. (Id. ¶ 69.) The error rate regarding whether patents were

[16]Given the somewhat subjective nature of these determinations, "disagreements" is probably a more accurate label than "error."

essential went in both directions, and thus the small number of errors largely balanced each other out over the course of the study. (Id. ¶¶ 69-71.) Specifically, out of the 442 patent families that Dr. Ding reviewed, 36 out of 305 patent families (or 11.8%) were changed from non-essential to essential, and 6 out of 137 patent families (or 4.4%) were changed from essential to non-essential. (Id. ¶¶ 70-71.)

From these adjusted totals, Dr. Ding then calculated the total number of essential patent families in each standard. For 2G, the total estimated number of essential patent families is 446. (Id. ¶ 77.) For 3G, the total estimated number of essential patent families is 1,166. (Id. ¶ 81.) For 4G, the total estimated number of essential patent families is 1,796. (Id. ¶ 85.)

However, TCL does not actually use the total number of SEPs per standard created by Dr. Ding because that would create a global rate and make it impossible to account for geographic disparities in Ericsson's patent portfolio. (Leonard Decl. ¶ 94.) Dr. Leonard therefore took Dr. Ding's world-wide results and determined how many total SEPs are registered in the United States for each standard. This actually causes the total number of SEPs to decrease slightly for each standard. (Id. Table 4.) Dr. Leonard calculated that there are 413 essential 2G families, 1,076 3G families, and 1,673 4G families.[17]

[17]Dr. Kakaes and Dr. Jayant also conducted an essentiality analysis on Ericsson's patents to determine the appropriate numerator (see Part 2 Section IV.B.2 below). This led to 55 patent families that were analyzed both by Dr. Kakaes and Dr. Jayant for the numerator, and Concur IP for the denominator. This therefore provides a useful cross-check on Concur IP's results. Of the 55 patent families that were analyzed twice, everyone reached the same conclusion on 41 of them, meaning they initially agreed roughly 75% of the time. (Kakaes Decl. ¶ 345.) Of those 14 families where they disagreed, Dr. Kakaes provides an explanation for 4 of the disagreements that are unrelated to the substance of Concur IP's analysis. (Id. ¶¶ 346–48.) One of them was explained because Ericsson's claim chart is broader than the declaration it submitted to ETSI, one was because of an inconsistency related to ETSI's database, and two errors were because Dr. Kakaes examined the file history, which showed that the patents were not essential. (Id.) Of the remaining ten disagreements, seven occurred when Dr. Kakaes or Dr. Jayant found the patent essential and Concur IP did not, and three where Concur IP found the patent essential and Dr. Kakaes or Dr. Jayant did not. (Id. ¶ 349.) This provides an error rate for Concur of 7/51 (13.7%) in favor of non-essentiality, and 3/51(5.8%) in favor of essentiality. These results are remarkably similar to Dr. Ding's, who checked 442 of Concur IP's assessments and found error results of 11.8% and 4.4% respectively. (Ding Decl. ¶¶ 64, 68.)

Ericsson made numerous challenges to the process that produced these numbers, although it proposes no alternative numbers. Ericsson challenged the results of this process because: (1) Concur IP team spent an average of 20 minutes and charged only $100 per patent, (2) they did not read the entire patent specifications, (3) the individuals in the Concur IP team lacked the qualifications to perform this work, and (4) Concur IP team knew whom they were working for and against. These criticisms led to Ericsson's ultimate conclusion that patent counting studies are highly subjective and inherently unreliable. The Court disagrees.

Ericsson argued that based on the total billing from Concur IP they must have spent on average about 20 minutes per patent, and charged $100, and this is plainly insufficient. By way of contrast, Via Licensing for example charges $10,000 to determine whether a single patent is essential before accepting the patent into a patent pool.[18] (Mallinson Decl. ¶¶ 91-92.) The Court is not persuaded that the tasks for which Concur IP charged are comparable to the task performed by Via Licensing. Patent pools ask customers to pay for each specific patent in the pool, so the greater the certainty in their process and the stronger the patents the more they can charge and convince customers and patent owners to join. (Mallinson Decl. ¶ 92.) Conversely, if prospective licensees discovered that a patent pool included non-essential patents it would undermine the patent pool's entire business model. Patent pools therefore require substantially greater certainty than is necessary or reasonable for counting the number of SEPs in a standard. While charging on average only $100 per patent family may be cheap, this process is only intended to provide a workable size of the relevant universe and has no need to be as precise as a licensing pool must be. The Court does not think that the internal procedures used by either patent pools or Ericsson to determine the essentiality of their own patents are fair bench marks for assessing quality of the analysis done by Concur IP. While they are similar tasks, they require very different levels of certainty because the results are being used in very different ways.[19]

[18]A patent pool is a vehicle for collecting and licensing a group of patents held by multiple owners. The business of a patent pool is to license rather than practice the patents.

[19]In addition, Concur IP conducted a similar study for another company, which allowed them to work much more quickly than if they were doing this for the first time. (TT Feb. 17, 2017, pp. 99:21-100:10.)

The Court is also not persuaded that the individuals on the Concur IP team lacked the qualifications to perform this work. At trial, Ericsson attempted to show that the members of the Concur IP team lacked the qualifications to perform this study because their industry experience was in consulting work, which Ericsson argued was insufficient to show they were persons of ordinary skill in the art. (Ericsson FOF, ¶ 265; TT Feb. 17, 2017, pp. 83:15-85:8.) However, nothing that Ericsson elicited on the stand from Dr. Kakaes convinced the Court that the Concur IP team lacked the qualifications or experience to complete their assigned task. In a similar vein, while it would have been better had the team not known who the parties were in this case, there is no requirement that an essentiality study be conducted in a blind manner, and the same concern applies with equal force to every expert in every case.

Ericsson's arguments regarding the patent specifications are more salient. Dr. Kakaes testified that the Concur IP team read the patent claims, but they did not read the entire patent specification. (TT Feb. 17, 2017, p. 100:20-21.) This means that they may not have noticed if a patent contained a means plus functions claim, likely would not have noticed if a patent used its own lexicography, and would not have read any specification disclaimer or the file history. (Id. pp. 100:20-110:15.) As discussed above, Dr. Kakaes found that the file history showed that the patent family was not essential for one 2G patent family (P07288 2G) and one 4G patent family (P10867 4G) out of the 55 overlapping patent families that were also examined by Concur IP. The Court therefore adjusts the total number of patents in each standard to account for Concur IP finding too many patents to be essential because it ignored file histories, as described below. (Kakaes Decl. ¶ 344, Table 16.) While Ericsson's concerns regarding means plus function claims, lexicography, and specification disclaimers could be substantial, they could also be entirely trivial. The Court declines to speculate on how often they would impact the essentiality determination.[20]

[20] The Court also notes an inherent tension in Ericsson's position on essentiality. It criticizes Concur IP for finding too many patent family essential because they ignored things such as the file history, but Ericsson itself initially claimed that it owned 235 essential patent families (Kakaes Decl. ¶ 95) and at trial only argued that it owned 179 essential patent families. The Court gives little weight to Ericsson's criticisms when it appears to have made the same error despite spending 50–80 hours assembling claim charts and employing an extensive review process involving multiple patent attorneys. (McLeroy Decl. ¶ 10.)

Ultimately the Court finds that the flaws are not enough to justify rejecting TCL's experts' calculation of the total number of SEPs entirely. However, the Court does find it appropriate to make certain adjustments to TCL's calculation of the overall number of SEPs. The only cross-check on the total presented by Dr. Ding and Concur IP occurred when they examined the same patents as Dr. Kakaes and Dr. Jayant. Excluding 2 families where the disagreement was not caused by the substantive analysis, Concur IP disagreed with Dr. Kakaes on the essentiality of 12 of the 53 overlapping patent families. (Id. ¶ 349.) These 53 patent families represent 6 2G family/standards pairs, 16 for 3G, and 35 for 4G.[21] (Id. ¶ 344, Table 16.) There were three 4G families that Concur IP said were essential that Dr. Kakaes said were not essential. Giving Ericsson the benefit of the doubt for every dispute between Concur IP and Dr. Kakaes, Concur over-declared 4G patents to be essential four out of thirty-five times, or 11.4%. The Court uses this figure for adjusting the total number of SEPs in each standard downwards. While the Court makes the adjustment because it is warranted, shrinking the denominators favors Ericsson in determining its share of the overall royalty burden.

TCL's final step in calculating the total number of patents in each standard is to calculate the U.S.-specific number of total SEPs. This is necessary in order to adjust the rate to account for differences in Ericsson's patent strength in each country, which requires a numerator and denominator stated in terms of U.S. patents. Because the essentiality analysis examined one-third of the total declared patents, Dr. Leonard multiplied the number of U.S. patents that were analyzed by three to determine the total number of U.S. SEPs in each standard. (Leonard Decl. ¶ 94, Table 4 n.3.) Dr. Ding calculated that globally there were 446 2G SEPs, 1116 3G SEPs, and 1796 4G SEPs. (Ding Decl. ¶¶ 77, 81, 85.) Dr. Leonard then calculated that there were 413 2G SEPs, 1076 3G SEPs, and 1673 4G SEPs. (Leonard Decl. ¶ 94, Table 4.) Applying the reduction for over-declaring patents to be essential in order to give Ericsson the benefit of the doubt leads the Court to adopt the following totals for the number of SEPs in each standard: 365 for 2G, 953 for 3G, and 1481 for 4G.

2. Determining the Total Number of SEPs Owned by Ericsson: The Numerator.

[21] The numbers do not total 53 because some patents cover multiple standards.

Ericsson identified 235 patent families it contends are essential to the 2G, 3G, and 4G standards, although Ericsson only provided claim charts to support its contentions for 192 of the families. (Kakaes Decl. ¶¶ 95-96.) Because Ericsson contended certain families are essential to multiple standards, there were a total of 219 patent family/standard pairs that had corresponding claim charts. (Id. ¶ 97.) Ericsson's patents were each evaluated by either Dr. Kakaes or Dr. Jayant to determine if they were truly essential. (Id. ¶ 20.) Dr. Kakaes conceded that many of Ericsson's patents were essential to a standard, but also testified that many were not essential. (Id. ¶ 22.) Ericsson provided testimony from its experts that disputed some of the findings of non-essentiality by Dr. Kakaes and Dr. Jayant. (Cason Rebuttal Decl. ¶¶ 13, 15-188; Sågfors Rebuttal Decl. ¶¶ 20, 23-295; Chen Rebuttal Decl. ¶¶ 14-15, 18-81; Bruhn Rebuttal Decl. ¶¶ 46, 49-69.)

As described below, the Court chose to apply the top down formula twice, using TCL's conceded number of SEPs, and using Ericsson's disputed number of SEPs. This more accurately reflects the reality faced by parties in a licensing negotiation who each have different views how many SEPs the licensor owns. The Court also adopts Dr. Leonard's conclusions regarding the impact of patents that will become essential during the course of the license, but the Court made its own calculations to account for the expiration of Ericsson's SEPs during the license. (Leonard Decl. ¶¶ 126-131.)

a. TCL's Essentiality Analysis.

Dr. Kakaes analyzed 180 out of the 192 patent families Ericsson alleged cover the 2G, 3G, and/or 4G standards. (Kakaes Decl. ¶¶ 1-6, 20, 96.) Dr. Jayant, an expert in speech coding, analyzed the remaining 12 out of the 192 patent families that Ericsson alleged cover portions of the 2G and/or 3G standards related to speech communications and primarily adaptive multi-rate (AMR) speech coding. (Jayant Decl. ¶¶ 1-13, 15.) Much of the analysis Dr. Kakaes and Dr. Jayant presented to Ericsson was not new because other licensees had taken the same positions during their negotiations with Ericsson. (Exs. 1289, 1689, 1715, 1717, 1718, 1729.)

The essentiality analysis performed by Dr. Kakaes and Dr. Jayant was conducted using ETSI's definition of essential described above. (Kakaes Decl. ¶¶ 105-106; Jayant Decl. ¶ 60.) When conducting the essentiality analysis, Dr.

Kakaes and Dr. Jayant ranked the patents on a scale of 1 to 3, where a 1 meant they did not see any evidence precluding a finding that the claim is essential under ETSI's IPR Policy, a 2 meant that under a proper claim construction the claim is not essential, and a 3 meant the claim is not essential under any reasonable claim construction. (Kakaes Decl. ¶ 113; Jayant Decl. ¶¶ 67-68.) For some patent families, Ericsson produced multiple claim charts for claims within the patent family. (Kakaes Decl. ¶ 100.) For those families, the entire patent family was given the rank associated with the highest ranked claim. (Id.)

For 2G, Dr. Kakaes and Dr. Jayant gave 29 out of 41 of the patent families an Essentiality Rank of 1, one of the patent families an Essentiality Rank of 2, and 11 of the patent families an Essentiality Rank of 3. (Kakaes Decl. ¶ 172.) For 3G, they gave 33 out of 51 of the patent families an Essentiality Rank of 1, two of the patent families an Essentiality Rank of 2, and 16 of the patent families an Essentiality Rank of 3. (Id. ¶ 173.) For 4G, Dr. Kakaes gave 74 out of 127 of the patent families an Essentiality Rank of 1, seven of the patent families an Essentiality Rank of 2, and 46 of the patent families an Essentiality Rank of 3. (Id. ¶ 174.) Thus, Dr. Kakaes concludes that Ericsson owns 29 patent families that are essential to 2G, 33 patent families that are essential to 3G, and 74 patent families that are essential to 4G. (Id. ¶¶ 172-174.) The Court refers to these as TCL's patent numbers.

At trial, Ericsson provided testimony from four of its employees who argued TCL's experts were wrong and additional Ericsson patents were essential to the standards. (Cason Rebuttal Decl. ¶¶ 13, 15-188 (arguing for the essentiality of 27 patents); Sågfors Rebuttal Decl. ¶¶ 20, 23-295 (arguing for the essentiality of 23 patents); Chen Rebuttal Decl. ¶¶ 14-15, 18-81 (arguing for the essentiality of 11 patents); Bruhn Rebuttal Decl. ¶¶ 46, 49-69 (arguing for the essentiality of 2 patents).) These 63 disputed patents represent 2 patent families that are essential to 2G, 14 patent families that are essential to 3G, and 51 patent families that are essential to 4G.[22] The Court refers to these as Ericsson's patent numbers.

b. Accounting for SEPs added to Each Standard.

Ericsson's proportional share will change as new patents are added to each standard because the denominator will grow, and some of those will belong to

[22]The numbers do not total 63 because some patents cover more than one standard.

Ericsson. To account for patents added to each standard Dr. Leonard created a model to determine the number of SEPs that will be added to each standard, and from that determined how many Ericsson SEPs will be added to each standard. (Leonard Decl. ¶¶ 127-131.) Dr. Leonard's model calculated the net result of these two changes, along with patents that expire, and then provided the net result of all three as a change in Ericsson's "value share," which is Ericsson's proportional share weighted by TCL's importance and contribution analysis discussed below. (Leonard Decl. ¶¶ 92, 126-31.) However, Dr. Leonard did not provide his calculations on the individual inputs or identify what specific sources he used in a meaningful way, although Ericsson also did not raise this point during the trial. (See Ex. 1119 n.2.) As a matter of general industry practice, licenses covering SEPs typically also cover patents issued or acquired during the term of the license. (Leonard Decl. ¶ 120.)

Dr. Leonard's model ultimately showed that newly issued patents will not significantly affect Ericsson's proportional share because Ericsson can only obtain additional patents when the standard also grows. (Leonard Decl. ¶ 130.) The Court is skeptical that his model is the best way to estimate the growth of the 4G standard, but ultimately the Court agrees that newly issued patents will not make a significant difference to Ericsson's overall proportional share. Even assuming new patents will be added to each standard during the license, there is no evidence that Ericsson will be more successful in obtaining SEPs in the next five years than it has been in the past.[23] The best case scenario for Ericsson is that it will acquire future SEPs at the same rate as it has in the past. Thus, Ericsson's newly acquired SEPs will be offset by SEPs being added to the standard. Therefore the Court accounts for the effect of new patents added to the 2G, 3G, and 4G standards by keeping Ericsson's proportional share constant.

c. Accounting for Expired and Expiring SEPs.

Both sides argued over the essentiality of patents that expired before any license would begin. (See, e.g., Kakaes Decl. ¶ 172 n.5.) United States patent law does not permit Ericsson to demand value for patents that have expired. Brulotte

[23]The Court actually suspects that Ericsson will be less successful in obtaining future 4G patents than its current proportional share of 4G SEPs suggests because 4G LTE is based on 2G GSM, so some of Ericsson's 4G SEPs reflect investments in research and development Ericsson made years ago

v. Thys Co., 379 U.S. 29, 32 (1964) ("we conclude that a patentee's use of a royalty agreement that projects beyond the expiration date of the patent is unlawful per se."). Because the FRAND undertaking is an encumbrance and commitment that exists on top of national patent systems, FRAND cannot permit what domestic patent law prohibits. (ETSI IPR Policy § 12, Ex. 223 at 6.)[24] SEPs that expire before a license begins therefore have no bearing on a fair and reasonable prospective royalty rate. Absent suggestion or stipulation by the parties, the Court adopts the date of closing arguments (May 18, 2017) as the most appropriate date to use for determining whether SEPs have expired. Expired and Expiring SEPs has the largest impact on Ericsson's 2G SEPs. For example, while TCL concedes that Ericsson owns 29 2G SEPs, 7 of them expired before closing arguments were made, and another 15 will expire before May 1, 2022. Unlike other adjustments which should generally affect both the numerator and the denominator of the proportional share, expirations should only modify the numerator. Because the total aggregate royalty represents the value of all expired and unexpired inventions in the standard, also removing an expired SEP from the denominator treats the invention as no longer having value. The invention however still has value, that value has merely been transferred to the public domain. To remove expired patents from the denominator (without decreasing the total aggregate royalty) would result in transferring the value from expired inventions to the remaining patents in the standard instead of the public. By removing expired SEPs from only the numerator of the top down formula the Court therefore apportions their value from the still patented features of the standard. Ericsson, Inc. v. D-Link Systems, Inc., 773 F.3d 1201, 1232 (Fed. Cir. 2014).

The first step in adjusting for SEPs that expire during the course of the license is to determine when Ericsson's U.S. patents expire. The Court relies on Trial Exhibit 1116. If that exhibit lists a U.S. patent for any standard, then the Court applies that expiration date to all other standards covered by this family if Ericsson argued that the U.S. patent was essential to each standard. (Ex. 1577.) For two families (P11899 and P14897), no U.S. patent was listed on Trial Exhibit 1116 for any standard, although the patent family did include U.S. patents. For those families the Court applied the expiration date of the European patents that were listed on Trial Exhibit 1116.

[24]ETSI IPR Policy does not oblige its members to act in violation of national laws or regulations, except where derogation by agreement between the parties is permitted.

After compiling the expiration dates of Ericsson's U.S. SEPs at issue, the Court calculates how many months each SEP will be valid over the course of the license. The Court prefers to calculate based on months instead of days because it provided much more workable numbers.[25] After determining the total number of months of validity for each of Ericsson's SEPs in each standard, the Court divides that number by 60 to represent the effective number of unexpired SEPs Ericsson will own throughout the license. This did result in some fractional results for the numerator, but this is not a problem because there is no particular reason the numerator must be a whole number.

The results were that based on TCL's patent numbers Ericsson owns 12 2G SEPs, 19.65 3G SEPs, and 69.88 4G SEPs. Based on Ericsson's patent numbers, it owns 12 2G SEPs, 24.65 3G SEPs, and 111.51 4G SEPs.

3. Calculating Ericsson's Proportional Share of SEPs.

Ericsson's proportional share of 2G, 3G, and 4G essential patents can be determined by dividing how many patents the parties assert Ericsson owns for each standard (the numerator) by the total number of patents in each standard (the denominator).

For 2G, both parties agreed that Ericsson owns 12 out of 365 essential patent families, which is 3.280% of all 2G essential patents.

For 3G, TCL conceded that Ericsson owns 19.65 out of 953 essential patent families, which is 2.061% of all 3G essential patents. However, Ericsson argued that it owns 24.65 3G essential patents, which would give it 2.58% of 3G essential patents.

For 4G, TCL conceded that Ericsson owns 69.88 out of 1481 4G essential patents, which would give it 4.761% of 4G essential patents. However, Ericsson

[25]Doing so required the Court to assume that each patent expires at the end of the month, and to treat the license as if it started on May 1, 2017 and ended on May 1, 2022. A patent that expired May 2017 would therefore have 1 month of validity, while a patent that expired April 2017 would have 60 months of validity. Both of these assumptions very slightly favor Ericsson (generally less than 1%), but the Court believes these assumptions are justified in view of TCL's failure to justify its own expiration calculations, as well as the simplicity they add to the calculations.

argued that it owns 111.51 4G essential patents, which would give it 7.525% of 4G essential patents.

C. Adjusting Ericsson's Proportional Share to Account for the Relative Strength of its SEPs.

After determining how many Ericsson patents were essential to each standard, TCL then analyzed the importance and contribution of Ericsson SEPs it conceded were essential to determine how valuable they are compared to other SEPs. While the Court reviews TCL's analysis, it found it too flawed to be used to calculate the overall rates which the Court derives from the top down analysis.

The rationale for evaluating the importance of SEPs is that even in the universe of standard essential patents, many are relatively trivial, while some are key features of the standard. TCL ranked Ericsson's SEPs on a scale from 1-3, with a 1 for patents that were important or technically valuable, 2 for patents that were moderately important, and 3 for patents that were only marginally important. (Kakaes Decl. ¶ 12.)

"Contribution" as TCL used the term in this context evaluates the invention compared to the alternatives that were available at the time the standard was adopted. This is because there are many parts of the standard that are essential and even very important because they add substantial value, but are a small contribution because there were other almost as useful options ETSI could have chosen when the standard was adopted. A contribution rank of 1 meant that TCL did not identify a viable alternative to the patent, a 2 meant the patent provided moderate improvement relative to the alternative, a 3 meant the feature provided marginal improvement relative to the alternative, and a 4 meant it provided no improvement to the standard relative to the alternative. (Id. ¶ 13.)

Dr. Leonard then used the importance and contribution scores to determine how many of Ericsson's SEPs would be ranked in the top 10% of SEPs. Based on a study done of patents in various industries, Dr. Leonard concluded that the top 10% of SEPs provide 65% of the value of the standard. He used this study to create a value share, which is Ericsson's proportional share adjusted based on the value of Ericsson's SEPs relative to the value-distribution of all SEPs in the standard.

1. The Importance and Contribution Analysis.

The importance analysis began by identifying the sections of the 2G, 3G, or 4G standards cited in Ericsson's claim chart. (Kakaes Decl. ¶ 116.) Key claim limitations of Ericsson's patents were then determined by considering what the patent described as the heart of the invention, or by reviewing the arguments and amendments the applicant used to overcome prior art, and/or the reasons identified by the patent office as the patentable subject matter. (Id. ¶ 117.) Once these key claim limitations were identified, the corresponding features of the standards cited in Ericsson's claim charts were identified. (Id. ¶ 118.)

The overall value of the key features to the standard were then analyzed by considering the following factors: (a) a prior technical solution (if any) that was in the standard prior to the adoption of the key feature, and if so, the incremental improvement (or technical value) of the key feature over the prior technical solution; (b) the incremental improvement of the key feature over other well-known prior art, including technology identified in the background section of the patent, or prior related standards; (c) the impact of removing the key feature from the standard in terms of performance degradation and implementation cost; (d) whether the accused technology is optional to the standard; and (e) how widely the accused technology/key accused feature is deployed in major markets. (Id. ¶¶ 119-120.)

For the contribution analysis, Dr. Kakaes identified alternatives to Ericsson's SEPs through a variety of ways, including: (1) written contributions submitted to ETSI or a 3GPP working group (e.g., TDocs and Change Requests); (2) prior art technical solutions identified in the patent at issue (e.g., applicant-admitted prior art); (3) prior art references cited during patent prosecution; (4) any technical solutions that were known in the art as evidenced by patent and non-patent literature; and (5) any other technical solutions that would have been known to a person of ordinary skill in the art and that could have served as alternatives. (Kakaes Decl. ¶ 122.)

Overall, 146 family/standard pairs that were given an Essentiality Rank of 1 or 2 were also given Contribution and Importance Rankings. (Kakaes Decl. ¶ 294, Figure 55.) Only 13 of the 146 family/standard pairs received both importance

and contribution scores of 1 or 2, while 58 family/standard pairs received an importance score of 3 and a contribution score of 4. (Id.)

2. Dr. Leonard's Use of the Importance and Contribution Analysis to Create a Value-Share.

Dr. Leonard attempted to adjust Ericsson's royalty rate based on the strength of its patent portfolio as compared to other SEP owners. The logic behind this is that if Ericsson's patents are above average in value, it should receive a higher royalty share, while if its patents provide less than average value for SEPs, it should receive a lower royalty rate. (Leonard Decl. ¶ 96.) Phrased another way, Ericsson's share of the total aggregate royalty depends on where its patents fall in the value distribution of all SEPs. (Id. ¶ 97.)

Dr. Leonard attempted to do this by applying a principle from an academic paper that shows that across numerous industries most patents are worth very little, and that the top 10% of patents are worth 65% of the value of patents in the industry, the next 10% make up 14.6%, and eventually the bottom 50% of patents make up 4.8% of the value in the industry. (Id. ¶ 100). Dr. Leonard treated all patents that received an importance score of 1 or 2 and a contribution score of 1 or 2 as top 10% patents. (Id. ¶ 105.) Using the 10%/65% ratio above, this led to Ericsson owning 3.1% of the U.S. 4G patent value share, 4.0% of the U.S. 3G patent value share, and 6.7% of the U.S. 2G value share. (Id. ¶ 108, Table 6.)

As a cross-check on his results, Dr. Leonard confirmed his results using a forward citation analysis, which attempted to determine the strength of patents by examining how often they are cited in future patent applications. (Leonard Decl. ¶¶ 102, 109-117, Table 7.) The economic logic behind using forward citations as an indicator of patent value is that a patent that is more important and valuable would be expected to generate a greater number of future innovations that then cite back to the patent in question. (Id. ¶ 102) Dr. Leonard argued that the positive relationship between forward citations and patent value has been confirmed by some empirical economics research. (Leonard Decl. ¶ 102; e.g., Ex. 1104 at 1-20.) The results of the forward citation analysis demonstrate that Ericsson owns a 4.0% value share of U.S. 4G patents, a 5.7% value share of U.S. 3G patents, and an 8.1% value share of 2G patents. (Leonard Decl. ¶ 116, Table 7.)

3. Flaws with the Importance and Contribution Analysis.

There are three flaws with TCL's importance and contribution analysis.

First, TCL uses the importance and contribution analysis to weight Ericsson's portfolio according to its relative value, but it never applies that analysis to the rest of the SEPs in the standard. (Leonard Decl. ¶ 108.) This means that TCL's "value share" is a ratio with inconsistent units, and it is unclear what it actually represents. Because TCL only analyzed the importance and contribution of Ericsson's SEPs, there is nothing to compare its rankings against to determine the strength of Ericsson's portfolio.

Second, in determining contribution scores TCL ignored important legal and factual issues that determine how an SEP's contribution affects its value. In identifying alternatives to each SEP, Dr. Kakaes caused what Ericsson characterized as a "ripple effect." This is because Dr. Kakaes did not analyze whether his alternatives are mutually inconsistent with each other, would perform worse than the standard, would even create a viable, functional standard, or require other patents owned by Ericsson (thus defeating the point of the analysis).[26]

TCL's contribution scores are also legally flawed because Dr. Kakaes did not examine who owned his proposed alternatives. An SEP's contribution is only relevant to its value because, prior to the adoption of the standard, patents with viable alternatives have less value than patents without viable alternatives due to competition. Broadcom Corp. v. Qualcomm Inc., 501 F.3d 297, 314 (3d Cir. 2007) ("Although a patent confers a lawful monopoly over the claimed invention, its value is limited when alternative technologies exist."). The degree to which alternatives will lower the value of a patent will depend on the quality of the alternatives, and who owns the alternatives. TCL's 1-4 rankings do not reflect who owns the proposed alternative patents. How much proposed alternatives will

[26] However, Ericsson's critiques would be stronger had Dr. Parkvall gone through more of Dr. Kakaes's alternatives and shown that they were inferior, impossible, or infringing. Dr. Parkvall instead testified that he did not go through most of Dr. Kakaes's alternatives because he "found his methodology such flawed and not a good one, I didn't see the point in wasting time trying to check each of his gradings." (TT Mar. 1, 2017, pp. 77:25-78:2.)

affect the value of a patent depends on a number of variables, including whether the alternative is unpatented, expired, part of the previous standard, owned by another company that lets manufacturers use it for free or at a low rate, an entity that aggressively protects its intellectual property, or by the company itself. See In re Innovatio IP Ventures, LLC Patent Litig., No. 11 C 9308, 2013 WL 5593609, at *20 (N.D. Ill. Oct. 3, 2013) (finding that the price of an SEP will be driven down more by an alternative in the public domain than an alternative owned by a competitor).

Third, Dr. Leonard assumed that any patent which received a contribution score of 1 or 2 was in the top 10% of patents in the standard that provided 65% of the value in the standard, while a patent that received contribution score of 3 or 4 was in the bottom 90% of patents that provided 35% of the value of the standard. (Leonard Decl. ¶ 107, Table 5.) As it turned out, the importance scores had no impact on Dr. Leonard's estimate of their value.[27] The critical distinction between a contribution score of 2 or 3 was whether its contribution was moderate, or marginal. (Kakaes Decl. ¶ 121.) Neither Dr. Kakaes nor Dr. Jayant provided a meaningful explanation on the difference between a moderate or marginal improvement, and it is not clear that this score can be used for determining whether a patent a top 10% or bottom 90% SEP. (TT Feb. 17, 2017, p. 142:16-24.) Dr. Leonard drew his top 10%:65% ratio from a paper by Dr. Jonathan Putnam, who found that across various industries the top 10% of patents contained 65% of the value in the industry. (Leonard Decl. ¶¶ 100-101; Ex. 319.) The Court is not persuaded Putnam's findings are applicable to telecommunications SEPs. Dr. Leonard also did not explain why a different skew was appropriate here compared to Innovatio, where he testified based on a different paper that the top 10% of Wi-Fi SEPs provided 84% of the value. Innovatio, 2013 WL 5593609, at *43.

Similarly, the Court is not persuaded by Dr. Leonard's forward citation analysis, which he used as a check on the importance and contribution analysis. (Leonard Decl. ¶ 102.) Its results generally contradicted the importance and contribution analysis done by Dr. Kakaes, and the Court is not convinced on this record that it provides a meaningful way to value SEPs. (Kennedy Rebuttal Decl. ¶¶ 215-221.) It does not appear that any other court or company has used a

[27]Because the importance scores were ultimately irrelevant, the Court need not discuss the validity of TCL's attempt to quantify the importance of Ericsson's SEPs.

forward citation analysis for such a task, and it is unclear whether companies would have the same incentives to cite to potential prior art, particularly in the context of multiple standards. In addition, while ignoring self-citations reduces the risk of gaming the system, it would also appear to ignore the possibility that one patent owner would naturally cite to itself because it is has been the leader in developing a particular technical area.

Because the Court has found fatal flaws with certain steps in TCL's top down approach, it does not accept Dr. Leonard's final numbers. However, the Court does find some value in the technical analysis, particularly to show that Ericsson's patent portfolio is certainly not as strong or essential as it has claimed. The Court uses this finding in part to assist it in determining the final FRAND rate.

D. Adjusting for Ericsson's Weaker Portfolio outside of the United States.

Generally speaking, Ericsson's portfolio is weaker outside the U.S. (Leonard Decl. ¶¶ 132-134.) If Ericsson does not patent the same technology in other regions, then that technology remains in the public domain in those jurisdictions. (Id. ¶ 132.) A fair and reasonable royalty must be proportionally related to an SEP owner's geographic patent portfolio strength, and ignoring disparities in geographic patent portfolio strength ignores the fundamental relationship between FRAND and domestic patent law. (ETSI IPR Policy § 15.7, Ex. 223 at 7.) This is because FRAND does not permit an SEP owner to charge a royalty for an IPR it does not own, and unpatented inventions are essentially in the public domain. (Leonard Decl. ¶ 132.) Nevertheless, the Court assumes that FRAND permits companies to agree to a global rate between themselves and structure their contracts accordingly, so long as such an agreement would not violate the patent law of each country where the products are sold. Many of the licenses presented to the Court during the course of the litigation reflect the fact that as a matter of commercial reality, firms regularly adopt a single world-wide rate.

It would be very easy to construct a FRAND rate using any of the approaches presented in this case without examining where an SEP owner actually has enforceable patents. In a top down approach, one would simply calculate the

number of SEPs owned by Ericsson, divided by the total number of SEPs, and then multiply that by the total aggregate royalty. Indeed, TCL began its top down model in such a way. It is not until Dr. Leonard generated U.S.-specific numbers that TCL began to tie its FRAND royalty to patents filed in a particular country. (Leonard Decl. ¶ 94, Table 4.) However, to look at patent families in the abstract without regard to where actual patents are enforceable would result in a subsidy to consumers in countries where the SEP owner has more enforceable patents from consumers that are not legally obligated to pay such a royalty. In essence, a global patent rate that does not account for differences in national patent strength provides the SEP owner a royalty based on features that are unpatented in many jurisdictions. See Ericsson v. D-Link, 773 F.3d at 1232 (requiring patent royalties to apportion the value of the patent feature apart from the unpatented features of the standard).

There is one important caveat to this general rule: patents can also be enforced where the product is manufactured. (Leonard Decl. ¶ 134.) This means that the SEP owner's patent portfolio strength in the country where the products are made effectively sets a global floor for the manufacturer's FRAND rate. Because TCL manufactures its products in China, the strength of Ericsson's SEP portfolio in China will therefore determine the lowest FRAND rate for any product TCL sells globally. (Id.)

There are two countervailing considerations for the Court in accounting for regional disparities in an SEP owner's patent portfolio: (1) the regional disparities have to be supported by evidence in the record, and (2) final rate(s) should avoid complications that disproportionately increase the complexity and difficulty in understanding and enforcing any final judgment. Courts would be faced with an insurmountable task if they have to resolve disputes involving the technical nuances of patent law in dozens of jurisdictions, where as here the parties have requested a global adjudication, especially if the sum of all of those disputes is relatively trivial. Where geographic disparities are relatively insubstantial or unsupported by the evidence, the Court disregards them in favor of a more understandable, administrable, and enforceable royalty structure.[28]

[28] For these reasons, the Court finds it unnecessary to create a separate rate for TCL's definition of the Asia-Pacific region, which excludes China. The entire region is less than 2% of TCL's total sales, and it's patent strength in that region is sufficiently close to China's for all standards that accounting for it separately would likely have less impact than a rounding error. (Ex. 1122.)

Dr. Leonard accounted for geographic disparities by determining how many SEPs Ericsson owns in the United States in order to make regional adjustments and create a global blended rate that is based on TCL's sales in each region. (Leonard Decl. ¶¶ 94, 132-34.) He first determined Ericsson's value share of SEPs in the United States. (Id. ¶ 94.) He then determined the country in each of TCL's sales regions where Ericsson has the strongest patent portfolio by value share, which he applied to the entire region. (Id. ¶ 133.) He then expressed that region's value share as a percentage of Ericsson's U.S. value share (with China as a floor). Blending the regional value shares and TCL's actual and projected sales for the course of the license to account for differences in selling prices, Dr. Leonard eventually created a single global rate. (Id. ¶¶ 138-39.) This process was designed to ensure that TCL's total royalty payments would reflect the regional variations in Ericsson's patent portfolio. However, because Ericsson's portfolio is stronger in the U.S. than the rest of the world, a global blended still means that TCL's sales throughout the world paying a higher rate to subsidize its sales in the United States.

Aside from the United States, the only other region where Ericsson has a stronger patent portfolio than China is Europe, and only for 2G and 3G. For the reasons described above, instead of trying to project future sales and use a weighted blended average to create a global rate, the Court instead adopts three sets rates for TCL's sales in: 2G, 3G, and 4G in United States; for 2G and 3G sales in Europe; and for 2G, 3G, and 4G sales in the rest of the world ("ROW"). Ericsson's European value share is 72.2% and 87.9% of its United States portfolio's value share for 2G and 3G respectively. (Ex. 1122.) For ROW, Ericsson's value share relative to its U.S. portfolio is 54.9% for 2G, 74.8% for 3G, and 69.8% for 4G. (Id.) The Court would have preferred to have the regional patent strength presented by country and not region to avoid lumping together the patent regimes of different countries, but Dr. Leonard presents his conclusions only by region. (Ex. 1122.) However, because of Ericsson's strength in China, the only relevant regional calculation of Dr. Leonard's is for Europe. The Court is much less concerned about using a single regional rate for Europe because many if not most of Ericsson's patents in Europe are European Patents. Microsoft Corp. v. Motorola, Inc., 696 F.3d 872, 878 n.3 (9th Cir. 2012) (noting that while European Patents are not a transnational patent, they are equivalent to a national patent in each designated state that is a signatory to the European Patent Convention).

The Court understands that these ratios are based on Dr. Leonard's value shares, which incorporate the importance and contribution analysis which the Court rejected above. However, this is not a significant problem because the regional numbers stated above are a ratio of one value share to another. This means that the ratios are only impacted by the importance and contribution analysis to the degree that Ericsson has disproportionately registered its less valuable patents (in Dr. Leonard's approach) in Europe and China compared to the United States. There is no reason to believe this is true, and if the importance and contribution analysis has any bearing on the value of patents (which the Court agrees it does, just not enough to apply it to the entire top down analysis), Ericsson would have a strong incentive to register those patents in foreign countries more frequently than others. For this reason, the Court is comfortable applying Dr. Leonard's regional adjusted portfolio strength ratios.

V. Calculating a Fair and Reasonable Royalty Rate.

The basic formula to calculate a top down royalty rate using a simple patent count is:

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

Filling in the numbers the Court has adopted above provides the following results:
2G:

USA: $5\% \times \left(\frac{12}{365}\right) \times 100\% = 0.16402\%$ of ASP

Europe: $5\% \times \left(\frac{12}{365}\right) \times 72.20\% = 0.11842\%$ of ASP

ROW: $5\% \times \left(\frac{12}{365}\right) \times 54.90\% = 0.090049\%$ of ASP

The 2G and 3G figures which the Court calculates compare to Dr. Leonard's final conclusion that a proper 2G/3G world wide blended rate is .21%. (Leonard Decl. ¶ 143.)

3G:

$$5\% \times \left(\frac{[19.65 \text{ or } 24.65]}{953}\right) \times [100\% \text{ for USA}, 87.90\% \text{ for Europe}, 74.80\% \text{ ROW}]$$

Using TCL's patent number:

USA: $5\% \times \left(\frac{19.65}{953}\right) \times 100\% = 0.10309\%$ of ASP

Europe: $5\% \times \left(\frac{19.65}{953}\right) \times 87.90\% = 0.090618\%$ of ASP

ROW: $5\% \times \left(\frac{19.65}{953}\right) \times 74.81\% = 0.07711\%$ of ASP

Using Ericsson's patent number:

USA: $5\% \times \left(\frac{24.65}{953}\right) \times 100\% = 0.12932\%$ of ASP

Europe: $5\% \times \left(\frac{24.65}{953}\right) \times 87.90\% = 0.11367\%$ of ASP

ROW: $5\% \times \left(\frac{24.65}{953}\right) \times 74.81\% = 0.09673\%$ of ASP

For 4G there are 4 different combinations, using a 6% up to a 10% total aggregate royalty, and using just the number of patents TCL concedes are essential, or up to the total number that Ericsson disputes are also essential:

$$[6\% \text{ or } 10\%] \times \left(\frac{[69.88 \text{ or } 111.51]}{1481}\right) \times [100\% \text{ for USA}, 69.80\% \text{ for ROW}]$$

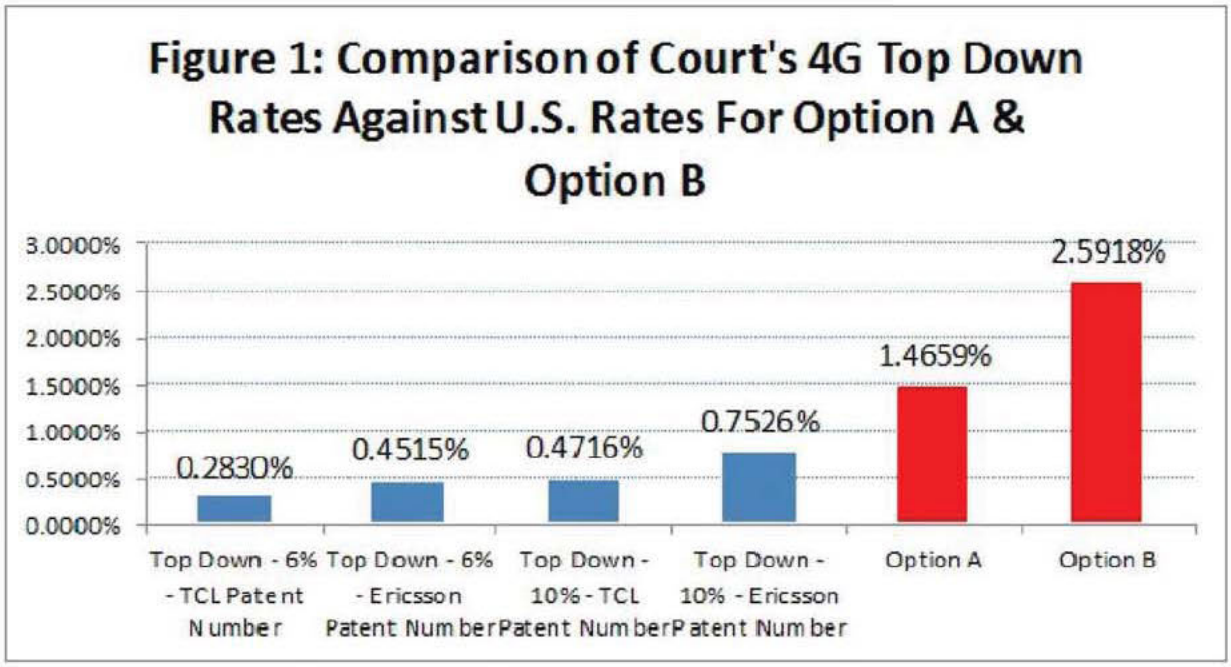
That formula returns the following results:

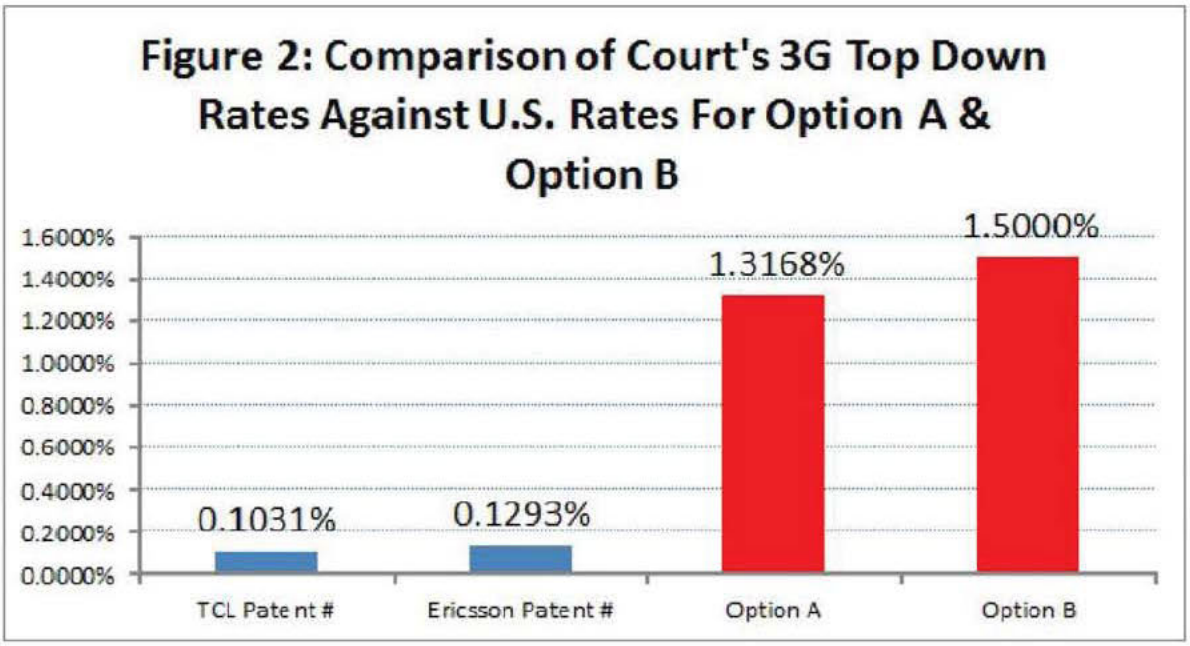
USA	6%	10%
69.88 Ericsson SEPs	0.28297	0.471611
111.51 Ericsson SEPs	0.45145	0.752576
Rest of World	6%	10%
69.88 Ericsson SEPs	0.19751	0.32918

111.51 Ericsson SEPs	0.31517	0.52529

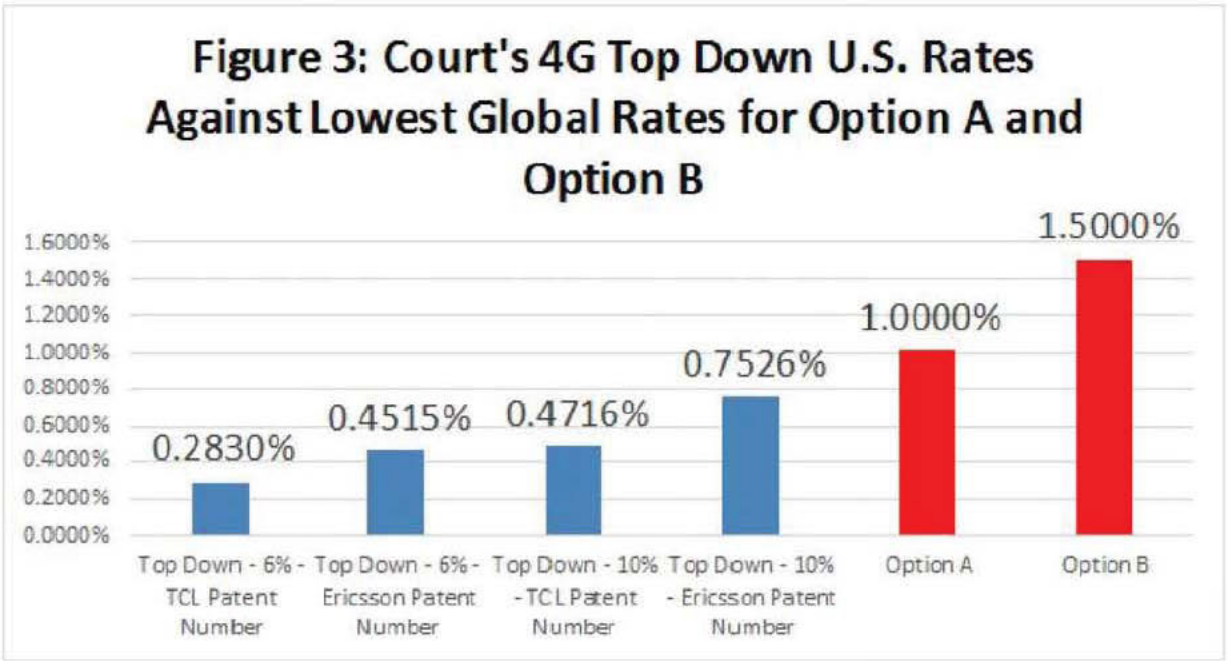
The 4G rates which the Court calculates compare to Dr. Leonard's final conclusion that a proper 4G world-wide blended rate is .16%. (Leonard Decl. ¶ 139.)

The charts below compare the U.S. 3G and 4G rates from the Court's top down analysis compared to the U.S. rates implied by Option A and Option B. The Court explains its conversion of unpacked rates to U.S. rates in Part 4, Section VI, below.





Even if one assumed the lowest possible rates under Option A (TCL sells exactly $3 billion entirely 4G sales) and under Option B (TCL's ASPs are above the cap), there is a substantial disparity in rates.



While the Court has some reservations about the top down analysis, there is no basis to reconcile the results of the top down analysis with Option A or Option B. Even if the Court assumed that every patent that Ericsson presented at trial was essential, applied a 10% total aggregate royalty, and ignored when patents expired, the 4G U.S. royalty rate would still only be .843%. Option A and Option B are therefore not fair or reasonable offers the the top down measure.

As discussed below (Part 4, Section VI), the Court use these numbers in conjunction with its analysis of comparable numbers to create its overall FRAND rate.

PART 3: ERICSSON'S EX STANDARD APPROACH

Ericsson presented the work of David Kennedy as a means of testing whether Ericsson's Options A and B are fair and reasonable. (Kennedy Decl. ¶¶ 225-29.) The ex-Standard approach is designed to estimate the value of SEPs independent of any value arising from incorporation of SEPs into a standard. (Id. ¶ 29.) The premise is that if the royalties sought by Options A and B are less than the ex-Standard value of the licensed technology, the analysis indicates that the royalties are fair and reasonable. (Id.)

The Court found the analysis flawed at multiple steps and rejects the conclusions.

Kennedy worked with Ericsson's technical expert, Dr. Parkvall, to perform three steps: (a) isolate and identify the specific contributions of 4G SEPs to the cellular standards by comparison to the next best available non-infringing alternative, (b) estimate the economic value of the technical contribution of all 4G SEPs over the next best available non-infringing alternative; and (c) apportion Ericsson's share of that economic value. (Id. ¶¶ 30, 230.)

Dr. Parkvall performed what he refers to as a "technology by technology" analysis. He began by subdividing Ericsson's SEPs into ten technology sub-areas. (Parkvall Decl. ¶¶ 55-69.) He then considered the Ericsson SEPs within each sub-area and identified the next best non-infringing way to implement the technology in the 2G, 3G, or 4G standard without using Ericsson's SEPs. (Parkvall Decl. ¶¶ 57, 70; Kennedy Decl. ¶¶ 231-32.) At that point, Dr. Parkvall identified the

benefits that each sub-area conferred on the 4G standard over and above the next best non-infringing alternative. (Parkvall Decl. ¶¶ 75, 93, 113, 145, 161, 184, 214-15.) Dr. Parkvall calculated a value for certain of these benefits, including improved battery life, faster data speeds/throughput, fewer connection delays/less latency, better uplink peak-to-average ratios, increased spectral efficiency, and coverage improvements. (Id.; TT Feb. 28, 2017, p. 131:11-24.) For other benefits, including decreased interference, increased service quality, increased network coverage, cheaper handset components, increased voice quality, and increased security, Dr. Parkvall did not calculate a precise value, but simply testified to the fact that they confer value on a handset. (Parkvall Decl. ¶ 215.)

Kennedy measured the dollar value that two of these benefits—improved battery life and faster data speeds—confer on a 4G device as compared to the alternative identified by Dr. Parkvall. (Kennedy Decl. ¶¶ 235-42, 248-57.) For the other two benefits—less latency and improved system capacity/network performance—Kennedy analyzed the value they confer on a 4G device, without calculating a specific monetary value. (Id. ¶¶ 258-72.)

To assign a dollar value to the improved battery life benefit, Kennedy relied on Dr. Parkvall's testimony that 4G "sleep mode" technology provides a 53% improvement in battery life over the next best non-infringing alternative. (Id. ¶¶ 236-37; Parkvall Decl. ¶ 184.) He also relied on the results of a survey by of 306 American smartphone users that was conducted International Planning and Research ("IP&R") in 2012. (Kennedy Decl. ¶¶ 239-41.) However, Dr. Parkvall conceded that many companies other than Ericsson were involved in creating Sleep Mode Solutions. (TT, Mar. 11, 2017,(Sealed Vol. 3) pp. 8:19-11:13.) Neither Dr. Parkvall nor Kennedy determined Ericsson's proportional share of Sleep Mode Solutions patents, or the number of accepted technical contributions that relate to Sleep Mode Solutions submitted by Ericsson or any other companies. (Id .; see also Kakaes Rebuttal Decl., ¶¶ 284-85, Figures 49-52 (finding Ericsson's share of Sleep Mode Solutions patents is just 2.3%, not 14.6%).)

Using these two inputs, Kennedy arrived at a dollar value of $15.90. (Kennedy Decl. ¶¶ 241-42, Figure 57.) Because other companies have contributed technology to the 4G standard that works in tandem with Ericsson's 4G Essential Patents, he apportioned out Ericsson's share of the $15.90 using the Signals approved contribution counting data. (Id. ¶ 238) This led him to conclude

that Ericsson's share of the value conferred on a 4G handset by improved battery life is $2.32 per handset. (Id. ¶ 242.)

To assign a dollar value to the faster data speed benefit, Kennedy relied on Dr. Parkvall's testimony that Ericsson's 4G Essential Patents improve data rates through multiple technology clusters. (Id. ¶ 249; e.g., Parkvall Decl. ¶ 146) (testifying that a system without Ericsson technology would not achieve 4G system throughput or bitrates).) For his dollar figures, he relied on a 2012 survey by IP&R, as well as a 2013 survey of more than 30,000 consumers in 26 countries by Accenture. (Kennedy Decl. ¶¶ 248-54.) Using these surveys, he arrived at a dollar value of $26.24 to $33.00 per handset. (Id. ¶¶ 251-54, Figures 59, 60.) After apportioning Ericsson's share based on contribution counts determined by Signals (Id. ¶¶ 252, 254), he concluded that Ericsson's share of the value conferred on a 4G handset by faster data speeds is $3.83 to $4.82 per handset. (Id. ¶¶ 252, 254, Figures 59, 60.)

Taken together, Kennedy estimated that just two of the benefits of Ericsson's 4G Essential Patents confer $6.15 to $7.14 of value on a 4G handset . The Court finds that Kennedy's result are highly suggestive of royalty stacking; i.e, valuing individual components of a standard in manner that accedes the aggregate value of the standard. Kennedy concedes these figures have never been the basis for any of Ericsson's licensing proposals, and no Ericsson licensee has ever paid anywhere close to $6.15 per phone for a license to Ericsson's 4G patents. (TT, Feb. 28, 2017, p. 133:13-23.)

While the Court has doubts about the ex-Standard method as implemented here, Ericsson is correct that TCL did not challenge Kennedy's ex-Standard methodology, but rather challenged the inputs to his calculations: Dr. Parkvall's technical analysis, the surveys by International Planning and Research and Accenture, and the use of contribution counting. (Kakaes Rebuttal Decl. ¶¶ 15-40, 285-85; Simonson Rebuttal Decl. ¶¶ 30-49.) The Court found TCL's criticisms of Ericsson's ex-Standard analysis persuasive.

Kennedy's apportionments are flawed because they relied on contribution counting, and because he apportioned based off of what percentage of the standard as a whole Ericsson owned, not the specific technologies he identified. (Kennedy Decl. ¶¶ 242, 252.) The Court identifies many of the problems with contribution

counting above (see Part 4, Section IV.B.3 below). While Kennedy did use Dr. Ding's patent counting results as an alternative, this still gave Ericsson credit regardless of how many patents it actually owned that were related to that technology. This is particularly confusing because Dr. Parkvall actually identified how many SEPs Ericsson owned for each technical area, but Kennedy did not use this information to determine. (E.g., Parkvall Decl. ¶ 134, 154, 178.) Ericsson is only entitled to 14.6% of the value longer battery life or faster connections if it can show that it owns 14.6% of the patents that cover those inventions. Kennedy did not attempt to show that Ericsson is responsible for 14.6% of the specific features he valued.

In addition, Dr. Itamar Simonson testified that the surveys used by Kennedy were irrelevant and biased. (Simonson Rebuttal Decl. ¶¶ 11, 33-37, 47-49.) The Court found Dr. Simonson's testimony credible. Kennedy has no experience in survey work, and the basis for his reliance on the surveys is questionable. By contrast, Dr. Simonson is exceptionally well credentialed in survey work. (Ex. 2387.) Kennedy conceded that Dr. Simonson is more qualified to address matters related to the study of consumer behavior and survey design. (TT, Feb. 28, 2017, p. 145:3-7.)

The Court finds that Dr. Simonson's criticisms of the survey work here are valid.

First, the IP&R survey suffered from many defects which make it unreliable as a basis for measuring the value of any Ericsson patented technology. (Simonson Rebuttal Decl. ¶¶ 33-46.) For example, IP&R focused on one feature at a time instead of presenting the bundle of phone features consumers evaluate in reality, and also singled out certain features. (Id. ¶¶ 39-44.) Research shows that singling out features without simultaneously considering other features tends to greatly overstate the importance of the focal feature, as compared to its impact in actual purchase decisions. (Id., ¶¶ 24-26, 28, 33-46.) Also, research shows that asking survey respondents direct questions about their willingness to pay for individual features and feature differences has been shown to be unreliable and susceptible to various influences. (Id. ¶ 26, 38, 43.)

Second, the survey from Accenture apparently focused on the value and interest in various mobile network services, not necessarily handset features. (Id.

¶ 48; Ex. 4845, pp. 2.) Otherwise, no information was provided by Ericsson showing the survey methodology, or the specific questions asked. (Simonson Rebuttal Decl. ¶ 47.) This prevents a proper assessment of the reliability of the survey (although, as noted above, any attempt to gauge feature value by asking questions about willingness to pay for specific features is unreliable). (Id.; see also id. ¶¶ 24-26, 28, 38.)

In the end, the Court found that the ex-Standard approach lacked fundamental credibility. If one takes a step back and credits Kennedy's work at face value, it is simply not logical that two features could have a value in excess of Ericsson's entire portfolio. Either there is something radically wrong in Ericsson's portfolio valuation, or Kennedy's work is not reliable. The Court draws the latter conclusion.

PART 4: COMPARABLE LICENSE ANALYSIS AND FRAND DETERMINATION

The second component of the FRAND obligation is to offer a rate which is non-discriminatory. The parties agree that like, or close to, like rates must be offered to firms which are similarly situated. (TCL COL, ¶ 34; Ericsson COL, ¶ 17.) The parties point to different clusters of firms for the comparison. TCL contends that the relevant licensees are Apple, Samsung, Huawei, LG, and HTC. (TCL COL, ¶¶ 36 *et seq.*) Ericsson focuses on firms in the middle and lower end of the market: LG, HTC, CoolPad, Kaarbon, and ZTE. (Ericsson FOF, ¶ 317.) The Court identifies the relevant firms, and then analyzes their rates to test Option A and Option B for discrimination.

I. Summary of the Comparable License Analysis.

The Court begins this section with an explanation of how it determined firms comparable to TCL for non-discrimination purposes, and then identifies the six firms that it finds are similarly situated to TCL: Apple, Samsung, LG, HTC, Huawei, and ZTE. The Court then explains the formula used to "unpack" a license. Unpacking is used to derive a one-way royalty rate so that licenses can be compared on a common basis. Here, unpacking requires the Court to account for cross-licenses, lump sum payments, pass-through rights, and other issues. The Court explains why it chose not to use dollar-per-unit rates and instead calculates

its unpacked results as percentage royalties without caps or floors. The Court then explains how it determined appropriate discount rates, revenue of each licensee, and the appropriate portfolio strength ratio, or PSR. The Court then analyzes the licenses from the six comparable firms and compares them to the results of Ericsson's Option A and Option B. The Court then explains why it rejected Ericsson's proposed requirement of competitive harm, and finally the Court provides its conclusions from the comparable license analysis.

II. Summary of the Experts and their Qualifications.

A. Unpacking.

Dr. Matthew Lynde conducted the unpacking analysis for TCL, and David Kennedy conducted the unpacking analysis for Ericsson. Dr. Lynde is an economist at Cornerstone Research, an economic and financial consulting firm. (Lynde Decl. ¶ 1.) He holds a bachelors and Ph.D. in economics from the University of California, Berkeley. (Id. ¶ 2.) His consulting work specializes in the economic and financial analyses of complex business and regulatory matters, and he has analyzed thousands of license agreements. (Id. ¶¶ 8-9.) He has testified extensively as an expert witness on the economic issues related to intellectual property and antitrust law. (Id. ¶ 8.) Kennedy is the Managing Director of the consulting firm Berkeley Research Group, LLC. (Kennedy Decl. ¶ 42.) He specializes in patent valuation, patent licensing, and patent sales, and has participated in or analyzed more than 150 patent-related transactions. (Id.) He holds a B.S. in Business Administration with a major in accounting from the University of Georgia, and has been a licensed Certified Public Accountant in Georgia since 1987. (Id. ¶ 50.)

B. Similarly Situated Firms.

To determine which firms are similarly situated to TCL, Ericsson relied on Dr. David Teece, while TCL relied on Dr. Janusz Ordover. Dr. Teece is a professor of Global Business at the Haas School of Business at the University of California, Berkeley, and received his Ph.D. in economics from the University of Pennsylvania. (Teece Decl. ¶ 2.) He co-founded and co-edits Industrial and Corporate Change, an academic journal that focuses on issues related to technological change, and has published hundreds of books and articles in the

fields of industrial organization, technology management, and public policy. (Id. ¶¶ 2-3.) He has testified as an expert witness over 100 times, including in a number of RAND, FRAND, and antitrust trials. (Id. ¶¶ 6-8.) Dr. Ordover is a Emeritus Professor of Economics at New York University, and former Deputy Assistant Attorney General for Economics in the Antitrust Division of the U.S. Department of Justice. (Ordover Decl. ¶ 1.) He received his Ph.D. from New York University, and has written extensively on topics such as antitrust, the licensing of intellectual property, and the FRAND commitment. (Id. ¶ 2; Ex. 451.)

C. Valuation of LG Patents.

To estimate the value of certain patents that LG transferred to Ericsson as part of their license agreement, Ericsson relied on Michael Pellegrino, and TCL relied on Dr. Andrew Wolfe. Pellegrino is the president of Pellegrino and Associates, LLC, a boutique intellectual property valuation firm. (Pellegrino Decl. ¶ 15.) His firm has conducted hundreds of intellectual property valuations, and he wrote the first and second editions of BVR's Guide to Intellectual Property Valuation. (Id. ¶ 16.) He received a bachelor's degree in computer science from the Indiana Institute of Technology, and a Master's degree in business administration from Ball State University. (Id. ¶ 21.) Dr. Wolfe earned his B.S.E.E. in Electrical Engineering and Computer Science from The Johns Hopkins University, an M.S. in Electrical and Computer Engineering from Carnegie Melon, and a Ph.D. in Computer Engineering from Carnegie Melon. (Wolfe Decl. ¶ 2.) He has published more than 50 articles on computer architecture and computer systems, and has testified extensively on patent issues. (Id. ¶ 11; Ex. 1600.) He works as a consultant on intellectual property issues for Wolfe Consulting, and teaches graduate courses on computer organizations and architecture at the University of Santa Clara. (Ex. 1600.)

The Court found that all of the experts were well-credentialed.

III. Determining The Relevant Firms.

The Court concludes that for purposes of license comparisons the analysis should include all firms reasonably well-established in the world market. This implies a necessarily wide spectrum, and correctly so for several reasons. First, ETSI contemplates facilitating competition in the market, particularly from

emerging firms. Second, excluding from the analysis the largest firms in the market would have the effect of insulating them, and further contributing to their dominant positions, by imposing a barrier in the form of higher rates for those not at the top end of the market. (See TT Mar. 1, 2017, pp. 171:22-173:25.) By the same token, TCL overstates the nature of the concern for small and medium sized firm.[29] Third, permitting Ericsson to define similarly situated very narrowly by picking and choosing criteria with no relation to its SEPs or the FRAND commitment would effectively allow Ericsson to read the non-discrimination prong out of the FRAND commitment.

In defining similarly situated firms, there is a similar thread among all experts in that they look to firms using the same technology and at a similar level in the value chain. (Ordover Decl. ¶ 61; TT Mar. 1, 2017, p. 104 (Teece); id., p. 6-7 (Kennedy).)

The Court finds that the concept of strategic groups advocated by Dr. Teece takes too narrow a focus. Under his approach, discrimination between firms in different strategic groups would never run afoul of FRAND, absent an adverse effect on standards development. (TT Mar.1, 2017, pp. 170-76.) The Court finds that competition for purposes of FRAND is not limited to Dr. Teece's definition of head-to-head competition. On the other hand, Dr. Ordover's view that TCL is similarly situated with every other firm that uses the same technology is too broad and would impose the same rate on large global firms and local niche manufacturers. (TT Feb. 15, 2017, pp. 74-75.)

The Court also believes that similarly situated should be broadly interpreted because the mobile phone market has been extremely dynamic over the last decade. In 2007, the six largest companies ranked by U.S. market share were, in order, Motorola, Samsung, LG, Nokia, Blackberry, and Apple. (Teece Decl. ¶ 163, Figure 16.) Within a decade Motorola, Nokia, Blackberry, and even Ericsson's own handset division would be shuttered or divested, events which Brismark acknowledged no industry observer would have ever predicted. (Brismark Decl. ¶ 61.) TCL itself first entered the U.S. market in 2011, and within six years was the fourth largest manufacturer in the U.S. by market share. (Cistulli Decl. ¶ 3.) The volatility of the handset market over last decade requires the Court

[29]ETSI was concerned about the availability of arbitration to small firms in deterring discrimination. (Ex. 5289 at 4, 6.) However, an arbitration scheme was never adopted.

to exercise a broad view of who will be similarly situated to TCL over the course of the five-year license which the Court adopts.

The parties agreed that Huawei, LG, HTC, and ZTE[30] are similarly situated to TCL. (TCL COL, ¶ 36; Lynde Decl. ¶ 84; Ericsson FOF, ¶¶ 308, 310.) The Court agrees that these firms are similarly situated to TCL because they meet the Court's criteria for well-established global firms. TCL argued that in addition, at least Apple and Samsung are also similarly situated to TCL. (TCL COL, ¶¶ 34-35.) Ericsson disagreed and argued that Coolpad and Karbonn, not Apple and Samsung, are similarly situated to TCL. (Ericsson FOF, ¶ 310.) The Court therefore needs to determine whether Apple, Samsung, Coolpad, and Karbonn are also similarly situated to TCL.

For the reasons set forth below, the Court finds that six firm meet the Court's criteria: Apple, Samsung, Huawei, LG, HTC, and ZTE. The Court appreciates Ericsson's position that certain firms should be excluded from the analysis because their licenses post-date Option A and Option B, but for the moment the Court focuses on similarity.

A. Factors Relevant to Finding Firms Similarly Situated.

In determining which firms are similarly situated to TCL, the Court's task is to identify other reasonably well-established firms in the global market. Certain factors obviously matter, such as the geographic scope of the firm, the licenses required by the firm, and a reasonable sales volume. These factors suggest that even among similarly situated firms, there may be degrees of similarity which may affect the weight that each unpacked rate has on the Court's conclusions. The Court does not believe that factors such as the firm's overall financial success or risk, brand recognition, the operating system of their devices, or the existence of retail stores have any bearing on whether Ericsson's royalty rates for its SEPs are discriminatory.

B. Local Kings are not Similarly Situated to TCL.

[30] TCL appears to have dropped ZTE from its list of similarly situated firms, presumably because Dr. Lynde could not unpack rates from its licenses. However, whether a firm is similarly situated to TCL is a separate question from whether the firm's effective rate can be calculated, and what that rate means for non-discrimination under the FRAND commitment.

In this case geographic scope is the most important factor in determining which firms are similarly situated to TCL. The Court heard testimony breaking down major firms into two types, global firms, and "local kings." (Guo Decl. ¶ 7.) As the Court uses the term, a local king is a company that sells most or all of its devices in a single country, often the same country where it is headquartered and manufactures the devices.

Local kings are not similarly situated to global firms for two reasons. First, their sales largely occur in one country, while a single country will generally account for a relatively small percentage of the global firm's sales. Because the global firm will be dealing with different marketplaces, different regulatory environments, and consumers with different tastes and preferences, a global firm is unlikely to be similarly situated to a local king. Second, local kings receive a different license from Ericsson. A local king only needs license to Ericsson's SEPs in one jurisdiction, and Ericsson is bound to limit its offer to a rate that reflects the SEP strength of its portfolio in that jurisdiction. However, for global firms, Ericsson asserted that it provides a license at a global blended rate which averages out the higher rates Ericsson could charge in some countries with the lower rates it could charge in countries with weaker or non-existent patent protections.[31] (Brismark Decl. ¶ 55.) Thus, a license between Ericsson and a local king does not reflect the rate that a global firm like TCL would have to pay.

Ericsson argued that Karbonn and Coolpad are similarly situated to TCL, but Karbonn and Coolpad are both local kings. (Ericsson FOF, ¶ 327; Guo Rebuttal Decl. ¶¶ 49-53.) Karbonn sells handsets almost exclusively in India, while less than 3% of TCL's sales occurred in India. (Teece Decl. ¶ 80; Guo Rebuttal Decl. ¶ 53; Ex. 1122.) It is unclear what percentage of Coolpad's sales are made inside China, but both sides agreed it was "most." (Guo Rebuttal Decl. ¶ 51; Teece Decl. ¶ 127.) Coolpad's sales outside of China are so small that Kennedy assumed that all of its sales were in China when he unpacked its license with Ericsson. (Kennedy Decl. ¶ 204.) Coolpad's 2014 annual report shows that roughly 93% of its total revenue in 2014 came from customers in China, and

[31]The Court is skeptical that Ericsson actually averages different levels of patent protection to create a global blended rate for global firms. First, there is no evidence that Ericsson actually does this in its business cases. Second, Ericsson's preferred metric for determining its portfolio strength is contribution counting. Contribution counts, discussed more below, are a single number independent of geography or intellectual property rights, and thus cannot be used to reflect or average geographic distinctions in patent portfolios.

virtually all revenue was from the sale of mobile phones and phone accessories. (Ex. 2389 at 82-83.) This stands in stark contract to TCL, where over 90% of its sales occur outside its home country of China. (Guo Rebuttal Decl. ¶ 11.) Based on this evidence, Karbonn and Coolpad are not similarly situated to TCL.

C. Apple and Samsung Are Similarly Situated to TCL

TCL is a one of the largest cell phone companies in the world, and sells a wide range of products around the world. TCL sells mobile devices in every continent, with South America taking the largest share at 26.4% of TCL's devices sold in 2015. (Guo Decl. ¶ 25, Figure 3.) TCL will require at least a multi-modal 4G license for Ericsson's SEPs, as well as 3G[32] and 2G licenses. In 2015 it was the seventh largest mobile phone seller by volume. (PDX 237[33].) For reference, in 2015 Huawei was ranked fourth by volume, LG was ranked sixth, ZTE was ranked ninth, and HTC did not reach the top ten. (Id.)

In 2015 Apple was the second largest seller of mobile phones in the world. (PDX 237.) Its devices cater to the high end of the market, but Apple also sells older and refurbished models at much lower price points to capitalize on customers at the lower segments of the market. (Brismark Decl. ¶ 75; Guo Rebuttal Decl. ¶ 33.) Apple sells its devices globally, manufactures them in China, and they are all multi-modal 4G devices. While Apple's phones have similar specifications to some of TCL's flagship products, both parties agree that Apple's products command much higher selling prices because of the incredible value of its brand. (Ericsson FOF, ¶ 18; Cistulli Decl. ¶ 72.) Ericsson agreed the premium that consumers pay for Apple products (and Samsung products, discussed below) is largely a function of brand value and other intangibles unrelated to the value added by Ericsson's SEPs. (Brismark Decl. ¶ 73.)

In 2015 Samsung was the largest seller of mobile phones by volume. (PDX 237.) Samsung also sells its phones globally. Similar to HTC, Samsung's products cater the mid to high end of the market. Samsung's products are similar

[32]It is clear that at least some, of TCL's devices would have pass-through rights to Ericsson's 3G SEPs because of a separate license agreement between Qualcomm and Ericsson, but the parties do not address the details of these devices or how that may affect the overall license.
[33]While PDX 237 is not in evidence, the Court found it to be an accurate summary of IDC data. (Ex. 1273.) The Court cites to other PDXs as accurate summaries of the evidence.

to Apple's because both companies sell their high-end products at a premium because of brand value, but that brand value has nothing to do with the value provided by Ericsson's SEPs. Samsung, like TCL, sells feature phones and smartphones, and requires licenses for multi-mode 4G, as well as 3G and 2G. (E.g., Guo Rebuttal Decl. ¶¶ 17-18.)

The Court cannot identify any dispositive reason why Apple and Samsung are not similarly situated to TCL with regard to Ericsson's SEPs. All three firms are all global firms, Ericsson has asked all three to pay a global blended rate for a multi-modal 4G license, they all create phones of similar technical specifications, and they all have substantial sales volume. Although Apple does not require 2G or 3G licenses, Samsung does, and Ericsson does not suggest that Apple's lack of 2G or 3G products justifies TCL paying a higher 4G rate than Apple. Apple and Samsung do sell many more devices than TCL, but the Court views sales volume only as a filter to separate out niche and small firms from the reasonably well-established global firms. Sales volume alone does not justify giving lower rates to otherwise similar firms. Ericsson identifies many other criteria in its attempt to show Apple and Samsung are not similarly situated, but exclusive applications, retail stores, brand recognition, and a proprietary operating system are irrelevant to determining a non-discriminatory rate for Ericsson's SEPs. Ericsson would clearly prefer that Apple and Samsung be considered *sui generis*, but the prohibition on discrimination would mean very little if the largest, most profitable firms could always be a category unto themselves simply because they were the largest and most profitable firms.

IV. Determining the Rates for Assessing the Presence of Discrimination.

The experts devoted substantial effort to analyzing the relevant licenses, an exercise made more complex in some cases by the presence of cross-licenses and lump sum payments. However, their license unpackings provided a common basis to compare the economic deal offered each licensee. One surprising result is that the experts' conclusions for each firm largely agreed and were rarely widely disparate.

There are certain terms which the parties used to describe various licensing arrangements which will make the analysis clearer. A cross-license or two-way license is in effect a reciprocal license: the licensee grants Ericsson the right to use

its infrastructure SEPs in exchange for a smaller payment. A licensee's cash payment takes the form of a lump sum or running royalties. A lump sum is a fixed payment or series of fixed payments regardless of how many units the licensee sells. A running royalty means that the licensee pays a royalty for each qualifying unit, usually either as a percentage of the unit's net selling price, or on a dollar-per-unit basis. If the running royalty is calculated as a percentage of the net selling price, in some cases Ericsson's royalty would be subject to a cap and a floor. For example, if the contract specified a 1% royalty, with a floor of $2 and cap of $4, then for a $300 device Ericsson would receive $3, for a $150 device it receive be $2 (because of the floor), and for a $500 device it would receive $4 (because of the cap).

A. The Unpacking Formula.

Some Ericsson licenses expressly state a clear one-way per unit royalty rate that the licensee must pay Ericsson for its SEPs. (E.g., Ex. 1277 at 18 (Huawei license).) However, the licenses with Apple, Samsung, HTC, LG, and ZTE all involve either lump sum payments, or meaningful cross-licenses. A license agreement with a lump sum payment or cross-license must be unpacked to arrive at a one-way rate. Unpacking a license involves evaluating all of its terms and other consideration so that the Court can calculate the effective one-way rate that each licensee pays Ericsson for its handset SEPs. (Lynde Decl. ¶ 86.)

Both sides generally agree on the formula to use to unpack cross-licenses. (TCL FOF, ¶ 185; Ericsson FOF, ¶ 150.) The unpacking formula starts with the basic premise:

$$\textit{Value of a license} = \textit{Licensor One-way Rate} \times \textit{Licensee Revenues}$$

Thus, if a licensor's one-way rate was 10%, and the licensee made $500 selling products that required a license, the value to the licensee, or what it would have to pay, would be $50. In the case of a cross-license, both sides receive value from the license provided by the other party, and the party which receives less value will have to give cash or other consideration to make up the difference. This cash difference is called a net balancing payment. Using Ericsson as an example, this formula is expressed as:

$$\begin{aligned} Net\ Balancing\ Payment\ = \\ [Ericsson\ One\text{-}way\ Rate \times Licensee\ Revenues] \\ -[Licensee\ One\text{-}Way\ Rate \times Ericsson\ Revenues] \end{aligned}$$

This equation has two unknown variables: Ericsson's rate for its SEPs and the Licensee's rate for its SEPs.[34] In order to make this equation solvable, both sides used a PSR to state a licensee's one-way rate as a ratio of Ericsson's one-way rate. (Kennedy Decl. ¶ 111; Lynde Decl. ¶ 93.) The PSR is:

$$Portfolio\ Strength\ Ratio\ ("PSR") = \frac{Ericsson\ One\text{-}way\ Rate}{Licensee\ One\text{-}Way\ Rate}$$

The PSR assumes that each party's one way license rate reflects the relative strength of its patent portfolio. (Lynde Decl. ¶ 93.) Using a PSR, the unpacking formula can be stated as:

$$Ericsson\ One\text{-}way\ Rate = \frac{Net\ Balancing\ Payment}{Licensee\ Revenues - \frac{Ericsson\ Revenues}{PSR}}$$

(Kennedy Decl. ¶ 112; Lynde Decl. ¶ 95.) Importantly, the net balancing payments and revenues must be stated in dollars of the same year, which generally requires determining the net present value of past and future payments and revenue. (Ericsson FOF, ¶ 152.) In addition, because the unpacking formula calculates a royalty rate, it can only be used for one standard at a time. This is not a problem for the revenue inputs or the PSR, which can be determined individually for each standard, but it is a problem if the licensee paid Ericsson a single lump sum that covers multiple standards. This will be addressed in the apportionment section below.

In unpacking the license agreements, the experts are not required to follow the assumptions Ericsson made in its business cases. Ericsson created a business case after signing each license agreement to memorialize some of its projections and assumptions, and to act as a "memo to the file." (Brismark Decl. ¶¶ 60-61.)

[34]Until late 2011 Ericsson through its joint venture with Sony produced cell phones and thus required a cross-license for those handsets. (Brismark Decl. ¶ 11.) After Ericsson divested its mobile phone business in February 2012, it now requires a cross-license only for its infrastructure equipment. (Kennedy Decl. ¶ 117.) With the exception of Samsung and ZTE, all of the other comparable licensees only required a license for Ericsson's handset SEPs.

Ericsson did not use the business cases before the Court in its actual negotiations, and they represent nothing more than after-the-fact attempts to model certain projections. (Id.) Ericsson's business cases do not reflect how much licensees are actually paying over the course of the license. Most importantly, experts are free to provide their own expertise and analysis based on experience and industry practice. (Kennedy Rebuttal Decl. ¶¶ 116-17.)

TCL's expert Dr. Lynde appears to have generally tried to follow Ericsson's methodology reflected in its business case or testimony. However, Ericsson's expert Kennedy appears to have sometimes followed Ericsson's business case, sometimes followed Dr. Lynde, and sometimes made his own assumptions. (Kennedy Decl. ¶ 115.) Sound methodology should preclude the experts from cherry-picking facts from the business cases or each other's reports they choose to accept; rather, they must provide a factual basis for their opinions. The Court is very cognizant of just how easy it is to pick particular assumptions or approaches in order to manipulate the unpacking analysis to arrive at a preferred rate for each license.[35] The more that the unpacking analysis can be manipulated, the less it represents what the parties actually agreed to do, and therefore the less useful it is to the Court.

Because the purpose of unpacking comparable licenses is to establish comparable rates, the licenses should all be unpacked in a similar manner. If a particular license is treated differently, the explanation for why needs to be in the record. It is not sufficient to simply say that Ericsson did it that way in its business case because: (1) Ericsson's decisions in its business case are not binding on this Court; (2) as explained above, Ericsson created these business cases after-the-fact to explain the license; and (3) the business cases themselves are just Ericsson's projections and at best reflect only Ericsson's view of the license, not the licensee's view, or what the licensee actually ended up paying.

The Court will now address four common issues that arose in how to apply the unpacking formula.

1. Treatment of Released Sales.

[35]For example, with the Samsung license, keeping all of the inputs exactly the same and changing only the discount rates and 3G/4G apportionment factor to those used by the experts in other unpackings, Samsung's one-way effective 4G rate can range from [redacted].

In a typical license, the licensee will buy his peace for past unlicensed sales with a one-time payment, or a release payment. Released sales are those that were unlicensed at the time they were made, but then retroactively covered by a subsequent license agreement. (Kennedy Decl. ¶ 26.) In the case of a cross-license where Ericsson's own infrastructure sales were not licensed under the licensee's infrastructure SEPs, Ericsson would also receive the benefit of a release of liability for its own past unlicensed sales.

Dr. Lynde initially treated released sales as separate from prospective sales, and thus treated any initial lump sum payment made by the licensee as separate from the prospective rate, unless he had evidence that Ericsson allocated some of the initial lump sum payment towards prospective sales. (E.g., Lynde Decl. ¶ 106.) Sensing that this may be problematic, Dr. Lynde later unpacked the Apple and Samsung licenses to include the release payments. (Lynde Rebuttal Decl. ¶¶ 78-80.) Because Dr. Lynde had already unpacked the HTC license with the release payment and did not unpack the ZTE licenses, the only license he did not unpack with the release payment was the LG license.

Kennedy generally incorporated the release period into his analysis. However, with the LG license he only included the released sales from the years in Ericsson's business case, and therefore excluded released sales from years not included in Ericsson's business case. (Kennedy Decl. ¶ 116.)

The license agreements themselves do not spell out any basis to allocate lump sum payments between past and future sales. Although Ericsson's actual release of a licensee from past liability is often triggered by the payment of an initial lump sum, the Court interprets this as a timing issue, and not that the parties agreed to pay different rates for past and future sales, or that they agreed that the initial lump sum would exclusively and entirely cover all released sales. (E.g., Ex. 5331 at 13, 15.) Following Dr. Lynde's approach would invite SEP-holders to manipulate their internal discussions and opinions towards whatever their goals are for the next FRAND dispute. This is particularly true where, as here, Dr. Lynde's decisions are based entirely on after-the-fact statements made by Brismark. (E.g., Lynde Decl. ¶ 105, citing Brismark Depo., May 18, 2016, p.183:3-15.)

The Court generally views released sales as part and parcel of the forward-looking terms of the license agreements. The Court decides this based on a pragmatic view of the negotiations between sophisticated parties. When Ericsson and Apple negotiated their license agreement, they both knew that there were unlicensed sales, and they had even engaged in substantial litigation across the globe over that very issue. (Brismark Decl. ¶ 108.) To then exclude released sales and the initial lump sum payment ignores the reality that, particularly for lump sum deals, the released sales are being paid for as part of the same transaction. The Court is therefore skeptical of any unpacking which ignores released sales and an initial lump sum payment for the purposes of determining a FRAND rate. The Court believes that parties to these license agreements generally care much more about the total amount they have to pay and the total value they receive, rather than whether a payment is labeled as a release from past liability or for the future license. Brismark himself seemed to generally share that view: when he was asked at his deposition how Ericsson divided the lump sum payments from Apple into released and prospective sales he responded, "We haven't done that because it's a one-time payment and it's for past and for future." (Brismark Depo., May 18, 2016, p. 185:1-11.) In addition, it is very likely that a licensee may choose to pay a larger lump sum in exchange for lower rates, a lower cap, a lower floor, or a lower percentage or dollar-per-unit running royalties. Ignoring these possibilities ignores the substantial flexibility that FRAND leaves parties with to structure their licenses in a friendly and bilateral manner. (ETSI Guide on IPR § 4.3, Ex. 224 at 7.)

It is certainly possible that parties could specifically agree to different royalty rates for released and prospective sales, but that is not the case for any of the licenses the Court unpacked.[36] The Court agrees with Kennedy that released sales should generally be included in unpacking each license. The Court will therefore treat released sales and release payments the same as projected sales and prospective payments and calculate a single rate over the course of the combined license and release period.

2. Apportioning Lump Sum Payments Between Multiple Standards.

[36]Ericsson's license with ZTE in 2011 for 2G/3G actually did state different percentage running royalty rates for released and prospective sales. (Ex. 1197 at 8.) However, this license was superseded by an amended license in 2015 and was not unpacked by either expert. (Ex. 1200.)

In order to determine the licensee's one-way effective royalty rate for each standard, the Court must determine exactly how much the licensee paid Ericsson for each standard. All of the comparable licenses except Huawei's contain a lump sum component. A lump sum payment creates a challenge for unpacking a license that covers multiple standards (e.g., 2G, 3G, 4G) because the effective royalty rate for each standard needs to be unpacked separately, even though the licensee paid a single lump sum net balancing payment that covers multiple standards. In some cases, the license agreement also covers things beyond handset SEPs, such as external modems, personal computers, implementation patents. The experts therefore had to determine how much the licensee paid for handset SEPs, and then apportion the net balancing payment across the licensed standards so that they could apply the unpacking formula for each standard.[37] However, each apportionment will affect each later standard, and the more assumptions the experts made, the more the license reflects the expert's decisions rather than the parties' agreed upon royalties rates.

Dr. Lynde generally unpacked the licenses he examined twice, once for 4G, and then again for a blended 2G/3G rate. (Lynde Decl. ¶ 21.) Dr. Lynde apportioned the net balancing payments based on the licensee's proportion of revenue for each standard. (Id. ¶ 96.) Kennedy generally unpacked lump sum licenses four times, for 4G, 3G, 2G EDGE, and 2G GSM/GPRS. (Kennedy Decl. ¶ 133.) Kennedy claimed that he apportioned the balancing payments according to Ericsson's own assumptions regarding the breakdown of revenue between the various standards by units. (Kennedy Decl. ¶¶ 129-133.) It is unclear, however, that Ericsson made those assumptions, or that it applied them to the lump sum

[37]The Court has previously ruled that implementation patents will not be covered by this FRAND adjudication because they are not SEPs. (Docket No. 1055 at 7.) TCL also did not show that Ericsson's cross-licenses to implementation patents had any net value that would require adjusting the licensees' net balancing payments in either direction.

However, licenses to Ericsson's SEPs for external modems and personal computers certainly do have value, and are a material term of this FRAND dispute. Ericsson's licenses with HTC and Samsung cover the licensees' sale of personal computers with cellular connectivity. (Ex. 1275 at 6 (HTC); Ex. 1276 at 4 (Samsung).) Ericsson's licenses with Apple and LG cover both personal computers and external modems with cellular connectivity. (Ex. 5331 at 2 (Apple); Ex. 199 at 2, 4 (LG).) Because both experts applied the entire balancing payment to handsets, the unpackings treated the licensees as paying 0% for external modems and personal computers in exchange for a higher royalty rate on handsets. The Court will treat TCL the same way.

payments. Kennedy actually appears to use estimates about the types of units in each projection to decide for himself how to apportion the lump sum payments between standards. (See Lynde Rebuttal Decl. ¶¶ 70-72.) It becomes particularly problematic when Kennedy apportioned between 3G, 2G EDGE, and 2G GSM/GPRS, because each additional unpacking relies on the previous apportionment assumptions such that any error compounds throughout the remaining calculations. This leads to some questionable results. For example, Kennedy concluded that Samsung agreed to pay virtually the same rate for 2G EDGE as it did for a multi-modal 4G license that included 2G functionality, and that Samsung actually paid more for 2G GSM/GPRS than for multi-modal 3G license that included 2G GSM/GPRS. (Kennedy Decl. ¶ 173.) The Court has trouble believing that Ericsson asked Samsung for less money the more its patents were used. Kennedy has not cited sufficient evidence to convince the Court that his apportionments regarding 2G have any basis in the license agreements or how the parties interpreted them.[38] Therefore, Kennedy's apportionments of net balancing payments between the 2G standards, and between 2G and 3G are not credible. Kennedy and Dr. Lynde do not disagree substantially over the 4G apportionment ratios for the projections that they both unpacked. Accordingly, the Court generally adopts Dr. Lynde's methodology for apportioning the net balancing payments between standards. (Lynde Decl. ¶¶ 96, 99; Lynde Rebuttal ¶¶ 70-73.)

3. Dollar-per-unit Rates, Caps, and Floors.

While Ericsson has in the past entered into some licenses dollar-per-unit rates or licenses with caps and floors, the Court declines to adopt a dollar-per-unit approach in determining FRAND rates here.

[38]This is also true because Kennedy never calculated a 2G PSR. Both experts cited to each other when they justifed why they used a 3G PSR to unpack a combined 2G/3G rate. (Lynde Decl. ¶ 93 n.3; Kennedy Decl. ¶ 131.) However, Dr. Lynde at least explained that it is because 2G patents are less important and more likely to have expired, and he created a blended 2G/3G rate and does not try to unpack each 2G standard. (Lynde Decl. ¶ 93 n.3.) Kennedy explained that the method he used to determine PSRs (contribution counting, discussed below in the PSR section) does not exists for 2G. Thus, rather than introduce inconsistencies from using a new metric, he just used the same 3G PSR. (Kennedy Decl. ¶ 131.) A 3G PSR cannot be used to calculate rates for 2G GSM/GPRS or 2G EDGE. The only comparable licensee that sells 2G products is Samsung, so in unpacking the Samsung license the Court chose to apportion out the 2G net balancing payment and calculate just 3G and 4G rates.

First, use of dollar-per-unit royalties is at odds with industry practices generally and specifically Ericsson's own past licencing practices, a point which Ericsson expert Kennedy acknowledged at trial. (TT Mar. 1, 2017, pp. 8-9.) For example, in Ericson's business cases for Samsung, LG, and HTC, Ericsson used running royalties, as did the actual licenses for Coolpad, Karbonn, Doro, Sharp, Huawei, ZTE, and LG. (TT (Sealed) Mar. 1, 2017, pp. 5-7, 10.)

Second, a percentage-based royalty better aligns the incentives of the SEP-holder and the licensee than a dollar-per-unit royalty. This furthers ETSI's express policy objectives of both rewarding SEP-holders and making their intellectual property available to the public. (ETSI IPR Policy § 3, Ex. 223 at 1.)

Third, in this case, Ericsson itself has repeatedly reaffirmed that royalties should be a percentage running royalty. Option A and Option B were both largely stated handset royalties as a running percentage royalties, and in its interrogatories Ericsson confirmed that its royalty rate should be calculated as a percentage of the handset price. (Ex. 131 at 15-18.)

Finally, there is no support in the record that a package of SEPs has a fixed, determinable value which would justify a fixed dollar-per-unit rate or a percentage rate as modified by floors or caps. Brismark explained that Ericsson seeks to apply a floor to its license agreements so that it can obtain a certain minimum amount of revenue for itself. (TT Feb. 28, 2017, pp. 50:23-51:2.) However, as noted above, the Court rejects Kennedy's ex-Standard analysis. In addition, on the stand Brismark explained that its existing caps and floors are solely the product of negotiations, not any sort of analysis of whether they are fair or reasonable. (TT Feb. 28, 2017, pp. 116:13-117:17.)

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

For these reasons, the Court will unpack these licenses as Ericsson has, a percentage of the net selling price of the licensed devices without a cap or floor.

B. The Inputs to the Unpacking Formula.

As explained above, unpacking a cross-license requires four inputs to determine Ericsson's one-way rates, the PSR, and the present value of: the net balancing payments, Ericsson's revenues , and the licensee's revenues. However, many of the disputes over these inputs are caused by the parties' use of different discount rates, different revenue projections, and different PSRs. The Court will address each of these inputs in turn.

1. Determining the Appropriate Discount Rate.

In order to unpack and evaluate a license the monetary terms of the unpacking formula (net balancing payments, licensee's revenue, and Ericsson's revenue) must be expressed in comparable units. This means that a discount must be applied to future payments so that they can be expressed in present value terms.[39]

In its business cases, Ericsson would sometimes use a discount rate to indicate the size of the risk associated with each licensee. (Lynde Rebuttal Decl. ¶ 74.) When Ericsson specified a discount rate in its business cases, it was usually 10% or 12%. Dr. Lynde generally adopted the discount rate Ericsson used in its business case to unpack the entire license. (Lynde Decl. ¶ 99.) On the other hand, Kennedy applied a number of different discount rates depending on the type of payment and licensee. (Kennedy Decl. ¶ 120.) He adjusted past sales at the Treasury Bill rate, future revenue and running royalties at 10% or 12%, and lump sums payments at the prime rate (slightly higher than the Treasury Bill rate). (Id.)

For example, in unpacking the Samsung license, Kennedy used a 12% discount rate for Samsung's revenue, but only a 10% discount rate for Ericsson's revenue. (Id. ¶ 171.) He also used a 10% for ZTE's future 3G sales and Ericsson's sales, but a 12% discount rate for ZTE's future 4G sales. (Id. ¶ 157.)

[39]It appears that the parties have unpacked all payments to the beginning of each license. If the Court declared the final rate as a running dollar-per-unit royalty, it would then have to go an additional step and determine how to implement that over the five-year license by either having the nominal rate increase to keep Ericsson's return constant in present dollars, or keeping the nominal rate the same and having TCL pay a higher effective rate in the first half the license to balance out the second half. Because the Court states its ultimate rates as a running percentage royalty, it need not worry about how the time value of money will affect these rates.

However, Kennedy did not explain why Samsung's projected revenue should be treated differently than ZTE's, or why Ericsson's revenue should be treated differently depending on which license is being analyzed. In order to avoid obvious cherry-picking problems and create comparable rates, and because there is no basis in the record to do otherwise, the Court will apply a uniform 10% discount rate to all revenue projections of both Ericsson and its licensees.

Kennedy also applied much lower discount rates to future fixed payments, usually around 3%. (Kennedy Rebuttal Decl. ¶ 110.) He did so because future fixed payments are much more certain and valuable, and thus the risk is better measured by applying the company's cost of debt. (Kennedy Decl. ¶ 120.) This leads to him discounting future fixed payments from anywhere between 1.7% and 3.8%. (Id. ¶¶ 190, 157.) The Court agrees that future fixed payments are more valuable than percentage payments because they are certain. However, the Court does not believe that the revenue projections for Samsung should be discounted at a rate more than four times higher than its lump sum payments, particularly when Ericsson used the same discount rate for both. (Id. ¶ 171 (applying a 2.9% discount rate for fixed payments, and 12% for future revenues).) The Court will apply a 5% discount rate to future fixed payments.

The revenue from a licensee and/or Ericsson's released sales must also be adjusted so that it can be stated in dollars of the same year as the projected sales. Because the licensee (or Ericsson, in the case of a cross-license) sold the product before paying for the license, the licensee effectively received an interest-free loan from the SEP-holder. Revenue from released sales must therefore be adjusted upward. The Court will adopt Kennedy's discount rate of using the Treasury Bill rate of 0.56% for released revenue. (Kennedy Decl. ¶ 120.)

To summarize, the Court adopts a 10% discount rate for all revenue projections, a 5% discount rate for future fixed payments, and a 0.56% adjustment for all past revenue. The Court also uses the mid-year convention for calculating discounted values, treating all the licenses that start in December or January as starting on January 1, and the LG license as starting on June 30, or halfway through the year. Finally, the Court treats all lump sum payments made in the first quarter of each year as if they occurred on January 1 of that year.

2. Estimating Revenue

In order to unpack a lump sum or cross-license there must be some estimate of the amount of money that a licensee has earned from its sales of products compliant with each standard. The experts used two sources for revenue information: Ericsson's internal projections in its businesses cases and data from International Data Corporation ("IDC"), a third-party market analyst. IDC data is based on actual handset sales,[40] which makes it much more reliable, but more limited because only data through 2015 was available, and IDC does not report infrastructure revenue. (Lynde Decl. ¶ 101.) Dr. Lynde and Kennedy both unpacked the comparable licenses with business case data. Where Ericsson made multiple projections in a business case, the experts either agreed on which one to apply, or they unpacked the license using multiple business case projections. Dr. Lynde also unpacked the Samsung, LG, and HTC licenses based on IDC data through 2015. Although Kennedy did not unpack any licenses with IDC, for the reasons discussed below the Court believes that independent third-party data serves as a valuable check on a party's internal and unvalidated projections.

First, IDC data is heavily relied on by experts for both sides, as well as the representatives for both Ericsson and TCL. Dr. Kakaes, Dr. Lynde, Cistuli, Dr. Guo, Brismark, Dr. Teece, Kennedy, and Pellegrino all used IDC data.

Second, in many cases, Ericsson's business cases dramatically underestimated the licensee's revenue when compared to IDC data. For example, Ericsson's business case for HTC projected that from 2014-2015 HTC would earn around [redacted] in 4G revenue off of [redacted] 4G units. IDC reported that during that period HTC actually earned over $11 billion on 28.5 million units. Similarly, Ericsson projected that from 2013-2015 LG would earn [redacted] in 4G revenue off of [redacted] 4G units. IDC reported that during that period LG actually earned over $29 billion in 4G revenue on 75 million 4G units. Ericsson's high projection estimated that from 2011 through 2015 Samsung would earn [redacted]

[40]It is unclear whether the revenue projections in Ericsson's business cases for Apple, Samsung, HTC and LG are based on the licensee's wholesale or retail sales. These were all lump sum deals, so Ericsson would not necessarily have had a business reason to prefer one over the other. Brismark stated only that its business cases "endeavor to use the most reliable sales data available at the time, either from market analysts or from the licensee." (Brismark Decl. ¶ 61.) To the extent that the business case data is wholesale data, it would tend to produce higher rates than IDC data. The Court keeps this problem in mind in ultimately setting a FRAND rate, and uses business case projections as the lower limit of the licensee's revenue, and IDC data as the upper limit.

[redacted] in 4G revenue off of [redacted] 4G units. IDC reported that Samsung actually earned $248 billion in 4G revenue off of 472 million units. Discrepancies of this magnitude are not attributable to rounding errors or using different discount rates, and they always occur in the direction that favors Ericsson.[41] IDC's business model relies on providing accurate data.

Third, IDC data reflects actual sales, not the projections of one party to the license. Ericsson's business cases could, at best, only reflect the rate Ericsson thought the licensee would pay over the course of the license and release period. However, the non-discrimination prong of FRAND does not incorporate an SEP-holder's projections; it applies to the actual terms and conditions. (ETSI IPR Policy, § 6.1, Ex. 223.) When Ericsson accepted the certainty that came with lump sum payments, it also accepted the risks and consequences of the licensee outperforming its projections. Excluding third-party data would allow Ericsson to take the benefits that come with lump sum deals (including Kennedy's lower discount rate for lump sum payments, which increases Ericsson's effective royalty rate) but none of the risk.

The one challenge posed by using IDC data in this case was that it was only available through 2015. In order to unpack a license with IDC data, the net balancing payment therefore had to be apportioned between the years covered by IDC data, and the remaining years of the license. The Court chose to apportion the net balancing payment proportionally based on the number of years of the license and release covered by IDC data. For example, Ericsson's license with HTC licensed HTC's sales in 2015 and 2016, and provided a release of liability for HTC's unlicensed sales in 2014. IDC data covers HTC's sales up through 2015, so the Court apportioned 2/3 of the total net balancing payment to the period covered by IDC data.

3. Using the Appropriate PSR

As noted above, the Portfolio Strength Ratio, or PSR, is the strength of Ericsson's SEP portfolio relative to the licensee's SEP portfolio, on a standard-by-standard basis. (Lynde Decl. ¶ 91.) Although both experts agreed on how to use a PSR and what it represents, they used numbers derived from very different

[41]This is so because licensee revenue is in the denominator of the unpacking equation; thus lower licensee revenue means a higher effective royalty rate.

sources. TCL used PSRs derived from Dr. Ding's patent counting study of how many essential patents each company owned. (Id.) Ericsson instead calculated its PSRs based on contribution counting, which is an estimate of how many ideas it contributed to the development of the 3G and 4G standards. (Mallinson Decl. ¶ 65-66.) Ericsson's use of contribution counting actually creates results more favorable to TCL, while TCL's results actually created results more favorable to Ericsson. The Court first addresses issues common to both PSR approaches, and then addresses TCL's use of patent counting and Ericsson's use of contribution counting.

Whether a PSR is calculated through patent counting or contribution counting, it still contains two basic assumptions. The first is that an SEP portfolio's strength is directly proportional to its size. The second is that each patent or contribution is treated equally, regardless of individual value of the invention, or whether it is for a handset, infrastructure device, or both. Both assumptions are also shared by the top down analysis discussed above. In the top down approach treating each patent equally was an express feature of the methodology advocated by Ericsson and others. However, it is less clear that assumption is valid in the context of negotiations between sophisticated parties.

Dr. Lynde and Dr. Ding calculated PSRs for TCL based off of patent counts. Based on Dr. Ding's patent census, Dr. Lynde calculated how many SEPs are owned by each licensee. (Lynde Decl. ¶ 91.) The PSRs are the number of SEPs owned by Ericsson that the licensee needs, divided by the number of SEPs owned by the licensee that Ericsson needs. Because Ericsson no longer makes handsets, the denominator of the PSR is the number of infrastructure SEPs owned by the licensee. (Id. ¶ 94; Ex. 1239.) Patent counting, while not perfect, does reflect the number of SEPs that are owned by each company. In addition, patent counts will reflect changes to a company's portfolio from purchases, expirations, and transfers of SEPs.

Ericsson calculated its PSRs based on standards contribution counting.[42] (Kennedy Decl. ¶ 122.) A contribution is a technical submission of an idea to a 3GPP working group. (Mallinson Decl. ¶ 65.) A contribution is then "approved" by the working group when it is included in the 3GPP technical specifications,

[42]This is a different concept than TCL's importance and contribution analysis discussed in the Top Down section. (See ___, supra.)

which are ultimately provided to ETSI. (Id.) Ericsson used standard contribution counts calculated by Signals Research Group, who conducted a study paid for by Ericsson to update Ericsson's own report on its contribution counts. (Mallinson Decl. ¶ 68.) Ericsson developed this methodology because it was concerned that there were alternative studies showing that it owned a low proportional share of 4G SEPs. (TT Feb. 28, 2017, p. 34:7-23.) Ericsson argued that because companies that participate in the standardization process often seek patent protection for their approved standard contributions, contribution counting can serve as a good proxy for the strength of their SEP portfolios. (Ericsson FOF, ¶ 162.) The Court disagrees.

Standards contribution counting counts contributions, not patents. Contributions can be made for ideas that are unpatented, unpatentable, patented by someone else, or split into multiple contributions. (TT Feb. 28, 2017, pp. 37-38; Bekkers Decl. ¶¶ 76-86.) Brismark testified that Ericsson has never actually done any analysis to determine whether its own contribution counts correlate to its SEPs. (TT Feb. 28, 2017, p. 38.) Ericsson's internal documents show that it has inflated its contribution counts by "hijacking" the contributions of other companies as well as requiring its subsidiaries to vote for Ericsson's proposals. (Ex. 1076 at 1;Bekkers Decl. ¶¶ 99-100.) TCL raised many additional flaws with standards contribution counting at trial that the Court notes here. (TCL FOF, ¶¶ 127-129; Bekkers Decl. ¶¶ 80, 90.)

The two major flaws with contribution counting are the absence of any evidence that it corresponds to actual intellectual property rights, and its inability to account for transferred or expired patents. (Bekkers Decl. ¶¶ 82-83; Mallinson Decl. ¶ 6.) For example, if Ericsson sold off a substantial portion of its SEP portfolio, Ericsson would still claim the exact same royalty as before it sold its SEPs based on an unchanged standards contribution count. Thus, contribution counting does not reflect the roughly two hundred U.S. patents that Ericsson has divested over the last decade. (E.g., Ex. 1126.) Contribution counting also permits Ericsson to demand royalties well beyond the expiration of the corresponding patents, if those contributions were actually tied to patents at all. These are incorrect results. While contribution counting may have its uses, it cannot be used to determine a FRAND rate for a patent portfolio, or unpack a cross-license. Except for the LG license (discussed below), the Court will adopt Dr. Lynde's PSRs for unpacking each license.

C. Unpacking the Comparable Licenses.

1. The Apple License.

Apple is a U.S.-based consumer electronics company and the second largest smartphone vendor by volume. (Brismark Decl. ¶ 103.) In 2008 Apple and Ericsson signed an agreement to license Ericsson's 2G and 3G SEPs. (Ex. 257.) That license expired on January 14, 2015. (Id. at 3.) After the expiration of that license, the parties engaged in extensive litigation in 2015 which resulted in a new global cross-license in December 2015, that will expire in January, 2022. (Ex; 5331; Brismark Decl. ¶ 104.) The 2015 license settled a total of 51 litigations between Ericsson and Apple around the world.

Under the 2015 license, Apple agreed to make a one-time payment of [redacted] (Ex. 5331 at 15.) Ericsson also received a cross-license to Apple's infrastructure SEPs, as well as a release of any past unlicensed sales. (Id. at 10, 13.)

Ericsson's business case for its license with Apple contains three sets of projections. (Ex. 4946.) Both experts unpacked the license according to Ericsson's mid projections. (Lynde Decl. ¶ 110; Kennedy Decl. ¶ 188.) Dr. Lynde does not unpack this license with IDC data because IDC data was only available through 2015, and the license was signed on December 19, 2015. (Lynde Decl. ¶ 113.) Although this license does give Apple the option of paying a running royalty instead of a lump sum, neither expert believes that Apple's sales are ever likely to drop low enough for Apple to make that choice. (Kennedy Decl. ¶ 189.)

The primary dispute between the experts concerns how to resolve two issues related to released sales. The first issue was how to treat Apple's 4G sales from 2012-2014, for which Apple paid Ericsson the 2008 license's [redacted] for 2G and 3G SEPs, but [redacted] for 4G functionality. The second issue was how to treat released sales in 2015. Both of these issues are relevant to the unpacking analysis because they affect the determination of Apple revenue figures and the allocation of the net balancing payments.

Based on his understanding of Brismark's deposition testimony, Dr. Lynde believed that Ericsson internally allocated Apple's initial lump sum payment such that Apple paid [redacted] for all released sales from 2012-2015. (Lynde Decl. ¶ 106.) He credited Apple with already having paid [redacted] for the sales from 2012-2014, and therefore deducted [redacted] for each 4G sale from 2012-2014, and [redacted] from each 4G sale in 2015 from the net balancing payment. (Id.) However, at trial it was clear that this understanding of Brismark's deposition testimony was incorrect, and that Brismark meant the [redacted] figure to be illustrative, not what Ericsson actually calculated Apple to have paid per 4G unit. (TT Feb. 16, 2017, p. 57:24-59:24; Brismark Depo., May 18, 2016, p. 184:10-20.) The Court therefore cannot accept Dr. Lynde's assumption that Apple paid [redacted] for released 4G sales from 2012-2015.

Kennedy instead adopted an assumption made by Brismark that Apple would pay the same rate for future sales and past sales, less the [redacted] per unit that it already paid for sales from 2012-2014. (Kennedy Decl. ¶ 193.) Kennedy assigned all of the net balancing payments to 2015-2022 sales, and calculated that Apple will pay [redacted] for each 4G unit. (Id.) Because Apple already paid [redacted] per unit for 2G and 3G functionality for its phones from 2012-2014, Kennedy assumed that Apple owed no additional royalties from those phones. (Id.) In essence, he found that Ericsson asked for a royalty of [redacted] for its 4G SEPs from Apple from 2012-2014 when it signed its 2015 license with Apple. Ericsson estimated that Apple sold [redacted] LTE devices during this period. (Ex. 4946.) Ericsson's business case also shows that Ericsson factored in the foregone LTE royalties as part of the release for this license. (Id.) Given the extensive litigation that occurred in 2015 between Apple and Ericsson, and Ericsson's own estimates that it was owed hundreds of millions of dollars in royalties for these units, the Court does not accept Kennedy's conclusion that Ericsson simply dropped its claims for 4G devices sold by Apple from 2012-2014. Instead, the Court finds that Apple paid for 4G functionality on its devices from 2012-2014 as part of its lump sum payments.

Neither expert provided a satisfactory method to unpack Apple's released sales. Dr. Lynde created a disjointed payment schedule based on an incorrect assumption, while Kennedy assumed that Ericsson gave up hundreds of millions of dollars. The simplest way for the Court to treat Apple's released sales where it paid for 2G and 3G but not 4G SEPs, without having to determine the marginal

value that 4G functionality added to a 2G/3G device, is simply to treat Apple's [redacted] per unit payments from 2012-2014 as a down payment on the 4G functionality that it would license from Ericsson in December 2015. This means adding the present value (adjusted to 2016 dollars) of those down payments to Apple's net balancing payments, and adding the revenue from those released sales to Apple's revenue.

The parties also disagreed on how to calculate the non-cash value Apple's cross-license provided to Ericsson, if any. Dr. Lynde calculated that, based on its business case, Ericsson would earn a little over [redacted] in 4G infrastructure sales from 2012-2021, while Kennedy conservatively treats the Apple license as providing no additional value. (Ex. 2457; Kennedy Decl. ¶ 191.) However, the difference between their figures is very small given the order of magnitude difference in revenue between Apple and Ericsson. The Court will adopt Kennedy's approach in order to avoid the uncertainty added from Ericsson's revenue estimates or using a PSR. Because Apple almost exclusively sells multi-mode 4G devices, the net balancing payment does not need to be apportioned between standards. Apple's one-way effective rate is therefore just its net balancing payment divided by its 4G revenue.

Apple Revenue: From 2012-2014 Apple earned $227,376,433,685 in 4G revenue according to IDC data. (Ex. 1000.) Using Ericsson's projections in its business case, from 2015-2021 Apple will earn [redacted] in 4G revenue. (Ex. 4946.) Apple will therefore earn [redacted] in 4G revenue from 2012-2021 that is licensed under the 2015 agreement.

Net Balancing Payments: Apple's net balancing payments to Ericsson contain two parts, the amount represented by Apple's down payment of [redacted] per device from 2012-2014, and the total amount of cash Apple must pay Ericsson under the 2015 license agreement. Based on IDC numbers, Apple produced 312,409,549 4G units from 2012-2014. At [redacted] a unit, in 2016 dollars this was [redacted]. Apple also paid [redacted] in cash from 2016 through 2021, which is [redacted] in 2016 dollars. These numbers add up to a total net balancing payment of [redacted].

Conclusion: Dr. Lynde calculated that Apple pays a royalty rate of [redacted], while Kennedy calculated that Apple pays a royalty rate of [redacted]. Based on the

above numbers, the Court calculates that Apple pays an effective 4G royalty rate of [redacted].

2. The Samsung License.

In January 2014, Ericsson and Samsung executed a global patent cross-license. (Ex. 1276.) The license included a release for the companies' past unlicensed sales going back until 2011, as well as future sales until [redacted]. (Id. at §§ 8, 13; Kennedy Decl. ¶ 163.) The license covers SEPs for 2G, 3G, and 4G, but excludes CDMA. (Lynde Decl. ¶ 119; Ex. 5316 at 6.) The license confers substantial grant back value on Ericsson, and settled extensive litigation between Ericsson and Samsung. (Brismark Decl. ¶¶ 121-22.) Under the license, Samsung agreed to make a one-time payment of [redacted], and annual royalty payments of either a [redacted] lump sum or per unit royalties of [redacted] per unit (2G), [redacted] per unit (3G) and [redacted] per unit (4G). (Ex. 1276 at 9-11.) Samsung also committed to purchase a [redacted] of thin modems from Ericsson. (Id. at 11; Ex. 4024.)

Part of the consideration Ericsson received in its 2014 license agreement with Samsung was a commitment from Samsung to [redacted] (Brismark Decl. ¶ 123; Ex. 4024.) Both experts attributed a value of [redacted] to this commitment. Kennedy did this because Dr. Lynde did (Kennedy Decl. ¶ 170), and Dr. Lynde only included it to be conservative because [redacted] (Lynde Decl. ¶ 117.) Dr. Lynde stated that he was not aware of any support provided by Ericsson for a [redacted]. (Id.) However, the Court cannot accept a conclusion merely because [redacted]; the conclusion must be supported by the record. The only evidence regarding the actual number of [redacted] from Brismark, who stated that Samsung [redacted] (Brismark Depo., May 18, 2016, pp. 130:14-132:4. [redacted], but Ericsson closed its modem division 7 months after signing the Samsung license. (Brismark Decl. ¶ 123.) Given the short period of time Ericsson would have had to provide thin modems, and absence of any evidence regarding how many were actually sold, the Court has no basis for attributing any value to the thin modem commitment.

From April 2011 through January 2014 Samsung was licensed to Ericsson's SEPs for certain 2G and 3G units that incorporated components made by ST-Ericsson, Ericsson's former joint venture with ST Microelectronics. (Id. ¶ 124; Ex. 4796.) However, Dr. Lynde does not appear to address these licensed sales in his calculations. The Court therefore made its own calculations to determine Samsung's released revenue, and the appropriate ratios for apportioning the net balancing payments between standards. Instead of creating a blended 2G/3G rate like Dr. Lynde, the Court chose to remove the amount it calculated was for 2G, and calculate just 3G and 4G rates.

Ericsson and TCL have both unpacked the Samsung license using Ericsson's high and mid business case projections. (Ex. 4936.) TCL has additionally unpacked the license using actual IDC data for sales from 2011 through 2015, or half of the license and release period. The experts have also unpacked this license with different discount rates, excluding and including released sales, and excluding or including infrastructure payment. Issues related to the appropriate discount rate and release payment have been discussed above. The Court will also include Samsung's infrastructure revenue because it represents part of the overall value of the license that Samsung received. Both experts combine Samsung's infrastructure revenue and SEPs with Samsung's handset revenue and SEPs in calculating Samsung's revenue and the PSR, implicitly treating infrastructure revenue and patents/contributions the same as handset revenue and patents/contributions.

Ericsson Revenue: Ericsson's provides the same revenue projections for itself in the mid and high business cases. During the license and release period Ericsson made $28,843,350,789 in 3G revenue, and $49,819,274,967 in 4G revenue. During the period covered by IDC data Ericsson made $21,478,610,988 in 3G revenue, and $19,773,222,860 in 4G revenue.

Net Balancing Payments: As explained above, the Court assigned no value to the thin modem commitment. Discounted at 5% for future fixed payments, Samsung's total net balancing payment is [redacted]. For the IDC unpacking it would be half of that, or [redacted].

Following Dr. Lynde's approach, the Court assumes that the net balancing payment was apportioned between standards according to the same ratio as the

licensee's revenue. (Lynde Rebuttal Decl. ¶ 71.) As explained above, this method was not perfect, but it was superior to Kennedy's method. Under the mid projection Samsung's net balancing payments were [redacted] for 4G, [redacted] for 3G, and [redacted] for 2G. For the high projection, Samsung's net balancing payments were [redacted] for 4G [redacted] for 3G, and [redacted] for 2G. Under the IDC unpacking, Samsung's net balancing payments [redacted] were allocated for 4G, [redacted] for 3G, and [redacted] for 2G.

PSR: As the Court explained above, it has adopted Dr. Lynde's PSRs, which for Samsung are 1.33 for 4G and 2.98 for 3G.

Samsung Revenue: The parties calculate Samsung's revenue based on Ericsson's mid and high business case projections, and TCL also calculates Samsung's revenue based on IDC data. (Ex. 1273.) Because IDC does not report on infrastructure revenue, for the IDC unpacking the Court will add Ericsson's high business case projection for Samsung's infrastructure revenue from 2011-2015.

Mid Projections:
3G: [redacted]
4G:

High Projections:
3G: [redacted]
4G:

IDC Data:
3G: [redacted]
4G:

Conclusion: Having now established the necessary inputs, the Court applies the unpacking formula for each projection. Samsung's rates based on each revenue projection are the following:

	Mid Projection	High Projection	IDC Data
3G:	[redacted]	[redacted]	[redacted]

4G: [redacted] [redacted] [redacted]

3. The Huawei License.

China-based Huawei is one of the world's largest suppliers of mobile devices and infrastructure equipment. (Brismark Decl. ¶ 115.) In January 2016, after an arbitration designed to resolve a negotiating impasse, Ericsson and Huawei executed a global patent cross-license to their respective 2G, 3G, and 4G Essential Patents until December 31, 2018. (Id.; Ex. 1277 at 7.) The arbitrators determined that Huawei would pay running percentage royalty rates of [redacted] for 2G and multi-mode 3G, and [redacted] for multi-mode 4G. (Ex. 1277 at 18.) Because this license expressly states the running percentage royalty rate Huawei will pay for Ericsson's SEPs, it does not need to be unpacked.

4. The LG License.

LG Electronics is a South Korea-based electronics company that manufactures a wide range of mobile devices. (Brismark Decl. ¶ 117.) Ericsson and LG are parties to a global patent cross-license that became effective as of June 27, 2014, and will expire on [redacted]. (Ex. 199 at 5.) Pursuant to the license, LG agreed to (a) make cash payments of [redacted] to Ericsson, plus additional cash royalties in the event that LG's sales exceeded specified thresholds, as consideration for a license under Ericsson's SEPs, (Ex. 199 at 11-12.), and (b) assign to Ericsson, or an entity selected by Ericsson, the rights to ten U.S. patent families ("LG patents"). (Ex. 198.) The license also releases LG from liability for 2G sales in 2013 and the first half of 2014, as well as all of LG's unlicensed 4G sales. (Lynde Decl. ¶ 132.) At the time of the license, Ericsson believed that all of LG's phones were manufactured with Qualcomm chipsets. (Brismark Decl. ¶ 120.) LG would therefore not have to pay Ericsson any 3G royalties because of the flow through provisions of a separate license agreement between Ericsson and Qualcomm. (Id.) Because the Court will not unpack 2G rates, only the 4G rate from the LG license needs to be unpacked.

The primary dispute between the parties in unpacking this license is the value of the ten patents LG assigned to Ericsson. Ericsson's expert Michael Pellegrino estimated that based on Ericsson's ability to license these patents to infringing companies, eight of the LG patents are worth $170,051,079 if they are

encumbered by Ericsson's existing license agreements, and $274,518,453 if they are not encumbered by Ericsson's existing license agreements. (Pellegrino Decl. ¶ 14.) At the time the license was signed, Ericsson internally valued the ten patents at $125 million. (Brismark Decl. ¶ 119.) However, TCL's experts argued that the ten LG patents actually had little to no value. (Lynde Decl. ¶ 135; Wolfe Decl. ¶ 17.)

The Court ultimately agrees with TCL that these patents have little value. The Court need not address issues with Pellegrino's valuation model because the underlying technical assumptions were all made by Ericsson. (Pellegrino Rebuttal Decl. ¶¶ 14, 16.) Ericsson had Pellegrino value eight implementation patents that it received from LG, but not the two SEPs. (Pellegrino Decl. ¶ 78 n.26.) Ericsson did not provide any estimate on the value of the two SEPs and therefore waived any argument concerning their value. Brismark explained the process Ericsson went through to review the value of the eight implementation patents, but at trial Ericsson never successfully demonstrated any features from any cellphone on the market that actually infringe the eight LG patents. (Brismark Rebuttal Decl. ¶¶ 39-43.) For example, Ericsson alleges that technology disclosed by U.S. Patent No. 8,078,134 - considered by Ericsson to be particularly important to the value of the transferred patents - was "a defining feature of the iPhone when it first launched." (Pellegrino Decl. ¶¶ 84, 85, 257.) If true, then the patent is invalid because Apple released the first iPhone before the patent's priority date. (TT Mar. 2, 2017, pp. 36:23-37:3.) If not true, the claims do not read on products in the marketplace. (TT Feb. 22, 2017, p. 59:23-60:18.) Left with no evidence that any products on the marketplace actually infringe the eight disputed LG patents, the Court has no basis to find that they have any value.

The remaining issue in unpacking the LG license was how to calculate the appropriate PSR. Dr. Lynde attempted to unpack this license using the patent counts he had used for other licenses, but it returned results that he deemed to be "implausible." (TT, 2/16/17, 34:2-10.) Dr. Lynde therefore used Kennedy's contribution count to unpack the LG license. (Lynde Decl. ¶ 141.) While the Court found that contribution counting was generally not credible, it will use contribution counts when both parties have done so.

LG Revenue: Ericsson prepared a business case scenario for its license with LG. (Exs. 32, 4069.) The Court will therefore unpack this license using the

business case estimates, as well as the IDC data. This licenses releases LG's unlicensed 4G sales as far back as 2011, and Ericsson's business case includes LG's 4G sales data since 2011, but Kennedy only unpacks this license with data from 2013 onwards. (Compare Ex. 4069 with Ex. 5316 at 14-16.) Ericsson's business case for LG includes at least two different projections for LG's revenue from 2011-2017, along with discounting LG's fixed payments at both 4% and 12%. (Ex. 4096; Ex. 32 at 1-2.) It also appears to contain a third projection of LG's revenues that assumes a unilateral license. (Ex 4096 ("BC"); Ex. 32 at 9.)

Kennedy stated that he found Ericsson's projections to be reasonable, but did not acknowledge that there were multiple projections or explain why he used the projection he selected. (Kennedy Decl. ¶ 176.) It appears he used the lowest of the three projections. Dr. Lynde stated that he followed Kennedy in using the lowest projections, neither expert explains why they selected that projection. (Lynde Decl. ¶ 138.) Based on this projection, LG will earn [redacted] in 4G revenue from 2011-2017. Based on IDC data, LG earned $33,068,403,004 in 4G revenue from 2011-2015.

Net Balancing Payments: The LG license required LG to pay a release payment of [redacted] in June 2014, and additional payments of [redacted] (Kennedy Decl. ¶ 174.) If LG revenues exceeded certain caps, then LG would also have to pay additional royalties on that revenue. Neither expert suggested that LG will hit those revenue caps. The license requires LG to pay Ericsson discounted total of [redacted] as a net balancing payment. Multiplying that number by 5/7 to account for the number of years covered by IDC data means that LG will make a discounted net balancing payment of [redacted] for the years covered by IDC data. As explained above, the Court assigned no additional value for the ten patents that Ericsson received as part of the LG license.

Ericsson Revenue: The Court adopts Ericsson's estimates of its own nominal revenue from 2011-2017 from its business case. (Ex. 4096 ("BC").) Discounted as described above, Ericsson projected it will earn $33,811,399,155 over the course of the license, and $20,382,731,453 during the period covered by IDC data.

PSR: The Court adopts the PSR used by both parties of 5.14 for 4G.

Conclusion: Having now established the necessary inputs, the Court applies the unpacking formula based on business case and IDC data.

	Business Case	IDC Data
4G:	[redacted]	[redacted]

5. The HTC License.

HTC is a Taiwanese supplier of 3G and 4G smartphones and tablets. (Brismark Decl. ¶ 113.) Effective December 31, 2014, Ericsson and HTC entered into a [redacted] global cross-license agreement. (Ex. 1275.) Under this agreement, Ericsson and HTC provided each other with worldwide licenses to their respective patents necessary to comply with the 2G, 3G, CDMA, WiFi, and/or 4G standards, Ericsson provided a release for HTC's unlicensed 2014 sales, and HTC paid Ericsson [redacted]. (Id.) HTC sales of 2G products are negligible, so both experts calculated only 4G and 3G rates.

Both sides have unpacked this license according to Ericsson's high projections, and TCL has also unpacked it with the available IDC data. (Ex. 5316 at 11 (Ericsson business case calculations); Exs. 1232, 1234 (TCL business case calculations); Exs. 1232, 1233 (TCL IDC calculations).)

HTC Revenue: Both experts are close enough to be virtually identical for the purposes of unpacking. According to Ericsson's business case, HTC would earn [redacted]. Based on IDC data, HTC would earn $11,653,381,244 in 4G revenue and $2,600,958,978 in 3G revenue for the two years covered by IDC data.

Net Balancing Payments: Because the license required HTC to make its [redacted] payment at the beginning of the license, no discount rate needs to be applied to royalty payments. (Kennedy Decl. ¶ 183.) For his calculations based on IDC data, Dr. Lynde applied [redacted] of the [redacted] lump sum payment because IDC data covers two out of the [redacted] covered by the HTC license and release. (Lynde Decl. ¶ 101.) The Court adopts these figures for the net balancing payment.

Ericsson Revenue: Kennedy and Dr. Lynde agree that the Ericsson business case for HTC includes Ericsson's estimates of its own 4G revenue of around $19.6 billion from 2014-2016. The HTC business case does not contain projections for Ericsson's 3G revenue. Kennedy appears to use Ericsson's 3G revenue from the LG business case. (Ex. 5316 at 13.) Dr. Lynde provided no value for Ericsson's 3G revenue because "[t]he Ericsson Business Case for HTC did not model Ericsson 2G/3G revenues." (Exs. 1231, 1232.) However, neither expert directly addresses the relevant question, which is whether the cross-license with HTC for its 3G SEPs provided Ericsson with value that needs to be unpacked. Because Dr. Lynde determined that HTC did have 3G infrastructure SEPs, the value they added to HTC's consideration needs to be unpacked to determine Ericsson's 3G effective royalty rate. (Ex. 1239.) The Court will follow Kennedy in using Ericsson's estimates of its own 3G revenue from the LG Business case. (Ex. 4069.) According to Ericsson's business cases, from 2014-2016 it would earn $18,319,314,937 in 4G revenue, and $8,510,906,341 in 3G revenue. For the period covered by IDC data, Ericsson would earn $11,385,908,345 in 4G revenue, and $6,033,282,125 in 3G revenue.

PSR: As the Court explained above, it has adopted Dr. Lynde's PSRs. His PSRs for HTC are 13.5 for 3G and 8.31 for 4G.

Conclusion: Having now established the necessary inputs, the Court applies the unpacking formula for each projection. HTC's rates based on each revenue calculation are the following:

	Business Case	IDC Data
3G:	[redacted]	[redacted]
4G:	[redacted]	[redacted]

6. The ZTE License

ZTE is a China-based vendor of mobile phones and Ericsson's competitor in the market for network infrastructure equipment. Ericsson has two separate global patent license agreements with ZTE: a 2G/3G [redacted] executed in 2011 and amended in 2015, and an 4G [redacted] effective on April 1, 2014, with an amendment date on July 1, 2016.[43] (Ex. 1197 (2011 2G/3G license); Ex.

[43]This last amendment was retroactive and not actually signed until October 2016.

1200 (2015 amended 2G/3G license); Ex. 1194 (2014 4G license); Ex. 4040 (2016 amended 4G license).) The 3G license expires [redacted] (Kennedy Decl. ¶ 153.) Both amended licenses ultimately expire [redacted] (Ex. 1200 at 1; Ex. 4040 at 4.) [redacted]. (Brismark Decl. ¶ 127.)

Ericsson prepared a business cases for both the 2015 amended 2G/3G license and the 2014 4G license. (Ex. 4855; Ex. 4023.) Ericsson also prepared another business case for ZTE's sales in China, which may have been used as part of negotiating the original 2014 4G license. (Ex. 1196.)

Kennedy unpacked the 2015 amended 2G/3G license, and the 2014 4G license. (Kennedy Decl. ¶¶ 152-53.) He did not unpack the original 2011 2G/3G license, or the 2016 amended 4G license. Dr. Lynde did not unpack any of the ZTE licenses. (Lynde Decl. ¶ 145.) Dr. Lynde provided multiple reasons for why he could not unpack the ZTE 4G licenses. (Id. ¶¶ 145-151.) The most persuasive reasons are that: (1) the business cases used by Ericsson and analyzed by Kennedy did not provide regional breakdowns of sales that matched the territory breakdowns in the license, (Ex. 1194 at 27); (2) the 4G license became effective on April 1, 2014, and the amended 2016 4G license became effective on July 1, 2016, replacing both the 2014 4G license, and the 2015 amended 2G/3G license; and (3) the 2014 4G license was valid for a fairly short period of time and therefore has minimal relevance to the question of ZTE's effective 4G royalty rate. (Lynde Decl. ¶¶ 145, 151.)

Kennedy responded to some of Dr. Lynde's criticisms in his rebuttal declaration, but he did not address these issues. (Kennedy Rebuttal Decl. ¶¶ 70-72.) When cross-examining Dr. Lynde, counsel for Ericsson attempted to show that Ericsson's business case did provide regional breakdowns, but his questions missed the mark. (TT (Sealed) Feb. 16, 2017, pp. 14-15.) Ericsson's business case for the 2014 4G ZTE license clearly contains regional breakdowns, but the breakdowns do not match the regional breakdowns in the license agreement. The license contains separate rates for China, Territory 1, and the rest of the world, which it calls Territory 2. (Ex. 1194 at 7.) Territory 1 includes virtually all of Europe, and countries such as the United States, Canada, Korea, and Japan. (Id.) For the business case to be useful in unpacking this license, the regional breakdowns in the business case would have to correspond to the regional

breakdowns in the license. However, Ericsson's business case contained breakdowns ZTE revenue for China, the United States and Western Europe (combined for infrastructure, separated for handsets), and the rest of the world (RoW). (Ex. 4023.) It is unclear what Ericsson's business case considers Western Europe, but it would be hard to accept that it included countries in Asia and North America. By having regional breakdowns that included only part of Territory 1, Kennedy's unpacking moved many countries from Territory 1 to Territory 2, and therefore calculated that ZTE would pay royalties for sales in those countries at [redacted] instead of [redacted] The Court does not know how much Kennedy's overall rates were impacted by relying on data that did not correspond to the territory definitions in the license. The Court therefore does not accept the results of Kennedy's unpacking analysis of the 2014 ZTE 4G license.

The Court also found it could not unpack the 2015 amended 2G/3G license. This license required ZTE to pay [redacted] where the entire functionality is provided by Qualcomm, who has pass-through rights with Ericsson. (Ex. 1200 at 2; Kennedy Decl. ¶ 153.) For Option A, Option B, and Ericsson's license agreement with LG, Ericsson agreed that if the licensee had pass-through rights from Qualcomm it will not owe additional 3G royalties. (Brismark Decl. ¶¶ 93, 120.) It is unclear why Ericsson treated ZTE's devices with pass-through rights differently than those made by LG and TCL. It is possible that the [redacted] license for these devices was actually Ericsson's royalty rate for its [redacted] SEPs in a device with [redacted]. This is supported by Ericsson's reference rates from October 2015, which suggest a range of 1%-1.3% for 2G SEPs for devices with Qualcomm chipsets. (Ex. 59.) It could also be that the [redacted] represents a royalty for 3G standards besides WCDMA. Brismark does not even mention the rate for devices with pass-through rights in his summary of this license. (Brismark Decl. ¶ 128.) Kennedy unpacked the license as if the revenue from devices with pass-through rights is 3G revenue. (Ex. 5316 at 18.) However, without knowing ZTE's pass-through rights it is impossible to know whether the [redacted] that ZTE must pay is actually for 2G SEPs, 3G SEPs, or something else entirely.

In addition, despite the 2015 amended 2G/3G license containing express percentage rates for 3G units of [redacted], and [redacted] devices with pass-through rights, Ericsson's preferred unpacking calculated ZTE to be paying [redacted],

which is higher than Ericsson's reference rates for 3G. (Ex. 59.) However, Brismark states that Ericsson uses its reference price sheets as a starting point in its negotiations, in part specifically so that Ericsson can ensure that it complies with FRAND. (Brismark Decl. ¶ 71.) That Kennedy calculated an effective rate which is higher than the rates that Ericsson says it starts with is difficult to understand.

For these reasons, the Court does not accept Kennedy's unpacking of ZTE's 2015 amended 2G/3G license.

D. The Terms of Offers A and B.

As explained above, the Court ordered Ericsson to file its FRAND contentions as part of this litigation. (Docket No. 120.) Ericsson eventually filed two offers, Option A and Option B. (Docket No. 138, 205.)

Under Option A, TCL would pay $30 million for its first $3 billion in handset sales for any standard, implying a 1% effective royalty rate. (Ex. 458.) For sales after $3 billion a year, TCL would pay a running percentage royalty of 0.8% for 2G GSM/GPRS, 1.1% for 2G EDGE, 1.5% for multi-mode 3G, and 2.0% for multi-mode 4G. For all running royalties (including those for external modems and personal computers), TCL would receive a 50% discount for sales in China.

Neither expert unpacks Option A's handset royalties to a percentage rate. The Court therefore unpacks Option A to determine the effective rate that TCL would have to pay because of the unique multi-standard lump sum provision that covers a fixed amount of sales and then turns into a running percentage rate per standard. If TCL sells exactly $3billion, then it will have to pay Ericsson 1%, but if it sells more or less than that, its effective rate for each standard would be somewhere between 1% and the express running royalty rate for sales after $3 billion, less the China discount. Option A does not specify how to determine which sales are part of the $3 billion. For example, if TCL sells $4 billion, does it pay $30 million for the first $3 billion in sales, the last $3 billion, or perhaps the the $3 billion with the lowest royalty rates? The Court assumes that Option A allocates the $3 billion and corresponding lump sum payment proportionally by standard according to TCL's revenue breakdown for that year. The Court also assumes that 20% of TCL's sales were in China. (Ex. 1252; see Ex. 5311.) The

Court unpacks Option A as a straight one-way license, declines to apply a discount rate, and unpacks it using TCL's actual 2014 and 2015 sales data. (Ex 1252.) TCL's net balancing payments each year per standard consists of the $30 million lump sum apportioned per standard by revenue, plus the running percentage royalty for each standard on its share of revenue over $3 billion. The Court ignores TCL's licensed 2G sales for the first quarter of 2014 because even if 100% of TCL's 2G sales from that quarter were licensed, its impact on the final results is negligible.

The Court calculates that for 2014 and 2015 combined, Option A would have required TCL to pay 1.0079% for 2G, 1.0535% for 3G, and1.0738% for 4G.

For 2G and 3G external modems, TCL would pay 1.5% for 2G and 3G with a floor of $0.40 per product, and for 4G external modems it would pay $3 if TCL sold them for more than $60, and $2 if they sold them for less than $60. (Id. at 10.) For personal computers, TCL would pay $0.5 for GPRS, $0.75 for EDGE, $2.25 for 3G single mode, $2.75 for 3G multi-mode, and $3.5 for multi-mode 4G. (Id. at 11.)

Under Option B, for mobile phones, TCL would pay percentage running royalty rates as follows: 0.8% of the net selling price for 2G GSM/GPRS, 1.0% for 2G EDGE, 1.2% for 3G, and 1.5% for 4G with a $2.00 floor and a $4.50 cap. (Ex. 459.) For external modems, TCL would pay $0.75 per unit for 2G or 3G, and 1.5% of the net selling price for 4G with a $2.00 floor. (Id.) For personal computers, the rates are the same as the non-China rates in Option A. (Id.)

While 4G rate for Option B is expressed as a running percentage royalty, it still needs to be unpacked because 4G units that are sold for less than $133 will pay a higher effective percentage because of the $2 per-unit floor. Using TCL's actual sales data for 2014 and 2015, Dr. Lynde calculated that because of the floor TCL would expect to pay $28,696,918 on 4G royalties, based on $1,443,651,809 in total 4G revenue. (Ex. 1253.) Option B therefore unpacks to an effective 4G royalty rate of 1.9878% over 2014 and 2015. Option B's 2G GSM/GPRS and 2G EDGE rates blended by revenue per standard from 2014-2015 result in a 0.8701% blended 2G royalty rate.

1. The Effect of Post Offer A and B Licenses.

Licenses for two the six firms which the Court has identified as relevant–Apple and Huawei–came into effect after Offers A and B were made. The Apple license was executed on December 19, 2015. (Ex. 5331 at 1.) The Huawei license was executed on January 13, 2016. (Ex. 1277.) The Court finds these rates to be informative, but declines to use them for a direct comparison in the FRAND analysis for several reasons.

First, the concept of "most favor nation," or here "most favored licensee," was never part of the ETSI FRAND equation, and in fact was rejected. (Bekkers Decl. ¶ 60.) Second, as a practical matter, Ericsson could not have been expected to factor into Offers A and B rates that had yet to be determined. Third, in many instances, Ericsson's business cases projected declining ASPs, and thus a lower economic return in later years. (E.g. Ex. 4936 (Samsung Business Case); Ex. 4069 (LG Business Case); Ex. 4929 (HTC Business Case).) In some sense, Huawei and Apple are reflective of the declining returns already assumed in the licenses which the Court finds comparable.

The Court uses the Apple and Huawei rates as bench marks to test reasonableness of the license comparisons which it uses, but not as absolute standards which must be met.

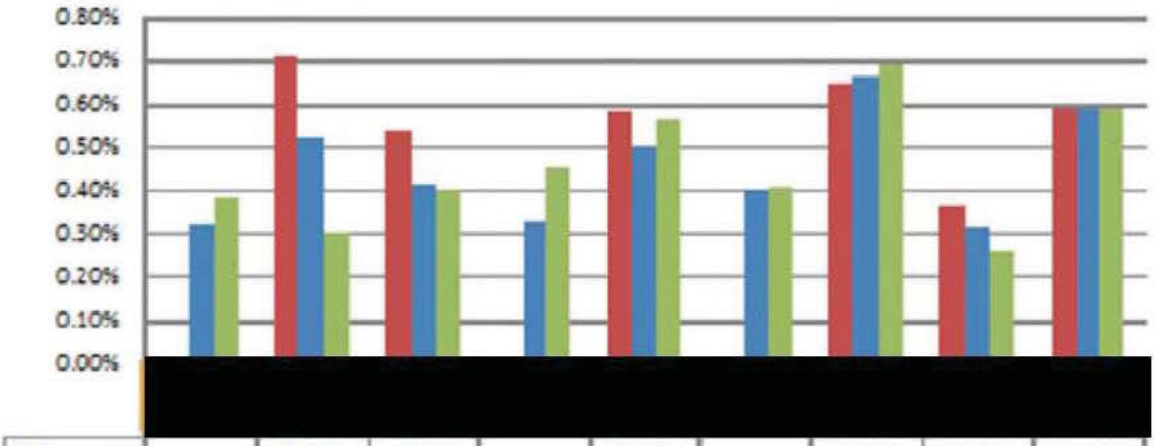
E. Competitive Harm.

Ericsson's experts suggest that discrimination must have the effect of impairing the development or adoption of standards. (Ericsson FOF, ¶ 306.) While both Dr. Teece and Dr. Lynde took this position, the Court finds that harm to the competitor firm offered discriminatory rates is sufficient. To be sure, one of the goals ETSI is to foster standardization and its resultant benefit to all firms, but that is not to the exclusion of protecting individual harmed firms. Indeed, Ericsson would engraft into the FRAND analysis the distinction which American antitrust law makes between the harm to competition, which is actionable, and mere harm to a competitor which is not. See Brunswick Corp. v. Pueblo Bowl-O-Mat, Inc., 429 U.S. 477, 488 (1977). The Sherman Act and its long history provide no guide to understanding ETSI's non discrimination under FRAND.

V. Ericsson's Offers to TCL were Discriminatory

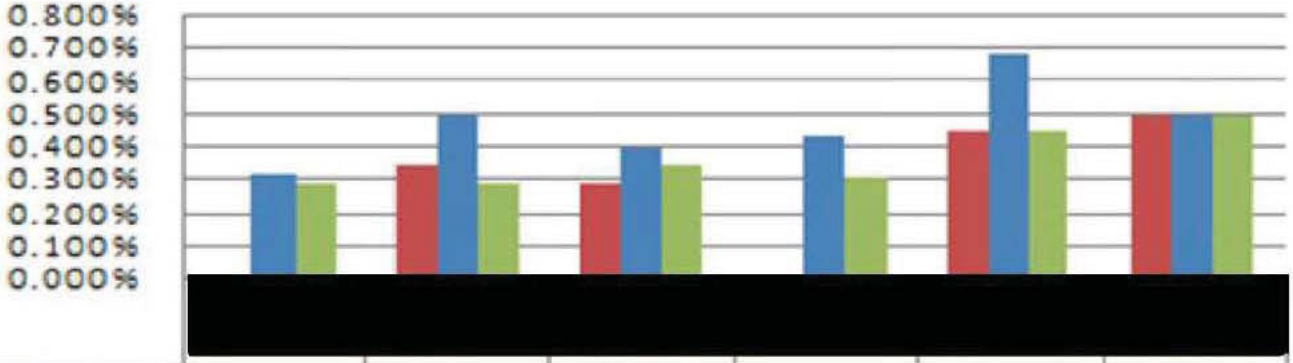
The Court found the following rates on the charts below based on each revenue source. However, Dr. Lynde's 3G rates are technically blended 2G/3G rates. The charts demonstrate two things. First, the Court's analysis and the parties' analysis were reasonably congruent. Second, the rates among firms differed, but they also in large measure showed a definable cluster.

Figure 4: Court's 4G Calculations v. Experts



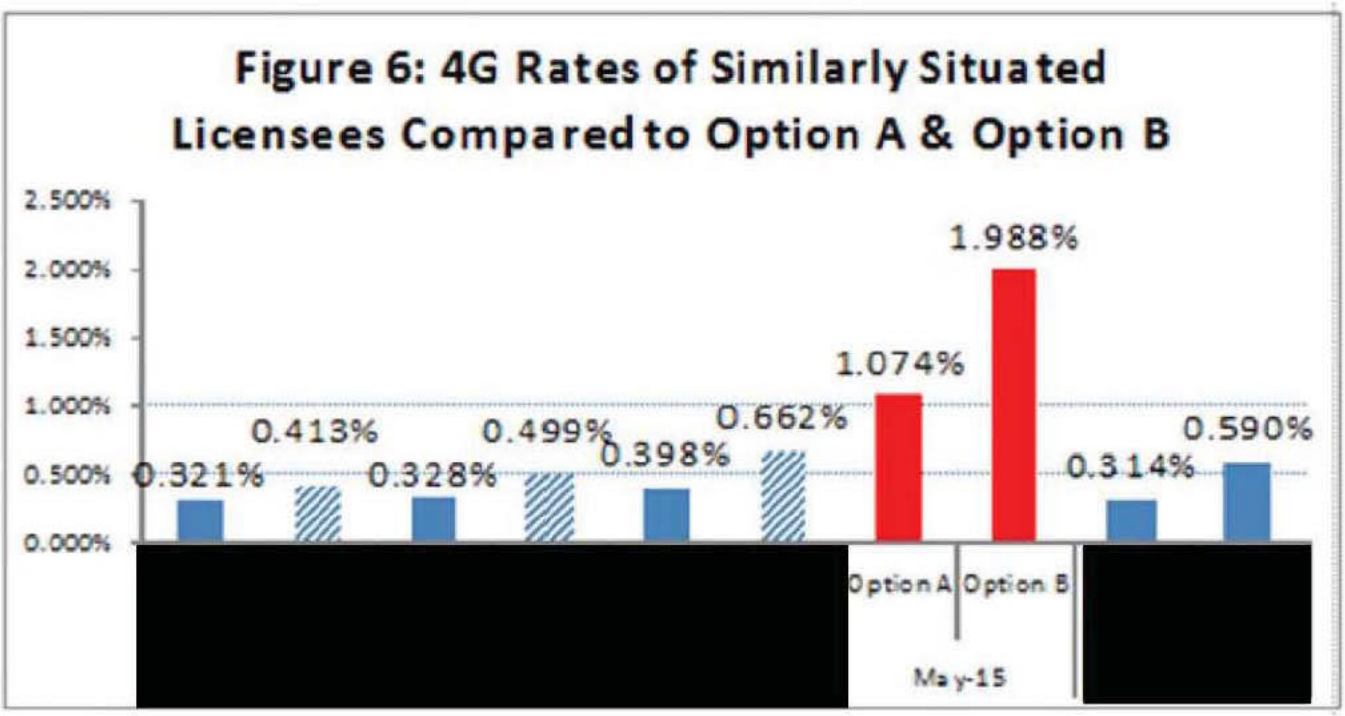
Kennedy		0.71%	0.54%		0.58%		0.65%	0.36%	0.590%
Court	0.321%	0.524%	0.413%	0.328%	0.499%	0.398%	0.662%	0.314%	0.590%
Dr. Lynde	0.38%	0.30%	0.40%	0.45%	0.56%	0.41%	0.69%	0.26%	0.590%

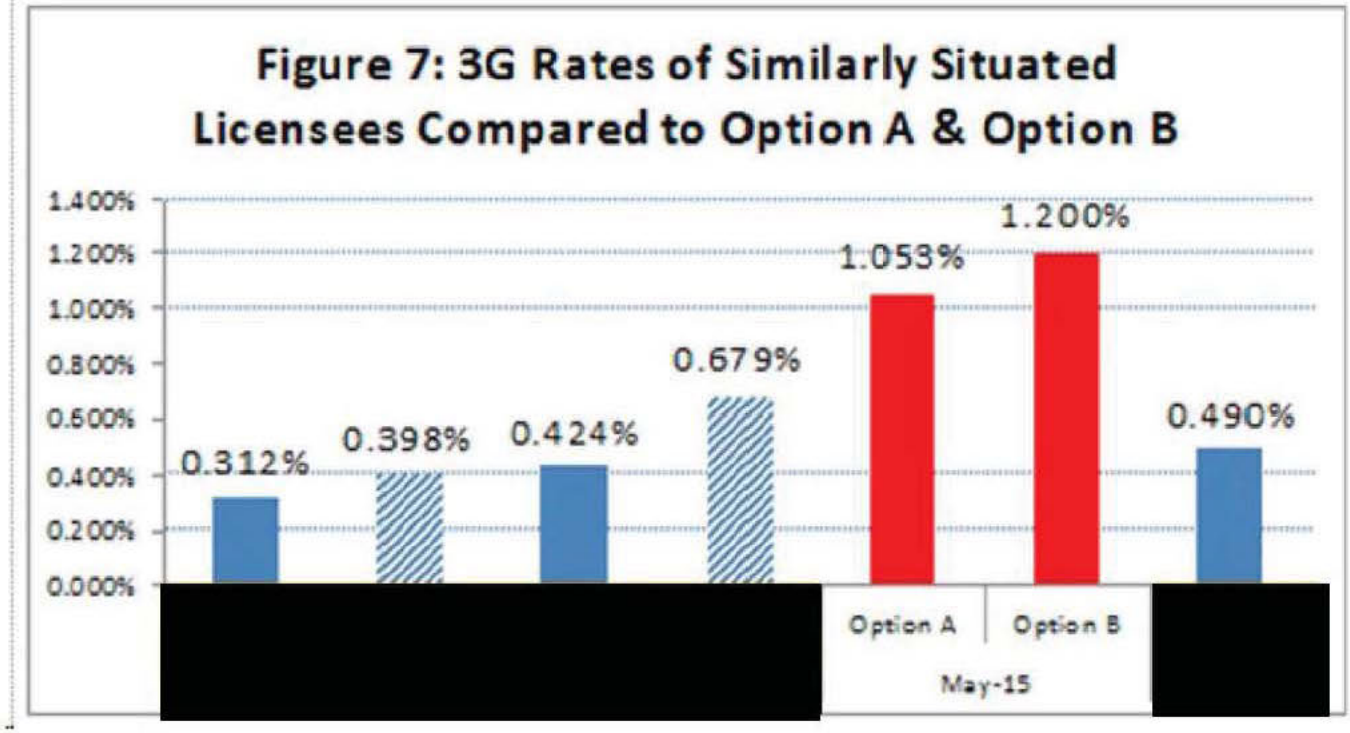
Figure 5: Court's 3G Calculations v. Experts



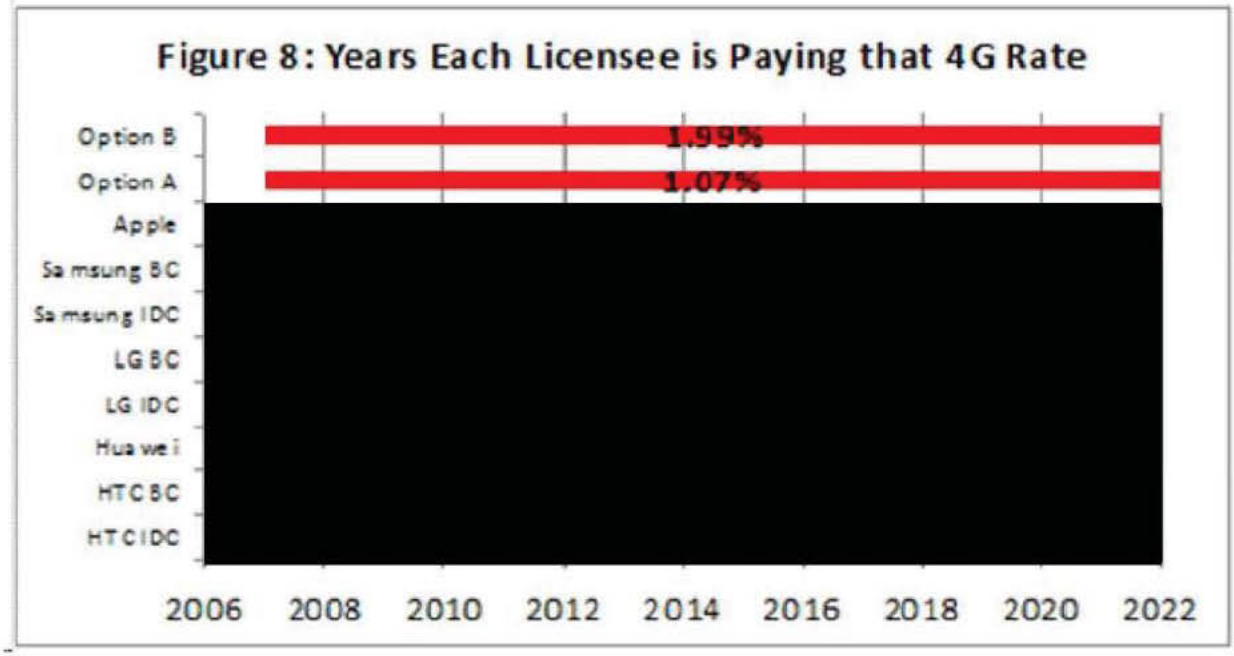
Kennedy		0.34%	0.29%		0.44%	0.49%
Court	0.312%	0.493%	0.398%	0.424%	0.679%	0.490%
Dr. Lynde	0.28%	0.29%	0.34%	0.30%	0.44%	0.490%

The Court now compares rates of comparable licensees against the rates Ericsson asked TCL to pay in Option A and Option B, based on when Ericsson signed each license and offered Option A and Option B in this case.





Discrimination cannot be judged based solely on whether an offer discriminates on the day it is made because license agreements last for multiple years. To determine whether a license is discriminatory, it must be compared against what similarly situated firms are paying throughout the entire course of the proposed license. Figure 8 shows the years that TCL would have to pay the rates in Option A and Option B against the rates similarly situated are paying for those same years.



The Court readily acknowledges that these unpackings are not perfect. However, by any measure, Option A and Option B are radically divergent from the rates which Ericsson agreed to accept from licensees similarly situated to TCL. TCL has carried its burden and demonstrated that Option A and Option B are discriminatory and do not meet FRAND terms.

VI. Setting a FRAND Rate.

Having found that Option A and Option B were not fair or reasonable and were discriminatory, the Court must now set a prospective rate. The Court begins by looking at the combination of rates derived from the top down and comparable

license analyses. At this stage it is important to remember that the comparable licenses unpacked to a "global" rate, while the top down analysis resulted in a U.S. rate, along with a modification for sales outside the Unite States which will also have to be added. In order to compare rates calculated from the top down analysis and the comparable license analysis, the comparable license rates must be converted to U.S. rates.

The Court starts with the assumption that the global value of a 4G license equals the value of the license in the U.S. plus the value of the license outside the U.S. Essentially, that the whole must equal the sum of its parts.

$$\textit{Global Value of License} = \textit{Value of License in U.S.} + \textit{Value of License outside the U.S.}$$

Recall from above that:

$$\textit{Value of a license} = \textit{Licensor One-way Rate} \times \textit{Licensee Revenues}$$

Combining these two formulas,

$$\textit{Global Rate} \times \textit{Global Revenues} = \textit{U.S. Rate} \times \textit{U.S. Revenues} + \textit{RoW Rate} \times \textit{RoW Revenues}$$

In the top down section the Court adopted Dr. Leonard's finding that Ericsson's patent strength outside of the United States for 4G was based on the floor set by Ericsson's patent strength in China because TCL manufactures its devices in China. Ericsson's 4G patent strength in China is 69.80% of its U.S. patent strength. Adding this to the above formula,

$$\textit{Global Rate} \times \textit{Global Revenues} = \textit{U.S. Rate} \times \textit{U.S. Revenues}$$

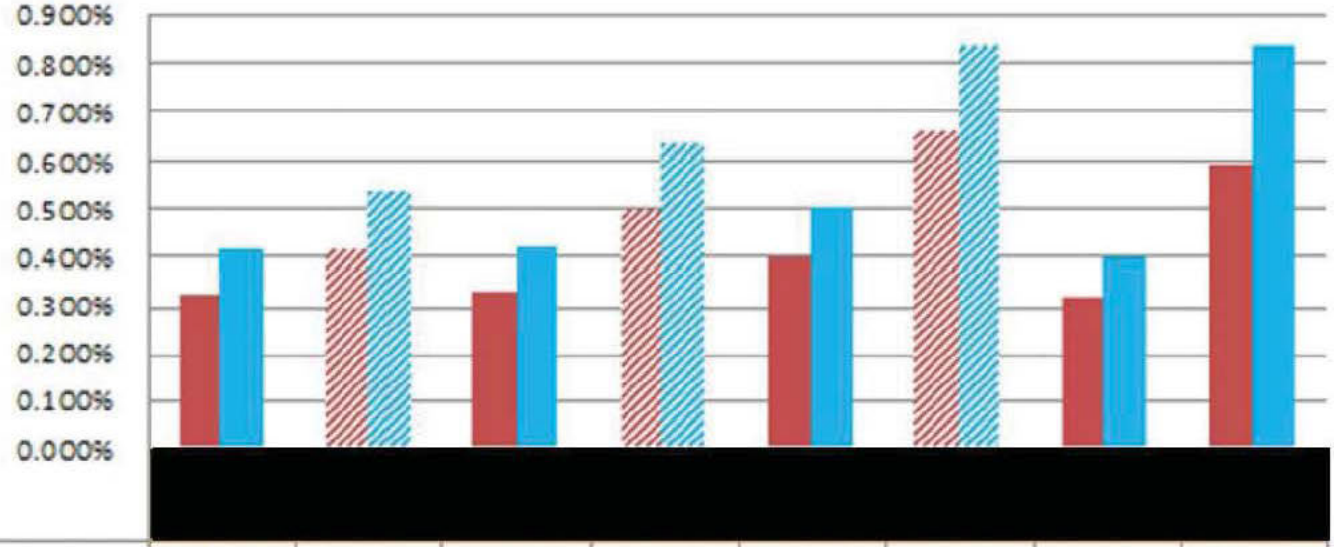
$$+U.S.Rate \times 69.80\% \times RoW\ Revenues$$

This can be restated as:

$$U.S.Rate = \frac{Global\ Rate \times Global\ Revenue}{U.S.\ Revenue + RoW\ Revenue \times 69.80\%}$$

The Court's unpacked rates are the global rates, and the Court uses IDC data to determine each licensee's proportion of sales in the United States. (Ex. 1273.) Based on the IDC data, the Court determined the U.S. rate below for each comparable licensee. On average, this resulted in a 30.35% increase in the licensee's rate.

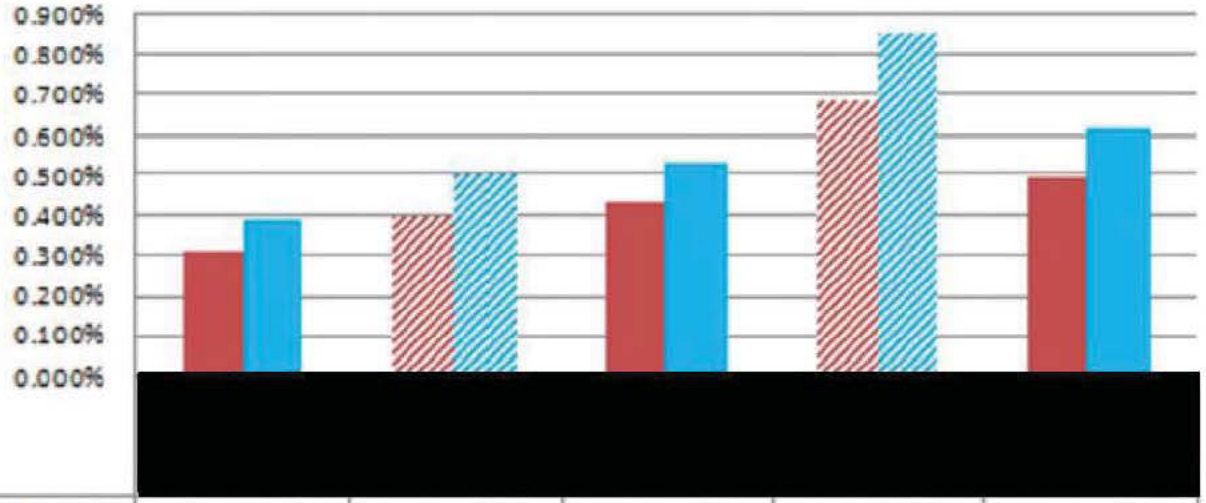
Figure 9: 4G Global and U.S. Rates



Global Rate	0.321%	0.413%	0.328%	0.499%	0.398%	0.662%	0.314%	0.590%
U.S. Rate	0.414%	0.531%	0.420%	0.638%	0.502%	0.836%	0.398%	0.839%

For 3G Ericsson's patent portfolio in China sets a global floor, except for sales in the United States and Europe. Ericsson's 3G patent portfolio in Europe is 87.90% of its U.S. portfolio, and it's China portfolio is 74.80% of its U.S. rate. Because the Court lacked the data to determine Samsung, Huawei, or HTC's sales in Europe, the Court will multiply their 3G global rates by 1.25 to create a U.S. rate. This resulted in the following U.S. rates:

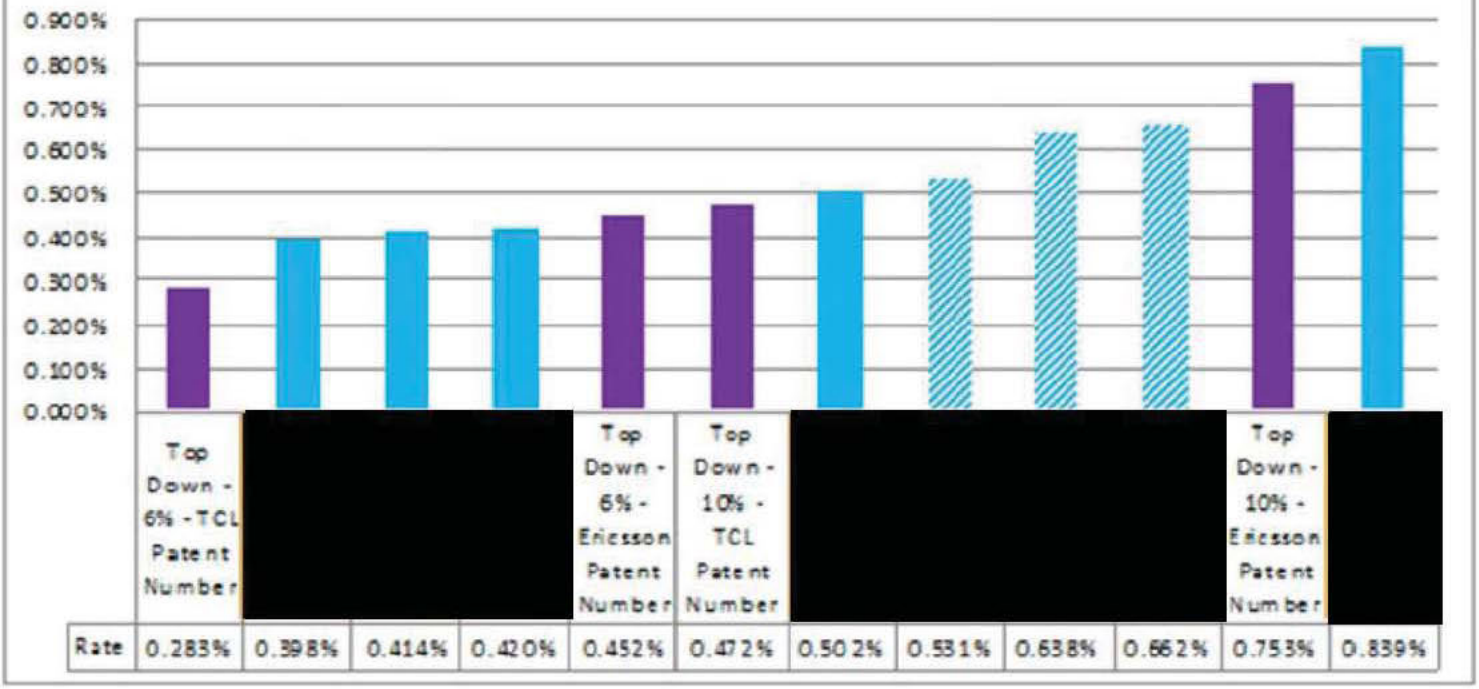
Figure 10: 3G Global and U.S. Rates



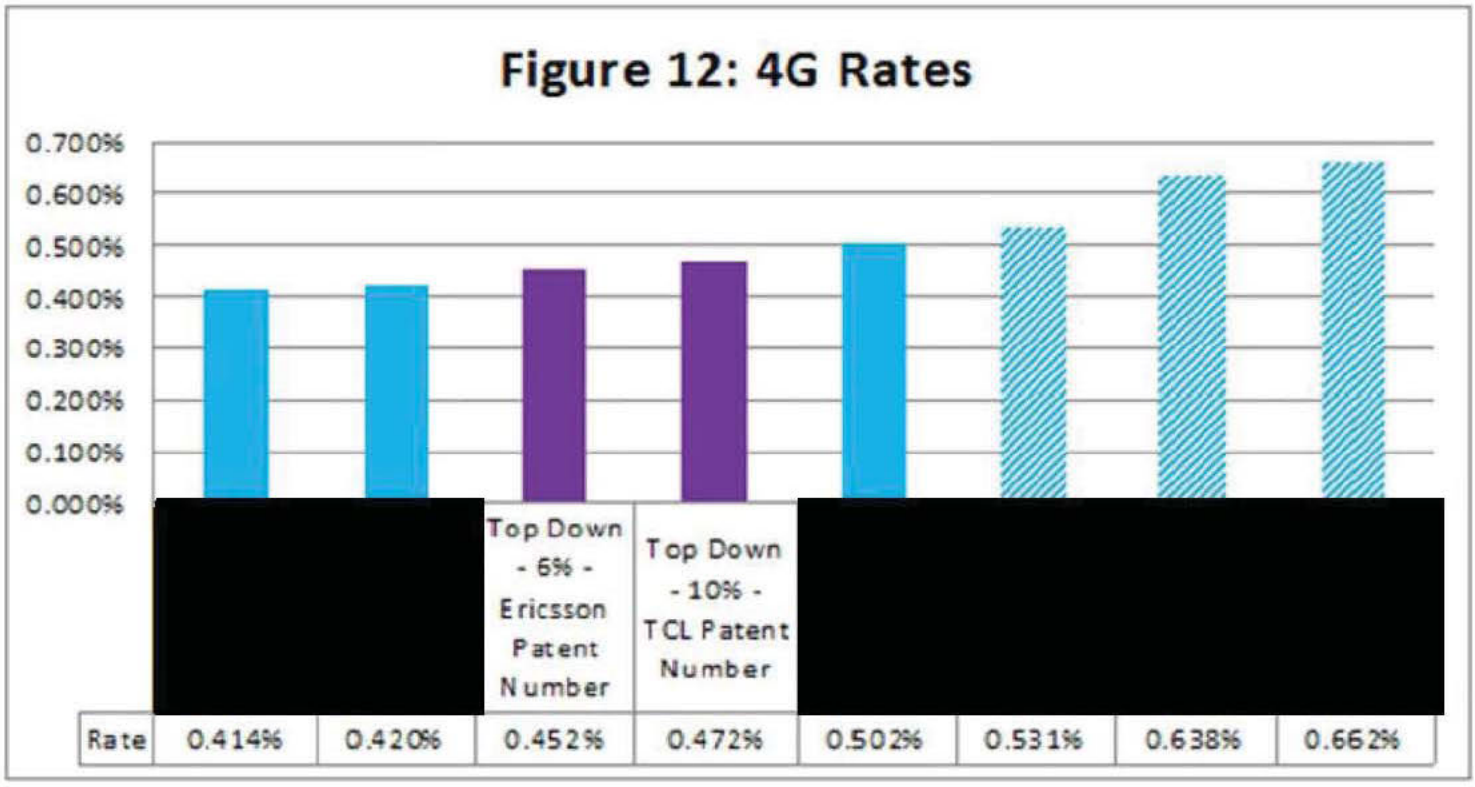
Global Rate	0.312%	0.398%	0.424%	0.679%	0.490%
U.S. Rate	0.390%	0.497%	0.529%	0.849%	0.613%

Now that the comparable license rates are stated in the same terms as the top down rates they can be compared against each other.

Figure 11: 4G Rates



In this case the comparable licenses and top down analysis act as a reasonable check on each other, with the top two rates and bottom two rates each containing one result from each analysis. In order to further narrow down the data, the Court will discard the top two and bottom two results to determine the central data points for a FRAND rate for Ericsson's 4G SEP portfolio.



The Court acknowledges that it cannot determine an appropriate FRAND royalty with exactitude. However, with abundant and largely congruent data before the Court, the Court finds that 0.45% is an appropriate FRAND for Ericsson's 4G SEP portfolio in the United States. This means that the FRAND rate for Ericsson's portfolio for the Rest of the World ("RoW") is 0.314%. Below is a chart comparing the Court's U.S. rate, the Court's RoW rate, all 4G rates, and Option A and Option B converted to a comparable U.S. rate.

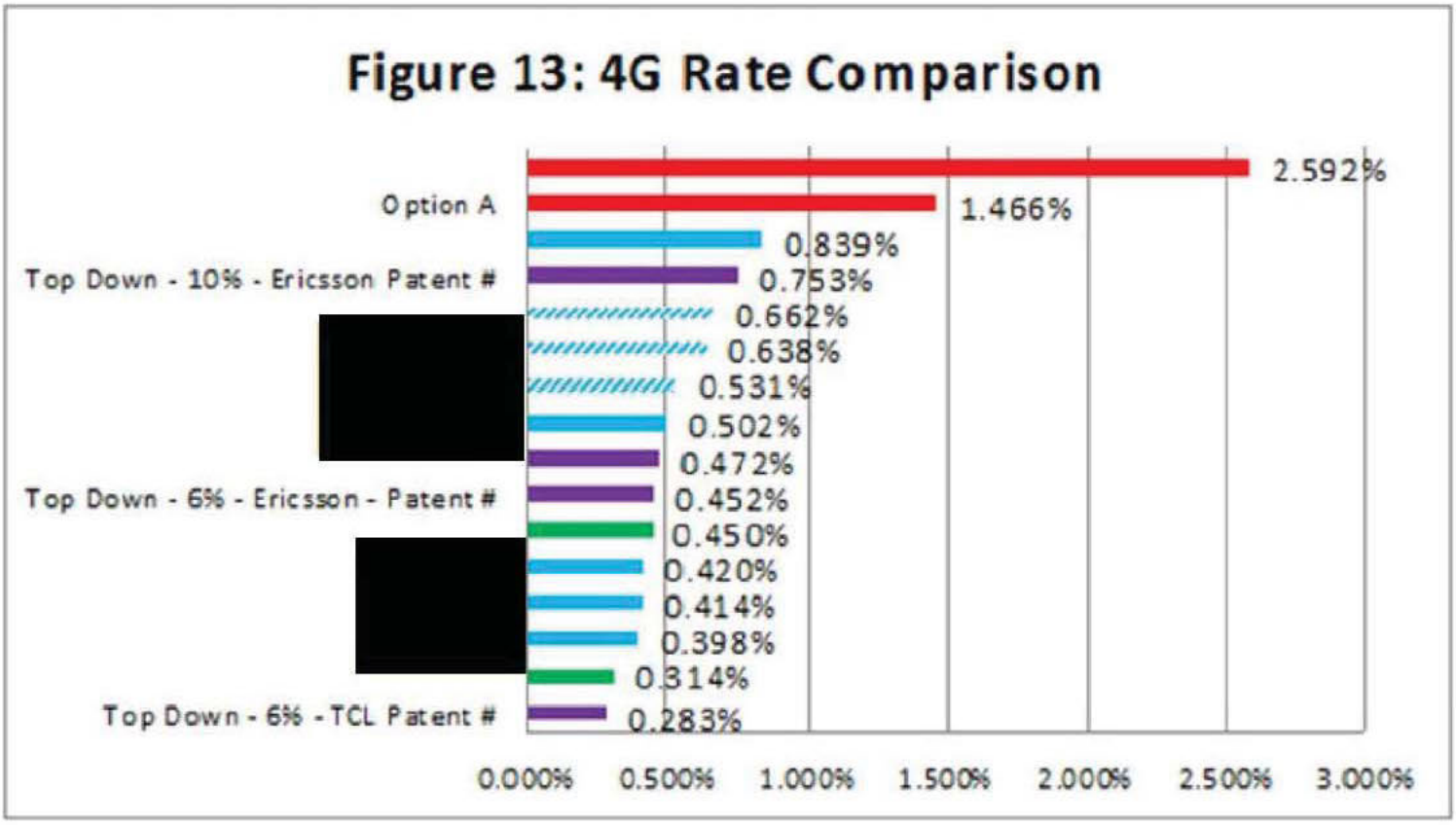
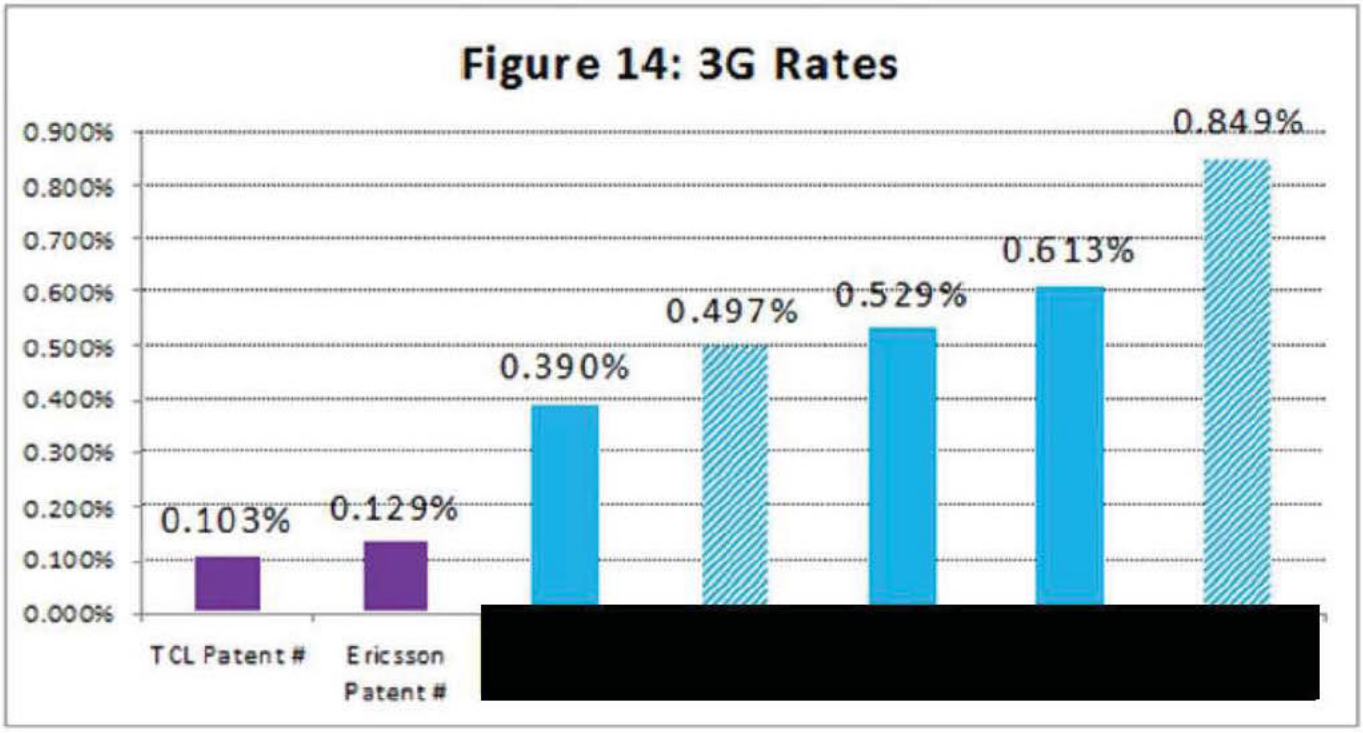


Figure 13: 4G Rate Comparison
Option A
Top Down - 10% - Ericsson Patent #
Top Down - 6% - Ericsson - Patent #
Top Down - 6% - TCL Patent #
2.592%
1.466%
0.839%
0.753%
0.662%
0.638%
0.531%
0.502%
0.472%
0.452%
0.450%
0.420%
0.414%
0.398%
0.314%
0.283%
0.000%
0.500%
1.000%
1.500%
2.000%
2.500%
3.000%

Figure 14 shows the 3G numbers previously accepted by the Court:



Here the top down analysis gave lower royalty rates than the comparable licenses analysis. The Court questions the reliability of the 3G rates from the top down where the difference between those rate and the market derived rates differ by more than 100%. The Court does note that 3G rates were less important to Samsung, HTC, and Huawei, who all generate substantially more 4G revenue than 3G revenue. The top down numbers reflect a U.S. rate, and modifiers must be applied to determine rate for Europe and the RoW. The Court adopts a 3G U.S. royalty rate of 0.30% for Ericsson's 3G SEPs. This means that Ericsson's 3G SEP royalty rate in Europe is 0.264%, and the RoW rate is 0.224%. These figures shown in Figure 15 below against the other 3G data points used by the Court, as well as the rates for Option A and Option B.

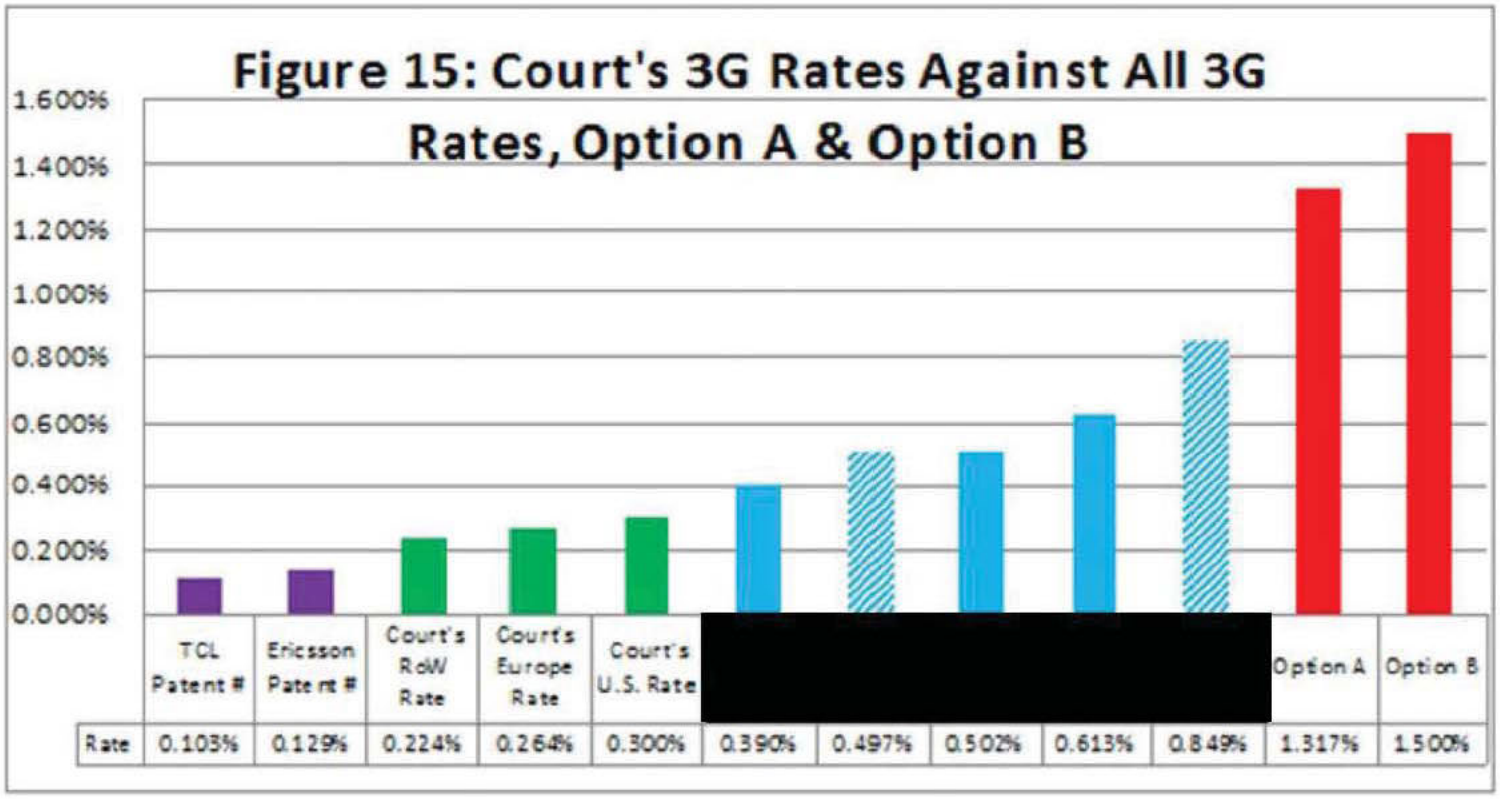


Figure 15: Court's 3G Rates Against All 3G Rates, Option A & Option B
1.600%
1.400%
1.200%
1.000%
0.800%
0.600%
0.400%
0.200%
0.000%
TCL Patent #
Ericsson Patent #
Court's RoW Rate
Court's Europe Rate
Court's U.S. Rate
[redacted]
Option A
Option B
Rate
0.103%
0.129%
0.224%
0.264%
0.300%
0.390%
0.497%
0.502%
0.613%
0.849%
1.317%
1.500%

As explained above, the Court calculated 2G rates based on the top down analysis, but could not reliably unpack 2G rates from any comparable licenses. The Court therefore adopts its results from the top down section of 0.16% for 2G sales in the U.S., 0.12% for 2G sales in Europe, and 0.09% for 2G sales in the RoW.

Figure 16: 2G Top Down Results Compared to Option A & Option B

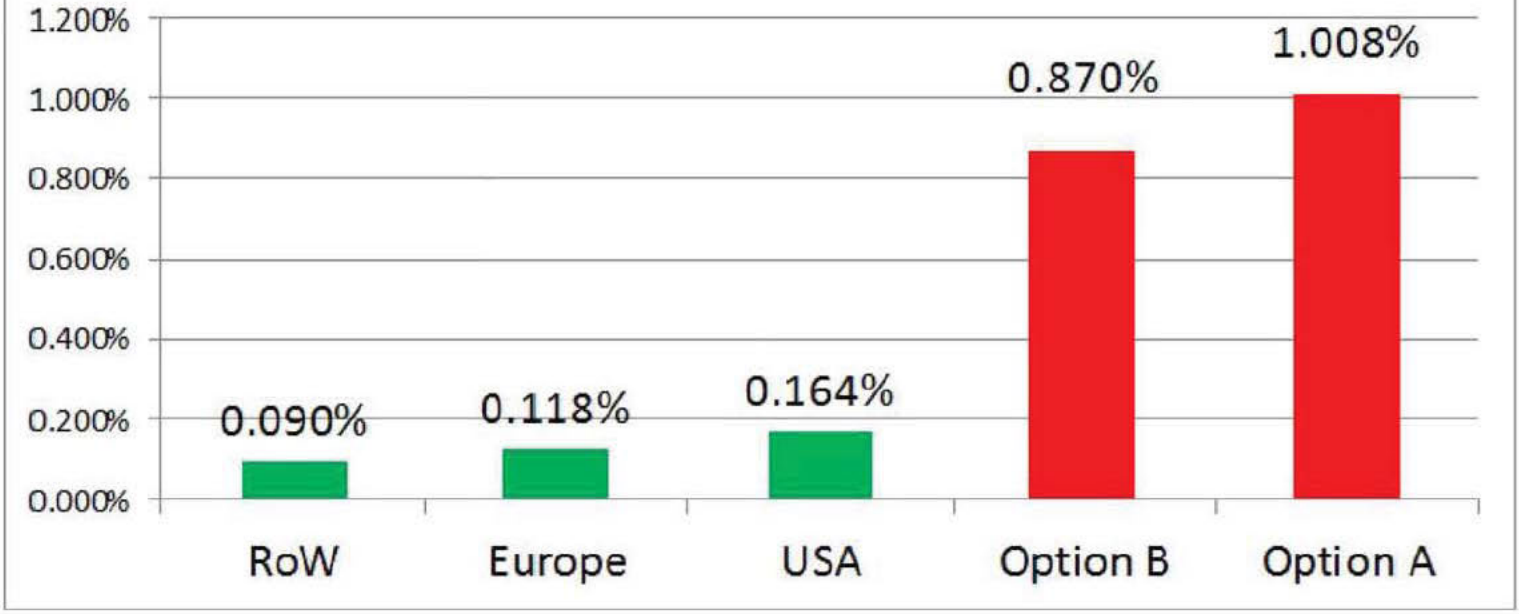
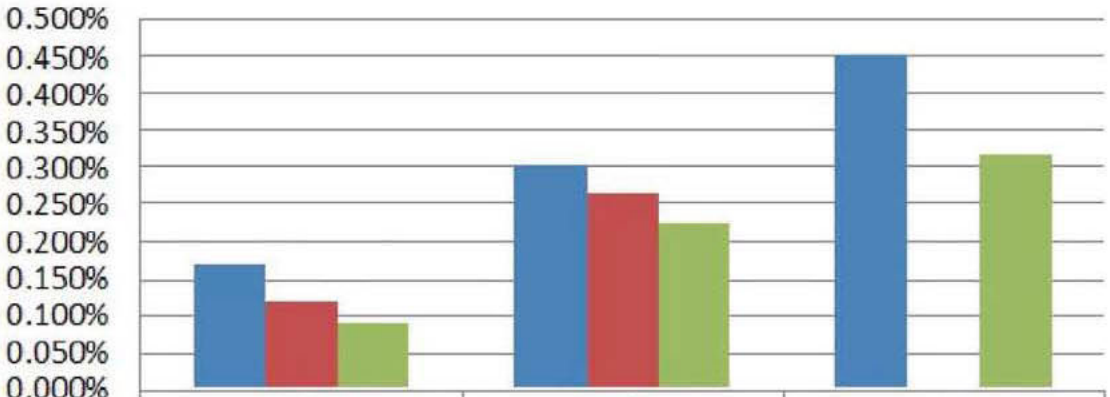


Figure 17 summarizes the Court's effort to establish FRAND rates:

Figure 17: Court's Final Rates



	2G	3G	4G
Court's U.S. Rate	0.164%	0.300%	0.450%
Court's Europe Rate	0.118%	0.264%	
Court's RoW Rate	0.090%	0.224%	0.314%

VII. Determing a Release Payment for TCL's Unlicensed Sales.

Ericsson had the burden of proving that it was entitled to a release payment, and the FRAND amount of that release payment. (E.g., Docket No. 1278 at 19-21.) Ericsson believes the release payment should be calculated at the prospective rate set by the Court. (Ericsson FOF, ¶ 351.) TCL argued that it should not owe a release payment because Ericsson failed to meet its burden because it failed to provide an amount that it believed TCL owed as a release payment, and because Ericsson harassed TCL with litigation in demanding the non-FRAND rates in Option A and Option B. (TCL COL, ¶ 74.) Alternatively, TCL's expert Dr.

Leonard concluded that TCL owed either $17,780,024 or $23,715,192, depending on whether certain sales are time-barred. (Leonard Decl. ¶ 152.) The Court adopts Ericsson's position that the past unlicensed sales should be calculated at the prospective rate, and finds that none of TCL's sales from 2007 onwards are time-barred.

The two elements Ericsson had to prove were its entitlement to a release payment and the FRAND amount of that release payment. (E.g., Docket No. 1278 at 19-21.) Ericsson met its burden to prove that TCL made unlicensed sales. (E.g., Ex. 142.) Ericsson never proposed a dollar amount for a release payment in a witness declaration, its trial brief, or its proposed findings, but buried in Kennedy's report calculating the effective rates for Option A and Option B there are numbers that do appear to be a calculation of TCL's royalties due under Option A and Option B for each year from 2007-2014. (Ex. 5315 at 4, 8.) Although Kennedy never presented them as such, at closing arguments Ericsson's counsel argued that based on these numbers, from 2007-2014 TCL would owe $97.2 million under Option A, or $98.5 million under Option B. Because the Court has found that Option A and Option B were not FRAND, the Court cannot accept either of these totals. In addition, Kennedy's calculations are inherently flawed because they ignore the fact that TCL's 3G devices already licensed to Ericsson's 3G SEPs because they incorporate Qualcomm chipsets. Ericsson's evidence therefore does not carry its burden regarding the amount of the release payment. However, as with all cases, the Court looks to all of the evidence regardless of which side produced it. (Ninth Circuit Model Civil Instruction No. 1.6.) Here, the Court looks to other evidence in the record to calculate a FRAND release payment despite the shortcomings in Ericsson's evidence.

In order to determine the amount that TCL owes Ericsson for its past unlicensed sales, the Court must determine the appropriate revenue figures, discount them, and then apply the final rates calculated above. The Court adopts Dr. Leonard's figures for TCL's unlicensed revenue from 2007-2015. (Ex. 1124 at 5.) The Court applies the same discount rate it did to the past sales figures for comparable licensees of 0.56% to reflect the fact that TCL received the benefit of Ericsson's SEPs well before it must pay for them. The Court discounts these figures to the end of 2017 and uses the midyear convention for simplicity. Finally, the Court applies the final rates to the discounted revenue numbers concludes that

TCL must pay Ericsson $16,449,071 as a release payment for unlicensed sales from 2007-2015.

In calculating the revenue figures for each standard, the Court treats all of TCL's 3G sales as multi-mode devices that have pass-through rights to Ericsson's 3G SEPs, and thus subject to the 2G rate. The Court acknowledges that this creates a very real risk of stacking,[44] because Ericsson demanded that TCL pay 2G royalties on a 3G multi-mode devices as if they did not have 3G functionality. However, such devices do have 3G functionality, and therefore receive far less value from Ericsson's 2G SEPs because they only use 2G functionality when they cannot connect to a 3G network. Ericsson should have proposed a methodology to determine the marginal value that 2G adds to a 3G device, which would be some proportion of the 2G rate.[45] If TCL's 4G devices also have similar pass-through rights, Ericsson also should have proposed a methodology to calculate a FRAND royalty rate on a 4G device which already has 3G functionality. Kennedy's calculation of the release payments under Option A and Option B requires TCL to pay the full 3G rate in each offer for all of TCL's 3G sales. (Ex. 5315 at 4, 8.) This ignores the reality that TCL's 3G devices are already licensed to Ericsson's 3G SEPs, and ignores both the express terms of those offers the Court's grant of Ericsson's own motion for partial summary judgment that such a term is not a breach of FRAND. (Ex. 458 at 11; Ex. 459 at 9-10; Docket No. 1055 at 8.) TCL's expert Dr. Leonard acknowledged that TCL should only have to pay a proportion of the 2G rate on its 3G devices with pass-through rights, but "conservatively" included the full amount in his calculations. (Leonard Decl. ¶ 150.) Because Dr. Leonard calculated a blended 2G/3G rate, this means that in his calculations it did not matter whether TCL's devices had to pay a 2G or 3G rate. Because the Court calculated separate 2G and 3G rates, the Court's approach actually leads to a smaller payment than the FRAND amount calculated by Dr. Leonard. While there are real concerns about stacking in the future if Ericsson believes that it is entitled to the full rate for each standard all backwards-compatible devices, such concerns are not present in this case because Ericsson is only demanding multi-standard royalties on 3G devices with Qualcomm chipsets,

[44]Stacking in this sense is Ericsson's proposed approach of literally stacking the full price of each standard for backwards-compatible devices for devices that have 3G pass-through rights.

[45] TCL similarly failed to carry its burden on this issue in setting the prospective rate. This is why its 3G devices with pass-through rights because of Qualcomm chipsets are subject to the full 2G or 4G multi-mode royalty rate.

and the Court's calculated 2G and 3G rates are relatively low compared to the total aggregate royalties for 2G and 3G.

The FRAND amount for TCL's unlicensed sales from 2007-2015 is $16,449,071. For sales from 2016 to the commencement of the license in this case, the release payment must be calculated as described above using the Court's final rates.

PART 5: CONCLUSIONS OF LAW

I. Jurisdiction and Venue.

The Court has jurisdiction over these actions pursuant 28 U.S.C. §§ 1331, 1338(a), 1367(a), 2201, and 2202. In its July 28, 2014 Order, the Court explained in detail the basis for jurisdiction under 28 U.S.C. §§ 1331 and 1338. (Docket No. 39, pp. 6-8.) The facts requisite to federal jurisdiction are admitted. (Docket No. 1376, Pretrial Conference Order, pp. 1-2.)

Venue for these actions if proper under 28 U.S.C. §§ 1391(a), (c), and (d).

II. Applicable Law.

As discussed in the background section, the ETSI IPR scheme creates a contract with third party obligations. The arrangement is governed by French law.[46] (Ex. 223, Clause 6.)

III. Legal Principles Underlying Court's Factual Analysis.

[46]Federal Rule of Civil Procedure 44.1 provides that once a party gives notice of its intent to raise an issue of foreign law, it becomes the district court's responsibility to determine the relevant foreign law and apply it to the issue at hand. Fed. R. Civ. P. 44.1; Republic of the Philippines v. Marcos, 862 F.2d 1355, 1361 (9th Cir. 1988) (en banc). In making this determination, courts may consider "any relevant material or source, including testimony, whether or not submitted by a party or admissible under the Federal Rules of Evidence." Fed. R. Civ. P. 44.1. Here the Court had the benefit of well-qualified legal experts on both sides. (See Huber Decl.; Fauvarque-Cosson Decl.; Stoffel-Munck Decl.)

The Court summarizes the legal principles which guide its factual analysis.

A. Valuing SEPs.

"When the standard becomes widely used, the holders of SEPs obtain substantial leverage to demand more than the value of their specific patented technology." Microsoft Corp. v. Motorola, Inc., No. C10-1823, 2013 WL 2111217, at *10 (W.D.Wash. Apr. 25, 2013) This monopoly power can lead standard-essential patent owners to overvalue their patents and "engage in anti-competitive behavior." Microsoft Corp. v. Motorola, Inc., 795 F.3d 1024, 1031 (9th Cir. 2015). "The tactic of withholding a license unless and until a manufacturer agrees to pay an unduly high royalty rate for an SEP is referred to as 'hold-up.'" Id.; see also Ericsson v. D-Link, 773 F.3d at 1209.

Because of these risks, standards organizations require that patents be licensed on FRAND terms and conditions. See Broadcom Corp. v. Qualcomm Inc., 501 F.3d 297, 313-14 (3d Cir. 2007). The FRAND obligation is designed to "encourag[e] participation in standard-setting organizations but also ensur[e] that SEPs are not overvalued." Apple Inc. v. Motorola, Inc., 757 F.3d 1286, 1332 (Fed. Cir. 2014)(overruled on other grounds by Williamson v. Citrix Online, LLC, 792 F.3d 1339, 1349 (Fed. Cir. 2015)); In re Innovatio, 2013 WL 5593609, at *9 ("[P]atent hold-up is a substantial problem that [F]RAND is designed to prevent.").

In valuing SEPs, courts have made clear that "the patentee's royalty must be premised on the value of the patented feature, not any value added by the standard's adoption of the patented technology . . . [so that] the royalty award is based on the incremental value that the patented *invention* adds to the product, not any value added by the standardization of that technology." Ericsson v. D-Link, 773 F.3d at 1232-33 (emphasis in original); Commonwealth Scientific & Indus. Research Organization v. Cisco Systems, Inc., 809 F.3d 1295, 1305 (Fed. Cir. 2015) ("CSIRO"); In re Innovatio, 2013 WL 5593609 at *9 ("The court's [F]RAND rate therefore must, to the extent possible, reflect only the value of the underlying technology and not the hold-up value of standardization.").

B. The Non-Discrimination Obligation.

No American cases have definitively addressed the non-discrimination requirement

Testifying as an economics expert rather than an expert on French law, Dr. Teece testified that FRAND is not violated if there is a "smidgen" of a difference in rates between similarly-situated companies. He defined a "smidgen" to mean a "small difference," which would not extend to the difference between a 0.5% and 2% rate. (TT, Mar. 1, 2017, pp. 102:18-104:8.) Ericsson's French law expert Dr. Huber opined that FRAND anticipates a range of rates depending on circumstances, and that there is not necessarily a single fixed rate which satisfies FRAND. (Huber Decl. ¶¶ 36-42.)

The Court concludes there is no single rate that is necessarily FRAND, and different rates offered to different licensees may well be FRAND given the economics of the specific license. (Id.) Based on the drafting history of ETSI's IPR Policy, Dr. Huber concluded that "the drafters did not intend 'non-discriminatory' to ensure the exact same treatment or identical license terms for all licensees to the same portfolio of essential patents." (Id. ¶ 44.) Significantly, Dr. Huber was the only legal expert to opine on the meaning of non-discrimination. It necessarily follows that TCL cannot claim that anything other than the nominally lowest rate in marketplace is *per se* discriminatory.

C. The Role of Licenses in the Analysis.

Licenses are a proper measure for determining whether an offered rate meets the FRAND requirements, but not the exclusive measure. While there may flaws in the consideration of licenses, the Court does not accept TCL's seeming blanket rejection of comparable licenses. TCL also raises a question whether all or any comparable licenses are in fact fair and reasonable, and why a licensee agreeing to a rate makes it by definition fair and reasonable. TCL COL, ¶ 20; See In re Innovatio, 2013 WL 5593609 at *39 (Judge Holderman explaining that determining what is FRAND requires more "quantitative and analytical rigor" than simply deferring to the patent owner's licenses).[47]

[47]Elsewhere Ericsson has argued "[t]he fact that many companies have entered into WCDMA licenses with Qualcomm since 1999 does not establish that the royalties or other terms included in those licenses are fair, reasonable and non-discriminatory." (Ex. 77 at 6.)

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

The Court finds that by looking at an array of licenses, concerns about FRAND compliance of any particular license, asymmetric information, and litigation pressures are substantially diminished. (See Leonard Decl. ¶ 50; Leonard Rebuttal Decl. ¶ 4; Lynde Decl. ¶¶ 40-42; Ordover Decl. ¶ 48.) TCL does acknowledge that prior licenses have "some" value, especially for larger licensees with the resources to test an SEP-holder's demands. (TCL COL ¶ 29.) In the end, TCL's concerns are overblown given the substantial congruence the Court found in its 4G results between the top down and comparable licenses analyses. The fact that TCL's and Ericsson's differing approaches and the Court's assessments of them provide remarkably similar ranges convinces the Court that its final rates are FRAND.

D. Similarly Situated Firms.

For purposes of non-discrimination component of FRAND, one must look to similarly situated firms. Here those firms are: Apple, Samsung, Huawei, LG, HTC, and ZTE. None of the legal experts opined on how one would define the appropriate set of firms to assess discrimination.

E. American Case Law re Royalties.

The Court acknowledges that Georgia-Pacific Corp. v. United States Plywood Corp., 318 F. Supp. 1116 (S.D.N.Y. 1970), and its progeny establish a multi-faceted test for establishing a reasonable royalty in a patent infringement case. Ericsson's approach using comparative licenses partially overlaps Georgia-Pacific. However, the Court did not find useful a full-blown Georgia-Pacific analysis in the unique context of a FRAND dispute.

IV. The FRAND Obligation.

In assessing the breach of contract claim, the parties focus on two components: the mutual duty of the parties to negotiate in good faith and the duty to offer a rate which are in fact FRAND.

The Court finds that Ericsson negotiated in good faith and did not commit a breach of contract by virtue of its conduct. Indeed, negotiations came to an end when TCL initiated this suit shortly after it had received an offer to which it responded with signaled an initial favorable reaction. (See Ex. 37 at 2.)

The parties take diametrically opposing positions on whether the licensor must make an offer which in fact meets all FRAND requirements.

In TCL's view, the duty under French law to negotiate in good faith is not the full extent of the FRAND duty. (Stoffel-Munck Rebuttal Decl. ¶ 22; TT, Mar. 1, 2017, pp. 99:19-100:12.) Rather, the contractual duty is to grant a FRAND license. (Stoffel-Munck Rebuttal Decl. ¶ 22.) TCL contends that this is consistent with the plain language of the policy which refers to a duty to negotiate in good faith, as well as a duty to be prepared to grant FRAND licenses. The ETSI Guide states that one of the "rights" granted to members is "to be granted licenses" on FRAND terms. (Id. ¶¶ 23-31 (emphasis supplied); ETSI Guide on IPR § 1.4, Ex. 224 at 4.)

In Ericsson's view, there is a range of offers which can satisfy the FRAND obligation. The FRAND commitment does not require each offer and counter-offer exchanged during the course of negotiations to be FRAND. Huber Rebuttal Decl. ¶¶ 29-29; cf. Ericsson v. D-Link, No. 6:10-CV-473, 2013 WL 4046225, at *25 (E.D. Tex. Aug. 6, 2013) (aff'd in part, vacated in part, rev'd in part, 773 F.3d 1201 (Fed. Cir. 2014)) (holding that, in RAND licensing under the IEEE patent policy, "both sides' initial offers should be viewed as the starting point in negotiations. Even if a court or jury must ultimately determine an appropriate rate, merely seeking a higher royalty than a potential licensee believes is reasonable is not a RAND violation"); Microsoft Corp. v. Motorola Inc., 864 F. Supp. 2d 1023, 1038 (W.D. Wash. 2012) ("Because the IEEE and the ITU agreements anticipate that the parties will negotiate towards a RAND license, it logically does not follow that initial offers must be on RAND terms."). In sum, Ericsson believes there is no duty to bring good faith negotiations to conclusion

with an offer which is in fact FRAND; it need only be prepared to offer FRAND terms.

The Court concludes that it need not resolve the legal question whether the FRAND duty under ETSI requires the licensor to offer rates which are in fact FRAND. There are two reasons. First, no damages will flow from any putative breach because the Court granted partial summary judgment on TCL's damages claim, in part because the Court excluded evidence of legal expenses which had not been timely produced. (Docket No. 1061, pp. 20-21.) Second, while finding a breach would be necessary for granting specific performance under TCL's breach of contract claim, it would also be superfluous.

Both TCL and Ericsson assert claims for declaratory relief. (Docket No. 1376, Pretrial Conference Order, 3, 6.) The Declaratory Judgment Act provides that a district court may "declare the rights . . . of any interested party . . . whether or not further relief is or could be sought." 28. U.S.C. § 2201. The availability of declaratory relief depends on whether there is a live dispute between the parties, and a request for declaratory relief may be considered independently of whether other forms of relief are appropriate. Powell v. McCormack, 395 U.S. 486, 517-518 (U.S. 1969). A declaratory judgment can then be used as a predicate to further relief, including an injunction. (Id. at 499 (citing 28 U. S. C. §2202).)

TCL seeks a declaratory judgment that Ericsson has not offered TCL license terms conforming to applicable legal requirements, including failing to offer FRAND rates. (Docket No. 31, ¶113.)

Ericsson seeks a declaratory judgment that Ericsson has (a) complied with its IPR licensing declarations to ETSI, ETSI's IPR Policy, and any applicable laws during its negotiations with TCL in regard to FRAND terms for a license to Ericsson's 2G, 3G, and 4G SEPs, and (b) in fact offered to grant TCL a license to Ericsson's 2G, 3G, and 4G SEPs on FRAND terms. (Ericsson Inc v. TCL., Case No. 2:15-CV-02370, Docket No. 17, pp. 18-19.)

Just as it would on the breach of contract claim, TCL bears the burden of proof on its declaratory relief claim, as well as on Ericsson's claim for declaratory relief. (Docket No. 1074, p. 4.)

V. Options A and B are Not FRAND.

As suggested by its findings of fact, the Court holds that TCL is entitled to a declaration that Offers A and B are not FRAND rates. TCL has carried its burden of showing that Options A and B are not FRAND. For like reason, TCL is entitled to a declaration of the FRAND rates here.

Whether judged at the time the amended FRAND contentions were made in May 2015, or at the time of trial, Ericsson's offers are not fair and reasonable, and are discriminatory. This is demonstrated not only by TCL's evidence, but also Ericsson's evidence. In particular, as of May 2015, Ericsson had already entered into licenses with Samsung, LG, and HTC–all of whom are similarly situated to TCL–at rates substantially lower than Option A and Option B. (TCL FOF, 40-42; TCL COL, 34-43; TT, 2/28/17, (Sealed Vol. 1) pp. 17:11-24, 20:24-23:3.) This is true whether one uses Dr. Lynde's "business case" rate determinations, Dr. Lynde's IDC rate determinations, or Kennedy's "business case" rate determinations.

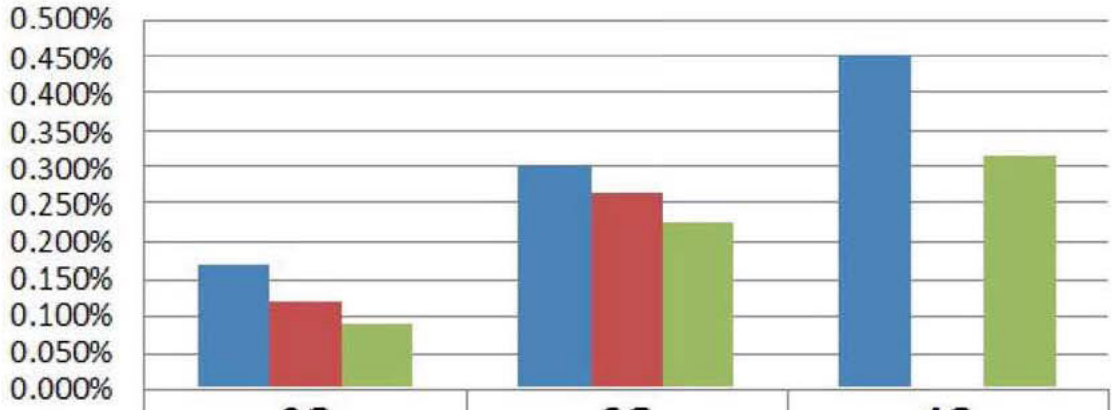
Although the Court makes limited use of the Apple and Huawei licenses as reasonableness checks, Ericsson's proposed rates are also discriminatory vis-à-vis these firms.

Ericsson's use of floors in its rates is itself discriminatory. In the absence of a credible showing that Ericsson's SEPs add a measurable incremental value, there is no basis for essentially discriminating on the basis of the average selling price where a floor would result in a higher effective rate for lower priced phones. Here, the Court has rejected Kennedy's ex Standard analysis. There is no predicate in this record for floors.

VI. Setting FRAND Rates.

The Court finds that the following rate are supported by the record and mandated by the FRAND obligation under ETSI:

Figure 17: Court's Final Rates



	2G	3G	4G
Court's U.S. Rate	0.164%	0.300%	0.450%
Court's Europe Rate	0.118%	0.264%	
Court's RoW Rate	0.090%	0.224%	0.314%

The rates which the Court adopts are both fair and reasonable and non-discriminatory.

VII. Release Payment.

Ericsson is entitled to a release payment that is calculated in the same manner, and with the same rates, as the going-forward rates adjudicated here, covering all of TCL's unlicensed sales from January 1, 2007 onward.

VIII. The Elements of the Adjudicated License.

The Court sets out the terms of the FRAND license adopted here.

With respect to End User Terminals (i.e., handsets and tablets), so long as they are TCL Products (as defined in Option B at §§ 1.7 and 1.25), TCL shall pay as a percentage of the Net Selling Price (as defined in Option B at § 1.16) the rates

set forth in Figure 17. In order to avoid confusion, products TCL sells under the Blackberry brand are TCL Products.

With respect to the sale of External Modems and Personal Computers, so long as they are TCL Products (as defined in Option B at §§ 1.9, 1.20, 1.25), TCL shall receive a royalty-free license because the revenues for these devices have already been accounted for in the unpacking analysis for handsets.

The License Period shall be five years from the date of the injunction which the Court enters. (Docket No. 1055, p. 9.) The license and related obligations shall extend to the TCL parties to this litigation and any company or other legal entity they control (i.e., more than 50% voting power). The present record does not permit the Court to calculate royalties for the period between the termination of the release period and the commencement of the injunction. In settling the form of injunction, the parties shall meet and confer to resolve the issue, and if unable to do so, the Court will receive additional evidence and resolve the issue. The royalty rates during this interim period shall be the same as adopted by the Court.

TCL's reporting and payment obligation shall be as set forth in sections 6.2 and 6.3 of Option B. The license shall also include the terms for pass-through rights and the terms which the which the Court previously found to not be a breach of FRAND. (Docket No. 1055 at 6-8.)

The FRAND amount to compensate Ericsson for TCL's unlicensed past sales is $16,449,071.

Because the Court's final judgment will take the form of an injunction, as opposed to a fully integrated license agreement, certain terms and conditions must be modified or removed in order to give effect to an injunction. (See Docket No. 1055 at 9.) The parties are directed to submit a proposed form of injunction that conforms to the Court's findings and conclusions within thirty (30) days.

Dated: November 8, 2017

James V. Selna
United States District Judge